Beyond the coffee corner

Workplace design and social well-being

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BEYOND THE COFFEE CORNER

Workplace design and social well-being

Susanne Colenberg

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Workplace design and social well-being

Dissertation

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A healthy office is a social office.

Drawing by Xueliang Li

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SAMENVATTING

Het doel van dit promotieonderzoek was om kennis te verzamelen over de manier waarop de indeling en inrichting van kantoren ervoor zou kunnen zorgen dat mensen zich prettiger voelen op hun werk. Ik ging ervan uit dat de invloed van het interieur op hoe mensen zich voelen en gedragen benut zou kunnen worden om hun welzijn en gezondheid te verbeteren. Uiteindelijk heeft het onderzoek vooral aandacht besteed aan de sociale aspecten van welzijn: hoe mensen met elkaar omgaan en of ze zich thuis voelen in de groep. Tijdens de coronapandemie was de belangstelling voor dit onderwerp gegroeid, omdat lange periodes van thuiswerken duidelijk maakten hoe essentieel sociaal contact is.

De pragmatische aanpak van dit verkennende onderzoek bestond uit zes studies met een mix van uiteenlopende methoden. Eerst is gekeken welke kennis er al beschikbaar was over de gezondheidseffecten van kantoorinterieurs. Daarna is dieper ingegaan op de betekenis van 'sociaal welzijn' op het werk en hoe je het kunt meten. Tenslotte is gekeken naar manieren om kantoorruimtes te ontwerpen zodat een 'sociaal kantoor' ontstaat. Uit de resultaten blijkt dat daarvoor meer nodig is dan een knappe koffiehoek.

Kantoorinterieur en gezondheid

Het onderzoek startte met de analyse van een ruime verzameling wetenschappelijke artikelen over de invloed van kantoorinterieur op gezondheid. Het uitgangspunt daarbij was dat gezondheid een combinatie is van lichamelijk, psychisch en sociaal welzijn. Voor het zoeken naar artikelen zijn brede zoektermen gebruikt en grote zoekmachines, waarna de gevonden artikelen systematisch werden geselecteerd op relevantie. De analyse liet zien dat onderzoek naar gezonde kantoren sterk in opkomst was, maar ook versnipperd over uiteenlopende wetenschapsgebieden. Hoewel de onderbouwing van gezondheidseffecten vaak nog mager was, bleek duidelijk dat het kantoorinterieur de gezondheid kan beïnvloeden in zowel positieve als negatieve zin.

Uit de artikelen kwam bijvoorbeeld naar voren dat grote open werkruimtes ('kantoortuinen') en veel achtergrondgeluid niet bevorderlijk waren voor het welzijn terwijl goed licht, de aanwezigheid van planten en persoonlijke invloed op de omgeving juist een positieve invloed hadden. De meeste onderzoeken hadden vooral naar lichamelijk en minder naar psychisch welzijn gekeken; voor sociale aspecten was maar weinig aandacht. De conclusie was dat dit onderzoeksgebied baat zou hebben bij een gemeenschappelijke taal, sterkere methoden en een ruimere opvatting van gezondheid.

In een tweede studie zijn ontwerpstrategieën voor gezonde kantoren afgeleid uit de verzamelde artikelen. Er is daarbij gekeken naar de aangetoonde gezondheidseffecten van interieurkenmerken en de theorieën waarmee die effecten werden verklaard. Door

in de schoenen te gaan staan van de interieurontwerper en de beproefde ontwerpoplossingen te koppelen aan gezondheidsdoelstellingen, kwamen vier typen strategieën naar voren: comfort realiseren, gezond gedrag stimuleren, herstel ondersteunen en sociaal welzijn bevorderen. De 'comfortstrategie' was het meest prominent aanwezig en was vooral gericht op het verminderen van belasting en gezondheidsrisico's zoals stress door geluid of drukte. De andere drie benaderingen hadden positievere uitgangspunten en waren gericht op het aanvullen van mentale en fysieke reserves van medewerkers in plaats van het minimaliseren van klachten.

De analyse van de artikelen liet ook zien dat het bevorderen van sociaal welzijn via het kantoorinterieur tot dan toe de minste aandacht had gekregen, terwijl daar genoeg mogelijkheden voor leken te zijn. De kantoorinrichting zou bijvoorbeeld gewenste sociale interacties en een gevoel van verbondenheid kunnen stimuleren. De volgende studies naar gezonde kantoren zijn daarom toegespitst op sociaal welzijn op het werk.

Sociaal welzijn op het werk

Om meer inzicht te krijgen in wat sociaal welzijn op het werk inhoudt en welke rol het kantoor daarin speelt, zijn uitspraken van kantoorwerkers bestudeerd over hoe zij hun werkomgeving ervaren. Er is gebruik gemaakt van bestaande interviewdata waarop 'concept mapping' is toegepast. Dit is een methode die kwalitatieve en kwantitatieve technieken combineert voor het vinden van overeenkomsten in bijvoorbeeld tekstfragmenten. Uit de analyse kwamen veertien thema's naar voren over sociale interacties op het werk, relaties met collega's en gevoelens van verbondenheid. De inhoudelijke verschillen met een bekende theorie over sociaal welzijn zouden erop kunnen wijzen dat sociaal welzijn een contextueel verschijnsel is dat vraagt om definities en meetinstrumenten die passen bij die context, bijvoorbeeld werk.

In de daaropvolgende studie zijn de uitspraken van kantoormedewerkers en bestaande vragenlijsten over het onderwerp gebruikt om enquêtevragen te formuleren over sociaal welzijn op het werk. Het doel van deze studie was om een brede, maar compacte set vragen (schaal) te ontwikkelen. Daarmee zou iemand kunnen meten welk effect veranderingen in de organisatie of werkomgeving hebben op sociaal welzijn. Een ruime selectie van die vragen is via een online enquête voorgelegd aan medewerkers van vier organisaties. Hun antwoorden zijn gebruikt om via statistisch modelleren te bepalen welke set het sociaal welzijn van medewerknemers het beste weergeeft.

Het best passende model bleek te bestaan uit twee groepen met elk vijf indicatoren. De eerste groep, 'verbondenheid' gedoopt, omvatte goede relaties met collega's en een gevoel van saamhorigheid op het werk. De tweede, die we 'veiligheid' hebben genoemd, betrof de meer basale behoefte om geaccepteerd en gerespecteerd te worden. Verder bleek het model vooral lange-termijnaspecten van sociaal welzijn te bevatten en niet

zozeer de kortstondige ervaringen. Hoewel deze voorlopige schaal nog verder getest moet worden op betrouwbaarheid en onderscheidend vermogen, kan hij alvast gebruikt worden voor het monitoren van sociaal welzijn en evalueren van interventies of ontwerpoplossingen.

Ontwerprichtingen

Uitgerust met meer gedetailleerde kennis over sociaal welzijn in de context van werk zijn twee studies uitgevoerd om te ontdekken hoe we kantoorruimtes zo kunnen ontwerpen dat ze sociale interacties en een gevoel van verbondenheid bevorderen. Eerder onderzoek had al laten zien dat negatieve interacties en het ontbreken van privacy nadelig zijn voor het welzijn op kantoor. Daarom was de vijfde studie binnen dit promotieonderzoek gericht op het verbeteren van privacy op de werkvloer.

Eerst zijn ruimtelijke beslotenheid en afzondering ('architecturale privacy') vertaald naar concrete, tastbare kenmerken van werkruimtes die mensen gemakkelijk kunnen herkennen en beschrijven. Om het vinden van passende ontwerpoplossingen eenvoudiger te maken, is tevredenheid met privacy onderverdeeld in verschillende aspecten, gebaseerd op wat mensen zintuiglijk ervaren. Vervolgens zijn via een online enquête mensen die in verschillende kantooromgevingen werken gevraagd naar de fysieke kenmerken van hun gebruikelijke werkplek en hoe tevreden ze waren met verschillende vormen van privacy op die plek.

Met behulp van statistische analyse is gekeken welke kenmerken van de werkplek het meest van invloed waren op hoe tevreden mensen waren over hun privacy. De resultaten toonden aan dat kleine, relatief afgezonderde kamers een grotere tevredenheid met privacy en minder hinder van geluid voorspelden dan bijvoorbeeld privacy-schermen rondom het bureau, zachte vloerbedekking en mogelijkheden om de zichtbaarheid van de medewerker in te perken.

Het doel van de laatste studie van dit promotieonderzoek was om te achterhalen hoe interieurontwerpers in de praktijk proberen om kantoorruimtes te creëren die sociale interacties en verbondenheid bevorderen, en zo het welzijn van de mensen die er werken verbeteren. Via diepte-interviews met ervaren interieurontwerpers over concrete kantoorprojecten waar ze aan hadden gewerkt, zijn hun aannames en keuzes expliciet gemaakt. De analyse bracht verschillende manieren aan het licht waarop de ontwerpers proberen om informele contacten en verbondenheid te stimuleren. Ze maken daarbij gebruik van 'ontworpen functionaliteiten': eigenschappen van de ruimte die ze doelbewust creëren, zoals een gevoel van privacy of een bepaalde sfeer.

De resultaten lieten zien dat de ontwerpers vooral bezig waren met het stimuleren van toevallige ontmoetingen en het creëren van plekken waar mensen in een informele sfeer bij elkaar kunnen zijn. Ze wilden bijvoorbeeld aantrekkelijke, ruime, herkenbare en

centraal gelegen pauzeruimtes maken. Dit zou bijdragen aan het gevoel van verbondenheid tussen de mensen die in het kantoor werken. Ze wilden ook dat deze plekken groepsidentiteit en een gevoel van geborgenheid zouden uitstralen. Daarnaast probeerden ze via het ontwerp mensen aan te moedigen om deze pauzeruimtes te gebruiken en informele interacties weg te houden van de werkplekken om daarmee ongewenste afleiding tegen te gaan. De ontwerpers waren zich ervan bewust dat verbondenheid ook gestimuleerd kan worden door het bieden van groeps-privacy voor persoonlijke gesprekken. De ideeën en aannames van deze ontwerpers kunnen nuttig zijn voor verder onderzoek naar de feitelijke invloed van kantoorruimtes op hoe mensen zich voelen en gedragen in relatie tot anderen.

Toepassingen en aanbevelingen voor verder onderzoek

De vergaarde inzichten over de invloed van kantoorinrichting op welzijn en gezondheid en mogelijke strategieën voor het ontwerpen van gezonde en sociale kantoren kunnen dienen als bronnen van kennis en inspiratie voor ontwerppraktijk en onderwijs. Zo kan de 'kaart' van ontwerpstrategieën een nuttig instrument zijn bij gesprekken tussen interieurontwerpers en hun klanten over de gewenste veranderingen en mogelijke opties voor een nieuwe kantoorinrichting. Dit kan vooral handig zijn voor beginnende ontwerpers. De onderzoeksresultaten die het belang aangeven van acceptatie en integratie binnen de groep van werknemers en hoe de werkomgeving kan bijdragen aan een gevoel van verbondenheid zijn met name relevant voor leidinggevenden.

Toekomstig onderzoek naar de invloed van werkomgevingen op welzijn kan voortbouwen op de classificatie van het kantoorinterieur die in dit onderzoek is ontwikkeld en de indicatoren van sociaal welzijn die zijn gevonden. Een volgende stap zou kunnen zijn om in kaart te brengen wat kantoormedewerkers ervaren als een sociaal kantoor. Met andere woorden, welke ontworpen functionaliteiten nemen zij waar en hoe beïnvloeden die hun beleving en gedrag?

Een meer geavanceerde stap zou zijn om een model te ontwikkelen dat sociaal welzijn voorspelt aan de hand van interieurkenmerken en de invloed daarop van externe factoren zoals de cultuur van de organisatie en de persoonlijkheid van individuele werknemers. Zo'n model biedt inzicht in welke specifieke elementen het meest van invloed zijn op hoe mensen zich voelen op het werk.

Uiteindelijk kan verder onderzoek ook inzicht bieden in obstakels voor het gebruik van wetenschappelijke kennis in de ontwerppraktijk. Dit zou kunnen helpen om de toepassing van wetenschappelijke inzichten bij het ontwerpen van kantoorinterieurs te verbeteren en zo een meer 'evidence-based' benadering te bevorderen.

SUMMARY

The aim of this doctoral research was to contribute to better working environments by generating knowledge for designers and organizations about the relationship between office interiors and well-being. This was based on the belief that the influence of an office's layout and design on the experience and behaviour of its users can be utilized to promote their well-being and health. Gradually, the focus narrowed down to the social dimension of well-being, a largely underexposed field that has gained importance during the Covid-19 pandemic.

The pragmatic mixed methods approach included six studies. First, the available knowledge about the health effects of office interiors was collected and analysed. Subsequently, the research delved into the meaning of social well-being for office workers and how it could be measured. Finally, design strategies for a 'social office' were identified. The results show that promoting social well-being through interior office design requires more than offering a fancy coffee corner.

Interior Design and Healthy Workplaces

The research started with a broad inquiry into the available evidence of interior office space's health impact in peer-reviewed articles. In this inquiry, health was considered to consist of physical, psychological and social well-being. This literature review, applying a deliberately wide-scoped and systematic search procedure, showed that the research in this rapidly emerging field was scattered and evidence had hardly been accumulated. However, it was clear that the interior office design was capable of influencing employee well-being in both a positive and negative manner.

The reviewed studies indicated that open-plan offices, shared workspaces, and high levels of background noise were associated with reduced well-being. In contrast, satisfying light conditions, greenery, and personal control of the environment were found to support well-being. Most of the reviewed studies focused on physical rather than psychological well-being and social well-being was generally neglected. It was concluded that to advance this area of workplace research, the field needed a collective vocabulary, more methodological strength, and a holistic approach that would include social well-being.

In the second study, potentially effective design strategies for healthy workplaces were inferred from the collected evidence about the design features' health impact and the rationales of the reviewed studies. By taking the perspective of the interior designer and connecting evidence-based design solutions to health objectives, four types of strategies were identified: increasing comfort, stimulating healthy behaviour, supporting recovery, and enhancing social well-being. Designing for comfort was the most

prominent in the literature and referred to the pathogenic approach of reducing demands, such as environmental stress and physical risks. The other three were classified as salutogenic approaches that go beyond minimizing complaints and mismatches by stimulating positive health outcomes that aim to increase the office worker's resources.

From this secondary analysis of the literature, it was concluded that the strategy of enhancing social well-being was the least developed of the four while it may have a large potential, for example, by creating affordances which enable social interactions and increase belonging. Therefore, this strategy was taken as the starting point for further inquiry into the relationship between interior design and the social dimension of well-being at work.

Exploring Social Well-being at Work

To improve an understanding of social well-being in a work context and the relationship with workplace design, office workers' statements about their new office environment were studied. Existing interview data were analysed by concept mapping, a technique that combines qualitative judgements with quantitative techniques to identify commonalities in, for example, textual data. From the analysis, fourteen themes emerged that reflected the office workers' experiences of social interactions, co-worker relationships, and feelings of belonging at work. The deviations from established theory seemed to indicate that social well-being is a context-bound phenomenon that requires conceptualization and measurement appropriate to the relevant domain.

In a fourth study, the insights about what mattered to office workers and existing questionnaires were used to collect and phrase items about potential indicators of social well-being at work. The study aimed to develop a broad yet concise measurement scale that could be used to establish the impact of interventions and organizational changes on social well-being. A large set of items was included in a survey that was administered to four organizations. Through statistical modelling of the employees' scores, it was analysed which set of items best reflected the underlying construct of social well-being at work.

The resulting model indicated a two-dimensional structure with five items for each dimension. The first dimension, named 'bonding', reflected the joy of positive relationships with others at work and a sense of community, while the second dimension, named 'psychological safety', reflected a basic need for inclusion and a climate of trust and respect. Furthermore, the model was dominated by long-term aspects of well-being rather than short-lived experiences. Although this initial scale has

to be validated more extensively, it can be used already for monitoring the social well-being of employees or evaluation of design interventions.

Directions for Positive Workplace Design

Equipped with more detailed knowledge about social well-being in the office context, two studies were conducted to explore directions for workplace design that stimulate the users' social well-being. Since the previous studies showed how negative encounters and a lack of privacy undermined employees' social well-being, the subsequent study focused on how to increase perceived workspace privacy.

First, architectural privacy was operationalized into concrete workspace features that could be easily reported by the users. To facilitate the development of appropriate design solutions, different dimensions of privacy perception were distinguished based on sensory perception. Through an online survey, office workers in different work environments were asked to report the physical characteristics of their usual workspace and their average satisfaction with privacy aspects in that workspace.

Through ordinal regression analysis, the relative contribution of the reported design features on privacy satisfaction was analysed. The results indicated that small, relatively isolated rooms better predicted satisfaction with privacy and noise than privacy screens, soft flooring and visibility control.

The sixth study aimed to identify design strategies practised by interior designers to create 'social offices' that support the social well-being of the users. Through in-depth interviews with expert designers about realized office projects, their assumptions and design decisions were made explicit. Means-end chain analysis revealed the different pathways from concrete design attributes to social well-being goals. Affordances, referring to designed functionalities or qualities, acted as the design strategies' backbone.

This final study shows that the workplace designers interviewed aimed to stimulate informal social interactions by creating attractive, spacious, recognizable, and spatially integrated breakout spaces. Communicating group identity, promoting visibility, and offering cosiness were meant to support connectedness. Several affordances intended to nudge office workers to visit breakout spaces and keep the interaction away from workspaces to prevent distractions. The designers recognised that social well-being could increase by offering group privacy for personal conversations. The designers' assumptions can serve as testable hypotheses to collect more evidence on the impact of interior office design on the behaviour, experience, and social well-being of office workers.

Implications and Future Research

The insights gathered about the nature of social well-being at work and design strategies identified for healthy workplaces can inform and inspire design practice and education. For example, the 'map' of design strategies can serve as a tool for workplace designers and their clients to discuss desires and options for the new office. It can also be of use for less experienced workplace designers. From a management perspective, the research highlights the importance of inclusion at work and indicates how the workplace may support a sense of community.

Future transdisciplinary workplace research can build on the developed taxonomy of interior office design and key concepts of social well-being at work. A next step could be to study the office workers' perspective on social offices: which affordances do they perceive? In the end, a causal model could be developed that predicts social well-being at work based on interior design features and taking into account external factors such as organizational culture and personality. Finally, research to identify the obstacles to more evidence-based design practice could provide starting points to increase the application of scientific knowledge in the design practice.

CHAPTER 1

1 INTRODUCTION

The purpose of this dissertation was to help improve workers' experience at the office and contribute to theory on positive workplace design. The research was motivated by observed mismatches between workplace design and office workers' needs and the belief that evidence-based design could increase workplace quality for the users. The aim, therefore, was to generate knowledge to inform design decisions and support future transdisciplinary workplace research.

The work presented in this dissertation revolved around the question of how interior office design could stimulate the social well-being of employees. It focused on identifying essential elements of positive design strategies, from pinpointing the desired outcomes to unravelling ways to turn the design in the right direction. This first chapter serves to introduce the topic and its multi-disciplinary audience, define the main concepts and their assumed relationships, and explain the pragmatic mixed-methods approach to the research. It concludes with an overview of the dissertation that serves as a reading guide to the following chapters.

1.1 Ambition and Motivation of the Research

1.1.1 Positive workplace design

Due to the bad press of open-plan offices in the past decade (e.g. Borzykowski, 2017; Brooks, 2022; Burkeman, 2013), one may forget that office life can also be enjoyable. The office could be a place where one can feel competent and part of a community, surrounded by people with similar backgrounds, interests, and objectives. Working at a well-designed office may stimulate creativity and connectedness and provide a sense of purpose. The office environment could function as a resource that addresses meaningful goals (Desmet & Pohlmeyer, 2013).

Positive design is an effect-driven approach that aims to stimulate subjective well-being and human flourishing by grounding the design in psychological theory and user research on what makes people happy (Desmet & Pohlmeyer, 2013). It builds on user experience research and positive psychology to promote well-being beyond a neutral state and extend design objectives beyond fixing problems toward adopting positive activities, evoking positive emotions, and offering valuable experiences (Pohlmeyer, 2013). Positive design matches the development across the social sciences to seek a better understanding of positive aspects of human experience and the salutogenic approach that focuses on the origins of health rather than those of disease (Mittelmark & Bauer, 2017).

Nurturing social relationships is one of those activities that make people happy (Lyubomirsky & Layous, 2013). Feeling connected to other people is a basic psychological need (Deci & Ryan, 2008). This social dimension of relatedness and belonging features in several established well-being models (Gallagher et al., 2009; Magyar & Keyes, 2019). Moreover, Reis and Gable (2003) have suggested that good social relationships may be the single most important source of happiness. At work too, social relationships are important to people's well-being (Rath & Harter, 2010) and face-to-face interactions are crucial to sustaining them (Nardi & Whittaker, 2002). For example, small talk at work is experienced as uplifting, enhancing positive emotions, and creating a sense of community, even though it disrupts cognitive engagement (Methot et al., 2021) and positive relationships promote employee flourishing by providing emotional support, friendship, and the opportunity to give to others (Colbert et al., 2016).

According to Desmet and Pohlmeyer (2013), positive workplace design may be a source of well-being through the affordance of happiness-enhancing activities at work, the experience of beauty, and the symbolic representation of what is important to the employees. Similarly, Vischer (2008) argued that a user-centred design approach can create a positive and supportive working environment that enhances human activities and helps people fulfil their aspirations. Workplace design is considered crucial to the nature, quality, and duration of employee social interactions at work (Ayoko & Ashkanasy, 2020) and may support or constrain relationship building through, for example, interaction opportunities or crowding (Khazanchi et al., 2018; Wohlers & Hertel, 2017).

In summary, workplace design may enhance workers' well-being by stimulating positive social interactions and relationships as long as it does not interfere with focused work. Organizations benefit as well because healthy and happy workers are productive workers (Diener & Seligman, 2004; Fisher, 2010; Oswald et al., 2015). However, in nowadays offices, this potential seems to be under-utilized.

1.1.2 Current office environments

In the past decades, offices increasingly featured open workspaces, either in open-plan offices or as an activity-based working (ABW) environment. The ABW office concept offers a variety of spaces that are designed to support specific work activities and from which office workers are supposed to choose the space that fits their current activity or preferences in order to increase productivity (Appel-Meulenbroek et al., 2011). Usually, ABW environments emphasize open and exposed workspaces above enclosed ones. In practice, office workers in ABW environments value the different types of workspaces provided but the preferred workspaces are not always available (de Been et al., 2015; Hoendervanger, 2021) which leads to problems of noise and lack of privacy.

Spatial openness has been found to support social interaction at work, but not just in a positive manner. In the popular media, a fierce debate about the pros and cons of open plans went on for years while overwhelming evidence accumulated of the negative consequences for employee well-being.

Evaluations of relocations to offices featuring open workspaces reported problems of noise, crowding, and deteriorated relationships (Engelen et al., 2019; Forooraghi et al., 2021). Improvement of communication possibilities was exchanged for loss of privacy (Kim & de Dear, 2013). Employees became more irritated, suspicious and withdrawn in open offices (Morrison & Macky, 2017), which negatively affected relationships. However, the open-plan office debate often was very black-and-white and it was not clear how specific characteristics of the open office space impacted specific aspects of well-being, thus lacking concrete starting points for improvement of the design. For example, the degree of correspondence between the spatial and conceptual closeness of people better indicates the fit between spatial design and privacy needs (Sailer & Thomas, 2020). Open-plan offices may have a positive influence on relationships if they are based on a thoughtful assessment of user needs (Morrison & Smollan, 2020) and their overall performance increases when a user-centred approach to interior design is applied (Candido et al., 2019).

The forced and prolonged working from home for most office workers during the Covid-19 pandemic from 2019 to 2022 raised awareness of the social function of the office. At first, office workers welcomed increased autonomy and reduced commuting, but soon it became clear that the extensive digital communication had its limitations, and the lack of personal contact was negatively impacting social cohesion. Organizations were quick to calculate the gains for cuts in office space. However, after a few months, many workers wanted to return to the office, above all for meeting with colleagues, socialising with people, and have impromptu face-to-face interactions (Gensler Research Institute, 2020a). The important weak-tie connections (Sandstrom & Dunn, 2014) suffered and new employees experienced difficulties in getting to know their colleagues and organizational values (de Bruin, 2020).

Although shortly after the first lockdown, the death of the office (Veldhoen, 1995) was announced again (Walsh, 2020), it is now commonly recognized that the office will survive as a place for being together and sharing experiences as well as for individual working (Humberd et al., 2020; Kirkpatrick & Marinho, 2021). According to Leesman (2021), intentions to return to the office depended on the home working experience and perceived quality of the office workplace ('Home is the new benchmark').

Today, organizations are busy sorting out how to adapt their office to the expected new reality of hybrid working, which refers to the combination of working at the office and connecting online from home or third places. Probable consequences are expanding desk-sharing policies, supporting remote working platforms, and turning some of the desk areas into coffee corners and video conferencing rooms, but much is still unsure. Time has to tell if office use will change in the long run and if pre-pandemic habits will be abandoned. However, the social function of the office as contributing to fulfilling employees' social needs seems to be increasingly recognized.

1.1.3 Knowledge gaps

Successful design of social offices requires a thorough understanding of the relationship between specific design elements on the one hand and well-being outcomes on the other, and every step in between. Strategic workplace design needs clear goals, an overview of the different attributes that make up the desired environment, and credible information about the possible effects of this environment on the user's experience and behaviour. Scientific research can support the articulation of design goals, goal-oriented development of design solutions, and evaluation of their effect. In such a process of evidence-based design, design decisions are based on the best available information from credible research (Hamilton & Watkins, 2008).

Within workplace research, approaches to well-being vary widely and often are not clear (Hanc et al., 2019) or too general (Engelen et al., 2019). Lack of clear well-being goals impedes evidence-based design processes and evaluation of their effectiveness. Regarding office space, research on its health and well-being impact tends to emphasize building physics, such as temperature, air quality, light, and noise, while paying less attention to the layout and tangible elements of the interior design (Altomonte et al., 2020; Jensen & van der Voordt, 2020). The emphasis on indoor air quality research may have resulted from the rise of the sick building syndrome (Ghaffarianhoseini et al., 2018; Redlich et al., 1997) at the end of the last century and a pathogenic approach to health. However, much of the indoor air research does not address the relationship between the perceived problems and the actual design features of the work environment, which makes it difficult to improve the design in this respect.

Empirical evidence on how workplace design stimulates activities and experiences that fulfil workers' social needs seems scarce. Although several studies relate social interaction to workspace layout (Appel-Meulenbroek et al., 2017; Sailer & McCulloh, 2012; Weijs-Perrée et al., 2019), they focus on mapping and predicting locations of face-to-face interaction without connecting these data to experienced well-being. On the other hand, studies on satisfaction with workplace characteristics that may support social well-being, such as privacy and possibilities for communication (Iris de Been & Beijer, 2014; Haapakangas et al., 2019; Rolfö et al., 2018), often do not connect this

satisfaction to the actual spatial planning or specific design features of the office. Moreover, satisfaction does not automatically imply well-being.

In summary, increasing positive and evidence-based workplace design requires a better understanding of well-being in the office environment, the design components that may impact this well-being, and the mechanism of this process of influence.

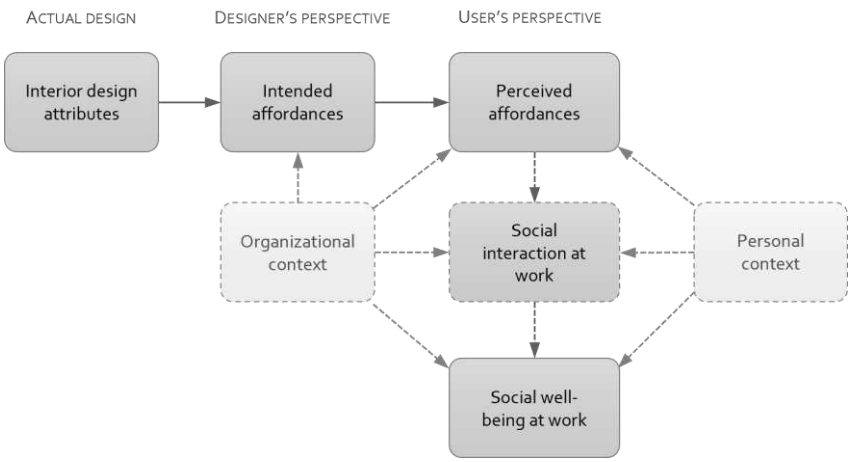
1.2 Research Aim and Scope

1.2.1 Aim and conceptual model

The aim of the research was to gather knowledge on the possible relationship between workplace design and social well-being to guide practitioners in their design decisions and provide a foundation for future research. The conceptual model in Figure 1 depicts the concrete design attributes as the starting point of a process of perception, behaviour, and experience that may impact the individual's social well-being. Regarding workplace design, the research focused on the interior design of office environments. It considered both the elemental design attributes and their composition into affordances. Affordances refer to functionalities of the design as intended by the designer or perceived by the user (see also Sections 1.2.3 and 7.2.1).

Figure 1

Conceptual framework showing the research scope of workplace design for social well-being through affordances and behaviour.



In contrast to architectural determinism, which refers to the simplistic point of view that space directly shapes behaviour (Bell et al., 2001, p.373), current environmental psychology has a probabilistic vision of the relationship between interior space, behaviour, and well-being. In this vision, perception, cognition, and external factors mediate and moderate the relationship between design and well-being. Therefore, this research acknowledges that the designer's view may differ from the users' perception and that aspects of the organizational context, such as job characteristics and hot-desking policies, or the personal context, such as personality and physical impairment, will influence the user's perception of the working environment. Similarly, varying circumstances, such as work activities and mood, will also shape the perception. However, since not much was known yet about the relationship between workplace design and social well-being, the scope of this research was limited to the aspects of interior office design that may impact the individual experience of social well-being at work and it leaves the investigation of the impact of contextual factors to future research.

Furthermore, the conceptual model underlying the research assumed that the perception of interior design qualities would impact the experience of social well-being both indirectly, through enabling particular social interactions, and directly, through values communicated by the design. After all, the cues about the people that use the space and the behaviour that is possible or appropriate in the place are important aspects of the psychological experience of interior space (Augustin, 2009, p.21). People can develop a bond with a place similar to interpersonal bonds which provides a sense of safety and comfort and is maintained by proximity-seeking (Scannell et al., 2021). This implies that one may experience feelings of connectedness to other people in a space without actually interacting with them.

The following sections further explain the main concepts of the conceptual model as depicted in Figure 1.

1.2.2 Interior design

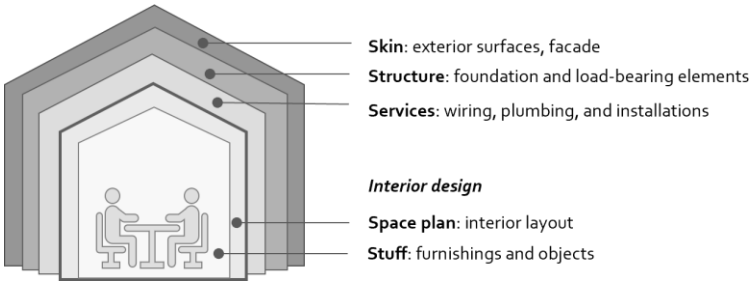
The research focused on interior office design because interiors directly connect humans and space by forming a second layer, on top of clothing, between the body and the outside world (Caan, 2011). A second, more pragmatic reason to focus on interior design was the relatively frequent and easy replacement of interiors compared to building construction and air-conditioning installations (Brand, 1994). This adds to the usability of design guidelines for this field.

Interior design deals with all qualities of human experience in the built environment, including the occupants' mutual relationships (Caan, 2011). It reaches beyond the visual decoration and includes spatial elements, such as walls and windows, and user-

relevant technology, such as artificial lighting and automated adjustability of furniture, but excludes construction and engineering, such as building materials and air-conditioning installations (Fig. 2). Interior design has interfaces with architecture, which deals with the design of interior volumes, and industrial design, which deals with the interaction between an individual and a product.

Figure 2

Office building layers (after Brand, 1994, and Duffy, 1990)



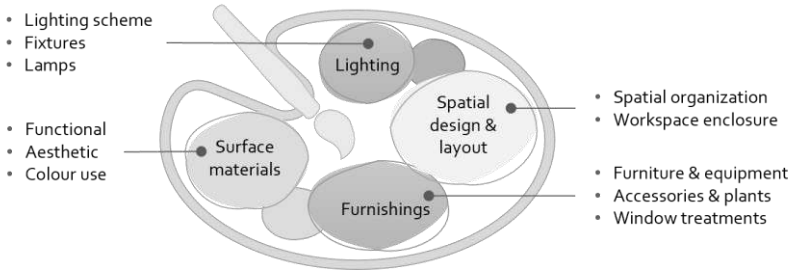
Interior design includes form, finishings, and spatial arrangement of design attributes inside a building that make the space habitable and support human functioning (Ching & Binggeli, 2018). Figure 3 (next page) depicts these attributes as the palette of workplace designers.

The components that interior designers can use to create the desired functionality and aesthetics of an office include the organization of spaces and objects within them, the modification of spaces and creation of enclosure by physical elements such as walls and doors, and the application of surface materials of different textures and colours, lamps and lighting fixtures, and furnishings, such as furniture, indoor plants, other objects, and window treatments. For example, finishings influence transparency and the distribution of light and sound which impacts the spatial and qualitative perception of a space. The combination of pattern, texture, and colour of textiles can create sensory delight (Caan, 2011).

The designers dealing with interior design usually are educated in interior architecture, interior design, architecture, or industrial design, with only the latter having a tradition of systematically studying user needs. Section 7.2.2 further explains the profession of interior design.

Figure 3

The palette of the interior office designer (after Ching & Binggeli, 2018)



1.2.3 Workplace affordances

The composition of interior design elements, as depicted in Figure 3, makes up the anatomy of the physical work environment as perceived by the user. To identify interior design features that may impact workers' social well-being, the work in this dissertation applied the theoretical lens of affordances. Gibson (1979) coined the term 'affordances' and defined them as 'what it [the environment] offers the animal, what it provides or furnishes, either for good or ill'. According to Gibson, affordances are arrangements of observable cues, which consist of substances and surfaces and provide detectable functions for the users. He insisted that perception of the environment is not composed of elemental building blocks, but instead, the users perceive affordances: they don't see environmental qualities but what the place can do for them (Gifford, 2014, p.30). Affordances that allow or block particular actions are strong determinants of behaviour (Bell et al., 2001, p.2).

Since Norman's (1988) popularization of affordances, different understandings of the concept have widely spread in the design community. Following McGrenere and Ho (2000), in this dissertation, an affordance is considered the actual utility or functional purpose (usefulness) of a design, recognizing that the degree of usability (perceived affordance) may vary depending on perceptual information and the ease of undertaking the action. This means that an environment may actually possess a certain possibility for the user (affordance), but if the users do not recognize it or are not able to make use of it, the affordance is still there but is not perceived as such.

Several scholars have applied the concept of affordances to the physical work environment and its support of social behaviour. Fayard and Weeks (2007) used the theory of affordances to study how the work setting shapes informal social interactions. They argue that affordances arise from both the *physical properties* of an environment and its *social meaning*, such as conventional rules regarding space use, which they call

'social affordances'. They identified propinquity, privacy, and social designation as essential affordances for informal interaction in photocopier rooms.

Spreitzer et al. (2020) defined 'social affordances' in the work context as 'the capacity of the physical environment to promote possibilities of social connection,' for example by offering coffee bars, and opportunities for playful engagement and assimilation of teams.

Affordances for social interaction can also be derived from space syntax theory, which argues that the layout of buildings allows for encounters and avoidance between users (Hillier et al., 1984). By analysing floorplans and observing behaviour, Rashid et al. (2006) and Koutsolampros et al. (2015) found that visibility and accessibility influenced face-to-face interactions and improved perceived privacy. According to Ashkanasy et al. (2014), affordances like architectural privacy, spatial density, and possibilities for workspace personalization are critical characteristics related to office users' needs.

1.2.4 Health and (social) well-being

Definitions of health

The work in this dissertation adopted the widely accepted definition of health by the WHO (2006) and took the perspective of the individual office worker. In the past decades, there has been a debate about the WHO definition, especially the unrealistic standard of 'a complete state' of health instead of, for example, the successful coping with chronic disease (Huber et al., 2011). Nevertheless, I consider the WHO definition a useful model for research on healthy workplaces because (a) it equals health to well-being, thus including the subjective experience of health, and (b) considers three dimensions of health, social, physical, and psychological, thus highlighting various aspects of human life. It implies a wider scope than, for example, narrow views of occupational health and safety in practice as a management response to the legal obligations of the employer (Zanko & Dawson, 2012) and the pathogenic perspective on health as the mere absence of disease.

The WHO definition paved the way for positive approaches to health that highlight the importance of creating environments that support well-being and reduce stress. However, an emphasis on 'the ability to adapt and self-manage in the face of social, physical, and emotional challenges', as Huber et al. (2011) propose, seems less useful to research on the impact of the rather static physical environment and seems to ignore the experience of happiness in favour of satisfaction or a sense of achievement. According to Kieman Fallon and Karlawish (2019), there has been little response to the proposal of Huber et al. (2011).

Occupational health and well-being

In occupational health psychology, a commonly applied approach to employee well-being is the Job demands and resources (JD-R) theory (Bakker & Demerouti, 2017). This model provides a useful lens for promoting well-being at work because it considers the balance between aspects that cost energy and could lead to burnout, such as overload and conflict, and aspects that generate energy and increase resilience, such as autonomy and social support. However, the impact of interior design on well-being is influenced by factors beyond job characteristics, for instance, aesthetics, sensory experiences, and personal comfort. The conceptual model at the base of this dissertation (Fig. 1) revolves around the relationship between these aspects of the physical environment and well-being at work and considers job characteristics as possible mediating variables of the organizational context that are not included in the current research scope. Nevertheless, social aspects of the job may be considered indicators of social well-being at work.

The JD-R theory has been operationalized by Berthelsen et al. (2018) through the Copenhagen Psychosocial Questionnaire, a risk assessment tool for the psychosocial work environment. This questionnaire includes social aspects of well-being at work but does not intend to cover a 'social dimension' of well-being as identified by not only the WHO but also by several scholars in the field of positive psychology or organizational psychology (e.g. Fisher, 2014; Gallagher et al., 2009; Keyes, 1998; Lamers et al., 2011). Chapter 5 discusses theories in the field of occupational health psychology that may be useful for studying social well-being at work.

Social well-being

Social well-being has been defined as a collective state, reflecting the well-being of a community, and as an individual state, reflecting a person's subjective well-being related to the social environment. Individual social well-being refers to the well-being that results from the perception of and interaction with the social environment and reflects interpersonal experiences and evaluations. Several psychological well-being theories consider social well-being to be a separate dimension. In their models, social well-being complements, for example, eudaimonic well-being, which refers to personal growth, subjective well-being, which refers to cognitive judgements such as life satisfaction, or hedonic well-being, which includes positive and negative affect. Chapters 4 and 5 of this dissertation delve further into the question of how social well-being at work can be defined.

1.3 Positioning in the Field

1.3.1 Research for design

This dissertation is written to obtain the degree of doctor in design research. Design is essentially a problem-solving activity. Consequently, research in the field of design can contribute to understanding the problems it should solve, their place in the context, and the effectiveness of the solutions provided by the design (Muratovski, 2022). This type of research that aims to inform design is called 'research for design'. Design research that focuses on understanding the process of designing is called 'research on design'. A fundamentally different approach is 'research through design', which refers to research embedded within the process of design. This type of design research aims to answer questions through the practice of design but beyond the scope of a particular design problem. This dissertation is based on research for design (Chapters 2 to 6) and, to a lesser extent, research on design (Chapter 7).

1.3.2 Disciplines and stakeholders

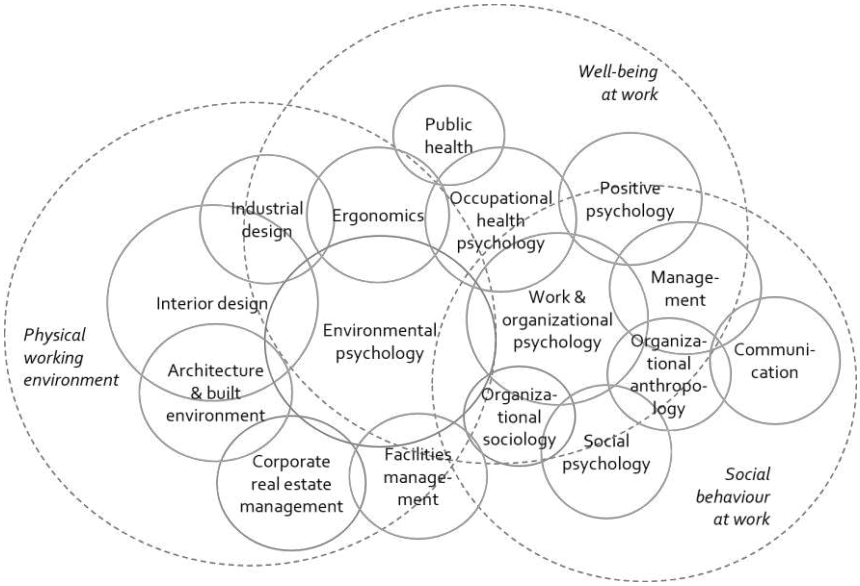
The research underlying this dissertation is essentially grounded in environmental psychology. However, due to the transdisciplinary nature of both design research and environmental psychology, it taps into a wide array of professional fields and research areas (see Fig. 4). The complexity of human-centred workplace design requires research on this topic to adopt a transdisciplinary perspective (Appel-Meulenbroek et al., 2021), which brings together expertise from social sciences and building-related disciplines and cross-boundary collaboration.

By studying the relationship between individuals and their physical settings (Gifford, 2014), environmental psychology is one of few disciplines that in itself connects people and buildings. It considers the environment as a pervasive and important influence on behaviour and mood (Bell et al., 2001, p.2-3). Other scientific research addressing the physical work environment is mainly found within the disciplines of facility management, corporate real estate, architecture, design, and ergonomics, and sometimes in marketing and management. Research on employee well-being and related (social) behaviour is predominantly the domain of psychology, management and other social sciences.

The organization's Department of Human Resources Management (HRM) should be involved in workplace design from the business perspective and their responsibility for a healthy work environment. In organisations, the well-being of employees typically is the responsibility of general managers and team leaders, supported by the Departments of HRM and Health and Safety (ergonomics). The Department of Communication may be involved in aligning the workplace design with internal branding.

Figure 4

Examples of disciplines involved with workplace design and social well-being at work



Designing the physical work environment is primarily the task of interior designers, architects, and product or interaction designers (industrial design), who may be assisted by experts in ergonomics and work-related psychology. Within organisations, the Department of Facility Management (FM) is responsible for the quality and daily maintenance of the office interior. Renovations and the interior design of newly built offices are usually supervised by FM. The discipline of corporate real estate management is concerned with the planning and design of office buildings from a strategic perspective with an emphasis on multi-site and long-range planning. Workplace consultants serve both disciplines and usually specialise in the evaluation of office space and strategic advice for optimisation. They may have a background in technology or social science and, technically, can pass scientific knowledge to practice.

To reach a broad audience, the research in this dissertation was designed to build bridges between the different worlds, for example by use of less-traditional methods, finding co-authors in fields neighbouring to my expertise of environmental psychology and interior design, and discussing implications for several areas of research and practice. It was also an explicit goal to publish the conducted studies in both building-related and psychology-related scientific journals and to distribute the knowledge through publications in popular media and presentations at practitioners' events (see the list at pp. 235-239).

1.4 Research Questions and Methodological Approach

1.4.1 Research questions

Based on the purpose of positive workplace design and the scope of interior design, office environments, and social well-being, the main research question was:

How can interior office design stimulate the social well-being of office workers?

To answer this main question, six studies were conducted that revolved around related research questions and took different perspectives.

1. Which features of interior office space have been found to impact office workers' health?
2. Which interior design strategies to enhance well-being can be inferred from this evidence?
3. What does social well-being entail for employees in contemporary offices?
4. How can social well-being at work be measured?
5. Which design features support workspace privacy as a counterpart to spaces that support social gathering at work?
6. How do interior designers aim to stimulate social well-being in offices?

The first two studies aimed to bring together insights into the influence of interior office design on the general well-being of office workers, thus exploring the well-being-enhancing potential of interior design and identifying the position of social well-being in this realm. The literature search used the wide scope of healthy offices and general search terms regarding offices and well-being to include as many relevant design features as possible. The first study outlined the established relationships between interior design and office workers' well-being and identified their parameters. The second study investigated the implications for positive workplace design by inducing interior design strategies from the collected knowledge.

Second, more knowledge was gathered about what social well-being at work entails and how it can be measured to establish the effect of design. Organizational literature covers many social aspects of employee well-being, such as professional isolation (Golden et al., 2008), loneliness in the workplace (Wright et al., 2006), and workplace friendship (Nielsen et al., 2000), but there have been few attempts yet to conceptualize the social dimension of well-being at work as a whole. A holistic view is important because a positive experience of one aspect of social well-being could be undermined by a negative experience in other aspects. Furthermore, adjustment to the work context

seemed to be important because social well-being may be a context-bound phenomenon as it results from interaction with other people in circles that may vary by environment. Therefore, a substantial part of the research was dedicated to conceptualizing social well-being in office settings, identifying its parameters and developing a tool to measure these parameters as desired outcomes of design changes.

The last two studies attempted to connect interior design features to office workers' social well-being. One focused on workspace privacy, which allows workers to withdraw from unwanted social interaction and have confidential conversations. Fulfilment of privacy needs in the workplace is important to health and productivity (Weber et al., 2021) and may reduce negative encounters that undermine social well-being. This study aimed to unravel the relative importance of design features to workers' satisfaction with different privacy dimensions at the workstation, adding a nuanced analysis to general workplace surveys. The second study on design aimed to capture the view of practitioners on the design of social office space as a different and new angle of exploring the main topic. By making their assumptions and decisions explicit, design strategies were identified that connect concrete design attributes to higher-order design goals through the creation of affordances. This last study ties the research together and provides ample directions for future research.

1.4.2 Mixed-method approach

Pragmatic

The motivation for the research was the practical issue of how to improve workers' conditions through utilizing the power of interior design. Therefore, an inductive and pragmatic mixed-methods approach was chosen to explore the assumed relationship between interior office design and workers' well-being. This inductive approach aimed at generating theory rather than testing existing theory and focused on how individuals interpret their world.

Explorative

In the sequential exploratory research design, referring to a sequence of qualitative and quantitative data collections and analyses to explore a phenomenon, the methods were blended in a complementary and additive way. Some of the qualitative data were quantified to facilitate the comparison and identification of patterns and uncover the generality of the phenomenon (Bryman, 2016, p. 628) For example, in the analysis of interview data, linkages between concepts were counted to elicit dominant patterns while the rich interview data provided more details on the reasoning behind them. In another study, the qualitative data acted as a preparation for quantitative analysis.

Online

The temporary context of the research impacted its methodological approach and possibly its results. The research was started in the year before the outbreak of Covid-19

and the subsequent lockdowns up to early 2022. The bright side of this situation was the growing concern for social well-being; the downside was nearly empty and inaccessible offices for almost two years, exactly coinciding with the main data collection period of the research. This means that the majority of the data collection was limited to online channels and it was not possible to collect data to establish the connection between the actual environment, behaviour, and well-being. These contextual limitations have directed the project further towards developing theory and methods and exploring strategies that were applied in the past.

1.4.3 Research designs

Literature review

The first two studies reported in this dissertation were based on a systematic literature search using two large and multidisciplinary search engines and general terms referring to occupational health and workplace design. From the acquired records, two overlapping sets of peer-reviewed articles on empirical studies were selected. The review of the first set of papers served to summarize the available evidence on the health impact of interior design and identify gaps in this area of workplace research. Parallel to this analysis, parameters of interior office space and office workers' well-being were identified. In the review of the second set of papers, their health scope, theoretical assumptions, design scope, findings about health-supporting design features, and outcome measures were used to identify different approaches to healthy workplaces and possible effectiveness measures.

Concept mapping

The third study aimed to explore social well-being in the context of offices by analysing employees' experiences of social well-being in their new work environment. The study used existing interview data from two post-occupancy evaluations of activity-based offices. Employees' statements referring to social well-being were extracted and analysed by group concept mapping, an explorative method that includes manual card sorting and computer-assisted hierarchical cluster analysis.

Survey

In the fourth study, data were collected through an online survey among office workers of several organisations and used to develop a scale (items for a short questionnaire) to measure social well-being at work. Structural equation modelling (SEM), a series of multivariate statistical techniques, was applied to construct and evaluate a concise and reliable set of statements on office workers' social well-being. In the fifth study, data collected through the same online survey were used to identify workplace design features that influence satisfaction with privacy and noise at the workstation. Capturing the satisfaction and design features in ordinal variables allowed ordinal regression

analysis which provided a predictive model of the joint contribution of the design features.

Interviews
In the last study, the knowledge gathered in the previous studies was used to infer design principles from multiple office design cases. Qualitative data on design goals and design decisions were collected through in-depth interviews with interior designers. From the analyses, tentative design principles for social offices were developed using means-end chain analysis.

1.5 Dissertation Overview

As a publication-based dissertation, each of the six content chapters includes one key journal article or conference paper that reports and discusses a study that was conducted to answer one of the six research questions (Fig. 5).

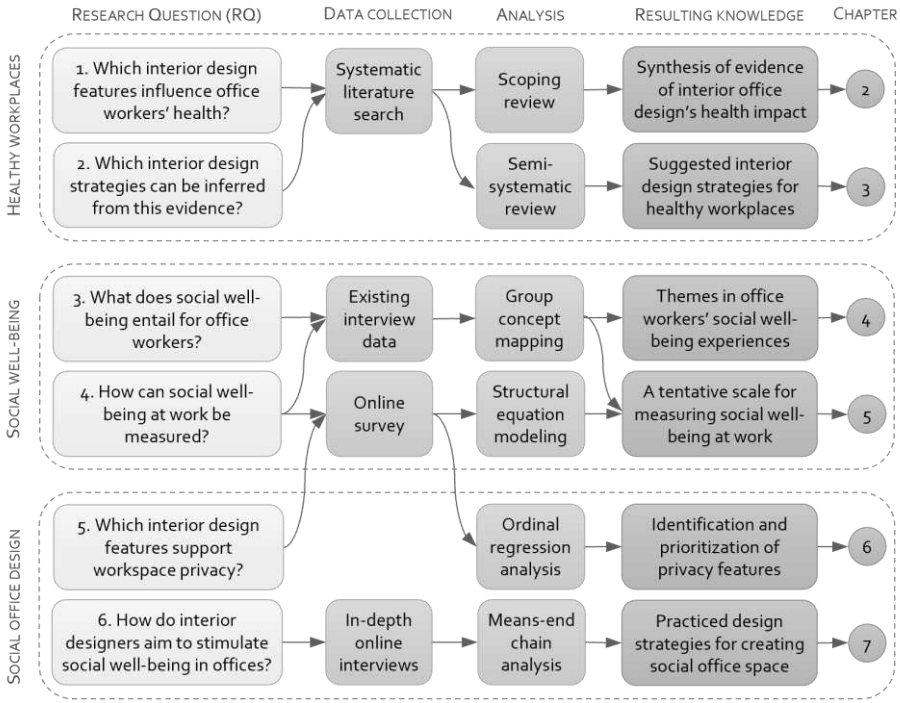
The first part of the dissertation addresses the design of healthy workplaces. It presents the existing research on interior office design and well-being and its implications for positive workplace design based on two literature reviews sharing the same database. In Chapter 2, the procedure of the literature search, the selection of papers for answering the first research question, and the findings of the first review are explained. Chapter 3 covers the second review, which identified interior design strategies for healthy workplaces (Research Question 2) based on a slightly different selection of papers.

The second part of the dissertation addresses the phenomenon of social well-being at work. In Chapter 4, social well-being in the work context is defined based on different themes in office workers' statements. Based on this analysis and the accompanying literature review of social well-being theory, it is argued that social well-being is a context-bound phenomenon and requires a measure appropriate to the work environment. Chapter 5 explains the procedure of item development, scale development, and scale optimization in the fourth study which was directed by the insights in employees' perceptions analysed in Study 3.

In the third part of this dissertation, the focus is turned back to office design. A study of workspace design features that predict perceived privacy (Chapter 6) provided knowledge about how to support privacy at work parallel to stimulating social interaction since both sides of the medal are important to social well-being. The final study (Chapter 7) yielded insights into strategies for enhancing social well-being in offices as practised by workplace designers. This sixth study elaborates on the role of affordances and their composition of design attributes.

Figure 5

Overview of the dissertation's content chapters with their main research question, the applied data collection method and analysis technique, and a summary of the resulting knowledge for design



Chapter 8 concludes the dissertation with a general discussion and future directions. In this Chapter, I summarize, synthesize and discuss the main findings, reflect on the quality of the research, and summarize the implications. In addition to this discussion, I present my vision of the ideal social office in Section 8.7.

After the aggregated list of references, a glossary is included to serve the multi-disciplinary audience of this dissertation. The data availability statement lists the locations where the data collected for this dissertation and essential research records can be found.

CHAPTER 2

This chapter is published as:

Colenberg, S., Jylhä, T., & Arkesteijn, M. (2021). The relationship between interior office space and employee health and well-being – A literature review. *Building Research & Information, 49* (3), 352-366.

Updates to this literature study can be found in:

Colenberg, S., & Jylhä, T. (Under review). Workplace design for employee health and well-being: An overview of the field. In C. Zheng (Ed.), *Research handbook on work-life balance and employee health.* Edward Elgar Publishing.

2 WORKPLACE DESIGN AND WORKER'S WELL-BEING

This chapter comprises the dissertation's first study, which was a literature review of the relationship between interior office space and employee health. The study gathered and synthesized existing evidence about this relationship and identified knowledge gaps. It serves as a basis for further research and shows the position of social well-being in this emerging field.

The chapter outlines scientific evidence of offices' health impact which was published in the twenty-five years up to 2019. For each of the selected peer-reviewed papers, a summary of the research design, the studied parameters of interior space, and the measured health outcomes are presented. The collected evidence is explained across six categories of design features and three dimensions of well-being, and converted to implications for workplace designers and managers. The suggestions for future research are based on the ratio in the studied literature between physical, psychological and social well-being and illness prevention versus health support.

2.1 Introduction

What is a healthy office? One might think of fresh air, daylight, and ergonomic furniture, since computer work increases musculoskeletal issues, such as neck, shoulder, and lower-back pain (IJmker et al., 2007; Janwantanakul et al., 2008). Research on sick building syndrome has shown that poor indoor air quality due to toxins, contamination, or inadequate ventilation could lead to a variety of physical health complaints. However, there are other side effects related to mental health, stress, and burnout, which have become a main occupational disease for office workers (Van der Molen et al., 2018). According to the WHO (2006, p.1), health is 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.' Thus, a healthy office could be defined as a workplace that at least does not harm employees' well-being, and, ideally, actively supports this well-being.

This study analyzed the relationship between interior office space and employee health by undertaking a systematic literature review. The interior space comprises individual workstations or desks and their surroundings, or the whole inner space of the office building, as opposed to the architectural outer shell and technical installations (see Fig. 2, p. 23). The design of interior space includes the use of spatial elements, lighting, surface finishes, furnishings, and accessories (see Fig. 3, p. 24) to realize the required functional and desired visual quality (Ching & Binggeli, 2018). For example, wall openings enable the passage of people, light, heat, and sound; window treatments

temper sunlight; and height and surface qualities of the ceiling affect acoustics and light. Elements of interior space are more frequently and easily changed than technical installations and building construction, thereby providing quicker wins to adjust the physical working environment.

Even though well-being is a trending topic in the real estate industry (Groen et al., 2018; Hanc et al., 2019; World Green Building Council, 2014), it often goes unnoticed in discussions concerning interior space (Smith et al., 2012). Meanwhile, the evolution of cellular offices into more open workspaces has triggered an ongoing debate on the presumed negative health effects of open-plan offices, and organizations have become more concerned about the contribution of interior space to their business goals. This challenges designers of interior space to consider both aesthetic and strategic perspectives (Haddad, 2014).

Certainly, for well-being, space matters. Following the job demands–resources theory (Bakker & Demerouti, 2017; Demerouti et al., 2001), the characteristics of the interior space can be a demand, for instance by causing environmental stress, as well as a resource, for instance by facilitating relaxation and social cohesion. In general, environmental stressors increase physiological arousal (Berlyne, 1960), cause stimulation overload (Sheldon Cohen, 1980) and evoke coping strategies, such as social withdrawal (Folkman et al., 1986). Meanwhile, opportunities to adjust to the environment mediate the experience of environmental stress (Barnes, 1981), and according to the attention restoration theory (Kaplan, 1995), green spaces aid recovery from environmental stress. In summary, a well-designed interior space can compensate for job demands and poor design can undermine job resources. Since a predominance of demands relative to resources predicts burnout (Bakker et al., 2014; Hakanen et al., 2008), this underlines the importance of a health-supporting office space.

Previous reviews addressing interior space in offices focus on specific outcomes (Ilies, Aw, et al., 2015) or specific features (De Croon et al., 2005; Engelen et al., 2019; Richardson et al., 2017); alternatively, they lack transparency in their methods (Groen et al., 2018; Rashid & Zimring, 2008; World Green Building Council, 2014). The review presented in this chapter covers the entire interior office space and uses the wide perspective on employee health defined earlier in this section. The main research questions of this review were:

> RQ1. What features of interior space in offices are studied in relation to employee health?
> RQ2. How are these features of interior space related to employee health?

2.2 Method

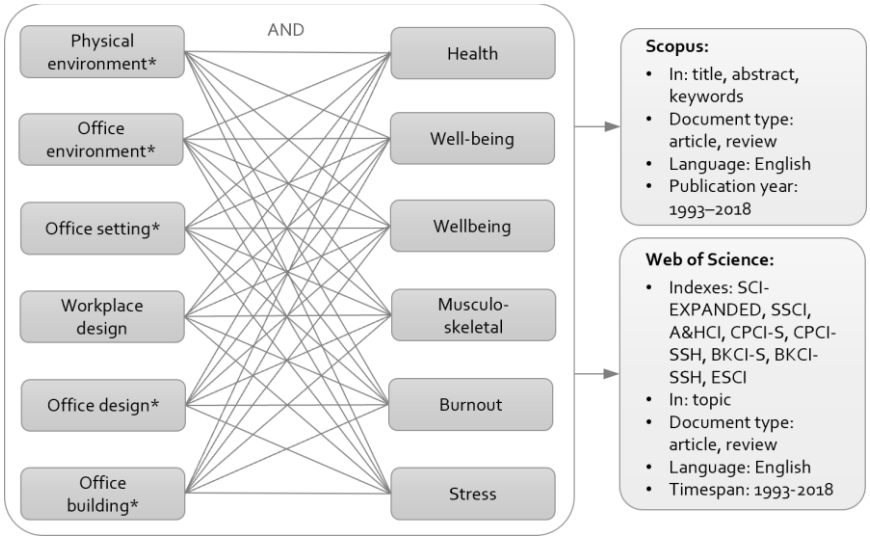
The review followed the guidelines of systematic literature reviews as presented by PRISMA (Moher et al., 2015) to make the reporting transparent.

2.2.1 Search strategy

To find the relevant papers, the multidisciplinary citation databases of Scopus and Web of Science Core Collection were used as search engines. Several test searches were conducted by two reviewers (A and B) in October–November 2017 to find a comprehensive search strategy for the review. Because terms referring to interior office space, such as 'office' and 'workplace' are used in multiple contexts in the literature (e.g., an office can be a doctor's consulting room or the workspace of a knowledge worker), it became apparent that the initial database needed to include a broad sample of papers for subsequent manual review.

Figure 6

Search strategy



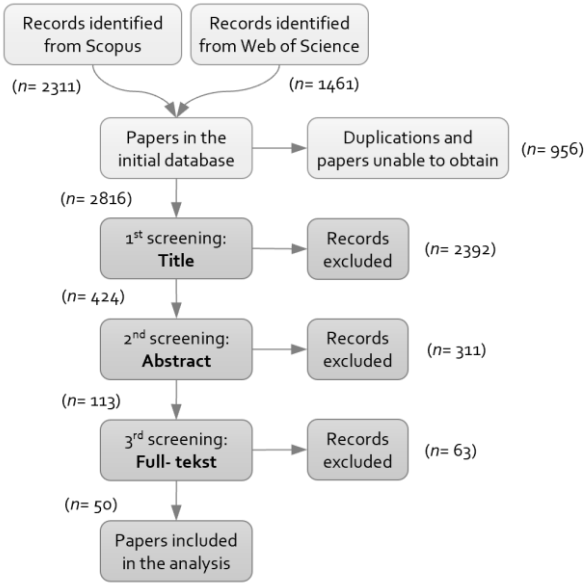
To establish the initial database of papers, the same search terms were used in both citation databases in December 2017 and later updated in April 2019. In both citation databases, each of the six search terms referring to interior office space was searched for in combination with each of the six search terms referring to health (see Fig. 6), resulting in 2816 papers forming the initial database (Fig. 7).

2.2.2 Study selection

The initial database was screened and reviewed in three phases (Fig. 7).

Figure 7

Overview of the screening process



In the first phase, reviewer A (I) scanned the titles to exclude the irrelevant papers. The second phase was undertaken by the same reviewer to further identify relevant and non-relevant papers based on the abstracts. In the third phase, the papers were categorized based on the identified office features. The initial categories were later developed to summarize the research results.

The full papers were divided among five reviewers (reviewers A–E) based on the abovementioned categories for independent review. This review phase was led and instructed by reviewers A and B. The engagement of multiple reviewers allowed to jointly decide whether a paper should be included or excluded, when needed. In each phase, all reviewers used the same eligibility criteria (presented in Table 1). Through this selection process, 50 papers were included.

Table 1

Inclusion and exclusion criteria used in the selection of papers

Inclusion criteria	Exclusion criteria
Setting: administrative office buildings or office floors	Setting: other environments, e.g. doctor's offices or factories
Empirical studies and systematic reviews	Theoretical papers, reviews of technology, position papers, etc.
Clear description of methods and measures	Data collection process or analysis not transparent
Dependent variable(s) including measures of actual or perceived physical, psychological or social wellbeing	Dependent variable(s) not directly measuring health, e.g. job satisfaction, motivation or productivity
Independent variable(s) including measures of actual or perceived interior space, comprising spatial characteristics and arrangements, lighting, surfaces, furniture and accessories	Independent variables not relating to interior space, but to, e.g., building construction, technical installations, facility services, behavioural interventions or technologies
Subjects being office workers in general, knowledge workers or clerical workers	Subjects being blue collar workers, special needs groups, elderly, etc.

2.2.3 Information extraction

A standardized template was developed and tested by reviewers A and B to extract the information from the papers. The template included six parts: (1) paper identification information; (2) used research strategy and methods; (3) data collection information; (4) information of the studied office environment; (5) independent and dependent variables regarding office and health; and (6) related results. In some papers, other dependent variables were also studied, but for this review, only results related to health and well-being were reported. All reviewers (A–E) used the same templates and the review process was instructed and managed by reviewers A and B. After the third phase, a quality appraisal was performed using the standardized forms developed by the Centre for Evidence-Based Management based on six types of research. The main conclusions of these appraisals were used, when needed, in the analysis phase.

2.2.4 Analysis strategy

The analysis was performed in two stages corresponding with the two research questions. First, content analysis was used to collect, group, and regroup the studied features of interior office space, following the instructions of Krippendorff (2004), Miles & Huberman (1994), and Tuomi and Sarajärvi (2012). The same process was followed for the studied health aspects. Second, the paper's findings of the relationship between interior office space and aspects of health and well-being were summarized, feature-wise and paper by paper. Based on this analysis, conclusions were drawn about the focus of the existing research on interior office space, and the resulting evidence for its relationship with employee health.

2.3 Results

2.3.1 Characteristics of the studies

The papers show that the relationship between interior office space and employee health is an upcoming research area; 40 of the 50 included papers were published within the past decade and 27 of them within the past five years. The vast majority of the studies were performed within one country, most of them in Europe. There are no clear differences in scope between the areas. The papers are scattered across the literature of different disciplines.

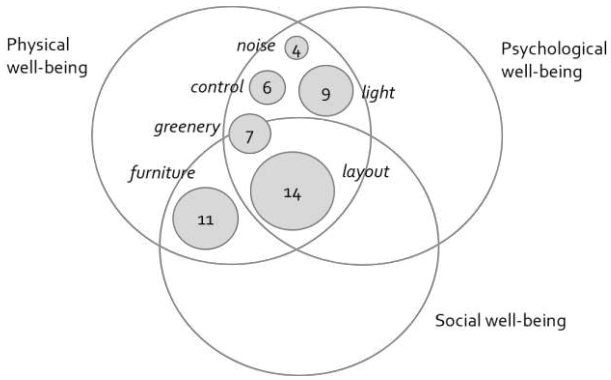
In most papers, it is unclear for which office type the data are collected: open-plan, cellular, or combination; and allocated workstations or flexible use. Most (39) of the papers concern field studies, eight are lab studies, one comprises both, and two are reviews. The two most frequently applied research designs are cross-sectional (15 papers), comparing groups at a single point in time, and controlled field studies (13 papers). The remaining studies are categorized as either prospective (pre- and post-test), longitudinal (one pre-test and at least two post-tests), or systematic literature reviews. The methods used vary widely, and not every paper reports effect sizes.

2.3.2 Identified features of interior office space

The most frequently studied features of interior space are layout and specific furniture, covering half of the included papers (Fig. 8). The other studied features concern light, greenery, control, and noise. Although the search strategy includes physical well-being, and social well-being, the studied features are predominantly related to physical aspects of health. In the next sections, the identified features of interior space in the reviewed papers are presented in detail followed by a summary analysis.

Figure 8

Number of papers on the identified features of interior office space and their association with health



2.3.3 Layout

Office layout refers to the physical office space and arrangement of objects within (Lee, 2010). The included papers studied office layout (Table 2) at two levels: (1) individual workspaces and their physical openness and size; and (2) arrangement of spaces within the office building. In these studies, the individual workspace is referred to as an office, room, cubicle, or bench.

Table 2

Papers addressing office layout and health

Paper	Studied interior space variable	Type of study (n) (response)	Major findings related to health and well-being
Jaakkola & Heinonen (1995)	Shared vs. single room	Cross-sectional (*n*=968) (resp.=71%)	Workers sharing rooms had more colds in the past 12 months than those in single rooms (OR 1.35, 95% CI 1.00-1.82).
Morrison & Macky (2017)	Own office, shared 2-3p, open-plan, other	Cross-sectional (*n*=1000) (recruited)	Employees in open-plan offices reported more negative interpersonal relations (p=.023), distrust (p=.010), and uncooperative behaviours (p=.003). Sharing an office with 1 or 2 others was best for co-worker friendships (p=.013).
Pejtersen et al. (2011)	Single room, shared 2-person, shared 3-6p., open-plan >6p.	Cross-sectional (*n*=2403) (resp.=62%)	Occupants in 2-person rooms reported 50%, those in 3–6 person rooms 36%, and those in open-plan offices 62% more days of sickness absence per year than occupants of single rooms (p<.001).
Pejtersen et al. (2006)	Single room, shared 2-person, shared 3-6p., open-plan 7-28p. or >28p.	Cross-sectional (*n*=2301) (resp.=72%)	In open-plan offices, occupants complained more about noise (60% vs. 6% in single rooms), cramped space (32/5%), unpleasant odour (17/7%), eye/nose/throat irritations (14-27/7-10%), headache (25/10%) and fatigue (21/8%) (all p<.001).
Bodin Danielsson et al. (2015)	7 types: single, shared room (2-3p), open-plan S/M/L, flex-, combi-office	Cross-sectional (*n*=5229) (resp.=57%)	Reported noise disturbance was much higher (p<.001) in open-plan offices (44%-60%) than in single offices (16%-20%) and shared rooms (33%). High effect sizes. Noise disturbances increased the occurrence of workplace conflicts but was only one explanatory factor.
Bodin Danielsson et al. (2014)	7 types: single, shared room (2-3p), open-plan S/M/L, flex-, combi-office	Prospective (*n*=1852) (resp.=57%)	Employees in traditional open-plan offices had elevated risks of short sick leave (OR 1.82, p<.01 to OR 1.92, p<.05) in comparison with those in single offices. Long sick leave was more common for men in flex-offices (OR 2.56, p<.05), and for women in large open-plan offices (OR 2.14, p<.05).

Note: resp. = response; CI= Confidence Interval; OR = Odds Ratio

Paper	Studied interior space variable	Type of study (*n*) (response)	Major findings related to health and well-being
Brennan et al. (2002)	Traditional vs. open offices	Longitudinal (*n*=21)	After relocating to the open office, the employees experienced more environmental stressors ($F(2,40)=25.06$, $p<.01$, $\eta^2=.56$) and were less satisfied with team member relations ($F(2,40)=11.74$, $p<.01$, $\eta^2=.37$). This did not change between 4 weeks and 6 months after the move.
Lindberg et al. (2018)	Workspace type	Longitudinal (*n*=231)	Mood sampling and heart rate recording during 3 days showed workers in open bench perceived 10% less stress (*B* -0.27, *95%CI* -0.54 to -0.02) than those in cubicles, but physiological stress did not differ. No differences between private room and open bench.
Haapakangas et al. (2018)	Open-plan vs. private rooms, # of quiet rooms	Prospective (*n*=129/206)	After relocation to open-plan offices, distraction (visual, noise, crowding, lack of speech privacy) was increased (*r* 0.47/0.58, *p*<.001); stress only increased in the office with few quiet rooms (*r* 0.28, *p*=.0006).
Meijer et al. (2009)	Duo-rooms vs. task-oriented office	Longitudinal (*n*=138)	The task-oriented office, including new chairs, had no or limited effects on work-related fatigue and health. In the long term, it had positive effects on perceived general health (62,0-65,9, *p*=.006) and musculoskeletal complaints (33-22%, *p*=.021).
Foley et al. (2016)	Activity-based working (ABW) vs. open-plan	Longitudinal (*n*=88/24)	The ABW environment reduced low back pain (OR 2.0, 95% CI 1.1-3.7, *p*<.01) and self-reported sedentary behaviour.
Duncan et al. (2015)	Spatial characteristics	Cross-sectional (*n*=5531) (resp.=12%)	In the open-plan office, the greater local connectivity and co-worker visibility were associated with more sedentary breaks and lower body-mass index (p<.001).
Engelen et al. (2017)	Floor space, desk types, distances, stair characteristics	Prospective (*n*=188)	In the new, 'active design' building (higher light level, lower noise level, larger distances to bathroom and kitchen, sit–stand desks available, open central staircase with daylight and views), the workers sat less, stood more, and reported less lower back pain (2.3-2.1, *p*=.036) than in the 14 former buildings.
Engelen et al. (2016)	Floor space, sit–stand desks, distances, stair characteristics	Prospective (*n*=34)	In the new buildings (same characteristics as above-mentioned), the workers sat less, stood more, and reported less lower back pain (2.5-1.7, *t*=-2.53, *p*<.01) than in the former four buildings.

Note: resp. = response; CI= Confidence Interval; OR = Odds Ratio

At the level of the individual workspace, the influence of layout is studied by comparing health measures of workers in two or more types of workspaces. As a main finding, these studies show differences between open-plan workspaces and smaller rooms, predominantly to the disadvantage of open-plan workspaces (Morrison & Macky, 2017; Pejtersen et al., 2006; Pejtersen et al., 2011); only cubicles are worse (Lindberg et al., 2018). Open-plan offices, variously defined, are associated with higher sick leave (Bodin Danielsson et al., 2014), lower levels of both physical and psychological well-being (e.g., Bodin Danielsson et al., 2015; Haapakangas et al., 2018), and deterioration of co-worker relations (Brennan et al., 2002). Duncan et al. (2015) and Engelen et al. (2016, 2017) find positive results for open-plan offices, but these are limited to physical well-being and related to less sitting time.

The activity-based working (ABW) environment is experienced more positively than open-plan or enclosed workspaces (Engelen et al., 2016; Foley et al., 2016; Meijer et al., 2009). Although these studies are limited by small samples and the absence of a control group, the findings are remarkable, because ABW also includes open-plan workspaces. Three longitudinal studies show that some effects occur only in the long term (Meijer et al., 2009), people do not get used to negative effects (Brennan et al., 2002), and positive effects disappear when moving back to the old situation (Foley et al., 2016).

Regarding 'size' of the workspace, which refers to the number of intended occupants or desks, four studies show that the larger the size, the more health complaints workers report. This is related to either bacterial contamination (Jaakkola & Heinonen, 1995) or stress caused by the presence of other people, such as noise (Bodin Danielsson et al., 2015; Pejtersen et al., 2006) and feeling cramped (Pejtersen et al., 2006).

At the level of the whole office building, the influence of layout is studied by collecting data from employees before and after they moved to a new office building designed to stimulate physical activity (Engelen et al., 2016, 2017). Stimulating features regarding layout included larger distances from workspace to communal facilities and a central position for the staircase. Combined with the other features of the new office, including furniture, light, and noise, the new layout is associated with less back pain. The decreased back pain could have resulted from the decreased sitting and increased standing time of the employees, which is found in both studies, although the authors do not statistically test this relationship. Since the employee's walking time does not change, it seems plausible that the decreased back pain was influenced by the new furniture rather than the new layout.

In summary, working in open workspaces with six or more occupants tends to have a negative relationship with well-being if there are no enclosed workspaces to divert to, as provided by ABW environments. The actual impact on physical health remains unclear, because these studies all rely on self-reporting.

2.3.4 Furniture

The reviewed papers analyze the health-supporting capacity of two types of furniture (see Table 3): (1) ergonomic furniture designed to fit the user's body or to stimulate alternating working postures, and thereby reduce musculoskeletal or visual discomfort while sitting (e.g., Robertson et al., 2013; Roossien et al., 2017; Van Niekerk et.al, 2012); and (2) activating furniture to stimulate physical activity or reduce sitting time (e.g., Carr et al., 2016; Graves et al., 2015).

Ergonomic, adjustable chairs reduce discomfort (Amick et al., 2012; Robertson et al., 2013; Van Niekerk et al., 2012), although this is not solely attributed to the use of the furniture, because it is often accompanied by ergonomics training. The provision of tactile feedback from smart chairs (Roossien et al., 2017) does not prove to be effective in decreasing discomfort or improving physical health.

Table 3

Papers addressing the impact of furniture on health and well-being

Paper	Studied office design variable	Type of study (*n*)	Major findings related to health and well-being
Karakolis & Callaghan, (2014)	Sit–stand desk	Systematic review(*n*=14)	Reduced trend in discomfort (e.g., at lower back) for sit–stand work compared with sit-only work. Alternating between sitting and standing may lead to higher wrist discomfort.
Robertson et al., (2013)	Sit–stand desk combined with training	Controlled lab study (*n*=22)	The trained group (with mandatory standing periods) had less visual and musculoskeletal symptoms than the minimally trained group (just a brief instruction, no mandatory standing).
Carr et al., (2016)	Long-term access to sit–stand desks	Cross-sectional (*n*=69)	Employees with sit–stand desks sat 66 min./day or less and stood 60 min./day or more. More walking time and steps taken is associated with less cardio-metabolic risk factors.
Graves et al., (2015)	Availability of sit–stand desk	Controlled field study (*n*=47)	Use of sit–stand desk decreased sitting and increased standing time, beneficial changes in blood pressure, no changes in musculoskeletal pain.
Healy et al., (2013)	Sit–stand desk accompanied by coaching	Controlled field study (*n*=43)	Sitting time decreased and standing time increased but no significant health outcomes except for blood glucose level, which improved within the intervention group. Moving time did not change.

Paper	Studied office design variable	Type of study (*n*)	Major findings related to health and well-being
Barbieri et al., (2017)	Non-automatic vs. semi-automatic sit–stand desk	Controlled field study (n=24)	Switches in table position from sit to stand were more frequent in the semi-automated table group, but the amount of time in the sitting position was the same during the two-month study period.
Torbeyns et al., (2016)	Bike desks	Controlled field study (*n*=38)	Fat percentage decreased (36.6% to 34.4%) among workers who had to use a bike desk. No significant changes in other health parameters like aerobic fitness, perceived musculoskeletal problems, or well-being (e.g., fatigue and relationship with colleagues).
Roossien et al., (2017)	Smart chair with/ without feedback signal	Longitudinal (n=45)	The feedback signal about sitting posture led to small or nonsignificant changes in sitting behaviour and local musculoskeletal discomfort.
Van Niekerk et al., (2012)	Adjustable chair	Systematic review (*n*=5)	Adjustable chairs with appropriate training hold the most promise in reducing musculoskeletal pain among workers who a must sit for prolonged periods.
Robertson et al., (2009)	Adjustable chair combined with ergonomics training	Controlled field study (n=216)	Ergonomics training with and without an adjustable chair led to lower musculoskeletal risk (and higher perceived control).
Amick et al., (2012)	Adjustable chair combined with ergonomics training	Controlled field study (*n*=184)	Workers who received a highly adjustable chair and office ergonomics training had reduced visual symptoms for at least 12 months. Training-only did not differ from the control group.
Grooten et al., (2017)	Dynamic chair (locked/unlocked) , conventional chair, standing desk	Controlled field (*n*=15) and lab study (*n*=13)	Field study: no differences in body movement and comfort between experimental conditions; task is more important. Lab study: use of the dynamic chair increased upper body and chair movements, but less than the standing desk.

Activating furniture is found to have few or mixed health effects despite reducing static sitting time. The furniture studied includes sit-stand workstations, being desks adjustable to the appropriate height to work seated or standing up, and a bike desk, which is a workstation with an exercise bike instead of an office chair. The experiments with this furniture show that their use leads to beneficial changes in blood pressure (Graves et al., 2015) and blood glucose level (Healy et al., 2013); other physical health parameters do not change. Results regarding musculoskeletal or visual comfort using this furniture are mixed: a positive relationship is found in two studies (Karakolis &

Callaghan, 2014; Robertson et al., 2013), and a negative in one (Karakolis & Callaghan, 2014), while in three studies (Graves et al., 2015; Healy et al., 2013; Torbeyns et al., 2016) there is no relationship found.

The relationship between the furniture intervention and participants' health is measured by changes in anthropometrics (Torbeyns et al., 2016), physiological parameters (e.g., Carr et al, 2016; Healy et al., 2013), or self-reported health (e.g., Grooten et al., 2017; Roossien et al., 2017). With the exception of Torbeyns et al. (2016), these studies do not address psychological or social well-being.

2.3.5 Light in the workspace

Both natural and artificial light in the office, spread through wall openings, translucent materials, and reflection on polished and light-coloured surfaces, result in a certain amount and quality of light in the individual workspace. The results of the papers on light are summarized in Table 4.

Table 4

Papers addressing the impact of light in the workspace on health and well-being

Paper	Studied office design variable	Type of study (*n*)	Major findings related to health and well-being
Thayer et al., (2010)	Light levels on work surface (among other elements)	Controlled field study (*n*=60)	The 40 participants working in the traditional office space (less light: 235 vs. 375 lux, less access to window views, poorer air quality, more low frequency noise) had higher physiological stress responses (heart rate variance and cortisol levels) than the 20 participants in the modern office space.
Lamb & Kwok, (2016)	Perceived light level (combined with noise and thermal comfort)	Cross-sectional (*n*= 114)	The most positive mood was reported in association with a comfortable (not inadequate or excessive) light level. The more environmental stressors workers perceived (light, noise, temperature), the greater the reported use of painkillers. Stressors negatively affect-ted mood and increased headaches and feeling 'off.'
Fostervold & Nersveen, (2008)	Direct vs. indirect lighting	Controlled field study (*n*=64)	Varying proportions of direct and indirect lighting did not affect perceived musculoskeletal or eye problems, mood, anxiety, or depression.
Joines et al., (2015)	Adjustable task lighting	Controlled field study (*n*=95)	Using the adjustable task lights had significant benefits for musculoskeletal and visual comfort. No negative results on health were found with adjustable task light use.

Paper	Studied office design variable	Type of study (*n*)	Major findings related to health and well-being
Veitch et al., (2008)	Lighting quality	Controlled lab studies (*n*=151/80)	Participants who perceived their office lighting as higher quality rated the space as more attractive. As a result they were in a more pleasurable mood and reported less overall discomfort.
Boubekri et al., (2014)	Workstations with or without windows	Cross-sectional (*n*=49)	Workers in workplaces with windows (where daylight was >2% of the outdoor illuminance) slept 46 min. more per night and reported better overall sleep quality and more vitality (+16%). No differences in self-reported physical or social function, bodily pain, or general health.
De Kort & Smolders, (2010)	Dynamic vs. static lighting	Controlled field study (*n*=83)	No significant differences between static and dynamic lighting in a monthly alternating scheme were found in perceived need for recovery, vitality, alertness, headache and eyestrain, mental health, or sleep quality.
Viola et al., (2008)	Blue-enriched white light vs. white light	Controlled field study (*n*=94)	Blue-enriched white lighting (17000K) had beneficial effects on daytime alertness, positive mood, eye discomfort, and night-time sleep quality and duration compared with white light (4000K). No effects on headache were found.

The papers on light show that adequate light levels and quality contribute to both physical well-being and better mood (Lamb & Kwok, 2016; Thayer et al., 2010; Veitch et al., 2008; Viola et al., 2008), but not to alertness (Van Duijnhoven et al., 2018). More daylight enhances sleep quality (Bjørnstad et al., 2016; Boubekri et al., 2014). Dynamic lighting with a variation of colour temperature during the day (de Kort & Smolders, 2010), and different proportions of direct and indirect light (Fostervold & Nersveen, 2008) do not impact health.

2.3.6 Greenery

In seven of the included papers, contact with nature is assumed to have beneficial effects on human beings, based on, for example, the air-cleaning ability of plants and studies of patient recovery. The studies related to this topic in offices are limited to views from the workspace on greenery, both real and artificial (Table 5).

Table 5

Papers addressing the impact of plants and nature views on health and well-being

Paper	Studied office design variable	Type of study (n)	Major findings related to health and well-being
Bjørnstad et al., (2016)	Amount of indoor/ outdoor nature contact	Cross-sectional (*n*=565)	More indoor nature contact in the primary workspace (plants or flowers, windows to the outdoors, sunlight, unobstructed views, nature elements in view) was associated with fewer subjective health complaints and sickness absence. Small effect sizes.
Fjeld (2014)	Open office with vs. without plants	Controlled field study (*n*=51)	Self-reported fatigue, cough, dry throat, and dry skin were lower in plant condition. There was no difference in headache, feeling heavy headed, nausea, irritated eyes or nose, or mental health.
Evensen et al., (2015)	Plants vs. comparable inanimate objects	Controlled lab study (*n*=85)	Environmental enrichment with either plants or objects at the computer workstation was observed to provide a restorative potential. Self-reported restoration was not affected by plants, objects, or window view.
Qin et al., (2014)	Plants: different sizes, colors and amount of scent	Controlled lab study (*n*=16)	Physiological measures (e.g., heart rate, EEG, skin resistance, blood flow, and saturation) showed little difference. Participants preferred offices with plants, especially green, slightly scented, and small plants.
Kahn et al., (2008)	Nature views through glass or plasma window vs. blank wall	Controlled lab study (*n*=90)	Nature view through glass window: more rapid heart rate recovery (restoration) from low level physical stress. Plasma window was not more restorative than blank wall.
Xue et al., (2016)	Nature views	Cross-sectional (*n*=413)	There are no differences in health concerns between workers with and without visual connections from the workstation to outdoor green space.
Kweon et al., (2008)	Posters abstract art and/or nature posters	Controlled lab study (*n*=210)	Increased proportions of nature paintings decreased state-anger because of decreased stress levels.

The presence of both real and artificial greenery shows mixed results, but none of them are negative. Regarding real plants in the workspace, field studies find a positive influence on health (Bjørnstad et al., 2016; Fjeld, 2000) but lab studies do not (Evensen et al., 2015; Qin et al., 2014). For real outdoor nature views, two studies find positive (Bjørnstad et al., 2016; Kahn et al., 2008) and one study find no health benefits (Xue et al., 2016). In lab studies testing the health effect of artificial nature views, a positive effect is found for nature posters (Kweon et al., 2008); nature views on a plasma display

window have no health effect (Kahn et al., 2008). Overall, the reviewed papers provide only limited evidence that greenery in the workspace has a positive impact on health and no evidence that greenery has a negative impact on health.

2.3.7 Individual control

The research on interior space and health extends to tangible options for office workers to control their physical work environment (Table 6).

Table 6

Papers addressing the impact of individual control on health and well-being

Paper	Studied office design variable	Type of study (*n*)	Major findings related to health and well-being
Wells, (2000)	Office personalization	Cross-sectional (*n*=338)	Indirect relation between personalization and employee well-being (via satisfaction with physical work environment and job satisfaction). Women personalized more than men and for different reasons.
Knight & Haslam, (2010)	Managerial control of office space	Cross-sectional (*n*=288, *n*=1643)	Both studies indicated that managerial control of space (lack of both involvement in layout changes and personal control of temperature for the worker) was moderately associated with feelings of physical and psychological discomfort in the office.
Bluyssen et al., (2011)	Control of lighting, noise, shading from the sun, ventilation, temperature	Cross-sectional (*n*=5732)	Perceived amount of control was positively associated with the level of overall comfort. Control of the sun shading has a stronger relation with comfort than control of noise, ventilation, or temperature.
Toftum, (2010)	Opening windows (control of ventilation)	Cross-sectional (*n*=1272)	In the buildings with opening windows, occupants reported more opportunities for control. The degree of perceived control was observed to have a greater influence on building-related symptoms than ventilation mode (natural or mechanical) per se.
Boerstra et al., (2015)	Personal desk fan controlled by self or other	Controlled lab study (n=23)	In the self-control condition (preferred by the subjects), perceived control of temperature, air movement, ventilation, light, and noise was higher. No differences in thermal comfort and intensity of sick building symptoms was observed.

Two types of control are addressed: (1) the possibility of adjusting the conditions of the workspace (Bluyssen et al., 2011; Boerstra et al., 2015; Joines et al., 2015; Knight & Haslam, 2010; Toftum, 2010), and (2) personalization of the workstation (Wells, 2000). Both control types are found to have a positive relationship with psychological well-being, and to a lesser extent, physical well-being.

The findings also show that actual control of one aspect of the environment leads to perceived control of other aspects (Boerstra et al., 2015; Toftum, 2010). The studies on individual control emphasize physical well-being, although perceived control is an important psychological factor in reducing stress (Spector & Jex, 1998). Due to the small number of studies, their mostly cross-sectional design, and mixed results, this review cannot present strong evidence that the control types investigated enhance health.

2.3.8 Office noise

The characteristics of the interior office space, including spatial arrangements, room dimensions, and finishing materials, influence noise by absorption or reflection of sound waves. In this review, only papers that present measurements using acoustic parameters are included, since (dis)satisfaction with noise does not tell how the noise is related to the characteristics of interior space (Table 7).

Table 7

Papers addressing the impact of noise on health and well-being

Paper	Studied office design variable	Type of study (n)	Major findings related to health and well-being
Jahncke et al., (2011)	Sound level, high vs. low	Controlled lab study (n=47)	More tiredness (yawning) experienced in high 'noise' condition (51 dBA) vs. low noise condition (12 to 39 dBA). No reliable noise effects on stress hormone levels.
Schlittmeier & Liebl, (2015)	Sound level and speech intelligibility	Controlled lab study (n=74)	Perceived disturbance and annoyance were lower if background sound level and speech intelligibility were diminished. Background sound (35/55dBA) was significantly more disturbing than 'silence' (25 dBA).
Seddigh et al., (2015)	Sound absorption (baseline/better/ worse)	Controlled field study (n=117)	Perceived disturbances and cognitive stress in the open-plan office were lower in the condition with enhanced acoustical conditions (more absorbing ceiling tiles and wall panels).

The reviewed papers indicate that high levels of background noise and speech intelligibility in the workplace negatively affect both physical and psychological well-being. A higher sound level causes higher self-rated fatigue (Jahncke et al., 2011), disturbance, and annoyance (Schlittmeier & Liebl, 2015). Shafiee Motlagh et al. (2018) find that a higher sound level slightly increases physiological stress, but Jahncke et al. (2011), using other indicators for physiological stress (see Table 7), do not find this effect.

Sound absorption lowering the sound level from 47 to 45 dB decreases perceived disturbance and stress (Seddigh et al., 2015). Schlittmeier and Liebl (2015) indicate that lowering the sound level might not solve noise problems; instead, it is the combination of a high sound level and high speech intelligibility that causes disturbance.

The four papers addressing noise indicate that acoustic qualities of office space affect health (Jahncke et al., 2011; Schlittmeier & Liebl, 2015; Seddigh et al., 2015; Shafiee Motlagh et al., 2018). However, only one of the papers explicitly analyzes the relationship between health, actual acoustics, and the design components of the office space.

2.3.9 Summary analysis

Table 8 (following pages) summarizes the features of interior office space studied in the reviewed papers, and the relationships of these features with employees' physical, psychological, and social well-being.

Table 8

Summary of the associations between interior office space and health

		Physical well-being													Psychological well-being						Social well-being	
		sickness absence	physiological stress indicators	cardio-metabolic risk factors / fat	musculoskeletal issues	skin / eye / nose / throat irritation	tiredness / fatigue / alertness	headache / nausea / dizziness	visual comfort	thermal comfort	unpleasant odour	overall comfort	sleep quality / duration	self-rated health / vitality	perceived stress	mood / depression / anxiety	general annoyance / anger	noise annoyance / disturbances	crowding / privacy	interpersonal relations	perceived organizational support
Layout	***Workspace openness/size***																				
	Shared vs. single room [1, 2, 3]	–				–														+	
	Open-plan [2, 4, 5, 6, 7, 8, 9]	–		+		–	–	–	–		–				–			–	–	–	
	Activity-based (mix) [10, 11]				+		0							±							
	Open bench vs. cubicle [12]		0												+						
	Open bench vs. private [12]		0												0						
	Distance to facilities																				
	Toilet/kitchen [13, 14]			+	(+)																
Furniture	***Activating desks***																				
	Sit-stand desk [15, 16, 17, 18, 19, 20]			+/0	+/-				+			0		0							
	Bike desk [21]			+	0		0													0	
	Ergonomic chairs																				
	Feedback chair [22]				0																
	Adjustable chair [20, 23, 24, 25]				(+)				(+)			0									

Note: + better health; – worse health; 0 no relation; () result in combination with other design features; dark cells: result of > 1 study

		Physical well-being												Psychological well-being					Social well-being	
		sickness absence	physiological stress indicators	cardio-metabolic risk factors / fat	musculoskeletal issues	skin / eye / nose / throat irritation	tiredness / fatigue / alertness	headache / nausea / dizziness	visual comfort	thermal comfort	unpleasant odour	overall comfort	sleep quality / duration	self-rated health / vitality	perceived stress	mood / depression / anxiety	general annoyance / anger	noise annoyance / disturbances	crowding / privacy	interpersonal relations	perceived organizational support
Light	***Natural light***																				
	Amount of daylight [26, 27]	(+)											+	+		(+)					
	Electrical lighting																				
	Light level/quality [13, 14, 28, 29, 30, 31]		(+)		(+)		0	(+)				+				+					
	Dynamic lighting [32]							0	0				0	0		0					
	Indirect lighting [33]				0				0							0					
	Blue-enriched light [34]							0	+				+			+					
Greenery	***Real nature***																				
	Plants [26, 35, 36, 37]	(+)	+/0			+/0	+	0				+	(+)	+		(+)					(+)
	Outdoor nature views [26, 40]		+											(+)		(+)				(+)	
	Artificial nature																				
	Artificial nature views [38, 39]		0												+		+				
Control	***Options for adjustment***																				
	Climate controls [41, 42, 43, 44]					+/0	+/0	+/0		+		+		+							
	Adjustable task lighting [46]				+				+					0							
	Identity marking																				
	Personalization [45]													+		+					

Note: + better health; – worse health; 0 no relation; () result in combination with other design features; dark cells: result of > 1 study

			Physical well-being													Psychological well-being					Social well-being	
		sickness absence	physiological stress indicators	cardio-metabolic risk factors / fat	musculoskeletal issues	skin / eye / nose / throat irritation	tiredness / fatigue / alertness	headache / nausea / dizziness	visual comfort	thermal comfort	unpleasant odour	overall comfort	sleep quality / duration	self-rated health / vitality	perceived stress	mood / depression / anxiety	general annoyance / anger	noise annoyance / disturbances	crowding / privacy	interpersonal relations	perceived organizational support
Noise	Background noise level [13, 14, 47, 48, 49]		[0]/-		(–)		–											–				
	Speech intelligibility [48, 49]		0															+				
	Sound absorption [50]														+			+				

Note: + better health; – worse health; 0 no relation; () result in combination with other design features; dark cells: result of > 1 study

References

[1] Jaakola & Heinonen (1995); [2] Morrison & Macky (2017); [3] Pejtersen et al. (2011); [4] Bodin Danielsson et al. (2014); [5] Bodin Danielsson et al. (2015); [6] Brennan et al. (2002); [7] Pejtersen et al. (2006); [8] Duncan et al. (2015); 9 Haapakangas et al. (2018) [10] Meijer et al. (2009); [11] Foley et al. (2016); [12] Lindberg et al. (2018); [13] Engelen et al. (2017); [14] Engelen et al. (2016); [15] Karakolis & Callaghan (2014); [16] Robertson et al. (2013); [17] Carr et al. (2016); [18] Graves et al. (2015); [19] Healy et al. (2013); [20] Grooten et al. (2017); [21] Torbeyns et al. (2016); [22] Roossien et al. (2017); [23] Van Niekerk et al. (2012); [24] Robertson et al. (2009); [25] Amick et al. (2012); [26] Bjørnstad et al. (2016); [27] Boubekri et al. (2014); [28] Van Duinhoven et al. (2018); [29] Thayer et al. (2010); [30] Lamb & Kwok (2016); [31] Veitch et al. (2008); [32] De Kort & Smolders (2010); [33] Fostervold & Nersveen; [34] Viola et al. (2008); [35] Fjeld (2000); [36] Evensen et al. (2015); [37] Qin et al. (2014); [38] Kahn et al. (2008); [39] Kweon et al. (2008); [40] Xue et al. (2016); [41] Toftum (2010); [42] Boerstra et al. (2015); [43] Bluyssen et al. (2011); 44 Knight & Haslam (2010); [45] Wells (2000); [46] Joines et al. (2015); [47] Jahncke et al. (2011); [48] Schlittmeijer & Liebl (2015); [49] Shafiee Motlagh et al. (2018); [50] Seddigh et al. (2015).

The findings of the relationship between interior office space and health are threefold. First, as Table 8 shows, open-plan offices, shared rooms, and higher background noise are the only features found to negatively affect health. Second, the other features analyzed in the papers more often improve health than do nothing for health. Third, positive relationships with health are reported for all features of interior space. Features that encourage physical activity, including sit–stand and bike desks, and increased distances to communal facilities, are found to have a positive relationship with physical well-being. Similarly, the increase of (day)light and individual control and the presence of plants and outdoor views show positive results for both physical and psychological well-being. Small shared rooms support social well-being.

Furthermore, Table 8 shows that interior office space is analyzed rather as the individual workspace (openness, size, furniture, light levels, and acoustics) than the wider interior space (e.g., meeting areas, staircases, or the arrangement of workspaces and workstations). Within the individual workspace, both spatial characteristics (e.g., openness, size, and distances) and presence of objects (e.g., furniture, plants, controls, and acoustic tiles) are measured, forming the designer's palette, as well as the qualities resulting from the design (light, views, perceived control, and noise). The features of interior space are often either studied in relative isolation (only 7 of the 50 papers cover more than one of the features in the left column) or all at once without analyzing their mutual relationship or ranking their influence on health.

Regarding health, Table 8 shows that the studies emphasize physical health symptoms, and pay less attention to psychological and especially social well-being. In addition, psychological well-being is measured in a more general way (mood, general annoyance, and stress) than physical well-being ('how is your back/wrist/head/nose/throat/sleep?'), while the measures for social well-being are not yet mature. The studies predominantly focus on ways to prevent and reduce health problems, such as ergonomic furniture to reduce discomfort, better lighting to reduce headaches, and sound absorption to reduce annoyance, and pay less notice to features that may enhance health, for example, real and artificial daylight to increase night sleep, nature contact as a means to recover from stress, and personalization as a means to enhance well-being.

2.4 Discussion and Conclusion

2.4.1 Strengths and limitations

This study brings together the empirical research on the relationship between interior office space and employee health and well-being published in the past 26 years. The strengths of this review are its wide scope and systematic approach to the collection and screening of the literature. Its limitations include its restriction to peer-reviewed journal papers in two databases. Future research should expand the scope to cover other types of publications, such as doctoral dissertations and scientific reports, as well as the use of more specific databases, such as PsycINFO and PubMed.

2.4.2 Implications

As a practical implication, the study provides support for workplace managers, interior designers, architects, and corporate real estate managers, for instance, as input for verbalizing and testing assumptions about the expected effect of a design. As Haddad (2014, p.284) states: 'Every design is a hypothesis but unlike scientific research the design hypotheses are rarely expressed in projects.' Although the studies surveyed in the literature review overall lack the numbers, consistency, and robustness to draw firm conclusions, they provide some directions for achieving health-supporting interior space.

First, it seems that open-plan offices should be avoided, although it is not yet clear to what extent the number of occupants, spatial density, and openness are related to health complaints. Furthermore, to support employee health, interior office space preferably should feature sit-stand desks, plants, and sufficient (day)light. Providing employees with sit-stand desks has been shown to have a positive impact on employees' physical well-being.

Although the positive health impact of viewing plants and nature in the workplace needs confirmation in large field experiments, thus far, the research shows that employees appreciate plants and feel better around them (Fjeld, 2000; Smith & Pitt, 2009). The positive influence of greenery and daylight is consistent with studies on biophilic design (Gillis & Gatersleben, 2015) and green space (Gilchrist et al., 2015). Above all, this review contributes to the debate on healthy offices by strengthening the evidence-based discussion.

For scientific scholars, this study contributes to a collective basis for research on interior office space to form a more united and mature research domain. The review brings together examples from different disciplines on useful research designs and instruments. It serves as a comprehensive reference source for further research in the area and provides a basis for a common language between disciplines, which helps

research on the work environment to develop as a multi-disciplinary field, as proposed by Appel-Meulenbroek et al. (2018).

2.4.3 Recommendations for future research

First, future research should aim to deepen understanding of the relationship between interior office space and employee well-being. One open-ended question is what combination of conditions causes negative experience of open-plan offices. Based on the work of Wohlers and Hertel (2017), future research could investigate how a well-designed ABW environment could minimize health risks and maximize health benefits. Regarding the impact of noise, future research should measure objective as well as subjective noise, and connect this to design features reducing actual noise, such as sound-absorbing wall and floor finishes and partitions and options for controlling or escaping noise.

In addition to the purpose of reducing office workers' stress, future research on interior office space should address positive design, strategies to enhance their well-being by facilitating restoration, relatedness, and health-supporting behavior. After all, several features of interior space have been shown to affect social interaction and relationships (Khazanchi et al., 2018; Sailer & McCulloh, 2012), and the presence of natural elements contributes to recovery from stress (Gillis & Gatersleben, 2015). Creating obvious, easy, and attractive opportunities for physical activity, relaxation, and positive social interaction may stimulate desired behaviour through 'nudging' (Thaler & Sunstein, 2008). In the included papers, this was limited to furniture and walking distances, but there may be other features that also nudge health-related behaviour, for instance, attractive staircases (Swenson & Siegel, 2013), visual communication (Kwak et al., 2007,) and the placement of food and drinks (Arno & Thomas, 2016; Kroese et al., 2016). For an effective application of nudges, more research is needed on the long-term effects and the conditions for lasting habits (Lally et al., 2010).

2.4.4 Conclusion

This research identified a lack of strong evidence in the literature on the relationship between interior office space and individuals' well-being, specifically psychological and social well-being. The features studied include layout, furniture, light, greenery, individual control, and noise. Future research not only should expand on the features of interior space and health aspects, but also should aim to develop a collective vocabulary, increase methodological strength, and work toward holistic models. Developing taxonomies for interior space in offices and psychological and social well-being could contribute to transdisciplinary collaboration and progress of the field. Wider use of observational and physiological measures, validated self-report measures, and longitudinal designs would add to the rigour. Including more moderating and

mediating variables, and performing multivariate and multilevel analyses could yield insights into the complex interaction of people and the environment. This would help office space research to mature and contribute to a more solid foundation for evidence-based design of healthy offices.

CHAPTER 3

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3 DESIGN STRATEGIES FOR WELL-BEING AT WORK

The previous chapter showed that workplace design is capable of impacting workers' well-being in several ways. The literature study reported in the current chapter identifies goal-oriented design approaches to support workers' well-being, recommended design solutions, and examples of effectiveness measures. Grounded in different disciplines, the strategies phrased in this chapter draw multiple perspectives on workplace design for well-being and offer practitioners and researchers a source of approaches. The study also shows how promoting social well-being by design relates to other strategies for healthy workplaces.

The chapter starts with an introduction to healthy workplaces and strategic workplace design. Subsequently, it explains how in this study, 59 papers were selected from the database that was created from the literature search in the previous study (see Section 2.2.1). Through content analysis, the papers were grouped in several manners to reveal four distinctive strategies in two main approaches: pathogenic and salutogenic design. The chapter closes with a discussion of possibilities to further develop these strategies and discover additional ones.

3.1 Introduction

A growing body of research is suggesting that workplace design is essential to a successful execution of business strategy (Chan et al., 2007) and to organisational performance (Van de Voorde et al., 2012). The awareness of the possible health-impact of building interiors has grown in recent years (Hanc et al., 2019; Jensen and Van der Voordt, 2020; World Green Building Council, 2014), and has become even more urgent during the Covid-19 pandemic (Cirrincione et al., 2020). Yet, a workplace is a complex composition of many different and sometimes conflicting elements. For example, measures to prevent virus spread could be at odds with acoustical comfort due to easy-to-clean yet sound-reflecting surfaces, or they could interfere with relatedness due to physical distancing that separates colleagues.

Creating healthy work environments, therefore, requires a wide view on potential health hazards and invigorators. Nevertheless, researchers and practitioners can have a blind spot for workplace factors that are not in the usual scope of their own discipline. For instance, in the field of organizational behaviour the influence of physical work environment has long been ignored (Ayoko & Ashkanasy, 2020a) and in facilities and real estate management the research on health and well-being is fairly limited (Jensen and Van der Voordt, 2020). Therefore, the aim of this chapter is to draw different

perspectives on healthy workplaces and provide leads for strategic and evidence-based workplace design, and transdisciplinary workplace research.

3.1.1 Workplace and health

Workplace can refer to the physical or the psychosocial work environment to the perspective of the organisation or the individual user, differing from one sector to another. In the first place, this study focuses on the physical work environment from the perspective of interior design. Interior design directly connects humans and space. It includes form, finish and spatial arrangement of design attributes such as spatial partitions and transitions, furnishings, lighting fixtures and sources, sound isolation, finish materials, accessories, and technologies relating to space (Ching & Binggeli, 2018). It reaches beyond decoration and includes spatial (architectural) elements, but it excludes building construction and engineering. The interior design usually is changed more easily and more frequently than the structural design or air-conditioning layout.

Secondly, as well-being can be considered a primarily individual benefit of healthy workplaces (Jensen and Van der Voordt, 2020), this study refers to the workplace as perceived by the individual user. Finally, this study focuses on office workplaces because office workers are the largest occupational group (U.S. Bureau of Labor Statistics, 2020) and offices are relatively comparable workplaces.

Regarding healthy workplaces, traditionally the emphasis has been on physical health, for instance as a consequence of air quality in office buildings. Polluted air has been identified as health hazard since the times of the Greek and Roman empires. The sick building syndrome that emerged in the 1980's associated physical complaints of office workers with, for instance, mould and toxic emissions of building materials and machines. However, already in 1948 the World Health Organization (WHO) defined health as 'a complete state of physical, psychological and social well-being' (WHO, 2006), uniting medicine and social science and equating health to well-being. More recently, an even wider perspective is advocated, including the dynamic ability to adapt and to manage one's own well-being (Huber et al., 2011). Designing a healthy workplace can thus have different starting points depending on the health perspective. This study followed the widely accepted WHO definition of health.

3.1.2 Strategic design

Strategic workplace design aligns the design of the work environment with long-term goals of the organisation, and might even be used to meet new challenges or create new possibilities (Chan et al., 2007). For example, if a company wants to increase productivity or innovation, it may decide that to achieve this goal the work environment should support employee health as much as possible, believing that healthy workers are more productive and creative. This strategy may include specific

health objectives and the use of design solutions that have shown to improve these health aspects directly or by stimulating healthy behaviour.

Since health has many faces, ideally, the responsible departments of the organisation work together to envision and create an optimal workplace. Then they would brief the workplace designer with desired health effects of the new work environment, and evaluate results to keep improving and responding to organizational changes, while the designer makes design decisions based on the best available evidence. In addition, researchers from different disciplines ideally work together to increase understanding of the relationship between workplace design and health. However, this is not common practice yet. Apart from segregation between disciplines, another complicating factor is that current research on well-being in office buildings often lacks clarity of design objectives and well-being conceptualizations (Engelen et al., 2019; Forooraghi et al., 2020; Hanc et al., 2019).

More explicit design strategies including well-chosen design solutions can direct workplace design and research towards desired health effects and support organisational goals. Furthermore, examples of scientific outcome measures show how to systematically test assumptions regarding effects of the applied design, thereby building up evidence to inform future design. Therefore, this study aims to contribute to a transdisciplinary and evidence-based approach of workplace design and design research by answering the following research questions (RQs):

RQ1. Which interior design strategies including evidence-based design solutions can be identified based upon scientific research on the relationship between workplace design and health?
RQ2. How can the effectiveness of these interior design strategies be measured?

3.2 Method

An existing database from a literature review that synthesized results on the impact of interior office space on employee health (Colenberg et al., 2021 – see Chapter 2) was used to identify the interior strategies. The database offered a way to include a broad sample of empirical workplace research and evidence-based workplace research for a semi-systematic literature review. According to Snyder (2019), semi-systematic literature reviews synthesize topics that are studied by various groups of researchers and contribute in understanding relevant research traditions.

The database was created by a systematic and transparent search procedure, which included entering every combination of six design-related and six health-related search terms into Scopus and Web of Science (see Fig. 6 in Chapter 2).

By using general terms for office space and occupational health rather than specific design elements or health complaints, finding studies from different disciplines was supported. The database contained 2816 papers that were published in peer-reviewed journals between 1995 and 2018. From the existing database, we extracted 59 papers using the following inclusion criteria:

- studying interior design (as defined by Ching and Binggeli, 2018) of an office environment,
- measuring health (as defined by the WHO, 2006) or healthy behaviour, reporting a clear and systematic research method,
- and written in English.

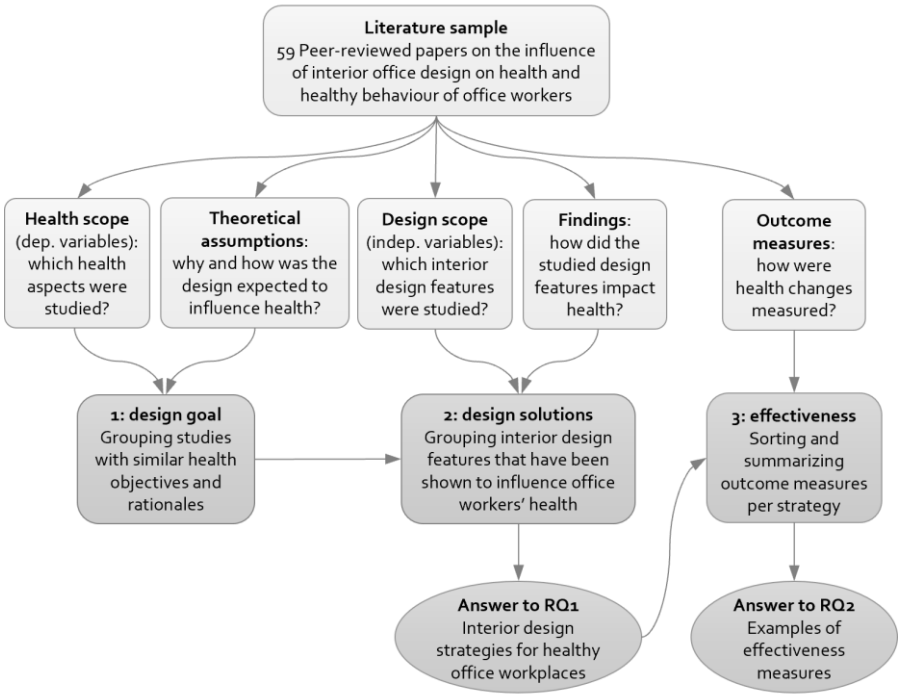
Based on these criteria, we excluded papers on employee health that did not relate indoor conditions to interior design features. After subsequently screening title, abstract and full-text, we included 59 research and review papers for analysis.

From each paper in the sample, we first extracted the data on study approach and outcomes (Fig. 9) using a template created for this purpose. Next, we applied qualitative content analysis using descriptive and concept coding (Miles et al., 2020). We first grouped papers with a similar health aim and subsequently grouped them by design scope. Studying theoretical assumptions and rationales per health group revealed implicit design goals. Based on the reported findings per design subgroup, we identified which design solutions could help to achieve which goal.

By combining these possible goals and solutions that emerged from the papers we distinguished different interior design strategies. Outcome measures that were applied in each group served as examples of how to determine the strategy's effectiveness. We divided these into self-report measures of perceived well-being and objective measures of actual health and behaviour.

Figure 9

Approach of the literature review to identify interior design strategies for healthy office workplaces and measures of effectiveness



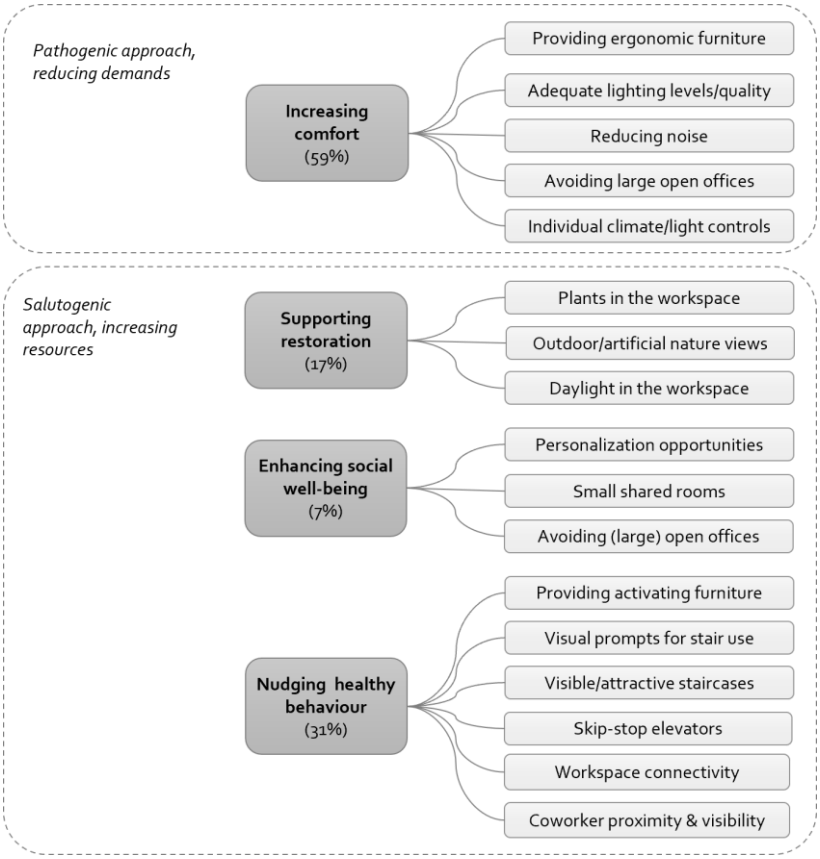
3.3 Results

We identified four design strategies for healthy office workplaces, aiming at office workers' comfort, restoration and social well-being, and stimulating healthy behaviour (see Fig. 10, next page).

The presented design strategies are not mutually exclusive; some papers included elements of different strategies. The most dominant strategy in the considered time-span (59% of the included papers, see Fig. 10) focuses on reducing environmental demands and decreasing harm and health risk, which refers to a pathogenic approach. The other three take a salutogenic approach (Antonovsky, 1996), aiming for renewal and increase of resources for coping with demands in the workplace. They relate to positive design that is explicitly intended to support human flourishing by, for instance, generating pleasure, personal significance and virtue (Desmet & Pohlmeyer, 2013).

Figure 10

Identified design strategies (% of the included papers) for healthy office workplaces including examples of evidence-based interior design solutions



3.3.1 Design for comfort

The most prominent strategy emerging from the selected papers aims to create a comfortable environment that protects users of physical and mental harm and stress. It has the longest tradition and can be considered the foundation of healthy workplaces, rooted in disciplines such as occupational health and safety, health psychology, ergonomics, building technology and medical science.

The majority of the selected papers in this review was predominantly directed towards the office worker's physical or psychological comfort. They frame the research within knowledge on medical conditions such as cardiovascular diseases and musculoskeletal issues, or take the psychological stress perspective: support of employee functioning (Vischer, 2008), the balance between environmental resources and demands (Demerouti et al., 2001), and privacy theory (Altman, 1975).

Ten papers investigated the health risks of different office types, comparing physical health conditions, environmental stress, mood, or sickness absence between occupants of workspaces varying in architectural openness and number of workstations (Bodin Danielsson et al., 2014, 2015; Jaakkola & Heinonen, 1995; Lindberg et al., 2018; Pejtersen et al., 2006; Pejtersen et al., 2011), or before and after implementation of a different office concept (Brennan et al., 2002; Foley et al., 2016; Haapakangas et al., 2018; Meijer et al., 2009). These studies showed that workspaces for a larger number of people were related to increased health complaints and distractions, especially in open-plan offices without the backup spaces provided by an activity-based working concept.

Seven studies aimed at reduction of musculoskeletal discomfort by providing ergonomic furniture designed to fit the user's body (Amick et al., 2012; Robertson et al., 2009; Van Niekerk et al., 2012) or stimulating alternating working positions (Grooten et al., 2017; Karakolis and Callaghan, 2014; Robertson et al., 2013; Roossien et al., 2017). Adjustable chairs were found to reduce discomfort, although it was not clear how much of this could be attributed to accompanying trainings. A smart chair and sit-stand desks showed mixed results regarding physical comfort.

Eight studies aimed at increasing visual or eye comfort, reducing physiological stress or headaches, or improving mood and alertness by more light on the work surface (Lamb & Kwok, 2016; Thayer et al., 2010; Van Duijnhoven et al., 2018), applying different lighting concepts or systems (de Kort & Smolders, 2010; Fostervold & Nersveen, 2008; Joines et al., 2015; Viola et al., 2008), or increasing perceived lighting quality (Veitch et al., 2008). Their findings indicate that adequate light levels and quality improve physical well-being and mood, but do not affect alertness.

A well-known source of discomfort and stress in offices is noise. A high level of background noise was found to increase physiological stress, yawning and psychological discomfort (Jahncke et al., 2011; Lamb & Kwok, 2016; Schlittmeier & Liebl, 2015; Shafiee Motlagh et al., 2018; Thayer et al., 2010). Better sound absorption was related to a lower level of perceived disturbances and cognitive stress (Seddigh et al., 2015).

Increasing comfort by offering possibilities to control indoor climate, for example by being able to open a window, temperature or lighting in the workspace, had mixed results. Self-control was preferred by office workers although actual effects on musculoskeletal, visual or overall comfort, or on headaches varied (Bluyssen et al., 2011; Boerstra et al., 2015; Knight & Haslam, 2010; Toftum, 2010). None of the included papers connected interior design to indoor air quality and health, although it was argued that building materials and plants could influence air quality (Fjeld, 2000).

3.3.2 Design for restoration

A second design strategy for healthy workplaces aims at providing a restorative work environment that supports recovery from physical and mental strain, grounded in environmental psychology and human biology. This strategy takes a step forward from minimising stressors and misfits. It aims at supporting recovery by implementing principles of biophilic design (Kellert, 2008) to create beneficial connections with nature. Papers in this category refer to Attention Restoration Theory (Kaplan, 1995), Stress Recovery Theory (Ulrich et al., 1991), and the biophilia hypothesis of Wilson (1984).

Seven studies relating to this strategy assessed the influence on fatigue and physiological stress of plants in the workspace (Bjørnstad et al., 2016; Evensen et al., 2015; Fjeld, 2000; Qin et al., 2014) and of real or artificial outdoor nature views (Bjørnstad et al., 2016; Kahn et al., 2008; Kweon et al., 2008; Xue et al., 2016). Most of these studies were lab experiments. The results varied from positive health effects to no effect at all, but at least the participants enjoyed the greenery. Other studies, including cross-sectional research designs and field experiments, focused on improving vitality, alertness and sleep quality through increased daylight in the workspace (Bjørnstad et al., 2016; Boubekri et al., 2014) or mimicry of daylight (de Kort & Smolders, 2010; Viola et al., 2008), also with either little or positive results for well-being.

3.3.3 Design for social well-being

A less explicit design strategy emerging from the selected papers aims at supporting social relationships at work and expression of identity, and is grounded in social, organisational and environmental psychology. This strategy differs from the other three by focusing at the outer-directed dimension of well-being that depends on interactions with other people (Fisher, 2014). Studies within this strategy refer to theory on personalization of space (Sommer, 1974), territoriality (Brown et al., 2005), and regulation of social interactions (Altman, 1975), and to the Job Demands-Resources Theory (Demerouti et al., 2001) in which social support serves as a buffer against burnout.

Morrison and Macky (2017) investigated a wide array of social demands and resources in the office and found that small shared rooms are best for friendships at work and that large open-plan offices undermine cooperative behaviour and trust, and increase negative interpersonal relationships. Wells (2000) studied workspace personalization as a means of increasing well-being. She found that allowance for personalization and the actual display of objects indeed were related to better well-being, mediated by satisfaction with the physical work environment and job satisfaction. Others addressed conflicts or satisfaction with team relations in studies on the effects of office type (Bodin Danielsson et al., 2015; Brennan et al., 2002) or furniture use (Torbeyns et al., 2016), finding that open-plan offices were negatively associated with quality of relationships at work.

3.3.4 Design for healthy behaviour

The fourth and relatively young strategy emerging from the selected papers aims to stimulate health supporting behaviour, namely physical activity at work. These studies are framed by medical risks of prolonged sitting and theory on behavioural motivation and habits (Aarts & Dijksterhuis, 2000), and implicitly lean on the concept of nudging (Thaler & Sunstein, 2008) that comes from behavioural economics and consumer psychology. Currently, nudging is often promoted as a seemingly easy and possibly effective means to influence human behaviour and there are several ways to apply it in the physical work environment (Venema & van Gestel, 2021).

The studies within this design strategy all targeted the employees' sedentary behaviour or amount of walking in the office. Among furniture offered to decrease sitting time (Barbieri et al., 2017; Carr et al., 2016; Graves et al., 2015; Healy et al., 2013; Torbeyns et al., 2016), sit-stand desks generally reduced sitting and increased standing time (while they were less effective in reducing discomfort, as explained before). Having more sedentary breaks was related to greater local connectivity (available routes) and co-worker proximity and visibility (Duncan et al., 2015; Wilkerson et al., 2018). After relocating to an activity-based working environment, office workers sat less than before (Foley et al., 2016). An attractive and accessible staircase, as well as breakout spaces and centralized facilities did reduce sitting time but did not increase moderate or vigorous activity (Jancey et al., 2016). Larger distances to bathroom and kitchen were supposed to increase walking, but this was not confirmed after relocating to new office buildings (Engelen et al., 2016, 2017).

Other studies focused on increased physical activity by nudging stair use. Signs outside the staircase and an interactive artwork featuring inside doubled the stair use compared to a control group and this effect lasted for at least six weeks (Swenson & Siegel, 2013). However, posters, floor stickers and stair banners had mixed effects. Point-of-choice prompts did work, motivational posters inside elevators did not (Lewis & Eves, 2012).

Or posters did increase stair use but after removal this dropped back to baseline (Kwak et al., 2007). In one case the nudging even lead to *reduced* stair use because it annoyed the office occupants (Åvitsland et al., 2017). A review by Nocon et al. (2010) also reported contradictory or non-significant results. This shows that prompts might be an effective design solution only in the right form and place, and when the nudging is accepted by the target group. Another design solution implemented to increase stair use was making stairs visible and implementing a skip-stop elevator that stops only at every third floor (Nicoll & Zimring, 2009). In other office buildings open central staircases did not lead to more walking (Engelen et al., 2016, 2017).

3.3.5 Measures of effectiveness

The outcome measures that were applied in the research papers (Fig. 11) serve as examples of how to estimate the effectiveness of a design strategy in achieving health improvement or consolidation.

Since well-being primarily is a subjective experience, many of the studies applied self-report measures, either by using previously validated scales, such as the Perceived Stress Scale (Cohen et al., 1983) and the Perceived Restorativeness Scale (Hartig et al., 1997), or – more often – newly created questionnaires. They address for example, health complaints, sickness leave, environmental stress, interpersonal relationships, and estimated physical activity, and usually are created for one study only with limited testing of validity and reliability.

Objective health measures included examination of bodily fluids, heart rate recordings, and measurements of the body weight and shape. They were used in experimental settings to compare health conditions before and after an intervention or to compare groups in different environments. Many of these measures are obtrusive to the participants, sensitive to privacy issues, and require medical equipment and expertise, which explains their limited use in field studies. Objective measures for design improvement included for example sound and light levels. Objective measures for behaviour change were mostly applied by automatic observation using wearables, such as activity trackers and sleep timers, sensors (for example, in chairs or under handrails), and cameras.

Figure 11

Effectiveness measures regarding health outcomes applied in the included research papers

Comfort	Restoration	Social well-being	Healthy behaviour
Self-report measures • Perceived comfort (general/ thermal) • Musculoskeletal discomfort • Eyestrain/ visual discomfort • Perceived lighting quality • Noise annoyance • Disturbance • Satisfaction with privacy • Perception of cramped space • Unpleasant odour • Percieved air quality *Objective measures* • Observed sitting postures, upper body movements • Lighting level (lux) • Background sound level (dBA) • Speech transmission index • Radius of acoustic comfort	*Self-report measures* • Alertness, sleepiness, fatigue, feeling 'off' • Mood, irritability, anger • Need for recovery • Experienced restoration • Vitality / energy • Perceived sleep quality • Reported physical or social function • Perceived fascination *Objective measures* • Heart rate recovery • Observed yawning • Directed attention capacity test • Observed fascination (e.g. viewing time)	*Self-report measures* • Satisfaction with team member relations • Co-worker friendships • Supervisor support • Organizational support • Frequency of conflicts, distractions • Negative relationships • Cooperative atmosphere, trust • Possibilities for personalization *Objective measures* • Observed workspace personalization	*Self-report measures* • Reported sitting/ standing/ walking time at work • Frequency of breaks in sitting time • Reported stair/ lift use • Level of physical activity *Objective measures* • Step count • Observed sitting/standing time, sit-stand transitions • Observed stair/ lift use

Office workers' physical, mental and social well-being	
Self-report measures • General physical/ mental health (rating), health concerns • Mood, anxiety, depression, tiredness, feelings of stress (physical/ cognitive) • Sick building symptoms: headache, eye/ ear/ nose/ throat/ skin irritation, nausea, feeling heavy headed, fatigue • Musculoskeletal complaints (e.g. lower-back pain) • Visual symptoms (e.g. blurred vision, difficulty focusing) • Reported sickness absence, number of common colds • Reported use of painkillers or sleep medication	*Objective measures* • Physiological stress: saliva cortisol, skin conductance, heart rate variability, EEG, ECG, respiration rate, fingertip blood flow, oxyhaemoglobin saturation, urine catecholamines • Cardio-metabolic biomarkers: systolic blood pressure, cholesterol, triglycerides, blood glucose level • Anthropometrics: waist cricumference, body mass index, fat percentage, spinal shrinkage, • Aerobic fitness: peak VO_2, resting heart rate • Tracked sleeping time and fragmentation • Registered/certified sick leave days

3.4 Discussion

3.4.1 Future research

This study has identified four workplace design strategies based on a sample of peer-reviewed papers on interior office space and health. Because of its wide scope and large time span, it is likely that this sample covers most of the approaches in workplace health research and an update would not lead to identification of different strategies. However, additional strategies and design solutions may emerge from research using different search strings and search engines, including grey literature (books, dissertations), and studying publications on virtual work environments and design of communication technology, phenomena that have increased rapidly during the Covid-19 pandemic.

More design strategies for healthy workplaces may also be identified by analysis of well-being theories in the work context. For example, Forooraghi (2020) and Roskams and Haynes (2019) applied the Sense of coherence theory onto office environments and argued that a comprehensible, manageable and meaningful workplace will ease health. This implies that next to interventions to support restoration, enhance social well-being and stimulate physical activity, workplace design strategies could also aim for creating a sense of control, ownership and empowerment, or providing clear rules about the use of workspaces. Strategies for empowerment match the positive health definition of Huber et al. (2011), that includes self-management and adaptation. Similarly, the combination of Person-Environment Fit Theory and Self-Determination Theory may suggest a strategy of adjustable design since needs-supply fit depends on individual, group and job characteristics (Appel-Meulenbroek et al., 2020).

Additionally, analysis of design projects that were carried out in practice to improve workers' health may reveal new design strategies by studying their approach, applied design solutions, and achieved improvements. We recommend studying projects across different work environments, because effectiveness of design solutions may differ strongly across work environments and work processes. Furthermore, studying interior design of other environments, for example, health care (healing environment), educational settings (learning environment), and retail (consumer behaviour), might reveal design solutions that could be applied to offices. Because design is not deterministic and design changes alone often will not be able to improve health, analysing practices could also reveal important contextual factors.

Within the strategies, more evidence-based design solutions could be generated by a larger amount and variety of systematic research on healthy workplaces. Conducting field-experiments would generate more knowledge of the designs' effectiveness in real-life settings whereas studies that rely on lab experiments provide a limited simulation of

office settings. Longitudinal studies are required to generate insights about long-term effects of changes in the work environment. For example, effectiveness of nudges could be tested in field experiments taking measures before implementation and several times during the intervention to track how long its effect last in real life. Measuring after the intervention has ended and the stimulus has been taken away will show if the nudging has been able to establish healthy habits. Qualitative research can contribute to the understanding why applied design solutions do or do not have the desired effect, for example by conducting spatial walkthroughs, card sorting, or experience mapping (Babapour Chafi & Cobaleda-Cordero, 2022).

Measurement of well-being in offices could also be improved by further operationalization of well-being concepts and developing measurement scales appropriate to the work context and office environment. General mental health measures may not cover all issues that are relevant to office workers' well-being. For example, social well-being may be context-sensitive and not yet been operationalized accordingly (Colenberg et al., 2020). However, there may be appropriate well-being scales available in psychology that just did not find their way to workplace research.

In addition to contextualized and validated well-being measures, a more fine-grained taxonomy and measurement of actual workplace design features is required to improve measures of effectiveness. The work of, for example, Cobaleda Cordero et al. (2019) on identifying spatial attributes of the office landscape, and the work of Kwon et al. (2019), Laurence et al. (2013), Sailer and Thomas (2020), Yıldırım et al. (2019) and Zerella et al.(2017) on classifying office furniture, layout characteristics and degrees of enclosure could serve as a basis for further development of design measures.

3.4.2 Practical implications

The current study offers workplace designers (interior architects and product designers), workplace managers (corporate real estate, facilities and human resources), and their consultants a source of design approaches. The identified strategies and explanation of their mutual relationships could support a wider perspective to healthy workplaces that reaches beyond comfort, merging pathogenic and salutogenic approaches to achieve a complete state of health (Keyes, 2014).

This study also shows promising directions for further development of design strategies for healthy workplaces. Obviously, the youngest strategy, nudging healthy behaviour, could be explored to a much greater extent. First of all, the targeted behaviour could be extended from decreasing sitting time or increasing stair use to, for instance, stimulating a healthy diet, following hygiene measures, taking regular breaks, having walking meetings, cycling to work, and any other activity that fits a healthy lifestyle, reduces health risk and generates positive experiences. For instance, nudging could also

be applied to engage people in social interactions that enhance their social well-being. Furthermore, additional types of nudges could be developed. In the analysed studies, most nudges were limited to graphs and warnings while they can take many other forms too. Translating Sunstein's (2014) top ten nudges into workplace design, one could think of simplifying the use of tools or furniture, access to healthy options (staircase, healthy food) by default and to less healthy options (elevator, snacks) by request, or rewarding desired behaviour in several ways, making healthy options more visible, easy and fun.

Also the least developed strategy that was identified, called workplace design for social well-being, has potential. Deliberately creating social affordances (Spreitzer et al., 2020), such as coffee bars and opportunities for playful interaction, and using technologies to enhance face-to-face interactions at work (Olsson et al., 2020) can increase the frequency or quality of positive interactions and thereby support relationship building. Offering opportunities for privacy regulation is important to facilitate private conversations as well as to prevent undesired interactions. Identity affordances (Spreitzer et al., 2020), such as incorporating possibilities for personalisation and workplace branding into the workplace design, can further increase feelings of belonging and place attachment.

To create restorative environments at work many more aspects of biophilic design could be applied. The reviewed papers mainly focused on direct experience of nature in the office through natural light and indoor and outdoor nature views, while (Kellert, 2008) distinguishes six main biophilic design elements and over 70 design attributes. He argues that apart from multi-sensory environmental features, such as plants, colour, water and natural materials, biophilic design could include the use of natural shapes, forms, patterns, processes, light and spatial attributes, as well as the support of place-based and human-nature relationships.

Regarding design for comfort more design solutions could be developed and tested that reduce environmental stressors, and solutions that go beyond ergonomics and instrumental control by further increasing psychological comfort. Vischer (2008) states that psychological comfort results from feelings of belonging, ownership and control over workspace. Additional means to reduce environmental stress could aim for privacy regulation, for example items that communicate someone does not want to be disturbed, or flexible partitions that could be controlled by the employee. Or they could aim for decreasing fear of contamination by, for example, applying easy-to-clean materials, communicating cleanliness, and nudging office users to take protection measures and follow hygiene rules.

3.5 Conclusion

In summary, four interior design strategies that aim to support or increase comfort, restoration, social well-being, and healthy behaviour were identified based on the review of a broad literature sample. These strategies invite workplace designers, managers, and researchers to take a transdisciplinary view at healthy workplaces and look beyond physical well-being. Although the Covid-19 pandemic initially has forced the attention to hygiene and physical distance, in the longer term the lockdowns and social restrictions made us aware of the human need to connect with each other in person and to get inspired by the environment. Salutogenic design could support people's resilience by replenishing resources for coping with demands. The presented examples of evidence-based design solutions and effectiveness measures could aid making design decisions explicit and testing assumptions. For academic scholars, this study provides directions for future transdisciplinary workplace research by outlining workplace design features and possibly related well-being aspects, indicating which ones are underexposed, and proposing additional research topics and methods.

CHAPTER 4

This chapter is published as:

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4 CONCEPTUALIZING SOCIAL WELL-BEING AT WORK

Directing workplace design towards enhancing employees' social well-being requires a thorough understanding of the phenomenon's nature in the context of work. Since social well-being depends on the experience of the social environment it may vary by life domains that are characterized by different circles of connections, different social needs, and different demands for social skills.

The study reported in this chapter explored the meaning of social well-being in the context of contemporary offices by reviewing established social well-being theory and identifying patterns in employees' experiences. The study used existing interview data from recent post-occupancy evaluations of two large activity-based flexible offices. Data-driven concept mapping of employees' statements on social aspects of well-being at work was applied to find commonalities in their perceptions. The key concepts identified were used as a basis for the development of a domain-specific scale (see Chapter 5).

4.2 Introduction

Currently, many organizations have programs to support employee's health and well-being (Browne & Evans, 2018). This is not surprising, since higher employee well-being has shown to increase organizational performance and decrease turnover (Harter et al., 2003; Van de Voorde et al., 2012). For human beings, interactions and relationships with people around them are crucial to their health and well-being (Baumeister & Leary, 1995; Diener & Seligman, 2004; Ryff & Keyes, 1995). This also applies to the work environment (Kahn, 2007). As Rath and Harter (2010) state: 'We are social beings, and our need to be connected to others doesn't disappear when we enter the office.' The organization benefits as well, because face-to-face contact at work boosts mood and productivity (Pinker, 2014), and high quality connections are a source of organizational improvements (Dutton & Heaphy, 2003). Additionally, friendship (Lopes Morrison, 2005) and perceived inclusion (Chen & Tang, 2018) at work increase engagement. For many, the current Covid-19 pandemic requiring long periods of social isolation and working from home has increased awareness of their social needs in the workplace: they miss meeting co-workers in the office (Gensler Research Institute, 2020a).

Fostering employee well-being requires proper measurements covering this important social dimension, to determine the need for and impact of interventions and to monitor well-being over time. Still, conceptualization and measurement of social well-being at

work is in its infancy (Fisher, 2014) compared to physical and mental well-being. Organizational literature covers many social aspects of employee well-being, such as professional isolation (Golden et al., 2008), loneliness in the workplace (Wright et al., 2006), incivility (Schilpzand et al., 2016), and conflict (Ayoko et al., 2003), but there have been few attempts to conceptualize the social dimension as a whole. This holistic view is important because a positive experience of one aspect of social well-being could be undermined by a negative experience on other aspects.

Furthermore, relatively few connections have been made with the office environment (Appel-Meulenbroek et al., 2018). In organizational research the role of the physical environment has long been outside the usual scope (Ashkanasy et al., 2014; Khazanchi et al., 2018), while it is clear that the social and physical work environment are intertwined (e.g. Ayoko & Ashkanasy, 2020; Gifford, 2014, p.342; Sander et al., 2019). Yet, in research on healthy offices social aspects are underexposed (Bennett, 2018; Colenberg et al., 2021; Forooraghi et al., 2020). As noted recently, there is a need for clearer definition of well-being constructs in building research (Hanc et al., 2019).

Developing a valid multiple-indicator measurement requires clear conceptual grounding (DeVellis, 2017; Rosas & Camphausen, 2007). The purpose of the study presented in this chapter was, therefore, to aid scale development by identifying components of social well-being in office environments. First, current social well-being theory and related characteristics of activity-based offices, given the current trend in office environments, were analysed. Second, social well-being components were identified as they emerged from case-study data. In Section 4.5, the results are discussed in the light of scale development and workplace management.

4.2 Social Well-being Theory

4.2.1 Established theory

The most prominent conceptualization of social well-being is by Keyes (1998), published half a century after the 1948 WHO's acknowledgement of a social dimension to well-being, in addition to physical and mental well-being (WHO, 2006). Individual social well-being – as opposite to societal or sociological well-being – traditionally has been measured through satisfaction with social support and adjustment to the social environment, which is closely related to mental health (Larson, 1993). The positive mental health approach of functioning well in social life has been the premise of Keyes' theory. He deducted five dimensions of social well-being from philosophy, social psychological theory and cultural analysis, reflecting the individual's (1) *integration* in a community, feeling part of a group, (2) *acceptance* of diverse characters and qualities of other people, feeling comfortable with others, (3) perceived *contribution* to the community, feeling a valued group member, (4) *actualization* or belief in the

community's evolution, feeling hopeful about its progress, and (5) perceived *coherence* of their social world, feeling they can understand what is happening around them.

In psychological research, social well-being is positioned as the outer-directed aspect of well-being that complements hedonic inner pleasure and eudaimonic inner growth (Fisher, 2014; Gallagher et al., 2009). Keyes levels social well-being with long-term and competence oriented eudaimonic well-being (Ryff & Keyes, 1995; Ryff & Singer, 2008), together labelled flourishing (Keyes, 2002), and separates it from transient moods of hedonic well-being or happiness (Diener & Ryan, 2008). This separation characterizes two main streams of psychological well-being research, although it is still under debate if these also reflect two types of well-being (Biswas-Diener et al., 2009; Gallagher et al., 2009; Magyar & Keyes, 2019).

4.2.2 Application to work environments

Recent measurements of the social dimension of employee well-being (Czerw, 2019; Kazemi, 2017; Rautenbach, 2015; Redelinghuys et al., 2019) rely on Keyes' (1998) conceptualization. However, there is reason to believe that the phenomenon might be organized in a different way, at least in the context of specific work environments, which might explain unsatisfying consistency coefficients of above measurements (Kazemi, 2017; Page & Vella-Brodrick, 2009). For instance, Cockshaw et al. (2012) found that workplace belongingness and general belongingness are distinct constructs, although both are related to depression. Gallagher et al. (2009) found a better fit for their well-being model when positive relationships, belonging to eudaimonic well-being (Ryff & Singer, 2008), was moved to the social dimension, serving as an addition to Keyes' dimensions.

Considering these studies and the notion that high quality connections (Dutton & Heaphy, 2003; Stephens et al., 2011) include both positive short-term interactions and longer term relationships, Fisher (2014) proposes the following conceptualization of social well-being at work: 'feeling embedded in meaningful communities and having satisfying short-term interactions and long-term relationships with others'. This definition taps into hedonic well-being and acknowledges the role of emotions and affective events at work as well as the eudaimonic notion of meaning and purpose. Integration of short-term and long-term aspects also characterizes Morrison and Macky's (2017) socially oriented well-being measure aiming at workplace evaluation. As Kazemi (2017) discusses, maybe Keyes' dimensions reflect conditions contributing to social well-being and not the sense of social well-being per se.

4.2.3 Social interactions, relationships and belongingness

Fisher's (2014) definition may be a useful start for further conceptualization of social well-being at work, but first its dimensions require elaboration. Feeling embedded in a meaningful community refers to the need to belong (Baumeister & Leary, 1995); its satisfaction called belongingness (Malone et al., 2012). It may comprise concepts such as a sense of community, affective and normative organizational commitment, and group cohesion, and on the negative side loneliness, social exclusion and ostracism. Sense of community results from feelings of inclusion, importance, and mutual benefit, as well as shared emotions with others at work (Blatt & Camden, 2007), which refers to social interactions. Social interaction can range from noticing other people's presence to deliberate exchange of information. In essence, social interaction refers to seeing, hearing, smelling and touching other people (Argyle, 1968). It involves verbal and nonverbal behaviour between two or more individuals, and can be contextual or enabling (De Jaegher et al., 2010). In open workspaces conscious co-presence is an important contextual aspect, whereas verbal and non-verbal interactions enable transaction of information, including knowledge, feelings and emotions. Social interactions can be experienced positively or negatively.

Positive interactions at work hold the subjective experience of vitality, positive regard and mutuality, and they help building and maintaining relationships (Stephens et al., 2011), which provide emotional and instrumental social support (Dutton & Ragins, 2007). Friendships, referring to informal and expressive relationships that include personal and confidential communication (Khazanchi et al., 2018), are particularly beneficial for well-being. In summary, Fisher's (2014) conceptualization includes cognitive and emotional long-term and short-term reactions to the presence and behaviour of other people at work and to representations of a work community, being a formal team, department or organization, or an informal group of co-workers.

4.2.4 Contemporary office context

Today, many people in the Western world work in offices which increasingly feature open workspaces and desk-sharing. The ongoing trend is an office concept referred to as activity-based working (Engelen et al., 2019) or activity-based flexible office (Wohlers & Hertel, 2017), offering a diversity of open and enclosed spaces designed to support different work activities, usually accompanied with a policy of desk-sharing (Brunia et al., 2016). Field assumptions behind this office concept are that open spaces and flexible use of workstations increase communication, which should be beneficial to collaboration and performance. This seems a simple causal relation but is actually a complex mutual interaction, since the physical work environment does not determine employee behaviour (Gifford, 2014, p.341; Vischer, 2008). Moreover, simply more communication is not always better for (social) well-being.

Although the diverse activity-based working environment is relatively new, open-plan and flexible (non-territorial) offices have been around for a few decades now, and research on the impact of open workspaces and desk-sharing on social interaction and well-being has been cumulating. Partly in accordance with above assumption, open workspaces featuring desk-sharing have been found to better support affinity than private offices (Bodin Danielsson & Bodin, 2009). Good opportunities for communication and interaction have also been found advantages of activity-based offices (Engelen et al., 2019).

However, open workspaces have been associated with increased noise and lack of privacy (Bodin Danielsson & Bodin, 2009) too, which outweighed the benefits for communication (Kim & de Dear, 2013), worsened interpersonal relations (De Croon et al., 2005) and increased conflict (Bodin Danielsson et al., 2015). Furthermore, employees in flexible, or non-territorial, offices experienced more uncooperative behaviours, feelings of distrust, and negative relationships compared to employees with their own workspace (Morrison & Macky, 2017). Hirst (2011) noted that the flexible use of workstations, or hot-desking, may create social tensions, mutual indifference, and a sense of isolation from colleagues. Haapakangas et al. (2019) found that, after moving to an activity-based office, employees' belongingness and satisfaction with communication had decreased, and employees who came from private offices experienced negative effects on social support. When moving from open-plan with assigned desks to a non-territorial activity-based office, reasons for dissatisfaction with the working environment were the high workstation-occupancy ratio, teams being split up, difficulties in finding colleagues and perceived injustice due to nesting (Rolfö et al., 2018).

In summary, the activity-based working environment can impact social well-being in many ways, both positively and negatively. However, it remains unclear what social well-being as a whole comprises in these specific work environments. Considering the possibly context-sensitive nature of social well-being and empirical research on specific demands and resources of activity-based offices regarding social aspects of well-being, the study presented in this chapter aimed to answer the following research question: 'What are components of social well-being in activity-based offices?'

4.3 Method

4.3.1 Using existing case-study data

The study used interview data from the recent post-occupancy evaluations of two activity-based offices in the Dutch public sector. The choice of public offices was based on the observation of Engelen et al. (2019) that this sector is underexposed in activity-based office research. These two cases represented the latest standards for Dutch governmental offices, such as an employee-desk ratio of 0.9 to 0.7, a minimum of 6 m^2 floor space per desk, and an average occupancy of 75% on peak days (Rijksvastgoedbedrijf, 2015).

Both cases were renovation projects where employees were brought together from several big and small offices located elsewhere into one large office (over 1000 workstations) that emphasized open-plan layout and featured desk-sharing. In both cases, for some employees desk-sharing was new while others already were used to it. Although officially non-territorial, most floors were assigned to (sub)departments, sharing building facilities. The evaluation was conducted by the Center for People and Buildings approximately 6 to 12 months after the organizations had moved into the new offices. The user-centred evaluation included occupancy measures, a building assessment, and an online survey followed by group interviews (focus groups).

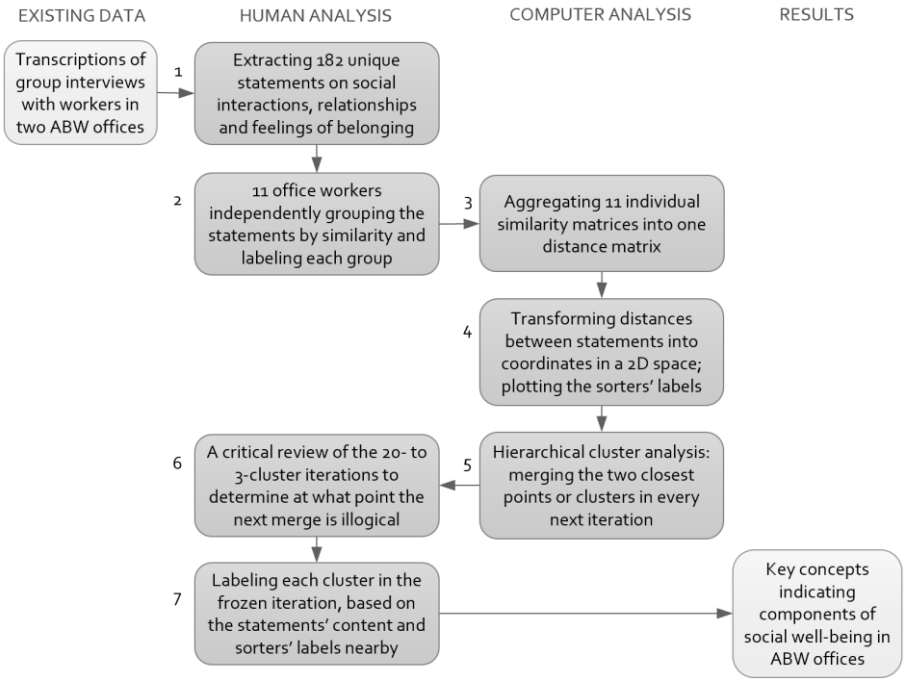
The data were extracted from the live documented 60-90 minutes interviews with 2 to 8 employees each, who volunteered to participate and were grouped by department. The participants were not questioned directly about their social well-being but aspects of social well-being came up while they were discussing their experiences with the new work environment. They were asked to name positive and negative aspects of their new work environment, explain their feelings, and discuss possible solutions for perceived problems. Focus groups like this allow participants to bring up issues they deem significant and challenge each other's views, offering the researcher insights in the way people collectively make sense of a phenomenon (Bryman, 2016, p.501–503).

4.3.2 Identifying key concepts through concept mapping

To identify communalities in the interviewees' perceptions of social well-being, concept mapping was performed. This is a conceptualization methodology that is used in a wide variety of disciplines (Trochim, 2017; Trochim, 1989). It consists of a multi-step process (see Fig. 12) of quantitative and qualitative analysis which results in a conceptual map of related concepts.

Figure 12

Overview of the concept mapping procedure



Concept mapping is a useful technique for specifying target constructs in an inductive approach to scale development (Rosas & Camphausen, 2007) and for thematic analysis (Jonsen et al., 2009). Moreover, it offers a solid method for establishing content validity (Rosas & Ridings, 2017) and improves reliability of text analysis by coupling human judgement to statistical analysis and by engaging the target group in the process (Jackson & Trochim, 2002).

Following the approach of Jackson and Trochim (2002), the first step of the study (see Fig. 12) involved unit creation by cutting different interviewees' statements (a maximum of two sentences) on social well-being from the interview transcriptions and pasting them into an Excel file. Criteria for statement extraction were: (a) content related to above descriptions of social interactions, relationships and belongingness, following Fisher's (2014) definition of social well-being, and (b) substantial literal difference to previous extractions, since this study aims to *identify* themes rather than gather data on frequency or importance of topics.

The extraction procedure was terminated after the analysis of the nineteenth group interview, at the number of 182 units, considering the capacity of human sorters to handle a maximum of 150 to 200 units each (Jackson & Trochim, 2002). Moreover, at that time, no more substantially different statements were coming forward (criterion b), which indicated thematic saturation. Saturation is recognized as a guiding principle in determining sample size of (group) interviews (Bryman, 2016, p.418; Mason, 2010).

The second step included manually grouping the employees' statements, which were printed on paper strips to provide the sorters with a better overview than on screen (Trochim, 2017). Trochim (1989) has suggested that a minimum of ten sorters is needed for a reasonable output reliability. In this study, eleven office workers who experienced activity-based offices and were native Dutch speakers volunteered to sort the 182 statements by content similarity and label their self-determined groups. For each of them, the sorting task took around 90 minutes, which underlines the maximum capacity of 200 units.

Step three to five (see Fig. 12) included computer analysis of the statements' mathematical similarity. First, the eleven binary similarity matrices that indicate if, according to the sorter, statements belong to the same group or not, were aggregated into one distance matrix. On this distance matrix, t-stochastic neighbour embedding was performed using Ward's algorithm and Python sci-kit learn (Pedregosa et al., 2011) to realize maximal distinction and internal consistency of the groups in a clear visualization (Van Der Maaten & Hinton, 2008). The statements' distances were translated into coordinates and they were plotted in a two-dimensional space, including the sorters' labels.

The hierarchical cluster analysis started with the 182 statements as single units, merging the two closest ones in every next iteration. From the 20- to 3-cluster stage, every iteration was studied to determine at what point further merging was considered illogical based on content. In the last two concept mapping steps (see Fig. 12), human judgement was used again to freeze the merging procedure at a logical stage and to label the clusters based on their statements' content.

4.3.3 Additional analysis for concept interpretation

Parallel to the concept mapping, the individual statements' content was reviewed to support the interpretation of the concepts to emerge. Two native Dutch speakers independently determined if the statement was phrased in a negative, neutral or positive way (inter-rater consistency $\kappa = .814$), and if it referred to short-term interactions, long-term relationships or feelings of belonging ($\kappa = .811$). Both reviewers entered their judgements into the Excel file. After termination of the cluster analysis, the statements were sorted by their cluster.

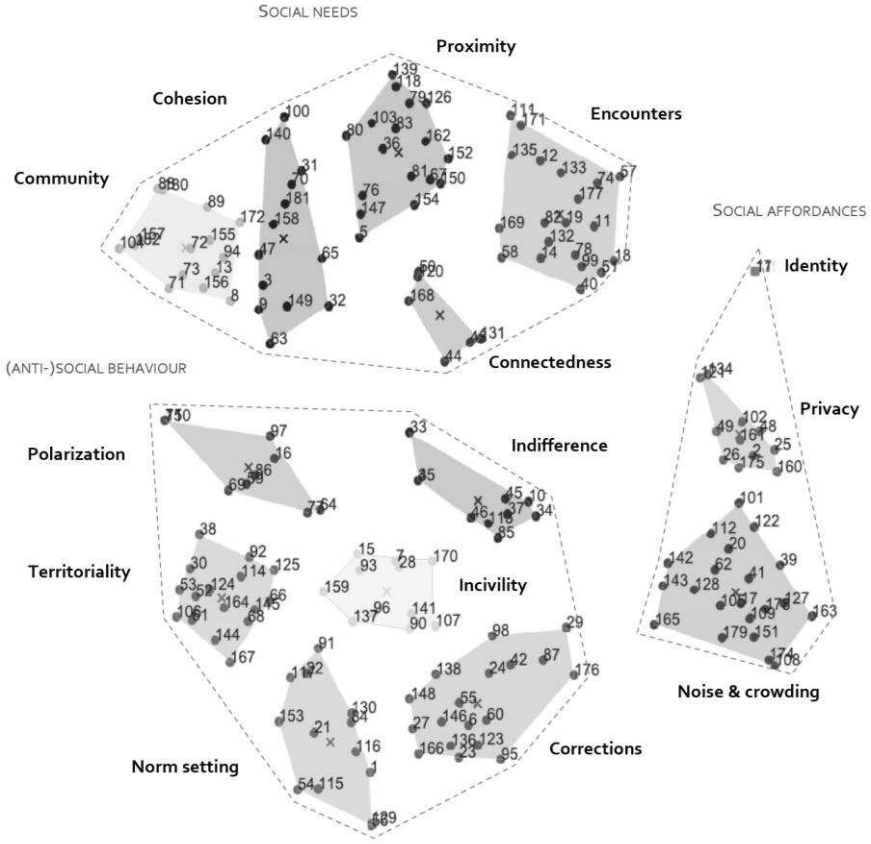
4.4 Results

4.4.1 Identified: 14 concepts in three areas

Figure 13 shows the 14 key concepts that emerged from the interview data. It visualizes the statements' similarity, as judged by the sorters, by the distance between them on the map (the closer the similar).

Figure 13

Each of the 182 employee statements on social well-being grouped into 14 key concepts and three overarching categories that emerged from the concept mapping analysis



The number of 14 concepts resulted from the decision to freeze the clustering process (Fig. 12, step 6) before the statements on privacy and identity of the environment, two clearly different aspects, would have been merged. The number of 14 also happened to be close to the sorters' average of 13 groups.

The 14 key concepts are situated in three regions of meaning (Jackson & Trochim, 2002), or overarching categories, based on the 3-cluster stage of the analysis. These categories reflect employees' social needs, their experiences with (anti-) social behaviour of others, and perceived social affordances of the physical environment. The number of statements per cluster rather reflects the duration or nuances of the conversation on this topic than the importance of the theme since only distinctive statements were extracted, no matter their frequency.

According to the additional interpretative analysis the 14 concepts together reflect long-term, eudaimonic well-being, represented by belongingness and relationships, as well as short-term hedonic well-being, represented by social interactions, while most of the statements emphasize short-term social interactions (Table 9).

Table 9

Number of different interviewee's statements per key concept and per social well-being dimension

		Int.	Rel.	Bel.	Illustrative statement
a	Encounters	11	7	2	'It is nice to meet new people.'
	Cohesion	0	5	8	'I feel like a guest in my own office.'
	Proximity	7	7	3	'I miss having sparring partners around.'
	Community	2	9	4	'I miss the socializing.'
	Disconnection	1	3	2	'Working from home has increased.'
b	Polarization	1	2	6	'People were sent away; "You don't belong here".'
	Territoriality	10	3	3	'Everybody creates a common for their own spot.'
	Indifference	6	1	3	'People don't report issues anymore.'
	Social norms	6	7	0	'Managers need to set the good example.'
	Incivility	8	0	3	'We share a building but they behave like a jerk.'
	Corrections	11	5	2	'I find it difficult to correct co-workers.'
c	Décor	0	1	1	'It is sad what the guest reception areas look like.'
	Privacy	7	4	0	'There's no place for confidential conversations.'
	Distractions	21	0	0	'I need less noise, less crowding, no doors opening behind my back, less chatting and telephone calls.'
	Total	91	54	37	

Note: Int. = social interactions; Rel. = relationships; Bel. = belongingness

In the statements on social interaction, the interviewees described observations of different behaviours and manners of communicating, and their emotional reactions to the presence and behaviour of random others. Most of the statements on relationships related to encounters, proximity, community and norm setting, referring to maintenance of social ties through meeting and co-locating with colleagues, and to clear rules of conduct as a way to stay on good terms.

Statements on belonging were prominent in cohesion, polarization, and identity, and mainly referred to familiarity with both people and environment, to group rights and obligations, and to social exclusion. In the majority of statements there was a negative tendency regarding social well-being.

In the next sections, the identified concepts within the three main areas are described based on the included statements.

4.4.2 Social needs

One of three main topics of the extracted statements referred to the employees' thwarted or fulfilled social needs. As to negative experiences, they expressed how they felt disconnected from their close colleagues while having an emotional and functional need to be seated together. In their statements on connectedness and physical proximity, they referred to an increased social distance caused by the new office environment. They observed that working from home had increased to escape from the office noise and crowding or because it felt useless to go to there if they could not be with their co-workers. This resulted in less frequent co-worker contact. Meanwhile, the use of headphones made co-workers look inapproachable and contacts were formalized because deliberately meeting each other now required appointments.

Regarding community and cohesion, the interviewees observed less socializing and they missed the 'traditional jokes', celebration of birthdays, and staying in touch with personal events in their colleagues' lives. They expressed feeling like a visitor in their own office and missed the visibility of their team's work. Statements on these thwarted social needs reflected the deterioration of close relationships and lack of belongingness as an observed downside of the new working environment.

Positive statements in the social needs area focused on desirable encounters, such as the increase of spontaneous positive interactions while being on the move and at the coffee machine, and the ease of meeting colleagues due to spatial openness and mobility. Interviewees also enjoyed choosing their workstation based on, for instance, visibility (the manager who wants to be approachable to his team) or inspiration (in the proximity of interesting colleagues).This increased the chance of positive social interaction. They perceived the new working environment to invoke more informal communication as well as more diverse connections.

4.4.3 Co-workers' (anti-)social behaviour

The statements on co-workers' behaviour in the shared workspace were largely about negative social interactions, such as claiming workspaces, disregard, and downright hostile reactions (polarization) that excluded outsiders. They described both experienced, witnessed, and instigated incivility, as distinguished by Schilpzand et al.

(2016). These incivility seemed connected to a scarcity of workstations and may have been unintended when judging from interviewee statements such as: 'It is not clear to me if it's sabotage or ignorance'. As territory marking was restricted by the office concept, which lacked possibilities to personalize the workstation or to lock drawers, the employees apparently resorted to other strategies for marking and controlling their workspace.

The statements on territoriality referred to identity marking, such as spreading out belongings and using one's voice as an audible marker, and to both anticipatory and reactionary defences as defined by Brown et al. (2005). One of the interviewees described a creative, or perhaps desperate strategy: 'I came across a note saying "out of order" but it turned out to be a reservation.' Another referred to social pressure: 'Co-workers told me I was a fool to give up my workstation, so now I leave my stuff too.' They experienced difficulties in correcting such behaviours of others because they did not feel they had the right to do so, did not feel comfortable doing so, had negative experiences while doing it, or did not want to put effort into correction. Therefore, they desired more clear rules and stronger action taken by the managers (norm setting).

The concept of indifference included decreased responsibility, for instance cancelling meeting rooms and reporting issues, emotional social support dealing with the new situation, or the lack of support. It also included a positive side-effect of less social cohesion: less social pressure to answer charges of absence. The only other positive statement in this overarching category referred to making an example by giving emotional social support.

4.4.4 Perceived social affordances

The third group of social well-being concepts that emerged from the concept mapping referred to social affordances (Gibson, 2014; Spreitzer et al., 2020). Affordances are properties of the environment that may facilitate or obstruct positive social interactions or feelings of belonging. The interviewees' statements on the perception of these affordances were all negative. They referred to a lack of spatial enclosure and to the high spatial and social density which increased the negative consequences of social interaction (noise, feelings of crowding) while not being able to control the amount of interactions. Many statements concerned unwanted talking in an open workspace and the feeling of having nowhere to go for a (private) phone call: 'My colleague prefers making calls in the toilet for the disabled.' Regarding belongingness, the statements included two different remarks on the unwelcoming décor and a complaint on getting reprimands for hanging things on the wall.

4.5 Discussion

4.5.1 Theoretical implications

In addition to deductive models of social well-being (Fisher, 2014; Gallagher et al., 2009; Keyes, 1998) this study serves as an inductive source of outer-directed well-being aspects that are significant to employees working in activity-based offices. The social well-being components identified reflect the broad spectrum as well as the significant nuances of social well-being as it is perceived in contemporary activity-based offices.

The results indicate that social well-being might not only include long-term, relatively stable eudaimonic well-being but also short-term hedonic well-being. The interviewees brought up both the direct impact of specific social interactions at work on their well-being and the adding-up of interactions, or lack of social contact, to thwarted belongingness and disintegration of social cohesion. This aligns with the literature on relationships and community building (Blatt & Camden, 2007; Stephens et al., 2011). In their statements, the interviewees emphasize short-term interactions and emotional responses. This points at the significance of daily hassles in the office or affective events (Ashkanasy et al., 2014) regarding social well-being. It favours Fisher's (2014) conceptualization of social well-being that includes both short-term and long-term aspects of well-being at work.

After a period of opposition between these two philosophical traditions, namely hedonics questioning the conceptual and methodological sophistication of the younger eudaimonia and eudaimonics considering hedonic pleasure less important to a good life, several scholars now think both should be integrated (Henderson & Knight, 2012; Lambert et al., 2015). As Waterman (2008) argued, eudaimonia does not exist without hedonia, which the concept mapping appears to confirm.

Regarding social well-being components, the results show that from Keyes' (1998) five dimensions only two are – to some extent – represented in the identified concepts. Although the statements differ significantly from Keyes' operationalization into survey questions, it could be argued that the concepts of cohesion, community, connectedness and incivility refer to (1) social integration, and that the perceived polarization, territoriality, indifference and norm setting relate to (2) social acceptance. None of the identified concepts seems to relate to (3) social contribution, (4) social actualization or (5) social coherence. Possibly, these dimensions require the individuals' reflection on their own role and understanding from a higher level of abstraction. This apparently did not come up for discussion in the group interviews, at least not explicitly related to presence and behaviour of co-workers, supervisors, or the organization, and may be less significant to employee well-being.

Additionally, a new dimension emerged from the data which reflected a connection with the physical context. This dimension comprised undesired social interaction, lack of relationship-building support, and thwarted belongingness, as well as increased possibilities for positive interactions invoked by the environment. The concepts of the environments' visual identity and privacy support, the noise and crowding caused by co-presence, and the positive encounters reflected the known pros and cons of activity-based offices as summarized in Section 4.2.4. This indicates that social well-being might not be a general phenomenon, reflecting functioning in social life anywhere, but rather a local phenomenon which is bound to (physical) context and reflects the entanglement of the social and physical environment.

4.5.2 Limitations

The office workers were not directly asked about their social well-being which implies that their statements referred to topics put forward by one or more group members. These topics might have been their most prominent or most recent experiences or the ones that were easiest to talk about, particularly in a group interview. They could have been the negative experiences because those are remembered more easily. In one of the cases, the evaluation showed that the users were relatively dissatisfied. It is possible that especially dissatisfied employees volunteered to participate in the group interviews. Furthermore, the longer the discussion, the more different statements could have been made about the specific topic, possibly at the expense of other topics. This might explain the emphasis on short-term interactions, since these are more concrete and probably more frequent than thoughts about long-term relationships or community awareness. On the other hand, the topics that have come up do reflect participants' significant experiences.

Other limitations concern the cases' specific cultural setting (Dutch government offices), relatively dissatisfied users, and size (over 1,000 workstations), as well as the one-researcher-only extraction of units and labelling of clusters. Using multiple interpreters and repeating the study with data from other settings could yield additional social well-being components to be considered in further conceptualization. For example, in smaller offices where people know each other better or offices where there is less scarcity on workstations, that have more enclosed spaces, or where the users are more satisfied with their environment, the users may express different aspects of social well-being.

4.5.3 Directions for future research

The context-bound properties and hedonia-eudaimonia integration of social well-being found in this study require further exploration and validation, for instance by developing and testing an occupational social well-being scale that captures the specific conditions in an activity-based office and addresses both hedonic and eudaimonic well-being. The study can be taken as a first step of inductive item generation, to be completed with deductive item generation from existing scales and theories, and several iterations of testing and validation, as suggested by Boateng et al. (2018). An item pool could be built up by mapping items from existing scales onto the 14 key concepts. Additionally, the 14 concepts could be used as a conceptual coding scheme for analysing qualitative data on social well-being aspects in contemporary offices, which could lead to new items or concepts serving scale development.

4.5.4 Practical implications

The interviewees' statements on the impact of their new working environment provide knowledge for team managers as well as facilities and human resource management. To prevent decrease of social well-being when moving into an activity-based office, managers should carefully prepare their team for the new situation and discuss possible difficulties as described in this article. In the new environment they should be alert to the signs of weakening ties, environmental stress, conflict and withdrawal. They should keep in touch with their team, monitor social well-being, acknowledge the sense of loss of the old environment, and act upon troubles, for instance, addressing an evolving incivility spiral (Andersson & Pearson, 1999) as soon as possible.

To facilitate building positive relationships and nurture feelings of belonging in activity-based offices, workplace managers and designers should carefully balance the visual and physical openness and standardization of the environment with the employee's need for privacy, identity marking and a sense of community. The interior surfacing should provide adequate sound absorbing and the work environment should offer a variety of spaces for personal conversations, uplifting chit-chat (Methot et al., 2021), spontaneous encounters and social events, as well as possibilities for and marking of team and organizational identity. Participatory design that involves employees and managers, could be a fruitful way to inform the design as well as enhancing belongingness and feelings of ownership.

Regarding the return to the office after the Covid-19 lockdowns, managers should balance protection against the virus with support of relationship-building activities, and give special attention to new employees' integration and staying in touch with home-workers. Now increased working from home is expected to stay, the office's social function as a meeting and community place will become even more important. This requires appropriate facilities for a larger proportion and diversity of face-to-face

interactions, as well as hybrid meetings combining conventional and video conferencing, but this still has to be balanced with adequate spaces for rest and working individually. The office has to offer a welcoming place for work and bonding with co-workers and organization. A positive side-effect of Covid-19 social distancing rules might be a reduction of crowding and related noise problems.

Although from a hygiene and belongingness perspective fixed workstations might be better than hot-desking, with substantial working from home this probably is not financially efficient. However, introducing identity rich home zones for teams may serve as a semi-territorial compromise, while a well-considered location of teams and mixing of departments and centralized facilities will still support casual encounters.

4.6 Conclusion

This study contributed to the conceptualization of individual social well-being at work. It provides a first step in development of a social well-being scale tailored to the context of contemporary offices. The concept mapping of case-study data revealed 14 key concepts reflecting employees' social needs, their confrontations with co-workers and the physical environment's social affordances. This indicates that – contrary to established theory – social well-being includes components of both short-term hedonic and long-term eudaimonic well-being and is nested in a spatial context, and thus workplace characteristics are to be considered when measuring and managing social well-being at work.

CHAPTER 5

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Colenberg, S., Jansen, S., van der Doef, M., & Kraaij, V. *Towards a new measure for social well-being at work.*

5 MEASURING SOCIAL WELL-BEING AT WORK

The process of evidence-based design does not only include the defining of desired outcomes and basing design decisions on existing evidence but also the testing and evaluation of design solutions that were newly created. Repeatedly measuring employees' social well-being as part of this testing and evaluating and monitoring the effects of changes in the environment requires a standardized measure appropriate for the context.

The study reported in this chapter builds on the previous study that explored office workers' experiences related to social well-being. It uses these office workers' experiences and existing questionnaires on aspects of social well-being in the work context as a base for constructing a new measure. Through statistical modelling of survey data, a 10-item measurement scale was developed which can easily be administered in offices.

5.1 Introduction

> *'We are social beings, and our need to be connected to others doesn't disappear when we enter the office.' (Rath & Harter, 2010)*

Humans have an intrinsic need for positive connections with others (Baumeister & Leary, 1995; Ryan & Deci, 2000). Satisfaction with this basic social need is a requirement for any individual's well-being. For example, positive social interactions, even with strangers, are sources of joy (Epley & Schroeder, 2014; Gunaydin et al., 2020; Sandstrom & Dunn, 2014; Stephens et al., 2011). Loneliness, defined as the discrepancy between actual and desired social relationships, is associated with feelings of anxiety, depression, and many other psychological and physical problems (Lim et al., 2020). The World Health Organization (WHO) has indicated social well-being as one of the three pillars of health, in addition to physical and psychological well-being (WHO, 2006). Similarly, several models within psychology consider social well-being an important component of subjective well-being, which is related to other components of well-being but covers the separate aspect of interpersonal experiences and evaluations (Gallagher et al., 2009; Keyes, 1998; Lamers et al., 2011).

Supporting well-being at work is important from both an ethical and a business perspective (Harter et al., 2003). In a holistic approach, this includes social aspects of well-being. In the context of the work environment, social well-being refers to the experience of connections with colleagues, clients, pupils, and other people present in the work environment. It may, for example, comprise the positive emotions that are associated with co-worker friendship (Colbert et al., 2016) and the uplifting experience

of small talk at the office (Methot et al., 2021). The prolonged working from home during the Covid-19 pandemic demonstrated once more the importance of personal contact for well-being at work. Although many homeworkers enjoyed reduced commuting and having more privacy at home than at the office, they also felt disconnected from their co-workers and missed spontaneous encounters (Gensler Research Institute, 2020b). Face-to-face interactions were home workers' main reason for wanting to return to the office (Colenberg & Keyson, 2021; Marzban et al., 2021). Because working from home is now widely adopted, lost comradery and isolation are considered major challenges for the near future (Babapour Chafi et al., 2021).

Establishing the effectiveness of interventions for enhancing social well-being and observing the impact of organizational change requires the availability of an accurate measure that captures the spectrum of the concept for a nuanced understanding. However, conceptualization and measurement of social well-being at work are still in their infancy (Fisher, 2014). Attempts to capture the concept of social well-being in the context of work, in full width, and using a multidimensional measure are often adaptations of Keyes' (1998) general social well-being scale (Bartels et al., 2019; Czerw, 2019; Kazemi, 2017; Markova, 2018; Mirbaha Hashemi et al., 2016; Redelinghuys et al., 2019). However, there is reason to believe that social well-being at work differs from social well-being in other settings (Bartels et al., 2019; Cockshaw et al., 2014; Colenberg et al., 2020; Czerw, 2019; Wijngaards et al., 2021) which implies that context-free measures may not be accurate.

Although there is a plethora of scales for measuring a single aspect of social well-being at work, such as having friends (Nielsen et al., 2000), experiencing relatedness (Van den Broeck et al., 2010), loneliness (Wright et al., 2006), and belongingness (Jena & Pradhan, 2018), it is not clear which combination of measures would best capture the wider concept of social well-being at work. Moreover, few of them include the experience of social interactions at work.

Short-term pleasures, such as pleasant social interactions, are considered a distinct dimension of well-being that is intertwined with the cognitive evaluation of experiences over a longer period creating engagement and meaning (Biswas-Diener et al., 2009; Fisher, 2010; Thorsteinsen & Vittersø, 2019). According to the broaden-and-build theory (Fredrickson, 2004), the experience of positive emotions broadens the individual's mindset of options for action, which promotes social bonds, which in turn increases resilience. As such, positive emotions produce optimal functioning within the present and over the long term. Support for this theory in the work environment has been provided by, for example, Xanthopoulou et al. (2012), who found that daily job resources, such as a psychological climate of cooperation and warmth, induce daily positive emotions at work that relate to the workers' personal resources, such as self-esteem and optimism.

In summary, I believe that the current literature lacks a domain-specific scale that captures a wide range of short-term experiences and long-term evaluations of interpersonal aspects of the work environment. The study reported in this chapter aimed to develop and evaluate such a scale in order to increase the understanding of social well-being at work and offer practitioners a useful measure of this concept. The study aimed for a short scale of up to ten items to keep the balance between conceptual richness and participant burden in organizational research, especially when combining the scale with other measures to capture overall well-being and accommodate the increasing demand for short scales (Ziegler et al., 2014).

5.2 Theoretical background

5.2.1 Established social well-being theory

Although many existing well-being measures include dimensions related to social well-being, such as connection to others, social interactions, depth of key relationships, and availability of social support (Linton et al., 2016), few treat social well-being as a distinct dimension defined by multiple determinants. The most prominent theory on social well-being (Keyes, 1998) is grounded in sociology and philosophy and defines social well-being as the individual's functioning in social life in a positive health approach.

Keyes (1998) created a general social well-being scale that focuses on a person's attitudes towards an unspecified community, society, or the world in general along five dimensions that represent challenges for individual functioning: (1) social integration: the feeling of belonging to a community and feeling close to its people; (2) social acceptance: trust in the goodness of people; (3) social contribution: the feeling to be valuable to the community; (4) social actualization: the impression that society is improving; (5) social coherence: being able to make sense of what's happening in society. This measure of how much individuals see themselves thriving in social life was considered to indicate flourishing, a state on the positive side of the mental health continuum (Keyes, 2002). Other conceptualizations of the social dimension to individual well-being focus on, for example, social capital, which refers to the strength of community ties (Helliwell & Putnam, 2004) rather than the experience of well-being.

5.2.2 Adaptations to the work environment

The prominent conceptualization of social well-being by Keyes (1998) seems to lack a seamless fit to the organizational context. Kazemi (2017) was the first to adapt the scale to the work environment and replaced, for instance, the item 'people in my community' by 'my colleagues' and 'the society' by 'my workplace'. Social acceptance, defined by Keyes as trust in others, was replaced by items about acknowledgement from the supervisor. The psychometric performance of this adapted scale was tested on a sample of educational staff. Although the study provided empirical support for a multi-dimensional nature of occupational social well-being, only the dimensions of social integration and social acceptance showed an acceptable level of internal consistency whilst the other three dimensions of the scale were found less reliable. Kazemi (2017) suggested that the social functioning as operationalized by Keyes may reflect conditions contributing to social well-being rather than the sense of social well-being per se.

To capture social well-being in the workplace, Markova (2018) too followed Keyes' (1998) model but only included the three dimensions of social integration, social acceptance and social actualization in order to explain interpersonal deviance. Exploring social well-being in an office context, Colenberg et al. (2020) found that only social integration and social acceptance resonated in statements from office workers on interpersonal aspects of their working environment. In contrast, the development of the eudaimonic well-being at work questionnaire of Czerw (2019) found only Keyes' dimension of social contribution, operationalized as self-worth in the context of the workplace, to withstand the critical evaluation of items. As Page and Vella-Brodrick (2009) pointed out, Keyes' (1998) measure of social well-being had poor internal consistency to begin with. However, their suggestion to substitute it with a one-item measure, such as 'positive relationships with others', may complement other dimensions of subjective well-being at work but does not serve the nuanced understanding that is needed for informing and evaluating interventions.

Other multidimensional measures of individual social well-being at work apply a different approach without a scale development procedure. Van Horn et al. (2004) defined the social well-being of teachers as a lack of depersonalization, indicated by, for example, caring for students and colleagues, and social functioning, for example feeling comfortable in relationships with students and colleagues. A factor analysis confirmed that their conceptualization of social well-being was a distinctive factor in teachers' well-being but the psychometric quality of the scale was not reported. Marin-Garcia et al. (2021) measured social well-being at work by asking employees about the quality of cooperation, if they generally get on well with colleagues, and if colleagues offer help and support. A more useful approach to social well-being at work is offered by the scale for relatedness at work by Van den Broeck et al. (2010), which is based on the Self

Determination Theory (Deci & Ryan, 2008). However, this scale does not include short-term experiences.

5.2.3 Domain-specific conceptualization

To develop a measure of social well-being appropriate to the context of work, a new start from the work context seemed more promising than adapting or uniting existing measures. Recognizing the long underexposed social dimension of well-being at work, Fisher (2014) conceptualized social well-being in the work context and included both eudaimonic and hedonic aspects. Based on a review of different approaches and models of psychological well-being, she proposed that social well-being at work may consist of 'feeling embedded in a meaningful community and having satisfying short-term interactions and long-term relationships with others.' At work, these meaningful communities may be departments, teams, and committees, or, for example, groups of people that share an area of interest or a location. Embeddedness reflects feelings towards such a group as a whole rather than the quality of individual relationships with members of that group. Interpersonal relationships and interactions at work may range from personal connections with co-workers and supervisors to regular contact with, for example, clients and pupils.

Fisher (2014) proposes that social well-being at work may include, for instance, friendship at work, satisfaction with peers and supervisors, giving and receiving social support, feelings of belonging, group cohesion, meaning at work, and positive energy for others. Although she considers having strong and satisfying relationships with others to be critical to social well-being, she explicitly includes transient but satisfying and helpful social encounters with others, such as co-workers or customers. Following the interaction-relationships-social structure framework of Hinde (1976), positive interactions can be a joy or a pain in themselves while they also form the foundation for long-term relationships, which in turn contribute to embeddedness.

Given the grounding in psychological well-being research, the work-context perspective, and the integration of short-term emotional and long-term attitudinal well-being, we considered Fisher's (2014) conceptualization a valuable starting point for the development of a domain-specific and multi-indicator scale. Using this conceptualization, we expected to find multiple components that differ from each other regarding feelings towards a group of people versus the experience of one-on-one relationships and short-lived experiences versus long-term relationships. We expected these components to correlate substantially because interactions build relationships and individual relationships may add up to group evaluations, while established relationships and groups may enhance opportunities for interaction.

5.3 Method

5.3.1 Overview of the empirical study

Following the suggestions of Boateng et al. (2018) and DeVellis (2017), the study was conducted in three stages: item development, scale development, and scale evaluation. Figure 14 summarizes how social well-being at work was operationalized through the combination of induction and deduction, and how the new scale was constructed and evaluated by applying exploratory factor analysis and structural equation modelling (SEM). SEM is useful for scale development because it enables the reduction of a large number of variables by examining relationships between them simultaneously while accounting for measurement error (Collier, 2020).

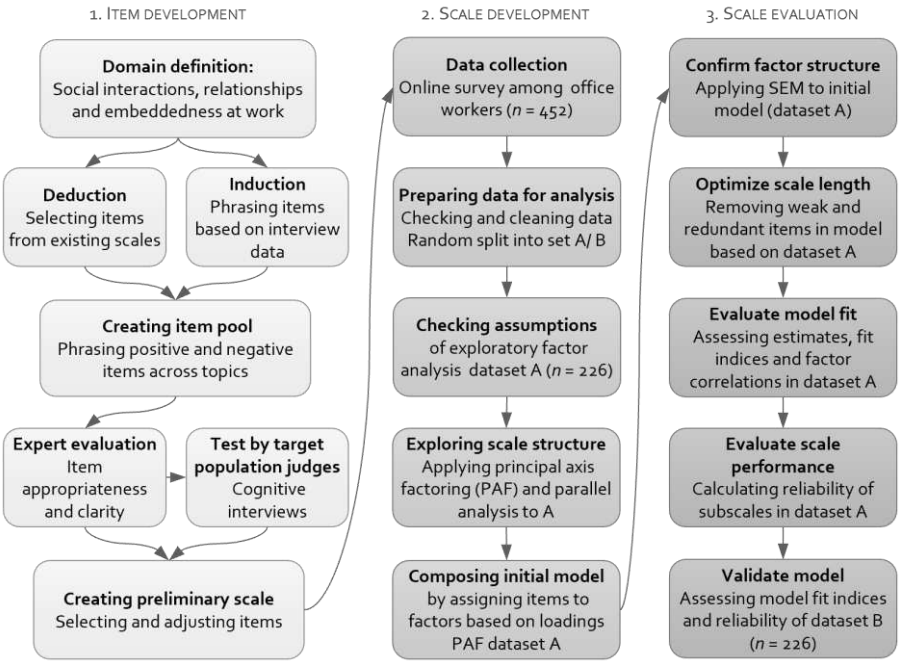
5.3.2 Domain definition and item creation

The domain of the construct to be measured followed the previously cited definition by Fisher (2014). A pool of items was composed by combining a deductive and inductive approach. First, relevant items were extracted from five existing questionnaires on well-being at work that covered a substantial part of our domain by addressing multiple dimensions of Fisher's definition. The questionnaires of Kazemi (2017) on occupational social well-being, Kouvonen et al. (2006) on social capital at work, and Van den Broeck et al. (2010) on relatedness at work covered several aspects of long-term relationships and embeddedness. The questionnaires of Morrison and Macky (2017) on demands and resources of the work environment and Pejtersen et al. (2010) on the psychosocial work environment additionally covered short-term social interactions. The 90 items which were extracted from these five questionnaires were sorted by social well-being dimension, two duplicate items were deleted, and common aspects were identified.

Additionally, new items were induced from a previous study on the conceptualization of social well-being in the office context (Colenberg et al., 2020). In this study, statements of office workers that were made during group interviews were used to identify social well-being themes in the workers' experiences. These themes were mapped to the items that were extracted from the existing scales to identify themes that were not yet covered. For the missing themes, items were phrased using the original interview statements. Based on this initial pool of deduced and induced items, 36 single-issue items were composed which together addressed all three assumed dimensions of social well-being at work, covered a variety of themes, and contained both positive and negative statements to avoid acquiescence bias.

Figure 14

Overview of the steps taken at the three stages of the empirical study



5.3.3 Preliminary scale creation

Dutch items in the pool were translated into English and English items into Dutch to create a bilingual set for international expert review. Five experts on well-being and social scientists with a large experience in constructing questionnaires reviewed the items and assessed their clarity and relevance to the stated definition of social well-being. Based on their judgement and comments, the best-rated items were selected and edited and additional items were created. In this manner, a set of 26 positive and negative items was composed that reflected the different dimensions of social well-being in the Dutch language. A response style of five-point Likert scales (1 = completely disagree, 5 = completely agree) was chosen to create semi-interval data appropriate for factor analysis, limit participant burden, and increase compatibility with other well-being measures, which generally use this Likert scale (Linton et al., 2016). The preliminary questionnaire was pre-tested by cognitive interviews with four office workers, all native Dutch speakers, as members of the target population. As a result, 24 items were kept for scale development and two were excluded due to ambiguity.

5.3.4 Data collection

The preliminary scale of 24 items preceded by the question 'To what extent do you agree with the following statements regarding your interaction with others (colleagues, supervisors, clients, students, etc.) at work (office/remote working)?' was included in a larger online survey on work environment and well-being. The items were presented in a random order to prevent order effect bias. An anonymous link to the larger survey was distributed by email among all approximately 1200 employees of four different organisations in the Dutch public sector between November 2020 and February 2021. In one of those organizations, an English version was distributed along with the Dutch version. At the start of the questionnaire, participants were informed about the purpose of the research and requested to consent to the use of their anonymous data.

In total, 567 employees (47%) answered at least the first three questions of the Dutch version of the survey and 472 of them (39% of the invited employees) completed one or more social well-being questions. Data were collected within different organisations to dilute the supposed impact of organisational culture on tendencies in social well-being responses. The invitation and reminder to participate were sent by a manager of the organisation instead of the researchers because of privacy reasons. To increase the engagement of participants, each organisation was promised a report of their aggregated results, provided that the response rate would guarantee acceptable reliability. The study was approved by the Human Research Ethics Committee of the Delft University of Technology (reference #1326, 30-10-2020).

5.3.5 Preparation of datasets

First, 20 cases were removed that had missing values at any of the social well-being items to prevent problems in SEM. Next, the remaining 452 cases were checked for low standard deviations (< .25) since this can indicate respondent misconduct (Collier, 2020). After this data cleaning, the sample was randomly split into a development set A (n = 226) and an evaluation set B (n = 226) to enable cross-validation while keeping a minimum of five participants per item as suggested by Howard (2016) and Carpenter (2018).

5.3.6 Model building and testing

To identify the dimensional structure of social well-being at work and the items' contribution to the dimensions, an exploratory factor analysis was conducted on dataset A using IBM SPSS Statistics 28. Parallel analysis using O'Connor's (2000) syntax and visual inspection of the scree plot were used to identify the number of factors. To assess the item's contribution to the factors, principal axis factoring (PAF) was applied. Oblique rotation (*delta* = 0) allowed the factors to be correlated and is considered appropriate for natural data (Field, 2013). To assess if the factor analysis yielded distinct and reliable factors, we inspected the items' communalities, the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO), which should be > .50, Bartlett's test of sphericity, which should be significant ($p < .05$) and the correlation matrix determinant, which should be >.00001 (Field, 2013).

We constructed a model by assigning items to a factor if their absolute loading was > .40 on their primary factor, < .30 on other factors and the difference between the primary and other loadings was > .20, following Howard (2016). Only factors having at least three significant loading items were retained. To confirm the factor structure, SEM (maximum likelihood) using SPSS AMOS 26 was applied. Model fit was evaluated based on a combination of absolute and incremental fit indices recommended by Collier (2020): the relative chi-square (χ^2/df), which should be between 1 (best) and 3 (maximum), the Comparative Fit Index (CFI), which should be ≥ .90, the Root Mean Square Error of Approximation (RMSEA), which should be < .080 with the upper bound of the 90% confidence interval below 1, and the Standardized Root Mean Square Residual (SRMR), which should be < .090 for an adequate fit. Pearson correlations between the factors (sum of items) were calculated to assess convergent validity and check for redundancy of factors.

Since three to five indicators per factor are considered optimal (Carpenter, 2018), and since we aimed to develop a short scale, we reduced the number of items by removing the weak indicators ($\lambda < .60$, Collier, 2020) from the model. Subsequently, redundant items were stepwise removed based on the highest mean inter-item correlation until we reached the desired number of items. The resulting solution was evaluated considering the desired mixture of negatively and positively worded items and retaining sufficient reliability. The reliability was tested by calculating Cronbach's alpha (α) and MacDonald's omega (ω) for each factor after reversing the negatively worded items. An alpha or omega between .70 and .80 was considered respectable and between .80 and .90 was very good (DeVellis, 2017).

5.4 Results

5.4.1 Sample and preparation of data sets

From the 472 valid questionnaires, 20 cases with missing values at any of the 24 items were removed. Data inspection did not reveal any respondent misconduct. Of the remaining 452 respondents, 47% were 50 years or older and 29% were younger than 40, which aligns with population demographics showing 48% were 50+ and 26% were 40- in 2018 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, n.d.). A minority was living alone (14%). 13% had a managerial position, 13% had been working for their department for less than a year, and 65% had longer than two years. Due to the pandemic, 56% were completely working from home at the moment they completed the questionnaire, although some of them had been to the office before, for instance, in between lockdowns. In total, 68% had been working at the office for at least several days since the first lockdown, which was imposed eight to eleven months ago at that time. Appendix A lists the mean scores per item, which were mostly positive.

Data inspection revealed that the social well-being items did not show any multi-collinearity; in contrast, some inter-item correlations were non-significant or very low (Appendix A). Rather than removing them before the analysis, they were marked for reconsideration during model building. Chi-square and t-tests showed that there were no significant differences in background variables or item scores between development set A (n = 226) and validation set B (n = 226) except for item 17, which was higher ($F(450) = 8.407$, $p = .035$) in dataset B ($M = 3.91$) than in dataset A ($M = 3.75$).

5.4.2 Exploring scale structure and composing a model

With most communalities around .50 (median .45), the sample size of dataset A was considered adequate for factor analysis (Field, 2013). Both the parallel analysis and scree plot indicated a two-factor structure. Since we expected the construct to have three dimensions, we also explored a three-factor solution, but the only difference with the two-factor model was a third factor with just one significant item loading, which is not useful. The KMO (.905), Bartlett's test ($\chi^2(276) = 2053.482$; $p < .001$), and determinant (7,489E-5) confirmed the reliability of the factor analysis. Table 10 shows the results (pattern matrix) of the PAF extracting two factors converged in eleven iterations.

Table 10

Summary of PAF results for the initial social well-being scale (dataset A, n = 226)

		Factor 1	Factor 2
1	My daily interactions at work are pleasant (a)	0.299	-0.321
2	I regularly have a good laugh with others at work (a)	**0.727**	-0.015
3	I often quarrel with others at work (a)	-0.049	**0.472**
4	I often am annoyed by other people at work (a)	0.088	**0.626**
5	Other people are hostile to me at work (a)	-0.102	**0.554**
6	I have heart-to-heart conversations at work (a)	**0.618**	0.149
7	I often get distracted by others at work (a)	0.011	0.132
8	At work, I don't have enough face-to-face contact with my co-workers (a)	-0.173	0.078
9	I like my colleagues (b)	**0.539**	-0.292
10	I have a good relationship with my supervisor (b)	0.165	-0.370
11	Some colleagues I do not trust (b)	0.114	**0.632**
12	I do not really feel connected with others at work (b)	**-0.572**	0.106
13	At work, I can talk about what really matters to me (b)	**0.607**	-0.106
14	My colleagues support me when I'm feeling down (b)	**0.632**	-0.102
15	Some people I work with are close friends of mine (b)	**0.517**	0.129
16	Some colleagues I rather avoid (b)	0.110	**0.641**
17	At work, I feel part of a community (c)	0.390	**-0.427**
18	My colleagues and I are a close team (c)	**0.586**	-0.170
19	I feel socially isolated at work (c)	-0.262	**0.518**
20	I sometimes feel excluded by my co-workers(c)	-0.227	**0.553**
21	I feel attached to my group of colleagues (c)	**0.555**	0.034
22	I feel accepted within the department (c)	0.301	**-0.557**
23	I feel others at work take me seriously (c)	0.162	**-0.557**
24	My connections at work are superficial (c)	**-0.519**	0.198
	Eigenvalues	7.355	1.393

Note: factor loadings >.40 appear in bold; items 1-8 (a) aimed to measure the experience of short-term social interactions, items 9-16 (b) long-term interpersonal relationships, and 17-14 (c) embeddedness at work.

Attributing items to a unique factor excluded items 1, 7, 8, and 10 (insignificant loading) and 17 (cross-loading) from further analysis. Since the negatively phrased items were not grouped into one component, we assumed that the reversed phrasing did not create a method factor based on response style. The two factors were interpreted as (1) bonding with other people at work and (2) psychological safety of the social work environment. Each factor included a mix of items that were intended for measuring interactions, relationships, or embeddedness instead of grouping them into separate factors. Refitting the factor analysis on the remaining 19 items showed that together the two factors explained 46,74% of the variance.

5.4.3 Model testing and optimization

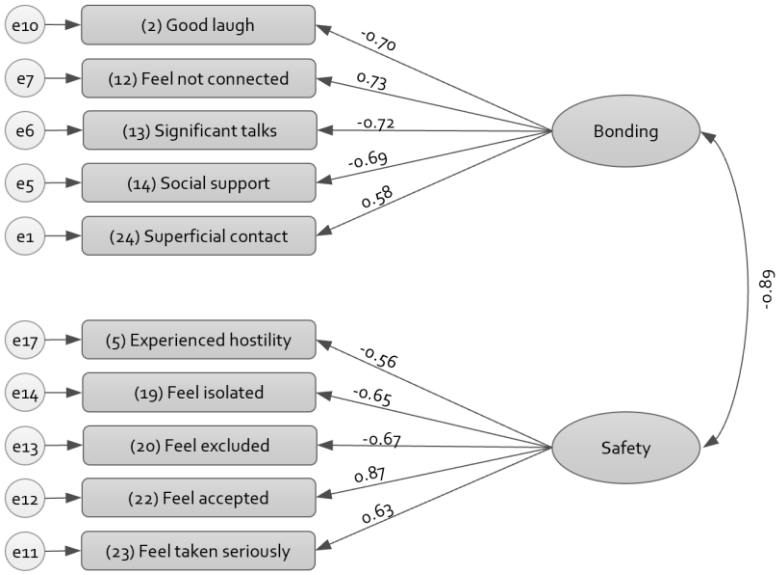
SEM applied to the 19-item model resulting from the exploratory factor analysis showed an acceptable model fit to dataset A with $\chi^2/df = 2.08$, *CFI* = .892, *RMSEA* = .069 (*CI90* = .059-.080), and *SRMR* = .063. All relationships were significant ($p < .001$). Adding a relationship between the residuals of items 11 and 16 increased model fit and raised *CFI* above the .90 threshold (acceptable) and decreased *RMSEA* to below .060 (good).

To optimize scale length, we reduced the number of predictors by first removing seven items with weak absolute loadings ($\lambda < .60$): (6) *Heart-to-heart conversations*, (15) *Having friends*, (21) *Feel attached*, (3) *Quarrel often*, (4) *Annoyed by others*, (11) *Do not trust some*, and (16) *Avoid some*. This resulted in a model containing seven items for *Bonding* and five for *Safety*. From the seven items reflecting bonding, we first removed (9) *I like my colleagues*, which had on average the highest correlation ($r = .49$) with the other items in the set since a high inter-item correlation indicates redundancy in measuring the underlying concept. Among the remaining six items, (18) *Close team* had the highest average inter-item correlation ($r = .47$). By removing this item too, each of the latent factors included five predictors of both positive and negative worded items.

The final model (Fig. 15) showed an excellent fit to dataset A with a *CFI* well above .95 and both *RMSEA* and *SRMR* below .060. The Pearson correlation between the aggregated scores of the subscales was significant ($r = .643$, $p < .001$), which was evidence for convergent validity, but did not exceed .85, which could have indicated redundancy. The model was validated by applying it to dataset B, which showed a good fit ($\chi^2/df = 2.201$; *CFI* = .954; *RMSEA* = .073 (*CI90* .051-.096); *SRMR* = .048). We also found an acceptable fit for each of the four organizations.

Figure 15

Standardized estimates of the final model applied to dataset A ($\chi^2/df = 1.567$; CFI = .975; RMSEA = .050 (CI90 .021-.075); SRMR = .038)



Both reliability coefficients, Cronbach's α and MacDonald's ω, (Table 11) reflect good reliability of the subscales in each of the datasets while not being so high as to indicate the over-inclusion of items.

Table 11

Reliability coefficients of the two subscales and the total scale in datasets A, B, and the entire sample (A+B)

	Cronbach's α	MacDonald's ω
Bonding (dataset A)	.781	.780
Bonding (dataset B)	.808	.808
Bonding (entire sample)	.795	.795
Safety (dataset A)	.813	.814
Safety (dataset B)	.805	.808
Safety (entire sample)	.808	.810
Social well-being (dataset A)	.866	.865
Social well-being (dataset B)	.879	.880
Social well-being (entire sample)	.873	.873

The distribution of the bonding and safety scores of the entire sample shows that on average, the aggregated social well-being score of the respondents is high (M = 39.25, SD = 5.23), but 26.8% experience a lack of safety as indicated by an average score on the five safety items below 4.00.

5.5 Discussion

5.5.1 Discussion of the findings

Based on the 24 items that were developed to measure social well-being at work, a two-factor and 10-item model was constructed which fits well with both the development and the validation dataset. The model indicates that social well-being at work on the one hand consists of feelings of bonding, including connectedness and companionship and referring to the need for relatedness, and on the other hand of psychological safety, which refers to a climate of trust and respect where people are comfortable expressing themselves (Edmondson, 1999). Both the items' content, the mixture of negative and positive worded items within a factor, and the acceptable correlation between the factors indicate that they are not just each other's opposite; they seem to refer to strongly related yet distinct dimensions of social well-being at work.

The bonding dimension reflects emotional involvement with others at work and the depth of personal relationships, while the safety dimension refers to a minimum level of inclusion which makes the individual feel comfortable among others at work, while social harassment is absent. This concept of psychological safety does not necessarily include the sympathy and understanding that characterize bonding, although the worker can feel protected by having positive relationships. From a two-factor theory perspective (Herzberg et al., 2017), the model's safety dimension could be considered a hygiene factor and a possible source of dissatisfaction, turnover, and burnout when lacking, whereas the bonding dimension may be a motivator, supporting flourishing.

The two-dimensional structure of social well-being at work resulting from the modelling indicates that the items referring to different elements of Fisher's (2014) conceptualization (i.e., interaction, relationships and embeddedness) are not organized as separate dimensions. Perhaps the three elements should be considered a typology of social well-being aspects, indicating different levels of experiences regarding duration (short-term vs. long-term) and abstraction (relationships with individuals vs. the community), while their boundaries are diffuse. Nevertheless, the subscale of bonding predominantly includes items about positive relationships with individuals, while the safety subscale emphasizes items about the work community. This may indicate that for bonding, interpersonal connections are the most important, while the dimension of safety rather refers to group behaviour than to the negative tormentor-victim relationships that characterize bullying (Einarsen & Skogstad, 1996).

Furthermore, the long-term aspects outnumber the short-term aspects; most items about social interactions were either found to be insignificant or less important than other items. Moreover, the 'surviving' item of regularly having a good laugh with others at work, which intended to reflect the short-lived pleasure of shared positive emotion, may also refer to the shared sense of humour or recognizing running gags, which can indicate an affective relationship or inclusion in a community. Perhaps this indicates that the short-lived experiences of specific social interactions are less important to social well-being than the evaluation of relationships and embedding.

The items that did not contribute significantly to social well-being at work may reflect aspects of the social work environment that are not exclusively related to feelings of well-being or the behaviour of others. For example, respondents may have attributed often being distracted to their own inability to focus and annoyance to having a bad mood rather than to others who are behaving badly on purpose. Moreover, distraction by others at work is not necessarily a negative experience. Interestingly, the factor analysis showed that a good relationship with the supervisor was less important to social well-being than other relationships at work, although it was moderately correlated to feeling accepted and taken seriously.

5.5.2 Contribution to the organizational literature

This study contributes to the literature about employee well-being by identifying different conceptualizations of social well-being and developing a model that may cover social well-being in the current work environment. It provides a domain-specific alternative to the mental health approach of Keyes (1998) and emphasizes the importance of personal bonding and psychological safety for employee well-being. Feeling safe is necessary to suppress the body's default of high alertness while chronic feelings of unsafety, such as loneliness, cause prolonged stress responses which result in disease (Brosschot et al., 2018) of which burnout is a topical work-related condition (Demerouti et al., 2021). Our model suggests that a feeling of safety in the social work environment largely depends on feeling accepted and underlines the importance of an inclusive workplace. Bonding with other people, on the other hand, can increase resilience. Social support, for example, has been found to buffer burnout (Bakker & Demerouti, 2007) and emotional exhaustion (Verhoeven et al., 2003). A recent study by Shih and Nguyen (2022) shows that a shared sense of humour enhances resilience through the experience of positive events, which is another example of well-being by the broaden and build theory.

The study also shows which aspects of social well-being at work may be less important than expected. Although having friends at work often is considered an indicator of interpersonal well-being at work (Bartels et al., 2019; Morrison & Macky, 2017; Van den Broeck et al., 2010), in our model this was one of the weaker indicators of social

well-being. The items of *Bonding* do reflect aspects of friendship, but maybe considering someone a friend means something different to Dutch employees, for example, discussing private problems and regularly seeing each other outside working hours. Not having friends in that sense might indicate that these employees have a relative high segmentation preference (Kreiner et al., 2009) and feel less need for close ties at work or want to keep a boundary between work and private life.

5.5.3 Limitations and directions for future research

This study is based on an adequate-sized sample which, however, represents a specific national and organizational culture that could have influenced the variance of responses. Although in our sample, the model has an acceptable fit for the different organizations, the model's relevance to other populations is to be assessed in samples among different countries, sectors and organizations of varying sizes and sectors. The scale's convergent and discriminant validity and its position in the nomological network need to be assessed by testing the correlation with related concepts, such as affective organizational commitment, emotional social support, workplace ostracism, workplace loneliness, and workplace harassment. A deeper understanding of the phenomenon will require research of possible antecedents of social well-being, such as affective events which involve others at work, team-based activities, and interactions elicited by office design, and consequences of low social well-being for burnout, turnover, and preference for remote working. Future research on daily fluctuations of social well-being may add patterns of intra-individual variation to the model as suggested by Ilies et al. (2015).

A possible limitation of this study concerns the data collection during the Covid-19 pandemic, a time when the prolonged working from home for many and the imposed social restrictions may very well have lowered social well-being at work. However, it is not clear if and how that could have been influencing the factor structure and the weight of indicators. Our samples included employees who had been exclusively working from home for up to ten months, who had been working at the office for some period or all along, and workers who had recently joined the organization. Each of these situations may have had a different impact on social well-being, but our groups were too small to compare. Moreover, for some, working from home or the absence of co-workers may have been a relief while others suffered from fewer opportunities for socializing. Extensive working from home is still the case three years after the onset of Covid-19 and currently is expected to remain common practice in organizations. Given this situation, the current data might not be that far from representing future reality, even when working from home is voluntary instead of imposed, but post-pandemic research is required to confirm this.

5.5.4 Practical implications

According to our evaluation, the developed scale is a reliable measure of social well-being at work. It can be used for observing interpersonal aspects of well-being at work in addition to other well-being dimensions, such as psychological well-being and physical health, in a holistic approach. As a separate measure, it could inform human-resources officers, facility managers, and designers about the effectiveness of interventions to increase social well-being, such as team-building activities, services for informal communication, and workplace design that stimulates positive encounters, supports group identity and reduces aggression. Managers could use the scale to assess the social climate and cohesion in their teams and notice signs of social exclusion. The items provide directions for taking actions to improve social well-being. Furthermore, it can be used to investigate the impact of organizational changes.

5.6 Conclusion

Social well-being is considered to be a separate dimension of overall well-being and well-being at work, yet a satisfying domain-specific measure was lacking. This study presents a two-dimensional ten-item scale for measuring social well-being at work appropriate for organizational research and practice. Items were developed by a combination of induction and deduction. Exploratory and confirmatory factor analyses indicated a two-dimensional structure of social well-being at work referring to bonding with others and feeling safe. The psychometric tests indicated good reliability. This initial scale can support a holistic assessment of employee well-being, assess the development of social well-being after organizational changes, and establish the effectiveness of interventions for enhancing social well-being. The study increases the understanding of social well-being in a work context and aids future research on the conceptualization and measurement of this important well-being dimension.

CHAPTER 6

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6 DESIGN FOR WORKSPACE PRIVACY

Lack of privacy is a prominent issue in contemporary offices. Stimulating social interaction at the office to enhance the social well-being of employees may worsen the problem, for example, because chatting creates noise and offering opportunities for eye contact increases visual exposure. Therefore, social offices should not only provide spaces that are designed for social interaction but also spaces that support individual-focused work and private conversations.

The study reported in this chapter aimed to identify interior design features that influence privacy satisfaction in office workspaces. Eight design features were defined that were easy to report by users and expected to influence visual, acoustic and physical privacy, noise from other people, and acoustic quality. Using survey data, the joint impact of these design features on the experienced privacy and noise was calculated through ordinal regression analysis. The resulting hierarchy serves to prioritization of design solutions.

6.1 Introduction

Workspace satisfaction has been observed to influence job satisfaction, which in turn is related to productivity and turnover (Davis et al., 2011; Van der Voordt, 2004; Wright & Bonett, 2007). It is therefore important for organisations to support user needs towards workspace privacy. The prolonged working from home during the Covid-19 pandemic has once more underlined that many offices fail to adequately support individual user needs. For the average employee, the home office performs better than the office workplace (Leesman, 2021). It offers considerably more privacy and quiet, and a better ambience than their pre-Covid workspace at the office (Colenberg & Keyson, 2021).

In the past years, perceived lack of privacy and noise annoyance have been the most prominent issues in office environments, especially in open-plan offices and activity-based working environments (Bodin Danielsson & Bodin, 2009; Engelen et al., 2019; Kim & De Dear, 2020; Marzban et al., 2021; Vanhoutte, 2015). Noise annoyance and perceived lack of privacy refer to unwanted social interactions. The tension between privacy and interaction may be especially salient if substantial working from home results in a higher need for social interaction at the office than before, while there still is a need for quiet workspaces at the office. Recent research showed that the expected crowdedness and the availability of private spaces for concentration and meetings determined employees' choice to return to the office (Appel-Meulenbroek et al., 2022).

However, without detailed knowledge about the sources of privacy dissatisfaction and their relationship with office workspace design, it is difficult to decide upon changes for improvement. Empirical studies that relate actual workspace characteristics to noise annoyance are scarce (Colenberg et al., 2021). Furthermore, in real-life settings, design features do not occur in isolation but are related to each other. Privacy is a complex concept with several dimensions which may impose different needs on the physical environment. Therefore, this study aims to explore to what extent specific workspace design features jointly predict satisfaction with specific dimensions of perceived privacy and noise in offices.

6.1.1 Experienced privacy at the office

A widely used conceptualisation of privacy is by Altman (1975), who defines privacy as the individual's ability to regulate and maintain an optimal level of social interaction. According to Gifford (2014, p. 171) current typologies of privacy are often based on the ideas of Alan Westin, who distinguished being alone ('solitude'), group privacy ('intimacy'), being among others without interaction and while not being identified ('anonymity'), and psychological barriers against intrusion ('reserve'). Solitude with no one else nearby is referred to as isolation. At the office, isolation from the sights and sounds of other people may be needed for concentration work and recovery from stress, intimacy for private conversations and bonding, and reserve to prevent feelings of crowding and reduce distractions.

In studies on satisfaction with office workspace privacy, there often is a distinction between visual privacy, which refers to not being seen, and sound, acoustical, or speech privacy, which refers to not being overheard (Kim & de Dear, 2013; Leder et al., 2016; Oldham, 1988). A recent application of Altman's theory to the work context distinguishes between input from others and output to others of general, social, visual, and acoustic stimuli (Weber et al., 2021). According to this perspective, perceived privacy at the office not only includes control over how much others can see or hear of you (disclosure), but also the absence of unwanted sound (noise) caused by other people. This means that the concepts of workspace privacy and noise from others are entwined. Since the intrusion of personal space could be considered a violation of physical privacy, this was added to the studied privacy dimensions.

6.1.2 Privacy by interior design

In this study, workspace design refers to the interior design of office space, which ranges from layout and arrangement of spaces to surface materials and furniture (Ching & Binggeli, 2018). In contrast to experienced privacy, *architectural* privacy (Sundstrom et al., 1980) at the office refers to the actual enclosure of the workspaces and whether a door can be closed. Architectural workspace privacy is importantly

influenced by spatial arrangement (Gifford, 2014, p.350). Naturally, a smaller room or more partitions will provide more enclosure and restrict accessibility. The number of workstations impacts the density and proximity of people within the workspaces. Spatial and social density reduce the possibilities to achieve desired privacy and can induce feelings of crowding. Even the arrangement of furniture matters, for example, whether users face each other or not, and the distance to neighbours (Laurence et al., 2013). According to the theory of prospect and refuge (Appleton, 1984), people prefer having their back covered, while being able to overview the area in front of them.

Furthermore, layout and spatial organisation determine the travel routes of people and sound within the office building. Passers-by can violate the office workers' privacy by looking into the workspace or producing noise by walking and talking. According to space syntax theory, office workspaces having a central, integrated position on the floor will attract more users than those having a less central, more isolated position (Sailer & Koutsolampros, 2021). In large or open office workspaces, people passing by closely can infringe the worker's personal space, since the preferred interpersonal distance in business relations is 1.20 to 3.50 m (Hall, 1966). Apart from physical openness, the use of transparent building materials enables vision from one space into the other and thereby reduces visual privacy. Solid partitions obstruct vision and additionally reduce sound transmission, especially if they are covered with sound-absorbing material. Surface finishes, such as floor covering, may influence the reflection and distribution of sound.

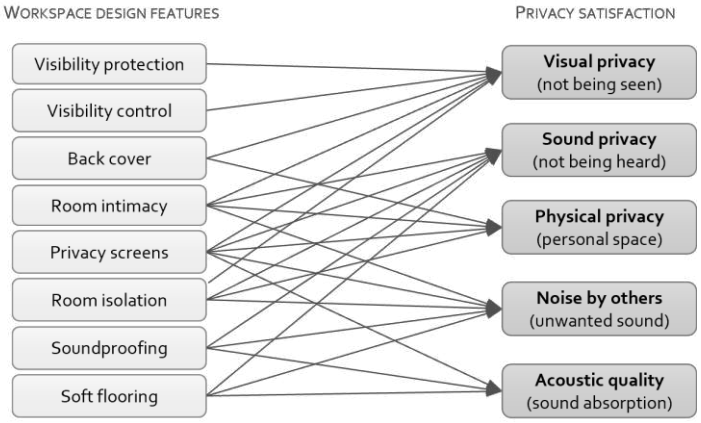
6.1.3 Conceptual framework

Based on the above definition of privacy dimensions, and the theoretical and practical identification of possibly related workspace characteristics, eight design features were chosen that were expected to reflect the architectural privacy and acoustic quality of an office workspace (see Fig. 16, next page). They include spatial characteristics, finishes and furniture, which cover important components of interior design. These design features were assumed to be easy to identify and report by office users.

Self-report measures are appropriate for individual experience and satisfaction. Noise, for instance, is a psychological interpretation that depends on sensitivity and situational aspects and not just on the sound level. Regarding design features, measurement of some might be more detailed or accurate when taken by independent observers, for example, the height of partitions, but we expect self-report measures reasonably accurate while much easier to obtain.

Figure 16

Hypothesized design predictors of satisfaction with privacy and noise



It was expected that satisfaction with visual privacy (not being seen) would be predicted by the visibility of the user from outside the workspace, possibilities to adapt their visibility, for instance through closing the door or closing curtains, and a back cover preventing others to approach them unseen or look at their computer screen. Furthermore, the number of roommates (room intimacy), the presence and height of privacy screens attached to the workstation, and the isolated location of the workspace were expected to affect visual privacy. An isolated position of the workspace aimed to reflect the risk of privacy violence and noise from people passing by.

Sound privacy (not being heard by others) was expected to depend on room intimacy, screens, isolation and the degree of speech transmission (soundproofing). Physical privacy (personal space, distance to others) was expected to depend on the back cover, room intimacy, screens, and isolation. Annoyance with the noise of others was expected to be predicted by large workspaces, lack of (sound-absorbing) screens, regular traffic around the workspace, and lack of soundproofing and soft flooring. Acoustic quality was expected to depend on screens, soundproofing and flooring material.

6.2 Method

6.2.1 Variables and measurement

The aspects of architectural privacy and acoustic quality that were chosen to reflect the scope of interior design and the various dimensions of privacy, as explained above, were operationalized into eight ordinal variables (Table 12), which were to be measured by self-report rather than direct observation.

Table 12

Operationalization of the degree of architectural privacy and acoustic quality of the office workspace ranging from a low (1) to a medium (2) and high (3) level

Design feature		Level 1 (low quality)	Level 2 (medium)	Level 3 (high)
a.	Visibility protection	Look in at eye level from 2+ sides	Look in at eye level from 1 side	Worker not visible at eye-level
b.	User visibility control	No possibilities for adjusting the visibility	Limited possibilities	Several possibilities
c.	Back covered when seated	No cover: back towards open space	Half-high or transparent cover	High & solid back cover
d.	Room intimacy	Large/open (> 6 pers.)	Medium (4-6 persons)	Small (1-3 persons)
e.	Privacy screens workstation	No screens attached/ next to the workstation	Low screens (can look over standing-up)	High screens (not able to look over)
f.	Isolation of workspace	People pass by regularly/ continuously	People pass by now and then	Few passers-by due to isolation
g.	Soundproofing of workspace	Any speech can be overheard	Only loud speech/ intonation passes	Workspace (almost) soundproof
h.	Flooring material	Hard, reflecting sound	In between, walking makes sound	Soft & absorbing sound

Architectural privacy, or actual enclosure, was operationalized into six variables (Table 12, row a-f) that were measured by self-report. Protection against visibility (a) was indicated by the reported number of sides from which passers-by could look into the workspace from outside, the door (if present) closed, due to openness or transparency of the wall or door at eye level. The degree of visibility control (b) was measured by the perceived amount of possibilities for workers to prevent people to look into their workspace from outside. Room intimacy (d) measured the number of persons sharing the room, i.e. the number of workstations as reported. Open workspaces were included in the category of large rooms. Isolation of the workspace (f) from traffic was expressed by the usual number of passers-by. Other aspects of workspace enclosure were measured by (e) the self-reported presence and height of non-transparent privacy screens attached or placed next to the workstations, and (c) to what extent the users feel their back covered by for example a wall or bookcase while seated at their workstation.

As self-report measures of acoustic quality, two acoustic design solutions were included that should be easy to identify by ordinary office users: (g) the degree of soundproofing, expressed by how well people at one metre outside the workspace can overhear speech from within the workspace, and (f) sound absorption by type of workspace flooring, ranging from a surface that is perceived as hard and sound-reflecting to one that is soft and well absorbing the sound of walking. Privacy screens attached to the workstation

may also support acoustic quality, but they will only absorb speech if they are sufficiently high (above 1.40m) and covered by sufficiently sound-absorbing material.

Satisfaction with privacy and noise in the workspace was measured through satisfaction with five workspace characteristics which were phrased and explained in the questionnaire as follows: visual privacy (yourself or your screen not being seen by others), sound privacy (not being heard by others), personal space (others sitting or passing by at a comfortable distance), the amount of noise by other people, and acoustics (echo and sound spreading). Respondents were asked to indicate their average satisfaction with these aspects of the workstation(s) they use at the office on a 5-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied).

6.2.2 Questionnaire and data collection procedure

Data were collected through an online survey among office workers in The Netherlands, which was developed for a larger study on workplace design and well-being. In this questionnaire, items with Likert scales were presented in a random order to prevent anchoring bias. The order of responses to ordinal variables alternated between low-high and high-low to prevent primacy bias. In the case of desk-sharing, participants were instructed to answer the questions with their usual or most used workstation in mind.

Four organisations in the Dutch public sector, recruited through the network of the first author, participated in the study. They occupied three different office buildings featuring a variety of workspaces, with an emphasis on traditional cellular offices but also featuring activity-based working environments. In each organisation, a key person distributed the anonymous link to the questionnaire among all employees, between November 2020 and February 2021. Of the approximately 1200 employees that were invited, 589 (± 49%) responded to the survey. Respondents who had joined the organisation after the first lockdown of March 13, 2020, were excluded from our analysis because they had not experienced the office at its normal occupancy. Between the lockdowns of Spring and Autumn 2020, working from home was still advised in these organisations and the Summer holidays further reduced occupancy. Additionally, respondents were excluded who did not indicate that they had been working at the office for at least several days since that first lockdown, because then memories of their office workspace experience might have faded or changed. Of these 351 respondents, some abandoned the survey before they reached the questions about privacy satisfaction. In total, 323 valid questionnaires were used for this study.

6.2.3 Sample characteristics

Approximately half (48%) of the respondents in our sample were 40 to 59 years old, 18% were younger than 40 and 34% older than 59. The majority (68%) had been working in their current department for more than two years. At the office, most of the respondents either formally (47%) or practically (17%) owned a workstation, and an additional 24% nearly always resided in the same area; only 10% indicated using a wide range of workspaces in the office. Due to Covid-19 restrictions, 43% of the respondents were completely working from home when they completed the survey, although they had been working in the office regularly or incidentally in between lockdowns, a few months before.

6.2.4 Statistical analyses and modelling

We tested our expectation that privacy and noise would be related by calculating Spearman's rank correlations between the five satisfaction variables. The distributions of all variables were explored through descriptive analyses. To evaluate the predictive power of combined design features and forecast the effects of design changes, we performed ordinal (i.e. cumulative logistic) regression analyses. Ordinal regression is a parametric statistical test to determine whether one or more predictor variables have a statistically significant effect on an ordinal outcome, such as Likert scale variables (Eiselen & Van Huyssteen, 2021).

Each regression analysis took one aspect of satisfaction as the dependent variable and several design features as independent variables (see Fig.16). According to Norusis (2012), the complementary log-log link function is best for variables heavy in positive values, the negative log-log for positively skewed variables, and the logit for more or less evenly distributed variables. For our data, the logit link provided the best results.

The ordinal regression analyses were started by including all of the predictors that were expected to be important to the dependent variable (see Fig. 16). When predictors seemed not to be helpful in the model, they were removed and the model was re-estimated. To check if the data met the required assumptions, they were assessed for multicollinearity and proportional odds. Since the odds ratio (OR) provides additional interpretations of the regression models in real-world contexts (Eiselen & Van Huyssteen, 2021), they were calculated through $e^{-\beta}$, β being the estimated coefficient (Norusis, 2012). All statistical analyses were performed using IBM SPSS Statistics 25.

6.3 Results

6.3.1 Correlations

As expected, satisfaction with privacy and noise were entwined. Table 13 shows the substantial and statistically significant correlations between all aspects of perceived privacy and noise annoyance, with the strongest relationship between visual and physical privacy (ρ = .600), and the least strong connection between visual privacy and acoustic quality (ρ =.479).

Table 13

Non-parametric correlations (Spearman's rho) between satisfaction variables

	Visual	Sound	Physical	Noise	Acoustic
Visual privacy	1	.528**	.600**	.520**	.479**
Sound privacy		1	.542**	.585**	.529**
Physical privacy			1	.554**	.557**
Noise of others				1	.599**
Acoustic quality					1

** correlation is significant at the 0.01 level (2-tailed)

The reported design features also correlated to each other, but coefficients were much lower (Table 14) and did not indicate problematic multicollinearity (Field, 2013, p.335).

Table 14

Non-parametric correlations (Spearman's rho) between design features

	Intim	Isol	Visib	Ctrl	Scrn	Back	Sndpr	Floor
Room intimacy	1	-.199**	.274**	.339**	-.404**	.556**	.376**	.136*
Isolation		1	.162**	.123*	.110	-.042	.012	-.048
Visibility protect			1	.264**	-.188**	.287**	.357**	.065
Visibility control				1	-.154**	.275**	.202**	.091
Screens					1	-.295**	-.254**	-.039
Back cover						1	.239**	.109
Soundproof							1	.150*
Soft flooring								1

** Correlation is significant at the .01 level (2-tailed); * significant at .05 level

In the studied sample, the smaller, more intimate rooms more often had privacy-supporting design features such as a covered back, less visibility of the user in the workspace, more control of visibility, and a more soundproof workspace, and more soft flooring which could reduce noise. Not surprisingly, privacy screens more often appeared in larger rooms and open spaces than in smaller rooms. More remarkable was the centrality of smaller rooms: apparently, in this sample they were more often located

within the office traffic flow (less isolated, more passers-by) than large workspaces. Extending the sample to other office buildings might lead to different correlations due to different design choices influenced by for example user preferences or budget.

6.3.2 Frequencies and distributions

Figure 17 illustrates that the majority of the respondents were satisfied with personal space and acoustics in their office workspace, but relatively many of them were dissatisfied with noise, sound privacy, and visual privacy. Note that this may have been influenced by the home working experience, which offered many office workers more quiet and privacy than working at the office.

Figure 17

Frequencies of the dependent variables

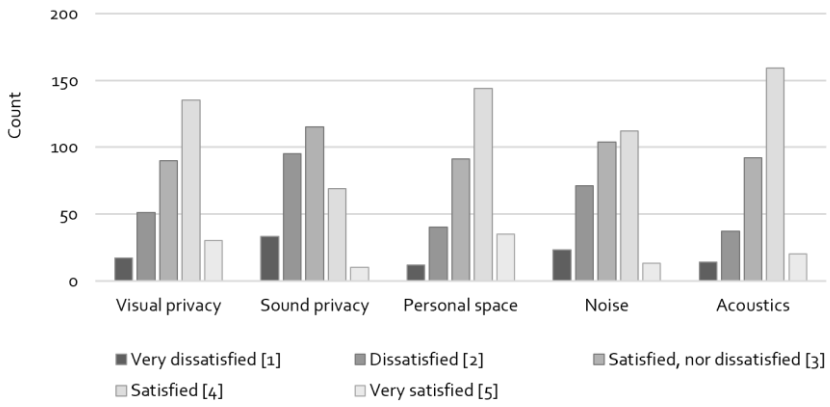
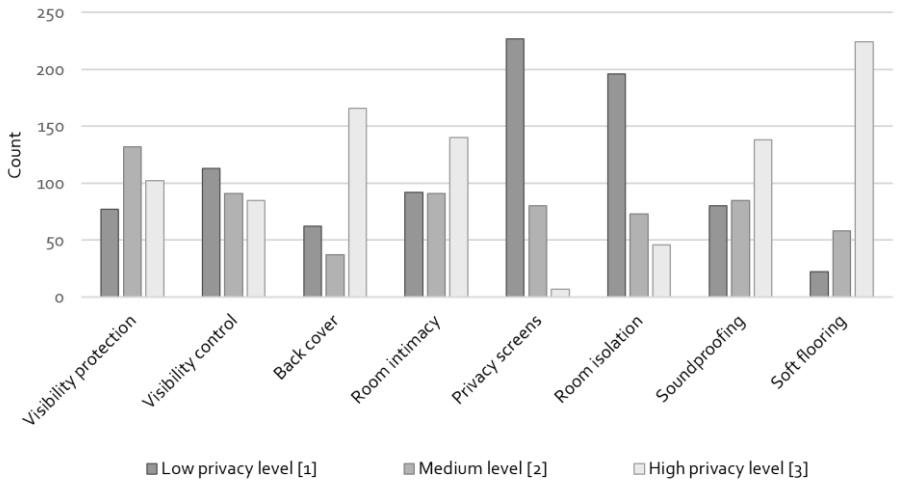


Figure 18 (next page) reflects the differences in workspace design within the sample. In these offices, only a few workstations featured privacy screens around them, but many had a high and solid partition behind them. Soft flooring was more common than a hard floor surface, soundproofing is reasonable, and the majority of the workspaces were integrated rather than isolated.

Figures 17 and 18 show that neither of the variables is normally distributed, hence a parametric test is the right choice to analyse relationships. The figures also show that several categories are filled with less than fifty cases. Sparse levels increase the risk of empty cells in the regression analysis, which undermine the reliability of the chi-square-based fit statistics and parallel lines test for proportional odds. To reduce this risk, the dependent variables were condensed into three categories: (1) dissatisfied, (2) neutral, and (3) satisfied.

Figure 18

Frequencies of the independent variables



Furthermore, the two smallest categories of independent variables *Back cover*, *Screens*, *Isolation*, and *Flooring* (see Fig. 18) were collapsed into their adjacent categories to form dichotomous variables: *Back cover* either high and solid (2) or low/transparent/none (1), *Screens* present (2) vs. absent (1), *Isolation* scored as isolated with infrequent passers-by (2) vs. central (1) with frequent passers-by, and *Flooring* as soft (2) vs. medium/hard (1).

6.3.3 Regression analyses

The first regression analysis of *Visual privacy* with all six hypothesized predictors (see Fig. 16, p. 122) showed that three of them did not significantly contribute to the model according to Wald's test: *Visibility Control*, *Isolation* and *Screens*. These three predictors were removed from the model. Furthermore, to solve the problem of empty cells, either *Back cover* or *Visual protection* had to be dropped, since dichotomizing *Visual protection* did not reduce the number of empty cells to zero. *Visual protection* was retained because the model fit was better (R^2 = .208) than for the model including *Back cover* (R^2 = .186).

Regarding satisfaction with *Sound privacy*, predictors of *Isolation*, *Screens* and *Flooring* appeared to not significantly contribute to the model. They were removed while keeping *Room intimacy* and *Soundproofing* (R^2 =.159). *Screens* and *Back cover* did not significantly contribute to satisfaction with physical privacy, and neither did *Screens* contribute to satisfaction with noise or acoustics. Excluding those variables resulted in a model including *Room intimacy* and *Isolation* for predicting satisfaction with physical

privacy (R^2 = .098), and a model including *Soundproofing* and *Flooring* for predicting satisfaction with acoustics (R^2 = .129).

In the first regression analysis with 'satisfaction with noise' as the dependent variable, neither *Screens* nor *Isolation* and *Soundproofing* had significant estimates. However, in the model with the remaining predictors *Room intimacy* and *Flooring*, the p-value of *Flooring* raised above 0.05. A model containing *Room capacity* and *Isolation* performed better (R^2 = .125)

The final regression models have a good fit to the data, which is indicated by a statistically significant 2-log likelihood test (p <.001) and a non-significant Pearson and Deviance test (p >.05) for each model. Additionally, a non-significant parallel lines test with a p-value above .05 for each model confirms the required assumption of proportional odds. Table 15 summarizes the results of the ordinal regression analyses which used the logit link function for each model and took the highest value of the predictors as the reference category.

Table 15

Estimated coefficients of design variables [value] predicting satisfaction with privacy and noise

	Visual privacy	Sound privacy	Physical privacy	Noise of others	Acoustic quality
Large room/open space [1]	-1.838**	-1.357**	-1.473**	-1.524**	
Not a small room [1, 2]	-1.230**	-0.949**	-0.805**	-0.818**	
Regular passers-by [1]			-0.528*	-0.479*	
Visual open workspace [1]	-1.181**				
Not visually closed [1, 2]	-0.591**				
Not at all soundproof [1]		-0.868**			-1.334**
Hard/medium flooring [1]					-0.853**

** Wald test (95% confidence) significant at .01 level; * significant at .05 level

All estimated coefficients are negative, which means that workers in these categories of workspaces (e.g. a large room or a visual open workspace) are associated with poorer satisfaction scores compared to users in the remaining categories of the ordinal predictor variable (e.g. a small room or workspace that offers low visibility). The absolute value of the coefficients reflects the strength of the association. An empty cell in Table 15 means that the predictor variable was not included in the regression model for theoretical or statistical reasons as previously explained.

The results show that an intimate room shared by less than four people is the best predictor of satisfaction with noise and any dimension of privacy. People working in a large room with more than six workstations or an open workspace are far more likely to rate their privacy and quiet as poor than people working in small rooms (ORs 6.04, 3.88, and 4.36 for visual, sound and physical privacy respectively; OR 4.59 for noise).

For people working in a large/open or medium-sized room, a poor satisfaction score is still two to three times more likely. This aligns with Leder et al. (2016), who found that workstations enclosed by full-height walls and doors contributed more to satisfaction than more subtle acoustic design.

A central position of the workspace with regular passers-by is more likely to trigger dissatisfaction with physical privacy and noise than an isolated workspace (ORs 1.70 and 1.61), but this effect is not as strong as for lower levels of room intimacy. An isolated position of the workspace in the building only affects satisfaction with physical privacy together with room intimacy, and it does not significantly affect satisfaction with visual or sound privacy. Apparently, passers-by are not perceived as a threat to visual or speech privacy, but people walking by regularly reduces physical privacy (OR 1.70) and increases noise annoyance (OR 1.61). In contrast, Appel-Meulenbroek et al. (2022) found that office workers preferred a workspace next to a walking route instead of an isolated workspace. Perhaps these preferences result from different needs than a desire for quiet and personal space.

A visually open workspace where people outside can look in from several sides is three times more likely to negatively affect satisfaction with visual privacy (OR 3.25) than a visually enclosed workspace. A workspace that is not entirely closed and transparent at eye level at one or more sides, is still likely to have a negative effect, albeit less than open spaces alone (OR 1.80). This means that adding solid partitions around workstations or covering glass walls may enhance satisfaction with visual privacy, even if one side still is open. As expected, soundproofing of the workspace, i.e. speech transmission, affects satisfaction with sound privacy, the amount of noise from other people, and perceived acoustic quality. However, absorption of the floor covering material only affects satisfaction with acoustics (OR 2.35). Apparently, soft flooring can reduce sound reflection but does not reduce speech transmission.

The hypothesized effects (as depicted in Fig. 16, page 122) of possibilities for controlling visibility and the presence of privacy screens at the workstation have not been confirmed by the regression analyses. The poor effectiveness of privacy screens could be due to their mostly low height in our sample (see Fig. 18), thereby barely capturing the sound of speech and enabling a standing person to look over them. The effect of a back cover on satisfaction with visual privacy was overruled by the effect of visual openness, which created a more powerful model. Possibly, regarding physical privacy presence of a high back cover is largely captured by room capacity, since in small and medium rooms workstations usually are situated with the chair between desk and wall, automatically providing a high obstacle that prevents people from approaching users from behind.

6.4 Discussion and conclusion

This study investigated the joint contribution of a variety of interior design features to satisfaction with noise and privacy in office environments. The results indicate that among the studied design variables, ceiling-high, speech-absorbing enclosure and a relatively isolated position of the workspace best predict satisfaction with privacy and noise. Privacy and quiet are needed for concentration and confidential work and for personal talks. Privacy screens, a separate back cover, and possibilities for managing visibility in the workspace add little to the prediction. These findings implicate that providing sufficient enclosure and stimulating casual encounters to take place outside the large workspaces may add more to solving problems with noise and privacy than applying acoustic solutions or privacy measures within these large workspaces.

Facility managers could use the study's insights when supervising office renovations to prioritize small-scale workspaces located away from traffic zones and having solid walls and doors above applying acoustic solutions in large open workspaces. They could collaborate with human resources managers to use interior design and signage to steer social interactions towards dedicated social spaces that occupy central positions in the office configuration, for instance by placing attractors such as water coolers (Fayard & Weeks, 2007).

Post-Covid research should confirm the findings using samples with more young office workers and a larger variety of design features and office settings, and analysing possibly interfering variables such as individual differences, situational factors, and organizational culture. Because although this study identified interior design features that significantly increase the probability of satisfaction with workspace privacy, these features do not determine satisfaction. Within the field of environmental psychology, it is widely recognized that perception of the physical work environment and perceived fit are influenced by many factors (e.g. see model Bell et al., 2001, pp. 434-435). Research shows that, for instance, a high personal need for privacy reduces perceived privacy-fit (Hoendervanger et al., 2019), negative emotionality reduces satisfaction with acoustic privacy (Marzban et al., 2021), and people who are more extravert, affiliative, and field-oriented have a smaller interpersonal space (Gifford, 2014, p.133).

Additional to individual differences, the social situation interferes with the design-perception relationship. For example, the possibility to choose from a variety of settings and adherence of others to protocols contribute to privacy fit (Weber & Gatersleben, 2021). Organizational policies regarding desk-sharing, the employee-desk ratio, and possibilities for identity marking may influence feelings of ownership, which mediate privacy satisfaction. For instance, Laurence et al. (2013) found that workspace personalization reduced the negative effects of low levels of privacy on well-being. Future workplace research could use the design features that were identified in this

study to develop more powerful models that predict privacy satisfaction through a path that includes these types of mediators and moderators beyond workplace design and by adding observational data to the self-report measures.

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CHAPTER 7

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7 DESIGN STRATEGIES FOR SOCIAL OFFICES

The expanded adoption of remote and hybrid working may increase the demand for spaces that afford in-person interaction and a sense of community at the office. The study reported in this chapter unravels workplace designers' strategies for creating these social office spaces which can complement the private and quiet spaces for individual working as described in Chapter 6.

In-depth interviews with fifteen experienced interior designers about realized office projects were analysed using means-end chain analysis. The aggregated strategies show the design attributes that were applied and the affordances that were created to achieve the designers' goals regarding the users' social well-being. The concepts identified in these strategies and the relationships between them serve as a workplace design taxonomy that can facilitate communication between designers and stakeholders and provide propositions for future research.

7.1 Introduction

The office is more than just bricks. It has a vital place within the organizational ecosystem, implying that workplace design serves as a strategic tool to influence employees' behaviour, well-being and performance (Becker, 2004). The Covid-19 pandemic and the consequent shift to remote work shed light on the social function of the office. Working from home for months, employees yearned for in-person meetings at the office, socializing, a sense of community, and shared enjoyment (Babapour Chafi et al., 2021; Colenberg & Keyson, 2021; Gensler Research Institute, 2020a; Marzban et al., 2021). Online social connections, although valuable, proved to be a limited substitute for face-to-face interactions (Marinucci et al., 2022).

However, remote working also offers significant advantages for both individuals and organizations. Hybrid working, characterized by a combination of office-based and remote work, has now become a new reality that organizations must adapt to (JLL Global Research, 2022). In organizations where employees have the freedom to choose their work environment based on the nature of their activities, the office must be appealing, comfortable, and worth the commute, offering a purposeful presence (Leesman, 2022). In light of the insights gained from the pandemic and the inherent human need for connection (Deci & Ryan, 2008), the presence of ample opportunities for informal social interaction emerges as a crucial factor. Furthermore, the workplace should contribute to a high-quality and meaningful work experience (Bentley et al., 2021), countering the potential isolation effects of remote work (Spreitzer et al., 2020). In summary, there are ethical and timely practical reasons to create office spaces that support employees' social well-being.

Given the evident social function of offices, the question arises of how to design spaces that foster social interaction and well-being. Social connectedness thrives when people engage in meaningful conversations, feel understood and appreciated, and have the opportunity to engage in pleasant and enjoyable activities together (Reis et al., 2000). Enhancing social well-being goes beyond simply adding a large coffee corner; it requires a multifaceted approach that supports a variety of social activities. However, the spatial requirements for social interaction may sometimes clash with the needs for focused work (Kim & de Dear, 2013), requiring careful planning. While space syntax theory can predict where people are likely to meet and gather based on floor plans (Sailer & Koutsolampros, 2021), it does not fully explain why people feel invited to socialize in certain spaces or what encourages them to visit and linger. Additionally, office spaces convey messages about the individuals who use them and reflect the organization's intentions (Spreitzer et al., 2020; Tann & Ayoko, 2020). To date, there is no comprehensive framework that guides design decisions by considering both the spatial and symbolic aspects of workplace design.

The aim of this exploratory study was to enhance our understanding of the relationship between workplace design and social well-being at work by identifying design strategies for creating social office space. To identify design elements that contribute to social office space, we turned to designers as valuable sources of insight. Designers possess the expertise to compose settings from tangible design attributes. On the other hand, regular users often perceive the environment as a whole, driven by their goals and daily habits, and are typically less conscious of the individual design properties (Gifford, 2014, pp. 23-24). Therefore, this study adopted the perspective of workplace designers and interviewed them about their approach to creating social office space, aiming to unveil their intuitive choices. The study primarily looked at interior design and used a method called means-end chain analysis to create a hierarchical cognitive model of the designers' stated decisions. This model suggests various connections between design attributes and outcomes that can be tested in future studies.

Before diving into the details of the research method and findings, it is defined what we mean by 'social office space' and the overall scope of workplace design. Additionally, we will explain two important theories that guide our analysis: the Theory of Affordances and the Means-End Theory.

7.2 Theoretical Background

7.2.1 Social office space and affordances

Expanding on the concept of healthy offices (Jensen & van der Voordt, 2020; Kropman et al., 2022), which prioritize the user's health and well-being, we can further define social offices as office environments that specifically support the users' social well-being. Social well-being at work, as described by Fisher (2014), encompasses feeling connected to a meaningful community and having satisfying social interactions and relationships. To achieve this, social office spaces should foster a sense of community, social cohesion, proximity, and positive encounters among office workers while minimizing incivility, conflict, alienation, and exclusion (Colenberg et al., 2020).

Understanding the impact of physical characteristics on the user's experience and behaviour is crucial. The theory of affordances, proposed by Gibson (1977), offers a valuable starting point in this regard. Affordances are detectable functionalities present in the physical environment that people perceive and interact with. Tann and Ayoko (2020) emphasize the significance of material affordances in their social semiotic framework, which aligns the physical and the social aspects of the work environment. They argue that the material properties of the workspace influence the nature of interactions and express meaning through the material quality of objects.

The notion of social affordances of the workplace, introduced by Fayard and Weeks (2007), highlights how the work environment facilitates informal interactions by offering propinquity, privacy, and social designation. Spreitzer et al. (2020) delve into how design attributes act as physical markers of functionalities that support well-being at work. They suggest that aesthetic, material and spatial attributes can evoke pro-social emotions, enhance the worker's identification with the organization, and promote social connections. For example, personalizing workspaces allows employees to connect over shared interests, while coffee bars and food spaces create a hospitable atmosphere that encourages employees to engage in casual conversations. However, empirical research on such affordances and their composition remains limited.

7.2.2 Interior office design

Office buildings are composed of multiple layers with a core of interior space, consisting of furnishings and spatial layout, which is surrounded by external layers of construction and installations (Brand, 1994). Over time, offices have evolved from process-driven and rigidly structured spaces into collaborative environments with open-plan layouts, shared areas, and smart office solutions, driven by technological advancements and societal shifts (Van Meel, 2000; Myerson & Ross, 2003).

Various disciplines, including interior designers, architects, workplace consultants, furniture suppliers, and facility managers, may be involved in the process of interior office design (Heebels & Kloosterman, 2016). Although the roles of architects and interior designers may be overlapping, their training can differ considerably. In the Netherlands, interior architects prioritize the relationship between interior space and individual users, focusing on safety, health, and well-being, while architectural engineers integrate buildings into the environment and protect users from weather conditions (Wet op de architectentitel, 2021). The aim of this study to enhance employees' workplace experience mainly falls within the realm of interior design.

The main objective of interior office design is to enhance the functionality, aesthetics, and psychological aspects of interior spaces (Ching & Binggeli, 2018). Interior designers utilize spatial planning, finish materials, furnishings, lighting systems, acoustic solutions, and technology in their palette to achieve the desired experience and align the environment with user behaviour (Ching & Binggeli, 2018; Heebels & Kloosterman, 2016). For office interiors, this involves visualizing corporate identity through colours and decorations and providing furniture tailored to specific work activities.

7.2.3 Means-End Theory

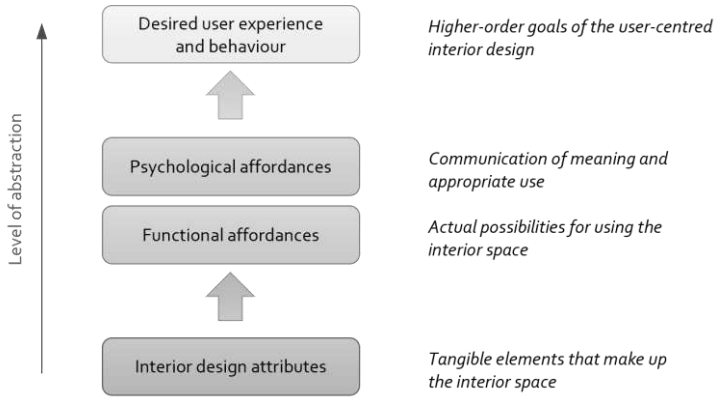
Designing interior space is a complex and purpose-driven endeavour that involves strategic decision-making. Within this process, designers must carefully choose from a range of design attributes to create an interior space that effectively elicits the desired user experience and behaviour. Means-end theory, as proposed by Gutman (1982), offers insight into this decision-making process by establishing linkages between concrete attributes of an artefact, their direct consequences for the user, and their contribution to higher-order goals or values. By examining these means-end chains, we can understand why specific attributes play a significant role in the decision-making process. According to Olson and Reynolds (2001), the anticipated consequences of these attributes that may have become habitual but were conscious at some time in the past are especially important to this understanding.

Originally developed to comprehend consumer decisions, the applicability of means-end theory has expanded beyond marketing to fields such as user experience, organization, and business research (Kilwinger & van Dam, 2021). In the context of user-centred design for office interiors, we argue that the principles of means-end theory are equally relevant. Similar to consumer decision-making, the cognitive process of designing can be seen as a problem-solving endeavour that involves seeking alternatives expected to yield positive negative outcomes while avoiding negative ones (Boradkar, 2010). Consequently, interior designers draw on their expertise, considering alternative design components (attributes) and their anticipated effects on user

experience and behaviour to achieve higher-order design objectives (Fig. 19). In essence, the Means-End Theory offers a valuable framework for understanding the decision-making processes inherent in the design of office interiors. By considering the anticipated consequences and experiences of the users, designers can make informed choices that align with the desired outcomes of the interior office space.

Figure 19

The means-end approach applied to understanding interior designers' decisions as a hierarchical cognitive model



When consumers purchase a product, the consequences they experience can take different forms. Some of these consequences are tangible and direct experiences, while others are more and emotional in nature (Olson & Reynolds, 2001). Interestingly, this distinction can also be applied to the affordances found within interior design. Functional affordances encompass the qualities of the interior space that directly enable or inhibit certain activities. For example, spatial connections that facilitate physical and visual access play a crucial role in usability, which encompasses the performance and behaviour component of user experience (Sauer et al., 2020). These functional affordances provide the practical functionality necessary for users to engage in specific activities within the space.

On the other hand, psychological affordances manifest as more abstract qualities of interior space that rely on interpretation to evoke emotional experiences and that indirectly shape user behaviour. For instance, the atmosphere created by a particular interior design or the symbolic meaning conveyed by objects can influence users on a psychological level. This category of affordances relates to user experience as an affective outcome (Sauer et al., 2020) resulting from the interaction between the user and the environment. Moreover, psychological affordances can also serve as indicators

that communicate the appropriate use of the space, providing users with guidance and cues on how to engage with the environment effectively.

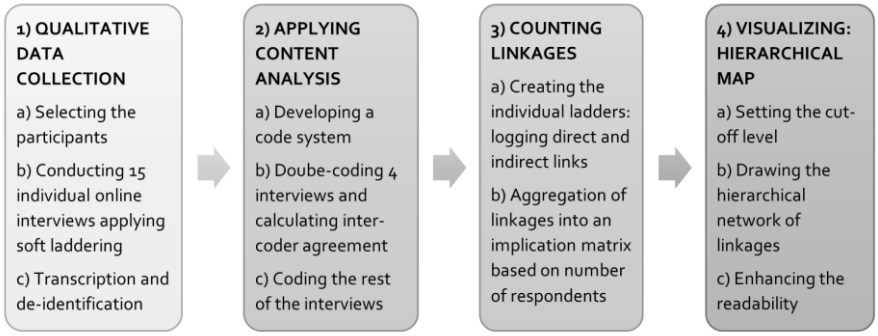
In summary, interior design has both functional and psychological qualities that impact usability and user experience. While functional affordances primarily focus on enabling specific activities and supporting performance, psychological affordances delve into the realm of emotions and interpretation, encompassing both affective outcomes and symbolic meaning.

7.3 Method

The study applied the means-end approach in four stages (see Fig. 20) to identify design attributes and affordances that are assumed to support social well-being. In the following sections, each step of the means-end chain approach is explained.

Figure 20

The steps of the means-end chain analysis which was applied to find common design strategies to create social office space



7.3.1 Qualitative data collection

Participant selection

Dutch interior designers who had more than five years of working experience and regularly designed office space were recruited through my personal network. Interior designers and architects with different educational backgrounds and working in different types of agencies were invited to reflect the profession's diversity. Several industrial designers were approached for participation but none of them had recently been involved in projects that matched our scope.

The participant's consent for using their data was confirmed through email. The study was approved by the Human Research Ethics Committee of Delft University of Technology (reference #1835, 11-10-2021).

The majority of the interviewees were trained as interior architects at an art academy in The Netherlands. Two had a grade in architecture from a university of technology and four had a different background, for example in fine arts. Five worked at an agency that specialized in office design, seven worked as interior designers in multiple sectors, and three worked for agencies that focused on architecture and building construction. One participant was male and 14 were female, which reflects the dominance of women in the profession (van Kempen et al., 2021).

Interview procedure

In the emailed interview invitation, the participants were asked to select one or two of their completed office projects that aimed to support the social well-being of the users as defined by Fisher (2014). Each interview focused on one or two specific design projects rather than on the designer's approach in general in order to simulate them to provide concrete and realistic examples of their decision process. Their projects included both renovations and new building constructions and both shared buildings and buildings accommodating one organization.

At the start of the interview, the aim of supporting social well-being was repeated and the designers were asked to explain how they had approached the social goals of the project. The interviews followed the natural course of the conversation about design decisions, guided by many 'why'-questions from the researcher to uncover underlying motives and probe more abstract reasons. This technique is known as soft laddering, which refers to the construction of 'ladders' from concrete to abstract concepts. When participants have substantial familiarity with the issue, as in our study, soft laddering, which allows participants to express their thoughts and motivations in their own words, is considered to result in much richer data than hard laddering, which uses pre-coded concepts (Miles & Rowe, 2004). The laddering technique focuses on identification and connection of concepts at three main levels: attributes, consequences, and values (Olson & Reynolds, 2001).

Transcription and de-identification

The interviews took place in November and December 2021 and lasted 35 to 65 minutes. Due to Covid-19 restrictions, all interviews were conducted online by the first author, recorded, and transcribed using MS Office 365 and Amberscript. They were de-identified by removing names and geographic locations and generalizing references to the organization's activities. After fifteen interviews, thematic saturation was reached.

7.3.2 Applying content analysis

Code system

For the analysis of interview transcriptions, Atlas.ti 22 software was used. Following the laddering technique, the first step of the analysis involved identifying meaningful attributes that were considered as competitive choice alternatives for designers. Descriptive codes for relevant design attributes, such as 'furniture' and 'colour use', were defined based on the interior designer's palette mentioned in Section 7.2.2. In the second step, codes for affordances and higher-end goals were established through content analysis of a random sample of seven interviews out of fifteen. The initial code system was developed by me and refined based on feedback from two independent workplace researchers who coded the same four interviews and discussed differences. This process ensured a balanced and representative code system capturing the key design aspects discussed by the interviewees.

Inter-coder agreement

Before coding the whole set of interviews, the reliability of the code system was tested by having two researchers who were not involved in the study before apply it to four randomly selected interviews. This test sample contained 32% of all quotations that were pre-defined by me. The independent coders were carefully instructed and minor changes to the code descriptions and length of quotations were made after their first attempt. In the second round of coding their inter-coder agreement was acceptable with Krippendorff's $_{Cu}\alpha$ 0,877. This means that 87.7% of the data were coded to a degree better than chance (Friese, 2019, p.280). Subsequently, the remaining transcriptions were divided between them for the final coding of the pre-defined quotations. Appendix B presents the final code system including the code descriptions. Queries in Atlas.ti were used to retrieve quotations relating to specific codes and code combinations.

7.3.3 Counting linkages

From codes to implications

To construct a hierarchical map of joint design strategies for social office space (depicted in Fig. 20 as Step 4), first the connections between different codes, referred to as 'linkages' or implications, were identified (Step 3). These linkages were established by analysing explicit mentions of concepts found in the interviews. To ensure agreement among coders, certain statements were divided into multiple quotations to prevent the occurrence of codes from the same category together. By examining the thematic orientation of these quotations and the designers' reasoning, it was possible to reconnect passages and establish horizontal linkages between codes, indicating choices made for the simultaneous application of design attributes.

Aggregation across participants

When aggregating the data across participants, we made the assumption that the reasoning behind the selection of design attributes would remain consistent for each individual. This assumption was supported by the fact that designers repeated their arguments during the interviews and across various projects. Additionally, the content analysis revealed that designers more frequently attributed their choices to personal beliefs and expertise (192 quotations) rather than project-related factors such as client preferences (n = 83), organizational culture (n = 35) or (n = 51) budget constraints and building limitations (n = 51). Consequently, we analysed the linkages based on the number of respondents rather than the frequency of the linkages, prioritizing commonly shared reasoning over context-specific design solutions.

To facilitate this analysis, the linkages were logged in an Excel datasheet and subsequently aggregated across participants. Python programming language was employed to create a summary implication matrix (Appendix C), which depicted the frequency with which each code led to any other code. Additionally, the total number of linkages was calculated. Throughout the aggregation process, duplicate linkages within participants were eliminated to ensure accuracy.

7.3.4 Creating a hierarchical map

To visualize the relationships between concepts, we created a hierarchical map using NodeXL, as suggested by Foolen-Torgerson and Kilwinger (2021). To distinguish dominant from incidental linkages, we set a threshold for relationships to be included in the map. Because preserving approximately 70% of the common implications in the hierarchical map is considered a good fit (Reynolds & Phillips, 2008) we included all relationships that were mentioned by at least three participants. Increasing the threshold increased readability but simultaneously reduced the reliability of the map (see Appendix C). The readability of the map was further improved by repositioning the concepts at four horizontal levels, preventing crossing lines as much as possible, and varying the line styles according to the number of linkages.

The means-end chain analysis focused on stated design decisions which were related to social well-being. Additional motives for applying design attributes or affordances brought forward in the interviews included explicit client preferences, restrictions or opportunities of the budget or the existing building, and other strategic goals, such as recruitment.

7.4 Results

7.4.1 Hierarchical map of design strategies

The relationships between the different design elements and desired outcomes can be organized in a hierarchical manner. This hierarchical map consists of design attributes, affordances, and higher-order goals that guide the designers in their approach to enhance social well-being. Figure 21 provides a visual representation of the design attributes that were mentioned by at least three of the 15 designers as a means to achieve the desired goals. According to the designers, these attributes contributed to the creation of affordances, which in turn facilitated the accomplishment of design goals.

The map captures a substantial portion of the 493 direct connections that were logged among the 22 concepts. It reveals that the designers primarily focus on two main aspects of social well-being: fostering a sense of connectedness among employees (see Section 7.4.2) and enabling informal social interactions (Section 7.4.3). To achieve these aims, they discuss ten different types of design attributes, ranging from colour use to the strategic placement of specific equipment.

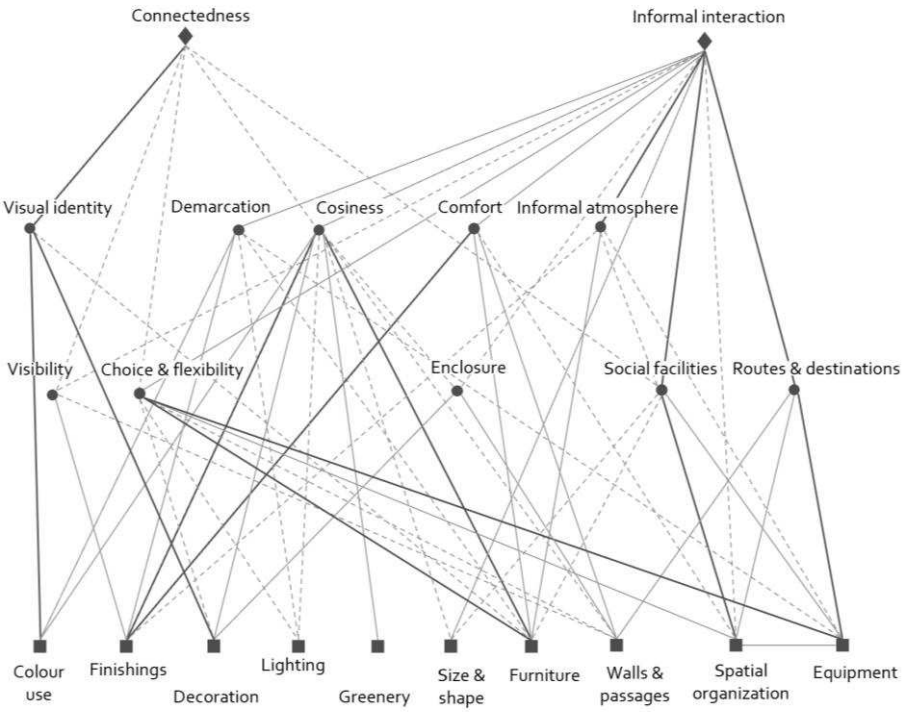
In most cases, the design attributes and higher-order goals are linked through the creation of affordances. This indicates that the creation of affordances plays a crucial role in the interior design process. The data indicated ten distinct types of social affordances. Detailed descriptions of the concepts can be found in Appendix B.

The map shows two exceptions to the means-end chains that include affordances: (a) the straight grey line between *Size & shape* and *Informal interactions*, which refers to literally creating room for gathering, and (b) the dashed line between *Spatial organization* and *Informal interactions*, which refers to centralizing spaces for interaction to create a social hub that guarantees bumping into each other.

In several cases, the designer's strategy does not extend beyond creating affordances and lacks a relation with a higher-order goal, as indicated by black lines between design attributes and affordances that continue to the higher level in grey (see Appendix C for the number of linkages). This is illustrated by the close attention to *Choice and flexibility, Cosiness,* and *Comfort* that do not result in equally strong connections with connectedness or social interactions. Four affordances (*Visibility*, C*hoice & flexibility*, *Cosiness*, and *Social facilities*) are related to both higher-order goals while the remaining affordances target only one of them.

Figure 21

Hierarchical map of the interior designer's strategies, showing the linkages between design attributes (■) *at the bottom, affordances* (●) *in the middle, and strategic goals* (♦) *at the top*



Note: The map shows direct linkages only, cut-off level = 3, explained variance 71.6%
Thicker black line = ≥ 8 linkages; solid grey line = 5-7 linkages; dashed grey line = 3-4 linkages

Among the affordances that were put forward by the designers, two abstraction levels may be identified. The lower row (Fig. 21) consists of concrete functional affordances that may directly guide user behaviour. These include *visibility* of people, *choice* options and *flexibility* in use, physical *enclosure* of spaces, *social facilities*, such as breakout spaces and kitchen areas, and walking *routes* and *destinations* that facilitate encounters. These affordances are all connected to the goal of stimulating *social interactions*. Additionally, providing *social facilities* is connected to *bonding*.

The upper row (Fig. 21) shows the more abstract psychological affordances that aim to evoke sensory or emotional experiences rather than offering action possibilities. These include the *visual identity* of a space that communicates values, symbolic *demarcation* of social areas, *cosiness*, which refers to a friendly atmosphere and sense of security, the experience of *comfort*, for example, softness and good acoustics, and an *informal* and

playful atmosphere that invites people to interact. These higher-level affordances generally have a stronger connection with the higher-order goals than the ones at the lower level. However, there are no linkages between the two affordance levels, except for the minor linkages between *Enclosure* and *Cosiness*, referring to intimate spaces, and between *Social facilities* and *Informal atmosphere*, which refers to creating lunch areas and breakout spaces.

According to interior designers, the most important attributes for supporting social well-being were *Furniture* and *Finishings*, followed by *Equipment* and *Decoration*. Artificial *lighting* was of minor importance and limited to the potential of lighting fixtures to offer adjustability and a spatial focal point and communicate cosiness by their style. *Greenery* was used almost solely to increase cosiness. Although *colour* is a prominent visual attribute of interior design, it seems to be of limited strategic value for supporting social well-being and was predominantly used to create identity and demarcation and to contribute to cosiness. The spatial design, including *Walls & passages* and *Spatial Organization*, mainly served social interactions. The following two sections explain how the design attributes were used in the strategies.

7.4.2 Design strategies to support connectedness

The higher-order design goal labelled *Connectedness* refers to the designers' aim to support social cohesion and a sense of community. Figure 21 shows that the participants applied five design strategies to achieve this goal: creating *Visual identity,* people *Visibility, Choice & flexibility*, *Cosiness*, and *Social facilities*. In this section, we explain how and why they created these affordances.

Creating a visual identity

The most practised strategy for connectedness was visualizing the identity of the organization in the interior design. Often, corporate colours were used for wall finishings, furniture, and other objects to indicate corporate identity. Additionally, logos, keywords from mission statements, and illustrations of the organisation's primary process were used as decoration, for example, by prints on window films. Participant #3 told of a term referring to a running gag that was shaped in neon light. 'It will be fantastic if you enter with a visitor, consultant, or new employee and you have to explain this'.

Furthermore, art collections and objects that were meaningful to the organization were incorporated into the new interior design. In one of the projects, cast-off working clothes and dissembled products of the organization were used as finish materials. The visualisation mostly aimed to express the general identity of the organisation, but in some cases, the decoration represented the place of business or colour variety was used to distinguish the different team areas and create group identity.

Creating people visibility

A second strategy for connectedness focused on the visibility of people by using transparent materials, such as glass walls, and by spatial openness which offers sight lines. One designer argued that visibility would reduce anonymity and alienation because when employees are seen by others, for example when entering the office, it would make them feel part of a group. The designers believed that seeing others increases awareness of their presence and thereby supports connectedness. As participant #11 explained: 'When you sit down here for a minute, you can see those colleagues and are reminded of the fact that you are all working for the same company.' Material transparency was also used to make a visual connection between spaces and their occupants, emphasizing their relationship and preventing them from feeling locked up.

Offering choice and flexibility

The designers argued that offering built-in possibilities for customizing and personalization would increase bonding because they support getting to know each other. They created opportunities for personal announcements, such as birth cards, and invitations for social activities by applying a variety of displays, from notice boards (*Equipment*) to show-cases (*Furniture*). At a more abstract level, some designers assumed that possibilities for the user to control the environment and choose between different spaces or different seating arrangements were basic needs which had to be satisfied to establish the psychological safety that allows for building personal relationships.

Providing cosy spaces

Several designers recognized the employees' need for withdrawal from the bustle and argue that providing shelter may increase the psychological safety required for sincere conversations. An intimate atmosphere was assumed to support peace of mind that allows for an open conversation with an office colleague and taking the time to discuss personal issues. Based on the wide array of design attributes that were used to create cosiness, this was the most complex and multi-faceted affordance. It also was the most discussed affordance, along with choice and flexibility.

Cosiness was created by using warm, more saturated, and darker *colours*, semi-transparent, natural-looking, and tactile *finishings*, *decorations,* such as rugs, cushions, curtains, and window film, diffuse and warm-white *lighting* and lighting fixtures with soft-looking lampshades, *greenery*, natural *shapes* and downsizing spaces, homely and upholstered *furniture* such as bookcases, armchairs, and couches. 'I think that a visible wardrobe expresses: "Well, you can linger here, take off your coat, come in, and feel welcome" ' (participant #5). Furthermore, the designers aim for cosiness creating *enclosure* with *walls*, plants or furniture, that covers the user's back. 'Seating in an alcove feels safer and more pleasant than a bench against a wall. A bench against a wall

protrudes, you can't hide, you're very much in sight. Sitting in an alcove provides protection, only your legs stick out' (participant #11). Several designers explain the observed popularity of enclosed 'train seats' by the cosiness and privacy they offer without being completely separated from the social environment.

Accommodating group activities
A small minority of the designers related the offering of social facilities to supporting connectedness. They aimed to support social gatherings, such as having cake or drinks together to celebrate birthdays and work successes, by including a work café or canteen featuring proper furniture for these activities. In one of the projects, the design provided showers to allow employees to join the organization's informal sports groups during their breaks.

7.4.3 Design strategies to stimulate informal social interactions

The goal of stimulating spontaneous and informal social interactions featured a more prominent role in the interviews than supporting connectedness. The 11 identified strategies to increase social interactions (see Fig. 21) aimed to increase eye contact and bumping into each other, lead office workers to spaces that are designed for social activities and nudge them to linger to further increase the chance of spontaneous conversations.

Creating walking routes and destinations
The most prominent strategy to stimulate informal social interactions was bringing people together by directing the traffic flows within the building and offering social destinations. The *spatial organization*, for example, grouping social spaces adjacent to workspaces, was used to create movement and direct office workers towards a central hub. Walking routes were manipulated through the positioning of *walls and passages*. Destinations were created by applying and strategically positioning *equipment*, such as coffee machines, printers, and lockers. 'Casual encounters are even more important [than work-related meetings]. Therefore the photocopier is not positioned in the corridor but has been placed in a niche here [in the central area]. So everyone meets each other here, whether they like it or not' (participant #9).

Offering facilities for social activities
A variety of breakout spaces was designed for eating, drinking, and playing together. The most important components of this affordance were *Equipment,* such as coffee machines and games, and *Spatial organization*, referring to the central position or clustering of this equipment, which explains the horizontal connection between the two attributes (Fig. 21). Four designers used *furniture* to create a social facility, such as lounge seats, a bar, or a large kitchen table. 'The bar and stools were intended to make people linger, for example at Friday afternoon drinks, instead of just grabbing something and leaving' (participant #8). The use of *Size & shape* to create social

facilities refers to the spatial capacity to accommodate large social gatherings or stopping for a chat in traffic zones. Four designers explicitly state that social facilities create an informal atmosphere by communicating possibilities for social activities.

Visibility of people and destinations

To support social interactions, the designers created transparent and open spaces where users would be literally and symbolically accessible, communicating their availability for interaction. 'Here, the kitchen is the focal point of the social area. […] Eating and drinking brings people together, therefore a kitchen like this is very important. We did not want to hide it […] but proudly show it' (participant #7). Since eye contact was believed to elicit conversations, they often used glass walls for meeting rooms and workspaces.

Creating an informal atmosphere

In the breakout spaces, the designers created a lively and playful atmosphere to invite users to socialize and communicate the permission to talk, being at a location where one would not disturb others. The most important attribute for expressing informality and playfulness was *Furniture*, for example, lounge seating, alcove seats, decorative chairs, bookcases, pouffes, and standing tables, which were often combined with homely accessories, such as rugs or table lamps. When explaining their choice of furniture for breakout spaces, five designers referred to body positions that may support informal conversations, such as hanging out at the bar and sagging on the sofa. Furthermore, *Equipment*, such as television screens, coffee machines and table games were used to directly create an informal atmosphere or indirectly through the planning of breakout spaces (*Social facilities*). Four designers used *Finishings* like wood and ceramic tiles to create an informal atmosphere, for example by referring to beach life and coffee bars. Other strategies were designing a printed wallpaper with hidden surprises to trigger conversations and removing the pre-fabric ceiling to degrade the corporate look. Remarkably, decoration was rather used to create cosiness and identity than to communicate playfulness.

Demarcation of social spaces

To indicate where it is appropriate to socialize, the designers not only considered the features of social space itself but also its boundaries and contrast with spaces for focus work and formal meetings. For this demarcation, the designers mainly used *colour* in different shades or degrees of colourfulness and *finishings*, for example, soft versus hard flooring. Three designers used contrasting *furniture* to demarcate functionalities, for example, sofas versus office chairs and a playful versus rigid seating arrangement. Three designers used *lighting*, for example, downlights to highlight a spot for gathering and underline the difference with standard office lighting. Four designers demarcated functions by morphology or room size.

Cosiness, enclosure, and comfort

In addition to stimulating spontaneous encounters and highlighting interaction opportunities, the designers also wanted to support personal conversations by offering physical and psychological comfort. They created spatial intimacy through physical and visual *enclosure* using solid *walls* and *decorations* like curtains and window foil. This architectural privacy was considered to contribute to a sense of shelter (*cosiness*, see Section 7.4.2). To make people feel comfortable and at ease and reduce concern about bothering others or being overheard, the designers used sound-absorbing *finishings,* upholstered seats and privacy screens. They distanced the social spaces from quiet zones and separated them by walls, which in some cases were placed only after neighbouring office workers had complained about the noise.

Choice and flexibility

Providing the users with a range of settings and possibilities for adjusting the environment to their needs is the most discussed affordance. This diversity predominantly serves to accommodate a variety of social interactions that depend on mood, conversation topic, or group size. *Furniture* and *equipment* are the most important means to create functional diversity while *decoration* is used to create aesthetic diversity and adjustable *lighting* provides user control. 'To provide a choice whether to sit here or further down the building, what type of seat, sitting high or low, in a closed, enclosed, or open space. This makes people feel comfortable, which, I assume, will enable connecting to others' (participant #15).

7.5 Discussion and Conclusion

7.5.1 Discussion of the findings

Designing for well-being in the future of work is a major concern (Bentley et al., 2021), especially with the rise of remote and hybrid working. The office spaces of the future will need to promote in-person interaction and create a sense of community to support employees' social well-being. This study aimed to uncover designers' strategies for creating such social spaces and identify the key affordances involved.

To create social offices, workplace designers primarily focus on stimulating informal interactions. Positive encounters and socializing are seen as the foundation for building relationships. Additionally, they recognize the importance of connectedness in the physical working environment (Sander et al., 2019). They aim to foster a sense of community and provide privacy for confidential conversations to ensure employees feel comfortable and not disruptive to others.

Affordances play a crucial role in the designers' strategies, connecting design attributes to user-centred project goals by creating functionalities and communicating appropriate use. The linkages between design attributes and affordances are abundant, indicating their significance. However, the linkages between affordances and strategic goals are less prominent. This may be attributed to the natural flow of conversation in the interviews, where frequent repetition of distant goals may not be obvious. Another explanation could be that in these cases, designers were influenced by personal beliefs that were intuitively related to social goals, such as supporting general well-being, or by explicit preferences expressed by clients regarding specific design attributes or affordances.

The type of affordances highlighted by the designers seems to confirm the expected two levels of abstraction, distinguishing between functional and psychological affordances. This corresponds to a design's communication of its primary, practical functions and its secondary, symbolic functions (Muller, 2003, p. 334-337). However, there is a lack of linkages between these two levels, suggesting that the designers themselves may not explicitly differentiate between concrete functional and more abstract psychological affordances. It is important to note that these missing linkages may also be a result of content analysis techniques employed to calculate inter-coder agreement, which required coders to choose the most prominent affordance in a quotation, thereby avoiding co-occurrence within a category.

In line with Space Syntax Theory (Hillier & Hanson, 1984), designers' strategies for increasing social interaction in offices emphasize the importance of physical openness and spatial integration of social areas. However, these strategies also underscore the significance of visual communication and the role of furniture and equipment in stimulating informal interaction. This emphasizes that facilitating movement is only one aspect, while the communication of meaning and providing comfort for lingering (Fayard and Weeks, 2007; Spreitzer et al., 2020; Tann & Ayoko, 2020) are equally important factors. An informal atmosphere can be considered a behavioural setting (Barker, 1968) that communicates the acceptability of informal interaction.

The identified design attributes primarily focus on furnishings, including furniture, decoration, greenery, and equipment, with a multi-sensory approach encompassing visual, auditive, and tactile experiences. Furnishings are considered the core of interior design, distinguishing it from architecture, which places greater emphasis on spatial structure and technical solutions.

The designers' stated use of artificial lighting primarily revolved around the visual appearance and adjustability of lighting fixtures with less attention given to light levels and technology that determines light quality. This discrepancy may be attributed to the limited in-depth study of lighting in interior design programs (Reddy et al., 2021) and a

less obvious relationship with social behaviour, although indoor lighting has a known impact on mood and social functioning (Küller et al., 2007; van Duijnhoven et al., 2019). The potential of greenery in office spaces is also underutilized, as plants can contribute to privacy, acoustic comfort, and positive mood (Aydogan & Cerone, 2021).

The identified affordances reflect a broad view of social office space that aligns with organizational literature. They align with design elements indicated by Spreitzer et al. (2020) as being supportive of pro-social behaviour and a sense of community, such as social facilities, visual identity, and affective affordances which promote generosity and caring. However, the interviewees' focus is on general connectedness and organizational identity rather than team cohesion and individual expression. Strict hot-desking policies that discourage territorial markers may influence this emphasis. Technology could offer flexible personalization to support individual well-being in these aspects.

7.5.2 Practical implications

The developed code system and hierarchical map in this study have practical implications for interior office design. The code system provides definitions of essential concepts, facilitating mutual understanding in this multidisciplinary field. The mental map visualizes the designers' decisions, which are often made intuitively and not explicitly. These tools can be used to discuss design solutions that meet the clients' desires for social well-being in the workplace. By focusing on the desired affordances and leveraging the expertise of interior designers, these discussions can lead to effective design solutions. Additionally, the identified strategies can inspire and educate less experienced designers who are working on creating office spaces that promote well-being in new ways of working, such as hybrid and activity-based models.

7.5.3 Implications for science

The means-end chain analysis employed in this study proved useful in uncovering the implicit and intuitive strategies of workplace designers. However, the linkages with higher-order goals were relatively weak. It is unclear whether this is due to designers focusing primarily on affordances or the limitations of the soft-laddering approach, which did not emphasize repeated connections with higher-order goals. This study contributes to the conceptualization of office design by identifying design parameters that not only enable specific behaviours but also encourage the use of specific spaces. This is important for systematic investigations into the effects of office design on behaviour and well-being (Sugiyama et al., 2021). The findings extend the theory of affordances (Gibson, 1977) into the domain of the work environment, with a specific focus on facilitating social behaviour and connectedness between office workers.

7.5.4 Limitations and future research

This study represents an initial step in defining social affordances in interior office space from the designer's perspective. To strengthen the findings, further research should involve a larger number of office projects, a wider variety of workplace designers, and cross-cultural comparisons. The use of triangulation can further enhance the robustness of the findings. Additionally, the fragmentation of rich interview statements compromised the identification of means-end chains. Future studies could explore qualitative approaches to establish the reliability of content analysis through discussions among multiple independent researchers.

It is important to note that the affordances identified in this study are based on the designers' assumptions. Designers can intend to guide behaviour in a certain way but users can choose to do something else or the design may not perform as expected (Søiland, 2021). Furthermore, there may be a discrepancy between the designer's memory and their actual strategy at the time. Therefore, it is essential to confirm whether the users indeed perceive these affordances and increase their connectedness and informal interaction. Correlational studies and experiments can be conducted to test each hypothesis represented in the hierarchical map, serving as a foundation for the further development of workplace design theory. It is crucial to bridge the gap between the designers' intentions and the users' experiences in order to create truly effective and user-centred office environments.

CHAPTER 8

8 GENERAL DISCUSSION AND FUTURE DIRECTIONS

The research reported in the previous chapters has increased the understanding of interior office design, social well-being at work, and their possible relationship from both the users' and designers' points of view. It strengthens the foundation for further research by identifying parameters for measurement and provides actionable insights to practitioners.

First, this chapter provides a summary, synthesis, and discussion of the main findings across the six studies. It presents the evolved conceptual model and explains the role of affordances and the tension between social interaction and privacy in the workplace design strategies. The chapter then provides a reflection on the quality of the research by discussing the methods, reliability and validity of the results, and the overall strengths and limitations of the dissertation. After discussing the implications for research and practice, directions for future research are provided along with a vision of the ideal social office. The chapter text concludes by briefly summarizing the overall contribution of this dissertation.

8.1 Key Findings

In the first part of the research, the systematic search of peer-reviewed papers (Chapter 2) brought together scattered evidence about interior design features that affect office workers' health (RQ1, see Fig. 5, p. 33): layout, furniture, light, greenery, control, and noise. The thematic analysis and synthesis offered new insights beyond the results of the individual papers and showed the knowledge gaps, methodological limitations, and the growth of the field. By taking the perspective of the interior designer in a secondary thematic analysis of this literature (Chapter 3), four types of interior design strategies were inferred from the gathered evidence (RQ2): providing comfort, supporting revitalization, enhancing social well-being, and nudging healthy behaviour. These strategies provided concrete directions for positive workplace design and future research.

The following two studies deepened the understanding of social well-being in the work context. The user-oriented, technology-enabled method of group concept mapping (Chapter 4) served as a pragmatic approach to capturing workers' experiences at the office that may reveal what social well-being means to them (RQ3). Employee statements elicited from focus group interviews were sorted by other office workers, quantified through multivariate analysis, and visualized in a concept map. The study indicated 14 key concepts of social well-being which referred to workers' social needs,

their problems in dealing with others, and the perceived lack of affordances for social well-being in the physical environment.

The scale development (Chapter 5) showed the structure and the most important indicators of social well-being at work that emerged from survey data. Items were developed based on the previous study, existing theory, and expert reviews. Exploratory factor analysis and structural equation modelling enabled the construction of a 10-item scale for measuring social well-being at work (RQ4) in two dimensions: psychological safety, which referred to feeling included and being treated with respect, and bonding, referring to meaningful interactions and feelings of belonging.

The last two studies focused on workplace design. In a quantitative study (Chapter 6), ordinal regression analysis of self-reported design features unravelled their joint contribution to satisfaction with workspace privacy and noise (RQ5). By capturing different design features in self-reportable, ordinal variables, statistical analysis could be applied to reveal their hierarchy in satisfying employees, which implies their recommended prioritization in design practice. Offering small and relatively isolated rooms was found to better predict satisfaction with privacy than soft flooring, screens around desks, and visibility control.

The collection of qualitative data through in-depth interviews (Chapter 7) provided a look inside the mind of workplace designers and their approach to designing for social well-being (RQ6). By following the natural course of the conversation and prompting questions about design choices, their reasoning behind the intuitive design process was made explicit. Content analysis was applied to reveal shared concepts and ideas. The means-end chain analysis enabled the identification of strategies that show the steps from concrete design attributes to the more abstract social well-being goals of stimulating informal interactions and co-worker bonding. Two types of affordances, functional affordances for action and psychological affordances for meaning, formed the backbone of the design strategies.

8.2 Synthesis and Discussion

In this section, the results of the six studies reported in this dissertation are synthesized in a conceptual model (Fig. 22) which has evolved from the conceptual model presented in Chapter 1 (Fig. 1). The model summarizes the insights on the structure of social well-being at work and the assumed associations of social well-being with workplace affordances. In the model, the affordances are grouped after the type of behaviour of experience they intend to generate: withdrawal (privacy), social interaction, or a sense of identity. After explaining the model, the discussion elaborates on the two abstraction levels of affordances that were found in Chapter 7 and the tension between privacy and interaction as additional implications for theory.

8.2.1 Conceptual model of workplace design for social well-being

The model in Figure 22 (next page) summarizes and integrates the findings on the relationship between workplace design and social well-being. It shows the identified affordances, the interior design attributes (the workplace designers' palette) that make up these affordances, and the actions or feelings they may afford that stimulate the short-term and long-term social well-being of office workers.

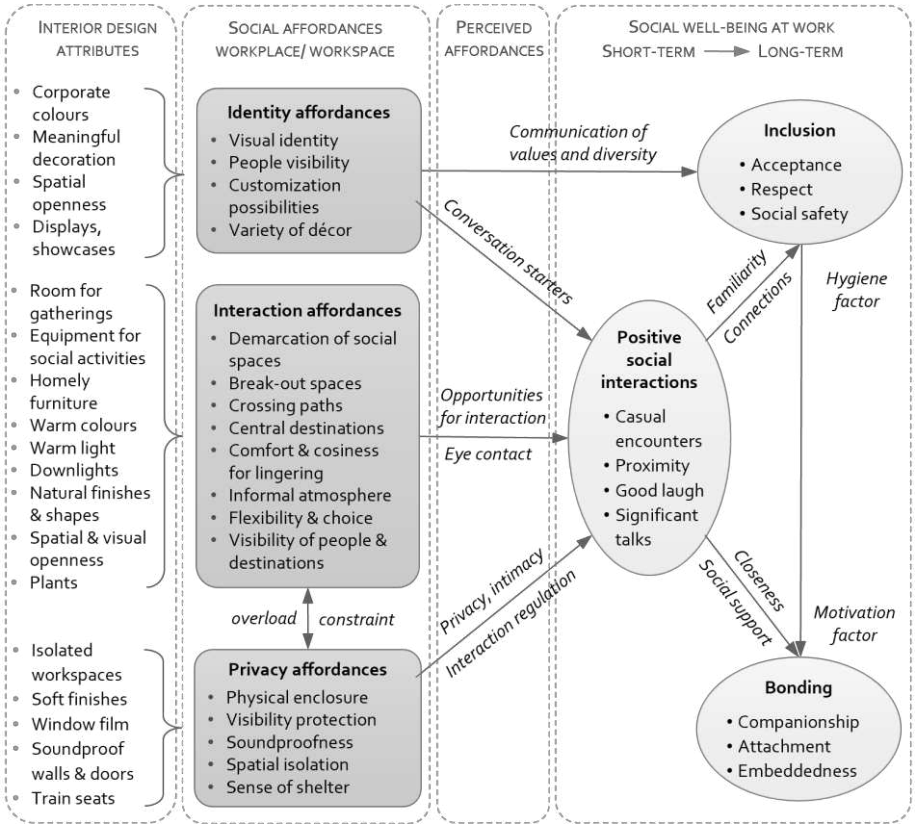
This conceptual model grants a central position to short-term social interactions at work which connect the design attributes and corresponding affordances with the long-term social well-being states of inclusion and bonding. As indicated by theory (Chapters 4 and 5), the weakness of the 'interaction items' (Chapter 5), and the designers' assumptions (Chapter 7), long-term social well-being is built and maintained through short-term social interactions, especially those face-to-face. It aligns with evidence that satisfaction with in-person interaction at work reduces loneliness (Cigna, 2020).

The findings presented in Chapter 5 indicate that the desired design outcome of positive social well-being includes two levels: the base level of inclusion and the higher level of bonding. In the results of the scale development, inclusion reflects the experience of psychological safety in the work environment and feeling accepted. It can be considered a hygiene factor (Herzberg et al., 2017) which leads to dissatisfaction when absent but in itself does not spark joy. It may be generated by a general familiarity with the workers around and having superficial connections, but at least, it does not include feeling alienated or harassed.

In contrast, the dimension of bonding was found to reflect a deeper connection with others at work and the feeling of being embedded in a community. This may be nourished by receiving and giving emotional support and experiencing closeness in contact with co-workers. Bonding may be considered a satisfying, motivating factor in the work environment. This implies that at a minimum level, the interior office design should support feelings of inclusion. It would include the prevention of anonymous, impersonal environments that cause feelings of alienation and environmental stressors that cause negative encounters, as indicated by the employees' statements in Chapter 4.

Figure 22

Synthesis of the findings: assumed relationships between components of workplace design, affordances, and dimensions of social well-being at work



The workplace designers interviewed (Chapter 7) address inclusion and bonding simultaneously in a more general approach of supporting connectedness or belonging. According to McClure and Brown (2008), belonging at work includes being familiar with the customs at work, togetherness, fun and camaraderie, and being recognized, aspects that resonated in the design solutions of the designers that communicate organizational values and facilitate being seen and spending time together.

Regarding social interactions, the employees' statements (Chapter 4) refer to casual encounters and proximity as positive social interactions they experience or miss in their work environment. The developed scale (Chapter 5) includes regularly having a good laugh and significant talks at work as positive social interactions, which may also indicate long-term relationships. Additionally, the interior designers who were interviewed (Chapter 7) consider eye contact, togetherness, and joint activities as

boosters of positive interactions. The central position of social interactions in this model implies that enhancing them should be the focal point of attention in workplace design for social well-being, which aligns with abundant evidence of the importance of both frequent and deep social interactions to well-being (e.g. Sun et al., 2019).

Furthermore, the findings from the interviews reported in Chapter 7 suggest that affordances are the linking pin between interior design components and social well-being by enabling beneficial behaviour and experiences. The workplace and workspace affordances that emerge from this dissertation can be grouped into three main categories based on the type of design solutions they mostly require: openness, enclosure, or visual communication.

Identity affordances refer to the communication of individual and group identity which is considered fundamental to human needs by several theories in environmental psychology. Clear boundaries, real or symbolic, and communication of customs create social groups and offer perceived control (Barker, 1968; Newman, 1972; Scott, 2005). Identity marking creates a sense of belonging and prevents conflicts in organizations (Brown et al., 2005). Psychological ownership supports place attachment (Altman et al., 1992; Scannell & Gifford, 2010) which is reinforced by proximity-seeking behaviour.

Interaction affordances are enablers of gathering and social interaction, such as the spatial characteristics in space syntax theory (Hillier & Hanson, 1984; Sailer & Koutsolampros, 2021), and the reduction of environmental stressors that impede social behaviour (Gatersleben & Griffin, 2017). Privacy affordances provide physical conditions for withdrawal and the experience of individual or group privacy. They include territory markers and physical separation or distance from other people.

The affordance of flexibility and choice runs through the three groups and refers to perceived control over the environment, which reduces stress (Spector, 1986). Note that the affordances in the model (Fig. 22) reflect *intended* affordances (see Fig. 1, p21) which are based on designers' expertise; the recognition of these affordances by office workers has to be confirmed in future research into *perceived* affordances.

8.2.2 Affordances for action and meaning

The research indicated that there may be two levels of affordances: functional affordances that provide material usability of the space and refer to concrete action possibilities, and more abstract psychological affordances that provide symbolic usability and refer to appropriate action possibilities. Material usability depends on the physical characteristics of the user and therefore is rather universal, whereas symbolic usability depends on the social-cultural characteristics and therefore is context-bound (Muller, 2003). The direct relationship between identity affordances and feelings of

inclusion at the top of the model (Fig. 22) refers to this symbolic value and communicative potential of design.

Space syntax theory (Hillier & Hanson, 1984; Sailer & Koutsolampros, 2021) focuses on material affordances of the spatial arrangement that enable movement and eye contact, which may indicate the minimal requirements for encouraging or discouraging social gatherings. Indeed, the designers aimed to stimulate informal interaction by manipulating walking routes and creating destinations, which is supported by evidence that face-to-face interactions at work can be stimulated by creating shared paths (Kabo et al., 2015) and that facilities, such as as water coolers, attract people (Fayard & Weeks, 2007).

However, providing concrete action possibilities is not enough to encourage social behaviour; the behaviour needs conditioning and should be perceived as appropriate and desirable. As Koutsolampros et al. (2017) found, spatial connectivity and distance to workspaces alone does not explain the usage of breakout spaces and other design features may be in play, such as look-and-feel and furniture.

Recognizing this social-cultural dimension, another type of affordances applied by interior designers refers to symbolic usability, communicating that it is appropriate to socialize, providing comfort to linger, and attracting people by offering possibilities for social activities. For creating these affordances they use colours, surface materials, furniture, decoration, lighting, morphology, and greenery rather than spatial organization. The synthesis of these elements may refer to a style or express an atmosphere and intends to evoke associations with similar informal settings.

8.2.3 The tension between social interaction and privacy

The findings indicate that stimulating social well-being at work largely entails stimulating in-person interactions at the office. Too much enclosure may constrain or discourage this interaction. However, social interactions are known to cause noise annoyance and distractions, interrupting the positive state of flow and thwarting the accomplishment of complex tasks. This may lead to dissatisfaction with privacy, especially in open-plan offices.

Enhancing social well-being at the office, therefore, can be at odds with enhancing office workers' privacy. An exception to this contradiction is the need for group privacy which is required for heart-to-heart conversations and can contribute to group cohesion by the demarcation of group boundaries. In essence, workplace privacy entails the possibility to regulate social interactions according to temporary needs (Weber et al., 2021), implying flexibility of space and space use.

The implementation of activity-based working (ABW) may aid the balancing of social interaction and privacy by increasing the worker's options for choosing an appropriate space. This office concept entails the flexible use of a variety of spaces that are designed for different activities, which range from individual focused work to collaborative group work and informal meetings. The perceived fit between the ABW environment and the users depends on job characteristics, task characteristics, behaviours regarding space use, the user's psychological need for privacy and relatedness, and age (Hoendervanger, 2021).

The influence of individual and situational differences implies that to be successful, an ABW office should not only offer a wide variety of adequately designed spaces to choose from but also abundant availability and well-trained users. This dissertation illustrates how scarcity and inadequate design may cause anti-social behaviour and lead to exclusion. The research indicates several strategies to accommodate a variety of social interactions, communicate the boundaries and appropriate use of the social spaces, and offer privacy at the workstation.

However, to prevent conflict, it is not enough to spatially separate focused work from social gatherings and offer adequate social spaces for the different activities. It requires training and nudging users to socialize at the appropriate places and be quiet in dedicated focused work areas. This is not easy; workers in ABW environments are known to choose a desk for the day irrespective of their activities (Hoendervanger et al., 2016). Many prefer the comfort of an ergonomic desk and since this piece of furniture is quite multifunctional, they do not feel the need to switch settings. Moreover, switching requires getting your stuff together and carrying everything with you while moving to another location. Although in the past years, technological development has led to smaller, lighter, and wireless devices and replaced much of the paper with digital archives and interactive platforms, usually people are reluctant to change habits and will tend to stay where they are.

For effective nudging, the desired behaviour should be easy, attractive, social, and timely (Service et al., 2015). The research provides several strategies to nudge people to social spaces, such as positioning informal meeting spaces at a central location which is easy to reach and visible from a distance, making them attractive by offering comfort and variety, and by communicating through the décor and furniture and equipment that it is appropriate to socialize. According to the designers, manipulating walking routes and centralizing equipment that attracts people, such as coffee machines and printers, may stimulate joyful encounters.

Above all, being with other people is a reward for voluntarily visiting a space because it supports the need for connectedness. This is a self-reinforcing effect: if the space is frequently visited, chances are high that there will be others present when visiting the

space. Moreover, frequently visiting a space and meeting people there will increase the cognitive-emotional bond with the location (place attachment), which in turn makes people return to those places. Similar to interpersonal attachment, place attachment is characterized by seeking proximity and a safe haven and it suffers from prolonged periods of separation (Altman et al., 1992; Scannell et al., 2021). Therefore, it is important to timely intervene when social spaces are underused.

8.3 Reflection on the Research Quality

8.3.1 Internal validity and reliability

A high reliability of the research was pursued by triangulation, adequate sampling, and calculation of reliability measures. The transparent and detailed reporting of our research procedures, such as the PRISMA guidelines for reviews, peer-reviewed and open-source publications, and public access to underlying data and research records afford replicability and add to the trustworthiness of the research.

Triangulation of qualitative and quantitative analysis was applied to identifying concepts of social well-being in offices (manual sorting, multi-dimensional scaling, and hierarchical cluster analysis) and workplace designers' strategies (coding concepts and counting linkages). Triangulation of data sources was used to develop the measure for social well-being at work (employee statements, theory, expert reviews, and survey data). Triangulation of researchers was applied to the literature review, coding and sorting the employee statements, interpreting the concept maps, and coding the designers' statements.

The credibility of the qualitative research is further supported by meaningful and rich descriptions of the findings, aggregation across cases, and systematic organization of the results by mapping their semantic differences and hierarchical relationships. As in any review, the search strategy was limited by the selection of search engines and search strings. By using general search terms of interior office space and well-being at work and large interdisciplinary databases, we intended to elicit a broad range of design features and health outcomes which was not dictated by our prior knowledge of the topic. To obtain reliable coding of interview data, the researchers were trained until a satisfactory inter-coder agreement was reached based on the calculation of kappa and Krippendorff's alpha. The reliability of the qualitative research could have been increased by respondent feedback during and after the analysis and by analysing outliers that contradict the emerging patterns.

In the quantitative analyses, internal validity was accounted for by a wide array of statistical tests and fit indices that confirmed the appropriateness of the methods and the reliability of the results. Furthermore, the content validity of the social well-being

scale was supported by the combination of induction and deduction. The internal reliability or stability of this multi-indicator measure is indicated by satisfactory values of Cronbach's alpha and McDonald's omega. More data are required to test for stability over time (predictive validity) and further investigate construct validity, including the distinction from related but different concepts (discriminant validity), such as organizational commitment, and the similarity with theoretically related constructs (convergent validity), such as belongingness. The requirement of self-reportability of architectural privacy excluded design features that are more difficult for employees to describe, such as sound and smell or spatial arrangement.

8.3.2 External validity and utilization of the research

The transferability of the results to other contexts is supported by adequate sampling, providing detail, and including the users' and practitioners' perspectives. For the collection of qualitative data through card sorting (Chapter 4) and interviews (Chapter 7), purposive sampling was applied to reduce the risk of nonrepresentative participants. The sorters were recruited from different ages, sectors, and offices provided they had experience with activity-based working environments. Interview candidates were selected based on ample experience in interior office design but different educational backgrounds and professional contexts to reflect the designers' population. Because all participants were acquired through my personal network their involvement in the topic may be above average and the strategies of designers with different values may be underrepresented.

The concept mapping was not used to its full potential because the interview data had been collected for a different purpose and we did not have access to the initial participants for sorting and rating the statements and discussing the results. Therefore, the generalizability was limited and the concepts and corresponding statements were taken as inspiration for scale development rather than concrete indicators of social well-being at work.

The quantitative studies used a convenience sample of office workers in four organizations that were recruited for the research. Although the overall response was relatively high and the sample was large enough to infer reliable results, the representativeness of the office worker population may be affected by their willingness to participate and their specific organizational context. A non-response analysis could have indicated the representativeness of age groups, provided that demographic figures were available. However, due to privacy reasons, little background information was collected. Further research on workers' characteristics and circumstances that influence social well-being at work may provide more starting points for non-response analyses. Since the organizations' offices included a variety of interior designs and ways of working, the office environment may be representative of the Dutch public sector.

Additionally, the generalizability of the results is supported by the richness of the qualitative data and the use of different perspectives. The ecological validity of the dissertation is high due to the use of real-world data: realized design projects, statements of employees in their actual office environment, and ratings of everyday office life. Regarding the utilization of the research, it can be noted that the results apply to current workplace research and practice in several ways (see Section 8.4). Furthermore, the questionnaire, sorting task, and interviews increased the participants' awareness of their knowledge, experience, and strategies regarding social well-being at work.

8.3.3 Overall strengths and limitations

By adopting a pragmatic approach, taking the perspective of the interior designer, and defining parameters, the results of this research closely match practical solutions that have the potential to improve office workers' daily work life. Escudero-Mancebo et al. (2023) conclude that so far, relatively few published design studies propose recommendations, guidelines, frameworks, and taxonomies, while these types of representations of knowledge are important to the growth of the design discipline. The work in this dissertation contributes to the development of a vocabulary of both social well-being at work and interior office design and the identified design strategies could serve as practical design guidelines.

Another strength of the work in this dissertation is the application of multiple methods, some of which may be new to design research. The group concept mapping and means-end chain analysis illustrate different approaches for organizing and quantifying qualitative data about design processes and user experience to objectify the main results in addition to rich descriptions. The structural equation modelling and ordinal regression analysis illustrate how quantitative methods borrowed from social science can be used to identify predictors of desired design outcomes.

Overall limitations of the research are the relatively homogeneous samples and the limited validation of results. Furthermore, the research may be biased by memory deficiencies and retrospective sensemaking because of the lack of real-time observations. Other limitations concern the national context of the office environments and designers' education, which are immersed in Dutch culture. In a less individualistic or more hierarchic culture employees may have different perceptions of social well-being.

8.4 Value for Science and Society

This research intended to deepen the understanding of interior office space, social well-being at work, and their mutual relationship to guide the improvement of workplaces through actionable insights. In Table 16 (next page), the possible implications of the research are listed for a multi-disciplinary audience (see Fig. 5, p.31). This audience includes academic researchers in, for example, design, architecture, ergonomics, organizational psychology, and environmental psychology, and professionals in, for example, workplace design, workplace management, human resources management, and design education. The implications of the dissertation concern the research methods, the findings, and the tools provided by the research.

The methods applied in this dissertation could serve as research-for-design examples for less experienced researchers and students in this relatively young discipline. It is essential that design, as a science of experience, develops empirical protocols similar to psychology as a science of the mind (Caan, 2011, p.97) and future design researchers receive training in both qualitative and quantitative methods (Escudero-Mancebo et al., 2023).

The dissertation displays the use of the evidence-based PRISMA guidelines for the critical assessment and transparent reporting of literature reviews, which is the most cited reporting guideline in health sciences (Caulley et al., 2020) but it seems not to have penetrated design research yet (Elshater & Abusaada, 2022). It shows how the consumer-oriented means-end chain approach can be applied to systematically analyse interview data to identify designers' strategies. To my knowledge, this technique was not used in design research before. It also introduces the group concept mapping technique to design research as a mixed method that integrates qualitative and quantitative analysis of user experiences. Furthermore, the dissertation shows how statistical techniques, such as structural equation modelling and ordinal regression analysis, serve as quantitative methods for identifying predictors of design outcomes by finding patterns in survey data.

Table 16

Possible contributions of the dissertation

Domain	Contributions
Scientific research	• A definition of interior office design to use as a practice-based scope for research on workplace design • An outline of available evidence of the health impact of workplace design, knowledge gaps, and methodological issues in the field • A showcase of quantitative, qualitative, and mixed methods applicable to design research • A deepened understanding of the phenomenon of social well-being in the domain of work as an alternative to general social well-being theory • An extension of affordance theory into the work context • A code system of design attributes and affordances to facilitate systematic analysis of interior office design and its impact • Self-report measures of architectural privacy and a multi-dimensional operationalization of satisfaction with privacy at the office • Testable propositions of relationships between design attributes, affordances, behaviour, and experience
Design practice	• Elicitation of workplace designers' intuitive decisions to educate and inform less-experienced workplace designers • Collected evidence on the health impact of workplace design to inform future design projects and enable evidence-based design • Identification of social well-being indicators to inform the development of new design strategies • Design strategies as a framework for developing design solutions that support well-being at work • Prioritization of design attributes that support workspace privacy • A mental map of the designers' strategies to be used as a tool for discussing desires and options with the client
Organizational practice	• Indication of the potential of positive and inclusive workplace design to enhance employee health • A social well-being measure to monitor employee well-being and notice signs of reduced safety and bonding after organizational change or interventions • Affordances and design attributes can inform design briefs and act as parameters in post-occupancy evaluations
Design education	• A description of the interior office design scope and its components related to social office space • Examples of design strategies and design solutions to support several dimensions of well-being at work • Examples of research designs and methods for establishing the effect of design strategies • A typology of social affordances of the workplace to stimulate the conception of design solutions that enhance social well-being

The conceptualization and operationalization of social well-being as a desired design outcome and the identification of accompanying design strategies could inform both students and practitioners in the fields of workplace design and management. A better understanding of social well-being at work aids the development of a high-quality work environment and technological interventions to enhance social interactions at appropriate locations in the office. The research indicates the type of activities that support social well-being and could be the objective of design interventions, such as technologies that break the ice or highlight shared interests (Mitchell & Olsson, 2019; Olsson et al., 2020). The design strategies identified in this dissertation should not be taken as a prescription of how to design social office spaces, but as a way to support the restructuring of existing ideas that characterizes idea generation in response to a new situation (Pasman, 2003).

In particular, the dissertation's identification and classification of workplace affordances support the knowledge transfer from experienced designers to students and junior designers. The research of Pasman (2003) showed that providing industrial design students with a problem-independent product typology enriched their design solutions and reduced fixation on their preconceived ideas, taking their new designs beyond existing categories. This typology-based approach differs from the process of metaphor, in which a symbolic concept is mapped on the design problem to induce new ideas by making combinations that partially fit. The metaphor approach seems to be dominant in interior designers' education at art academies that emphasize aesthetics and symbolic expression of the design and often put novelty above usability. Structured design knowledge and organized visual material could advance the field of interior design by supporting systematic research and transformation of existing knowledge to new design situations, which may not only increase the novelty but also the functionality of the designs.

Furthermore, the developed models of social well-being themes, indicators, and design strategies can serve as a tool for discussing clients' desires and design options, inform design briefs and research designs for post-occupancy evaluations, and function as a foundation for further theory building. The assumed relationships between workplace design and social well-being at work can be considered theoretical propositions to be confirmed by future empirical research.

Finally, it would be a big step forward if workplace-related education taught future designers and commissioners about the significance and methods of evidence-based design, how to include it in design projects, and how to conduct post-occupancy evaluations. It should be explained to them that evidence-based design is not simply an extra set of requirements which might impede creativity and aesthetics. It rather is a professional mindset and an essential process for improving the quality of work environments and workers' well-being.

The Center for Health Design (2010) defines evidence-based design as 'the process of basing decisions about the built environment on credible research to achieve the best possible outcomes'. It distinguishes eight key steps for an evidence-based design process. To illustrate how scientific research can inform the evidence-based design process in several ways, Table 17 summarizes how the knowledge generated by the work in this dissertation and the tools developed may support each of the steps of an evidence-based approach towards designing social offices from articulating goals to prototyping and evaluating the realized design.

Table 17

Summary of the dissertation's contribution to evidence-based design of social offices

Evidence-based design step		Contribution of the research
1.	Define evidence-based goals and objectives	• Four categories of health goals within two approaches (Chapter 3) • Dimensions and components of social well-being at work (Chapters 4 and 5)
2.	Find sources for relevant evidence	• Systematically collected evidence of office design features' health impact (chapters 2 and 3)
3.	Critically interpret relevant evidence	• Discussion of existing (Chapter 2) and created (Chapter 6) evidence • Examples of research quality criteria and study limitations (Chapters 2 to 8)
4.	Create and innovate evidence-based design concepts	• Design strategies to inform the development and evaluation of prototypes (Chapters 3, 6, and 7)
5.	Develop a hypothesis	• Examples of hypotheses underlying the design strategies identified (Chapters 3 and 7
6.	Collect baseline performance measures	• An overview of existing health measures (Chapter 3) • A scale for measuring social well-being at work (Chapter 5) • Operationalization of privacy dimensions (Chapter 6)
7.	Monitor implementation of design and construction	-
8.	Measure post-occupancy performance results	• An overview of applied effectiveness measures (Chapter 3) • A scale for measuring social well-being at work (Chapter 5) • Operationalization of privacy-related design features and satisfaction dimensions (Chapter 6)

Note: the eight steps are defined by the Center for Health Design, https://www.healthdesign.org

8.5 Future Research Directions

The dissertation provides several leads for further inquiry into the relationship between workplace design and the social well-being of employees. In this section, the leads are grouped into three stages from additional explorative research to causal modelling. To increase the utilization of scientific knowledge on positive workplace design, research on obstacles to evidence-based design practice is needed.

8.5.1 Extending and refining the social office space taxonomy

A first step may be the further exploration and demarcation of workplace affordances and corresponding design components that influence social well-being at work to reinforce the foundation for future measurement and modelling. It may also be used to build a visual database for inspiring and guiding workplace designers. More examples of relevant design attributes and affordances and their measurement may be found by a systematic review of the relationship between interior office space and *social* well-being, using the parameters identified in this dissertation as search terms. Additionally, discussing the elicited design strategies with a wider array of designers may add examples and refine definitions.

Similar to the creative space typology of Thoring et al. (2021), the social office space taxonomy could include three levels: space type, spatial qualities (affordances), and spatial characteristics (design attributes). Following the frameworks of Muller (2001) and Pasman (2003), the knowledge structure of affordances may include a typology of function (intended use) and meaning (connotation) of a particular office space. The corresponding design attributes (perceptual features) may then serve as a typology of form, which includes their orientation and arrangement in space, individual proportion, geometrical form, and material qualities, reflecting the palette of the interior designer. At the top level, the spaces may be characterized by the activities they are supposed to support and their location in the building, for example, a lobby, coffee corner, library, game room, or project room.

The classification and quantification of intended and perceived affordances may require a 'semiotic syntax' in addition to the space syntax technique that measures spatial affordances such as physical enclosure. This semiotic system would include a classification of multisensory design attributes, such as sound, tactile, and olfactory characteristics of finish materials. Since the visual dominates the other senses and presents multiple properties at once (Stokes & Biggs, 2015), the visual analysis of actual and depicted interior spaces seems a sensible start for developing measures. The inquiry into semiotic classifications may draw upon insights and methods from, for example, consumer research and commercial architecture while acknowledging the typical properties of office settings and the influence of organizational culture.

8.5.2 Capturing office workers' perception of social affordances

Parallel to the refinement of the social office design taxonomy, future research may explore how users perceive workplace affordances in real office environments and the mechanisms through which the perceived social affordances influence social behaviour and social well-being states.

Methods for gathering detailed and rich insights into the experience of actual social office spaces are, for example, walk-through interviews (Babapour & Cobaleda-Cordero, 2020) and visual analysis of participant-led photography (Shortt & Warren, 2019). In this qualitative research, the influence of organizational culture can be included. Time-prompted experience sampling and location tracking (Markkanen et al., 2023) enable quantitative measuring of location-bound experiences of social well-being. Items of the scale developed in this dissertation can be used to construct an experience-sampling questionnaire. The response on repeated questionnaires may be increased by offering a social network facility connected to the measurement app as suggested by Chen (2021).

Manual or automated observation of space utilization and behaviour can serve as a triangulation of methods for the data collection on the perceived social affordances. Mobility sensors can measure the occupancy of spaces. Auditory sensors that capture actors and tone of observation through sentiment analysis enable the collection of data on the frequency and nature of social interaction in particular spaces. Virtual reality may be useful to investigate the design characteristics that make up perceived affordances but an artificial environment may be less adequate to capture the designs' effect on the multi-sensorial experience of social interactions. Similarly, coding pictures by workplace designers and using software to quantify the depicted characteristics, for example, calculating colour values as applied by Motoki et al. (2021), and connecting these data to user ratings of the pictured space may support the identification of perceived affordances but does not predict real experience and behaviour.

8.5.3 Developing a causal model

Establishing the causal effects of workplace design on well-being would require experimental studies, for example, measuring the social well-being of the same individuals before and after exposing them to design changes. Conducting these experiments in realistic office environments would increase their generalizability to the real world, especially since social well-being entails connectedness with real people. The measurement of changes in long-term social well-being, such as embeddedness and in-depth personal relationships, would require longitudinal research. Influencing social well-being at short notice would be limited to influencing the quality and quantity of social interactions and the communication of identity by removable design features.

Another way to establish a predictive model is by collecting cross-sectional data on perceived office design on the one hand and experienced social well-being on the other of office workers participants in a wide variety of office interiors. They would have to complete the questionnaire on their state of well-being while being at the office or having been there recently to provide reliable results about the impact of design on well-being. This type of study may connect the independent design variables to the dependent well-being variables through, for example, path analysis and multi-level analysis considering office workers are nested in office buildings. It also allows for the inclusion of confounders, such as job satisfaction, personality, and organizational culture, which may mediate or moderate the relationship between design and well-being at work. Since the design features that may influence social well-being are not limited to the workstation or workspace but include communal areas, such as breakout spaces and traffic zones, this research design requires a substantial sample of office buildings.

8.5.4 Investigating obstacles to evidence-based design

The motivation for this dissertation originated from the widely observed disparity between office workers' needs and their actual work environment and the belief that the process of evidence-based design could contribute to closing this gap. However, the current research indicates that establishing evidence-based workplace design practice is still a long way to go.

This dissertation showed that this academic field is relatively young and the scientific research on positive workplace design is scattered and limited. Yet the research on this topic has continued to grow in recent years and many studies were added to the body of literature described in chapter two. The numerous reads of our literature review and other overviews of workplace design research indicate a large interest in the topic among the academic audience, which may predict further growth of the field.

However, it is unclear to what extent the scientific knowledge reaches the practitioners. Our interviews with interior designers showed that they mainly based their decisions on intuition and the client's explicit preferences, for example, the outcomes of user workshops. These workshops are important for creating a feeling of ownership of the new environment and gathering knowledge about the needs and expectations of the current participants, but they do not represent the entire user group nor the users of the future, such as new employees. Although several of their strategies seem to align with established theory, the designers mainly refer to popular psychological beliefs or personal experiences rather than scientific literature, consulted experts, or project evaluations.

Research into the current practice of evidence-based design and reporting of scientific design studies may reveal the obstacles to transferring knowledge from science to design practice. Would it help if academics were stimulated and supported to produce a popular version of every academic publication they produce, give interviews about their projects, and more often present at practitioners' conferences and research summits? Could more and well-written systematic reviews and their open-source publication support the use of these valuable sources of evidence for practitioners?

Research among stakeholders may explain obstacles to conducting post-occupancy evaluations and the publication of transferable insights. The fields of corporate real estate and architecture do not have a tradition of post-occupancy evaluations and sharing learnings; designers and clients simply move on to the next project instead of the regular feedback-seeking which is common in the retail and hospitality sector (Oseland, 2023). What is holding organizations or designers back to share their insights on what works for office users and what not? How could workplace and interior design magazines, which now mostly serve as a source of aesthetic inspiration and advertisement, be convinced to publish critical reflections from the user's perspective and references to independent sources of knowledge? Would calculations of the return on investment persuade real estate owners to conduct post-occupancy evaluations that include users' experiences?

8.6 Overall conclusion

The studies in this dissertation demonstrate that workplace design impacts the well-being of office workers in several ways. However, knowledge about the role of interior design is limited and scattered compared to the value of social well-being. Towards building a solid foundation for future workplace research, the studies in this dissertation identified key components of interior office design in relation to social well-being at work through quantitative, qualitative and mixed-method approaches.

The research indicates that to enhance social well-being in offices, the workplace design should stimulate informal social interactions at the office, communicate group identity, and offer workspace privacy. These workplace affordances are assumed to support building and maintaining co-worker relationships and communities, social inclusion, and the reduction of negative encounters. Recommendations for future workplace research include further developing a social office space taxonomy of key concepts and their relationships and investigating workplace affordances from the users' perspective.

Developing effective interior design strategies for well-being is important to the future of work. Although design alone cannot guarantee the users' well-being, without a supportive workplace, their flourishing is unlikely (after Sommer, 1974).

8.7 A Look into the Future: the Ideal Social Office

The insights gathered in this dissertation and gained during my years as a workplace researcher and consultant allow me to envision the ideal social office, a place where workers can enjoy each other's company and feel embedded in a working community.

In this vision, four areas of functionality emerge, each of which may consist of a range of spaces and facilities that are characterized by specific affordances. It takes into account the current trend of hybrid working that seems to reduce (but not diminish!) individual desk work at the office since many prefer and have the opportunity to do focused work at home. In the hybrid working model, large variations in occupancy may require flexible use of workstations and sharing the office with other organizations or local communities.

8.7.1 A welcoming entrance area

The ideal social office has a welcoming and safe entrance area inside and outside the building. The main entrance is clearly marked, for example by a canopy and illuminated signs, and is approached through an accessible and attractive walkway which may be lined with greenery or art. The appearance of the building fits the identity of the occupying organization(s). Other entries for employees, for example at the bicycle parking, are also clearly marked and accessible, and the routing to the reception area or directly to the workspaces is easy and attractive.

Upon entering the reception area, the receptionists are clearly visible without suffering from drought and cold from outside. The reception area may double as a coffee bar and offer a diversity of seating arrangements for visitors and employees, in a formal but friendly atmosphere. A large artefact symbolizing the organization's identity may be the space's focal point. Furthermore, the area may feature a wardrobe and temporary exhibitions, is light-filled, decorated with plants and visuals referring to the organization's primary processes, and has good acoustics.

8.7.2 Varied and dynamic communal areas

The office's communal areas for social interaction, such as the lounge, restaurant, and formal meeting rooms, may be positioned at intersections of walking routes between the entrance and workspaces. They should include a variety of breakout areas that attract people through unique features, subtle aromas, comfort, good coffee, and possibilities for fun activities or peaceful togetherness. To attract users throughout the day, it is important that these areas offer comfortable furniture, good light and acoustics, and a variety of atmospheres.

Inclusion is supported throughout the office building by good accessibility in every sense, ample choice options regarding atmospheres, furniture types, equipment, and privacy degree, and visual references to diverse groups in the organization. Regularly changing decoration, which may be intriguing, interactive, or humorous, supports the continuous attraction and provides conversation topics. Technology supports dynamic social space and the involvement of users.

Figure 23

Illustrations of communal social areas

Photo: Chiel van Diest. Design: Van Dijl Architecten.

Photo & design: Carola van de Bilt, Studio Binnenbeeld.

Figure 23 includes two examples of central communal spaces designed to stimulate informal social interactions. The picture on the left shows a lounge area featuring diverse and comfortable seating and warm colours. The dark ceiling was intended to increase cosiness since the budget was not sufficient for actually lowering the ceiling. The picture on the right shows the communal social space of a small company. It features a large table for having lunch together, a beer tap and a billiard and is decorated with plants. In the background, the picture shows an identity wall that features certificates earned by the employees.

8.7.3 Team-based neighbourhoods

A third area of functionality in the ideal social office includes workstations and small meeting spaces that are dedicated to different teams to provide a home base in the flexible working environment. Within these 'neighbourhoods', the workspaces are organized around an informal meeting area for each team or department, which includes a coffee machine, a kitchen, and a bar or kitchen table to have coffee or lunch together. Ideally, this meeting area is positioned at the intersections of walking routes between the office floor's entrance, facilities such as toilets and lockers, and workspaces.

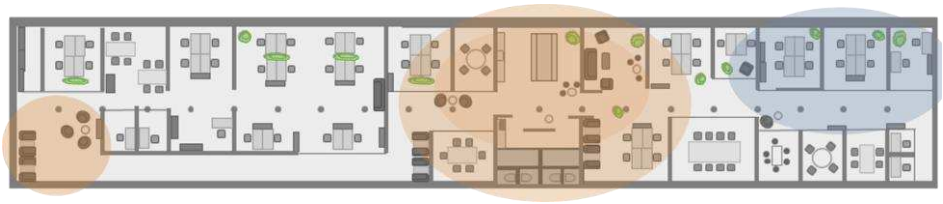
The neighbourhoods offer several seating arrangements for informal meetings, including 'train seats' which offer intimacy, and standing tables for a quick chat. Abundant small meeting rooms can be used for ad hoc meetings, calls, and touching down for limited individual working.

In the ideal social office, the neighbourhoods feature open and enclosed workspaces and small meeting rooms of various sizes and degrees of transparency. The workspaces accommodate small clusters of desks for a maximum of four team members. Most of the workstations are situated in rooms for two to four persons to support privacy but there may also be larger rooms for interactive work or rooms which are temporarily dedicated to project teams. The workspace area features private pods for focused work that are also equipped for individual video calls (stable wifi, soundproofing, sufficient and evenly distributed light) and a cornered-off quiet zone.

Figure 24 indicates a possible layout fitted into the current premises of ID Studiolab, the office where I had my desk as an employee of the Department of Human-Centred Design at TU Delft.

Figure 24

Example of a neighbourhood floorplan



Note: Informal meeting areas at the entrance and the heart of the office floor are marked in orange and the quiet working zone is marked in blue.

Abundant greenery serves as decoration and increases visual privacy. Plants, books, soft flooring, acoustic ceilings, panels, and upholstered seating aid in distributing and absorbing sound waves, which reduces noise. Most workspaces feature a glass wall facing the corridor but most walls are solid, providing privacy and personalization possibilities. The glass walls are partly covered by decorative and translucent window film that refers to the organization's values or primary process. The patterns and coverage of the film is dense enough to provide visual privacy and open enough to detect occupancy. The colour scheme in the office is light and balanced and may subtly refer to the corporate branding. Natural-looking finishes, such as wood, and bright but warm lighting create a pleasant ambience. Pendant lights mark spots for informal gathering and table lamps may demarcate quiet zones and create a homely atmosphere.

Figure 25

Illustrations of social spaces in team-based neighbourhoods

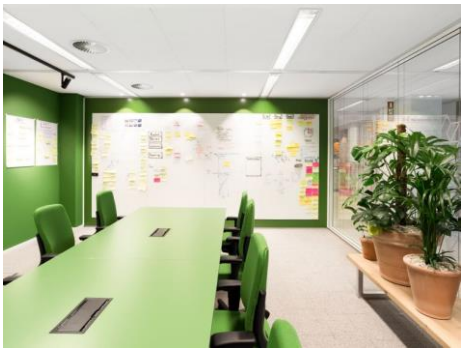


Photo & design: ZENBER Architecten.

Photo: Roos Aldershoff. Design ZENBER Architecten.

Figure 25 presents two examples of social spaces in the team-based neighbourhoods. The left one features colourful collaboration room with a whiteboard wall and plants providing privacy. The picture on the right features a small and mobile seating arrangement which provides intimacy in an open space. It can be used for conversations and for individual work activities that do not require sound privacy or adjustable furniture.

In the ideal social office, workers are nudged to use the dedicated social spaces for their socializing and informal meetings by offering comfort, a playful environment, and privacy for intimate conversations. Privacy affordances and clear signs communicate appropriate behaviour in the focused workspaces and remind the users of being quiet. In the workspaces, technologies timely remind focused workers of having a break and meet co-workers, for example, the inflatable lamp with an alarm of dynamic light textures designed by Remmerswaal (2020).

Although a desk-sharing policy may inhibit a fixed personalization of workstations, there are ample possibilities to customize the team area with decoration and furniture selected by the users. These personalization possibilities may be reduced further away from the core to create fluid neighbourhood boundaries which increase flexibility.

8.7.4 Social traffic zones

In the ideal social office, the traffic zones that connect the neighbourhoods, communal areas, and the entrance area support social well-being through decoration that communicates the organization's values and products and it offers room and comfort for conversations resulting from chance encounters. This implies that staircases are pleasant spaces with good acoustics and attractive decoration which may be interactive. This also applies to locations where paths cross, such as near elevators, toilets, and large

meeting rooms, which additionally may feature seats or standing tables to support engaging in conversations.

Figure 26 pictures an example of a 'social traffic zone' situated in a light-filled atrium. It features an extra wide staircase designed to halt and chat without obstructing the traffic. Some of the stairs' landings feature seats (outside the picture frame). Downstairs are 'train seats' built in the wall which allow for more private conversations while offering the possibility of eye contact with passers-by. A variety of meeting spaces is situated around the atrium. The adjacent workspaces have adjustable shutters for privacy regulation.

Figure 26

Example of a social traffic zone designed to stimulate casual encounters

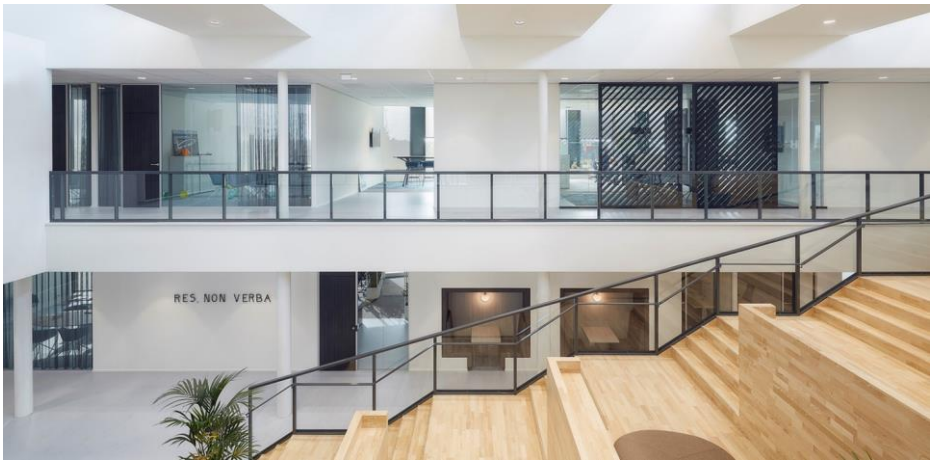


Photo: Gerard van Beek Fotografie. Design: BDG Architecten.

8.7.5 Inclusive design

The ideal social office celebrates diversity and accommodates choice, flexibility, and practicality to meet a wide range of user needs. These needs may include wheelchair accessibility, impaired visibility and hearing, neurodiversity, high sensitivity, personality differences, chronic illness, pregnancy and menopause, allergies, and the employees' diversity of gender identities, religions, and ethnic backgrounds. This inclusive design increases the overall usability of the office space and nurtures company culture. Biophilic design may be a useful approach to increase comfort and make spaces attractive to a wide audience since it touches on universal needs. Inclusive and universal design are essential requirements for supporting social well-being at work.

APPENDIX A

Social Well-being Item Descriptives and Correlations

This appendix includes several statistical details of the items (variables) that were used in the scale development reported in Chapter 4. Table 18 shows the item's descriptives and reflects the distribution of the respondent's social well-being scores.

Table 18

Item descriptives (n = 452), indicating items with extreme scores and low variance

	Item	Mean	SSD	Variance	Skewness	Kurtosis
1	Pleasant interactions	**4.07**	**0.58**	**0.34**	-0.89	**4.38**
2	Good laugh	3.94	0.73	0.53	-0.64	0.88
3	Quarrel often	1.76	0.71	0.50	**1.06**	**2.52**
4	Annoyed by others	2.46	0.88	0.78	0.44	-0.02
5	Experienced hostility	**1.62**	0.70	0.48	**1.11**	1.73
6	Heart-to-heart conversations	3.64	0.80	0.64	-0.54	0.12
7	Distracted by others	3.06	1.03	1.05	0.10	-0.87
8	Not enough f-t-f contact	2.69	0.96	0.92	0.40	-0.56
9	I like my colleagues	**4.17**	**0.61**	**0.37**	-0.10	-0.43
10	Good relation supervisor	3.90	0.71	0.51	-0.64	1.39
11	I do not trust some	2.64	1.03	1.06	0.16	-0.75
12	Feel not connected	2.24	0.84	0.71	0.61	0.36
13	Significant talks	3.81	**0.69**	**0.48**	-0.75	1.18
14	Social support	3.88	0.71	0.50	-0.46	0.61
15	Having friends	3.03	1.01	1.02	0.10	-0.64
16	Avoid some	2.59	1.03	1.07	0.29	-0.80
17	Part of community	3.83	0.80	0.65	**-1.08**	1.84
18	Close team	3.53	0.88	0.78	-0.43	0.06
19	Feel isolated	**1.94**	0.82	0.67	0.80	0.50
20	Feel excluded	2.00	0.86	0.73	0.91	0.90
21	Feel attached	3.58	0.87	0.76	-0.50	-0.13
22	Feel accepted	**4.09**	**0.67**	**0.44**	-0.74	1.82
23	Feel taken seriously	3.98	0.75	0.57	**-1.32**	**3.44**
24	Superficial contacts	2.66	0.87	0.75	0.22	-0.53

Note: relatively extreme means (< 2 or > 4), small SSDs (<. 70), and variance (<. 50) and relatively high skewness (> 1) and kurtosis (> 1.5) appear in bold.

Table 19 includes the correlations between each of the items, reflecting the extent to which they measure different (low correlation coefficient) or similar (high correlation coefficient) aspects of social well-being at work. See Table 8 for variable labels.

Table 19

Item correlation matrix indicating low and non-significant inter-item correlations

Item	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00											
2	0.36	1.00										
3	-0.26	**-0.19**	1.00									
4	**-0.19**	**-0.14**	0.41	1.00								
5	-0.36	-0.25	0.40	0.28	1.00							
6	0.30	0.43	**-0.13**	**-0.11**	**-0.15**	1.00						
7	***-0.04***	***-0.02***	***0.02***	0.23	***-0.01***	***-0.03***	1.00					
8	-0.20	-0.25	**0.13**	**0.12**	**0.17**	**-0.12**	***-0.04***	1.00				
9	0.49	0.54	-0.32	-0.30	-0.34	0.40	**-0.10**	**-0.15**	1.00			
10	0.31	0.23	**-0.15**	**-0.12**	-0.27	0.25	**-0.12**	**-0.08**	0.30	1.00		
11	**-0.16**	***-0.06***	0.28	0.38	0.36	***-0.03***	**0.12**	**0.08**	-0.27	-0.22	1.00	
12	-0.34	-0.49	0.21	0.20	0.36	-0.37	***0.02***	0.25	-0.46	-0.25	**0.17**	1.00
13	0.37	0.52	**-0.18**	**-0.17**	-0.28	0.49	***0.02***	**-0.15**	0.45	0.32	**-0.14**	-0.45
14	0.39	0.49	-0.24	**-0.14**	-0.29	0.42	***0.02***	**-0.16**	0.57	0.24	**-0.18**	-0.43
15	**0.17**	0.32	**-0.12**	**-0.10**	**-0.10**	0.26	**-0.10**	**-0.15**	0.22	***0.04***	***0.05***	-0.26
16	**-0.18**	**-0.12**	0.32	0.39	0.32	***-0.06***	**0.08**	**0.08**	-0.27	-0.23	0.59	**0.18**
17	0.43	0.44	-0.29	-0.27	-0.38	0.27	***0.02***	-0.21	0.46	0.32	-0.22	-0.48
18	0.26	0.48	-0.26	-0.24	-0.27	0.29	**-0.11**	-0.20	0.52	0.21	-0.24	-0.44
19	-0.40	-0.46	0.25	0.26	0.41	-0.27	***0.06***	0.27	-0.47	-0.29	**0.18**	0.45
20	-0.35	-0.40	0.31	0.28	0.43	**-0.19**	**0.08**	0.21	-0.44	-0.31	0.30	0.38
21	0.30	0.45	**-0.15**	**-0.11**	**-0.17**	0.33	***-0.02***	**-0.09**	0.41	**0.08**	**-0.08**	-0.39
22	0.45	0.48	-0.31	-0.29	-0.49	0.33	***0.02***	**-0.13**	0.52	0.40	-0.29	-0.48
23	0.45	0.29	-0.33	-0.37	-0.38	0.22	**-0.08**	**-0.17**	0.42	0.46	-0.33	-0.32
24	-0.35	-0.36	0.21	0.24	0.24	-0.43	**0.11**	0.21	-0.41	-0.32	0.23	0.44

Note: non-significant correlations ($p > .05$) appear in bold italic; low correlations (between -.20 and .20) appear in bold

Item	13	14	15	16	17	18	19	20	21	22	23	24
13	1.00											
14	0.50	1.00										
15	0.24	0.29	1.00									
16	**-0.09**	**-0.14**	**0.10**	1.00								
17	0.45	0.47	**0.18**	-0.26	1.00							
18	0.45	0.52	0.27	-0.21	0.46	1.00						
19	-0.41	-0.41	-0.20	0.25	-0.53	-0.44	1.00					
20	-0.39	-0.35	**-0.14**	0.35	-0.51	-0.37	0.54	1.00				
21	0.41	0.49	0.32	***-004***	0.34	0.49	-0.28	-0.25	1.00			
22	0.49	0.52	**0.17**	-0.27	0.63	0.47	-0.51	-0.54	0.35	1.00		
23	0.38	0.35	**0.13**	-0.29	0.51	0.34	-0.36	-0.42	**0.18**	0.56	1.00	
24	-0.40	-0.39	-0.32	0.22	-0.46	-0.42	0.41	0.34	-0.30	-0.44	-0.35	1.00

Note: non-significant correlations ($p > .05$) appear in bold italic; low correlations (between -.20 and .20) appear in bold

APPENDIX B

Code System Social Office Design

This appendix contains the code system that was developed for the content analysis of the interviews with workplace designers that are reported in Chapter 7. It includes the names and descriptions of four code groups (Design attributes, Affordances, Strategic design goals, and Project context) and 29 codes. The codes were used to label quotations in the interview transcriptions in order to identify attributes, affordances and design goals related to social well-being and to discover the linkages between the statements and communalities in the designer's strategies.

Design attributes

This code category encompasses codes that refer to the interior designer's palette: the components that were used to create affordances and thereby achieving project goals.

Table 20

Codes referring to design attributes

Code name	Code description
Colour use	Hue, colour combinations, colour contrast, warm vs. cool colours, brilliant colours vs. pastels, light vs. dark colours.
Decoration	Styling, removable objects or the design layer on top of floor/wall/furniture finishes. Examples: rugs, table lamps, curtains, cushions, signing, art, pictures, prints, window film, wallpaper.
Equipment	Devices, amenities, items, and technology that belong to the design. Examples: coffee machine, pantry, kitchen, canteen, copier, television, whiteboard, beer tap, sockets, table tennis, swing, game corner.
Finishings	Functional finishing (external layer) or construction material of floors, walls, ceiling, and furniture. Examples: wood, glass, steel, concrete, textile, modular ceiling, windows, carpeting, acoustic layers (e.g. baffles or spray), bulletin board, and whiteboard-finished walls.
Furniture	Removeable or built-in elements for seating, storage, display, or separation, including their arrangement and positioning. Examples: chair, couch, bench, pouffe, table, bar, cabinet, stool, platform, shelving unit, lockers, coat rack, partitions, and room divider.
Greenery	Living plants. Examples: planters, foliage walls, hanging plants, moss-grown panels, indoor gardens, indoor trees.
Lighting	Level and quality of artificial lighting, lamps, lighting fixtures.

Code name	Code description
Size & shape	Intentional size or shape: form (e.g. natural forms, straight angles, sloping walls), architectural style, spaciousness, spatial capacity, oversized or downsized, human scale, etc
Spatial organization	Spatial planning, space allocation, and arrangement of functions (e.g. workspaces, meeting areas, and toilets) within the building. Examples: zoning of activities, spatial layout, clustering or separation of activities, multifunctionality of spaces, and allocation of building blocks.
Walls & passages	Using fixed elements to create openings, closed spaces, and physical connections. Examples: doors, walkways, staircases, rooms, booths, passages, atriums, and squares.

Affordances

This category includes codes referring to the properties of a space or area that aim to evoke a particular experience or encourage particular behaviour. Affordances are functionalities of the physical environment (e.g. walking routes or a lounge area) that are supposed to aid in achieving project goals and generating benefits for the organization. They are created by the composition of design attributes, such as colour or layout.

Table 21

Codes referring to affordances

Code name	Code description
Choice & flexibility	Built-in user control. The adjustability of furniture and lighting, flexible space, multiple use options, and opportunities for personal expression (e.g. a bulletin board). Offering freedom of choice, possibilities for personalization, and the perception of control.
Comfort	Providing bodily comfort and the absence of environmental stressors and hindrances. Adequate levels of sound, light and temperature, good acoustics, freedom of movement, and comfortable or ergonomic furniture. Fundamental qualities of the indoor environmental independent of its function or atmosphere.
Cosiness	Cosy, calming, friendly, and hospitable atmosphere; providing shelter, intimacy, and protection. Psychological comfort. Separation from the hustle and bustle.
Demarcation	Marking the boundaries of a place and communicating its functionality. Symbolic demarcation, differentiation from adjacent areas, and repetition of design attributes to indicate the similarity of places.
Enclosure	Architectural privacy, physical and visual enclosure of spaces. Protecting the users from being seen and heard and preventing crowding. Reducing visibility and accessibility, creating rooms, using partitions, etc.
Informal atmosphere	A playful, loose, and lively appearance as opposed to corporate and business-like environments. An accessible and dynamic place which offers being among people.

Code name	Code description
Routes & destinations	Directing the traffic: routing, creating pathways, barriers, crossings, and people magnets. Features to attract people, get them to move, and make them bump into each other. Also: features to separate traffic flows.
Social facilities	Places for eating, drinking, and playing together. Providing facilities or tailoring spaces to joint activities that are not work-related, such as celebrations, having drinks, playing games, and having lunch or relaxing together.
Visibility	Create sight lines, enabling eye contact and seeing each other.
Visual identity	Making the design reflect the character of the users. Aligning the design with the corporate branding, including references to their products or place of business, and integrating meaningful objects into the design.

Strategic design goals

These codes refer to the end-goals of the design project: what did the new work environment have to support regarding social interactions, co-worker relationships, and social cohesion? This category includes, for example, more or fewer interactions of a particular type, getting to know each other better, and feeling part of a community. It focuses on strategic project goals and excludes the creation of physical functionalities (affordances), which are supposed to contribute to the end goals. Note that only codes from this category that referred to the users' social well-being were used in the means-end analysis and the other design goals and project context codes were ignored.

Table 22

Codes referring to strategic design goals

Code name	Code description
Connectedness	Creating and maintaining relatedness (feeling) by the design: e.g. social cohesion, belongingness, team spirit, loyalty, integration, embeddedness, shared identity, and pride.
Social interactions	Stimulating social interactions (behaviour) by design: socializing, casual encounters, spontaneous meetings, catching up, meeting new people, etc.
Other design goals	Other purposes of the new office interior, e.g. talent recruitment, supporting new ways of working, spatial efficiency, accommodating organizational growth, and prevention of undesirable behaviour.

Project context

The last code category includes comments on external factors that influenced the design or the project's success. Examples: financial or construction restrictions, disagreements, project specifications, outcomes of user participation, and the designer's personal opinion or preferences. Includes comments on how they approached the project (process), post-occupational changes, and user experiences.

Table 23

Codes referring to the project context

Code name	Code description
Budget/building	Comments about budget, costs, financial or technical restrictions, the potential of the existing building, etc.
Client/specifications	Explicit requests of the client, outcomes of user participation, mandatory alignment with corporate branding and organizational regulations, project scope, design brief, etc.
Culture	Comments about organizational culture and customs, employee type, their way of working, expectations, habits, etc.
Design process	Project approach, sequence of actions, what has inspired the designers, working with building blocks, organizing workshops, collaboration with other parties, etc.
Designer's opinion	The designer's intuition, personal opinion, advice, or professional or moral attitude. 'I think…', 'It is best to…', 'This space asked for…', 'You just need…', 'Otherwise it would be boring', 'People always like…', etc.
Post-occupancy	Comments on the user's opinion, the use of the spaces, and changes to the interior space after project completion. What the designer knows about the users' experience and behaviour.

APPENDIX C

Details Means-End Chain Analysis

This appendix contains the data underlying the hierarchical map of the workplace designers' strategies for creating social offices (Chapter 7, Fig. 21).

Table 24 presented below includes the explained variance at different cut-off levels. It shows that including connections in the map that were mentioned by less than three designers (cut-off levels one and two) would increase the explained variance, and thus the reliability of the map. However, adding these lines would also make it very difficult to read the map and it would fail to highlight the most important connections between the concepts. On the other hand, presenting only the linkages in the strategies of more than three designers (e.g. cut-off levels four and five) would significantly reduce the explained variance and make the map a lesser reflection of the variety of strategies.

Table 24

Number of included linkages and explained variance by cut-off level

Cut-off level	**1**	**2**	**3**	**4**	**5**
Number of direct linkages	493	420	353	323	272
Explained variance	100%	85.2%	71.6%	65.5%	55.2%

Table 25 (next page) contains the number of direct linkages between each of the concepts. It shows the linkages that existed in the strategies of only one or two designers and therefore were not included in the hierarchical map that applied a cut-off level of three direct linkages. See Appendix B for concept descriptions.

Table 25

Implication matrix showing the number of linkages between the identified design attributes, affordances and strategic goals

Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 Decoration		1	1	2			2			1	**6**		2	2	1	2	2	**5**	**9**	**3**		
2 Colour use			1	1		**3**						1	**7**			1		**7**	**9**			1
3 Size & shape						1					1		**4**	2	**3**	2	2	**3**	2	1	**5**	
4 Furniture	2		**3**		1	1			2	1	**2**	1	**4**	1	**4**	**5**	**7**	**9**	**4**	**10**	2	
5 Greenery			1									1	2			1	2	**6**	1			
6 Finishings		1		1				1			1	1	**7**	**5**		11	4	**9**	2	2	**2**	
7 Lighting						1					1	1	**3**		2	2	2	**3**		4		
8 Spatial organization				2					**5**			**6**	1		**7**	**3**	1			**6**	**3**	
9 Equipment			2					2				**9**	1		**7**		**3**	2		**7**		
10 Walls & passages			2	1		2			2		**6**	**6**	1	**3**		**5**	1	4		**3**	1	
11 Enclosure										1				1				**3**		2	**4**	
12 Routes & destinations								1						1			1			1	**12**	2
13 Demacration																1	1				**7**	1
14 Visibility											1								1		**4**	**4**
15 Social facilities				1					1	1		2					**4**		1	1	**10**	**4**
16 Comfort						1					1							1			**5**	
17 Informal atmosphere				1		1				1									1		**9**	2
18 Cosiness													1							1	**5**	**3**
19 Visual identity																	1			1		**9**
20 Choice & flexibility				2								1			1	1	2		1		**6**	**4**
21 Social interactions											1	1			1					1		
22 Co-worker bonding																					2	

Note: Grey-marked cells indicate a number of direct linkages above the cut-off of three, which are represented in Fig. 21, p.144.

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GLOSSARY

This alphabetical list contains several terms that are used in this dissertation and may have different meanings in different disciplines or contexts. Here, the terms' explanations refer to their meaning in the context of the presented research on social well-being at work and workplace design which are embedded in social science and design research.

Activity-based working (ABW) environment: a workplace that provides a variety of spaces which are designed to support specific work activities, such as focused work or small group meetings (and not particularly to stimulate physical activity).

Affect *(noun)*: positive and negative feelings or mental states which include emotions.

Affordance: features of the physical environment that offer action possibilities for the user; perceived functions. Affordances can enable action directly or indirectly by communication of appropriate behaviour. They are composed of design attributes, such as objects and surfaces.

Architectural privacy: actual spatial enclosure that provides protection against intruders and exposure to others, e.g. walls and doors, soundproofing, and appropriate distances between chairs.

Atmosphere: an overall tone or mood of a place.

Attachment: feeling an emotional bond with a person or a place.

Belonging: being a member of a group; feeling at ease in a group or place.

Belongingness: a sense of belonging; feeling welcome and accepted.

Biophilic design: a design philosophy that promotes connections with nature by translating natural materials and phenomena into the design of the built environment.

Break-out space: place in the office designed for relaxation, socializing, and play.

Cognition: the mental process of obtaining knowledge through perception, thinking, and interpretation.

Connectedness: feeling connected and having affinity with a particular person or group.

Community: a territorial or relational group referring to occupants of a space or a group of people that are related by, for example, their positions or professional interests.

Companionship: a feeling of fellowship or friendship, spending time together and experiencing closeness, confidence, and support.

Crowding: a feeling of stress resulting from too much social or spatial density, i.e. the perception of too many people in the space or people being too close.

Design: a plan, drawing or model to show the appearance and workings of something *or* the action of producing a design.

Design attribute/ design component: constructive element of the physical environment that belongs to the interior designer's palette, e.g. walls, surface finishes, furniture, and other objects. The designer chooses from these tangible elements and decides on their spatial arrangement to compose an interior design by shaping and decorating the interior space and creating functionalities.

Design feature: an interesting characteristic or important property of the physical environment which is related to space use and perception. May refer to objects (design components), their arrangement (layout), and resulting qualities (e.g. 'look and feel'), thus overlapping both 'design attributes' and 'design qualities'.

Design parameter: a distinct aspect of the interior design that can be divided in units or classes and measured. Parameters can be numbers, sizes, or types of design attributes or quality assessments, such as ratings of functionality.

Design quality: a functionality or value of the interior design, either as intended by the designer or as perceived by others. Qualities regarding the use of the space may be referred to as affordances.

Design research: research to inform design ('Research *for* design'), research into the process of design ('Research *on* design') or research embedded within the process of design ('Research *through* design').

Design strategy: a tactical approach to create the most effective product or environment, basing design decisions on a vision about how to achieve particular goals.

Embeddedness: the quality of being firmly and deeply ingrained in and influenced by a social environment; the closeness of interpersonal relationships and social ties.

Engagement: a positive, fulfilling, work-related state of mind; is considered to be the antipode of burnout.

Ergonomics: the understanding of human behaviour and performance in purposeful interaction with systems (products, machines, environments) and the application of that understanding to design, for example, to increase the efficiency of product use. Ergonomics is also called human factors.

Evidence-based design: the process of setting design goals, basing design decisions on the best available information from credible research, and evaluation of results to inform future projects.

Exclusion (social): the feeling of not been included and being kept apart from others, either after explicit statements (rejection) of by being ignored (ostracism).

Flourishing: optimal human functioning and living to one's full potential; having positive emotions, a sense of meaning, engagement, interest, and purpose in life.

Human-centred design: a branch of the design discipline that focuses on the interaction between products or spaces and their users in the social context and studies, for example, usability, ergonomics, expression of meaning, and aesthetics. Also referred to as people-centred design and user-centred design.

Incivility: negative behaviour, such as rudeness and other acts of disrespect, that may be unintended or deliberate (not clear for the observer). Not as serious and explicit as bullying, aggression, and violence.

Inclusion: the state of being included within a group; being treated as a member. In this dissertation, the term inclusion does not particularly refer to the practice or policy of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized. However, in the work context, this practice is essential for supporting the social well-being of all staff.

Inclusive design: the process of matching the environment with as many user needs as possible, granting physical and psychological access to every user. Also known as universal or barrier-free design.

Informal social interactions: casual, non-instrumental, and often ad hoc social interactions that are not directly related to work tasks.

Informal atmosphere: an overall tone or mood of a space that refers to leisure.

Interior office space: the indoor environment of office buildings or the area within another building type that serves to accommodate office workers.

Interior design / interior architecture: the shape, appearance, and arrangement of spaces and visible objects within a building, including the layout, surface finishings, furnishings, and lighting. In this dissertation, interior design equals interior architecture and includes the structural design and remodelling of existing buildings, whereas in other contexts interior design may refer to interior decoration only.

Interior decoration: creating atmospheres, focusing on finishes, furniture and colour palettes.

Intimacy: the closeness of a relationship (social intimacy) or a small enclosed space (physical intimacy).

Layout: spatial configuration; the floorplan showing, for example, rooms and passages and the arrangement of furniture and equipment.

Nudging: a strategy to direct behaviour by a subtle 'push' without actually limiting the individual's choice options.

Office: a building, or part of a building, that accommodates office workers, 'white-collar' workers or 'knowledge workers', doing clerical or administrative work. Note that in the workplace literature, 'office' sometimes refers to a workspace or room but in this dissertation.

Open-plan office: an office building or office floor that features workspaces with several desks (i.e. usually a large number) in the space between walls. (Dutch: kantoortuin)

Perceived privacy: perceived control over how much others can see or hear of you (disclosure) but also the absence of unwanted stimuli caused by other people, such as noise, crowding, and visual distraction.

Personal space: the invisible bubble of intimacy around an individual, a moving territory which stretches and shrinks with circumstances, such as the angle of orientation.

Personalization: the customizing, adjusting, and decoration of space or objects, often performed to signal ownership and express the user's identity.

Positive design: the design of objects or environments that stimulate the users' well-being.

Proximity: social or physical closeness.

Relatedness: feeling connected to others, feeling loved and cared for.

Research design: a strategy to answer a research question including the type of study, parameters, data collection, and analysis plan.

Restoration: restoring health and energy, recovery from stress, revitalizing. Restorative environments foster this process, for example by providing contact with nature.

Sense of community: a feeling of belonging, emotional connection, and personal commitment between members of a group.

Social capital: the value for an individual derived from having positive connections with others in a social network. In this dissertation it is considered a possible indicator of social cohesion, not a synonym.

Social cohesion: the strength of relationships and the sense of solidarity among members of a community, e.g. the connectedness between workers and their willingness to cooperate with each other to reach common goals. Can provide belongingness.

Social interaction: any kind of conscious contact between two people, ranging from noticing each other's presence to eye contact and conversations.

Social safety: feeling free to speak up and discuss problems, feeling treated with respect and not harassed, intimidated, or discriminated. Psychological safety in the work environment.

Social well-being at work: experiencing positive social interactions (short-time), and feeling included and personally connected to others (long-term) at work.

Spatial connectivity: the extent to which spaces are physically or visually connected; a high connectivity supports movement through the building and may thereby stimulate social interaction.

Territoriality: attitudes and behaviour related to the perceived, attempted, or actual ownership of a physical space, e.g. marking, defending, and personalization.

Thriving: a psychological state that reflects the joint experience of vitality and learning.

Train seats: a piece of office furniture consisting of two benches, usually with a high backrest, and a table, all fixed to the floor. In some cases, a ceiling bridges the benches' back rests or the entire set is built into a niche.

User: an individual using a space, e.g. as an inhabitant, visitor, or employee. In this dissertation, 'users' mainly refers to individuals present at the office and performing activities in the interio office space.

User-centred design: see human-centered design. In interior design, the two terms generally refer to the same concept of creating interior spaces with a primary focus on the people who will use them. Any perceived differences between the terms are likely to be semantic or subjective rather than substantial distinctions in the design philosophy or approach.

Visual communication: the use of visual elements to convey ideas and information, including signs, graphics, illustrations and elements of interior design that express meaning by their appearance.

LIST OF PUBLICATIONS AND PRESENTATIONS

The following pages present my research output related to this dissertation. The list includes scientific and popular publications and oral presentations on healthy workplaces between 2020 and 2023. Within each category, the publications are presented in chronological order of production. Below each of the references the contribution of the individual authors is explained. For recent updates, please visit my profile page at LinkedIn, Research Gate, or Google Scholar.

All scientific articles, conference papers, and book chapters in this list are published open source or will be publicly accessible through the TU Delft Research Repository six months after publication due to Section 25fa of the Dutch Copyright Act.

Peer-reviewed journal articles

Colenberg, S., Jylhä, T., & Arkesteijn, M. (2021). The relationship between interior office space and employee health and well-being – A literature review. *Building Research & Information 49* (3), 352-366. https://doi.org/10.1080/09613218.2019.1710098

Colenberg and Jylhä planned the research, analysed the data, and wrote the manuscript; Colenberg collected the data and revised the manuscript; Arkesteijn reviewed the manuscript.

To date, this is the most read article in the history of the journal and has 60+ crossrefs.

Colenberg, S., Appel-Meulenbroek, R., Romero Herrera, N., & Keyson, D. (2021). Conceptualizing social well-being in activity-based offices. *Journal of Managerial Psychology 36* (4), 327-343. https://doi.org/10.1108/JMP-09-2019-0529

Colenberg initiated and planned the research, obtained and analysed the data, and wrote and revised the manuscript; Appel-Meulenbroek, Romero Herrera, and Keyson reviewed the manuscript.

Colenberg, S., & Jylhä, T. (2022). Identifying interior design strategies for healthy workplaces – A literature review. *Journal of Corporate Real Estate* 24 (3), 173-189. https://doi.org/10.1108/JCRE-12-2020-0068

Colenberg and Jylhä initiated and planned the research; Colenberg analysed the data and wrote the manuscript; Jylhä reviewed the manuscript.

Emerald Literati Outstanding Paper Award 2023

Colenberg, S., Jansen, S., van der Doef, M., & Kraaij, V. (Submitted). Towards a new measure for social well-being at work.

Colenberg initiated and planned the research, collected and analysed the data and wrote the manuscript; van der Doef and Kraaij reviewed the items; Jansen supervised the analyses; Jansen, van der Doef, and Kraaij discussed and reviewed the manuscript.

Colenberg, S., Appel-Meulenbroek, R., Romero Herrera, N., & Keyson, D. (Accepted). Interior designer's strategies for creating social office space. *Ergonomics.*

Colenberg initiated and planned the research, collected and analysed the data and wrote and revised the manuscript; Appel-Meulenbroek, Romero Herrera, and Keyson reviewed the manuscript.

Peer-reviewed conference papers & posters

Colenberg, S. E. (2020). Developing a scale for measuring social well-being in non-territorial offices. In K. Teoh, L. Torres, & A. Jain (eds.), *14th EAOHP CONFERENCE 2020: Promoting healthy and sustainable work. Book of proceedings* (pp. 213-214).

Colenberg wrote the abstract, created the poster and presented the poster at the online conference; Romero Herrera and Keyson reviewed the abstract and the poster.

Colenberg, S. E., Romero Herrera, N., & Keyson, D. V. (2020). Workplace design for social well-being: A conceptual model and research strategy. In A. Kämpf-Dern, & M. Will-Zocholl (Eds.), *Future workspaces: Proceedings of the Transdisciplinary Workplace Research Conference 2020* (pp. 203-216).

Colenberg wrote the abstract and manuscript and presented the paper in Frankfurt; Romero Herrera and Keyson reviewed the manuscript.

Colenberg, S., & Jylhä, T. (2020). Designing for health: strategies for enhancing employee health by workplace design. In A. Kämpf-Dern, & M. Will-Zocholl (Eds.), *Future workspaces: Proceedings of the Transdisciplinary Workplace Research Conference 2020* (pp. 82-93).

Colenberg wrote the abstract and manuscript; Jylhä reviewed the abstract and manuscript; Colenberg and Jylhä presented the paper at the hybrid conference in Frankfurt (Jylhä online, Colenberg in person).

Colenberg, S., & Keyson, D. (2021). Expected user needs towards the post-Covid office: better support of social interactions and concentration. In T. Jylhä, & V. Danivska (Eds.), *Proceedings of the 20th EuroFM Research Symposium* (pp. 23-28). https://eurofm.org/2021/06/14/proceedings-20th-eurofm-research-symposium/

Colenberg initiated and planned the research, collected and analysed the data, wrote the manuscript, and presented the paper at the online conference, Keyson reviewed the manuscript.

Colenberg, S., Romero Herrera, N., & Keyson, D. (2022). Interior design features predicting satisfaction with office workspace privacy and noise. In T. Jylhä, & V. Danivska (Eds.), *Proceedings of The 21st EuroFM Research Symposium* (pp. 91-102). https://doi.org/10.4233/uuid:3e3c6023-8093-400d-9433-e53045ec02cd

Colenberg initiated and planned the research, collected and analysed the data, wrote the manuscript, and presented the paper in Breda; Romero Herrera and Keyson reviewed the manuscript.

This paper received the conference's Best Paper Award.

Colenberg, S. E., Romero Herrera, N. A., & Keyson, D. V. (2022). Workplace affordances of social well-being: A conceptual framework. In A. Ciaramella, C. Tagliaro, I. Mariotti, & C. Rossi-Lamastra (Eds.), *Proceedings of the 3rd Transdisciplinary Workplace Research Conference, 2022* (pp. 247-257).

Colenberg planned the research, collected and analysed the data, wrote the manuscript, and presented the paper in Milan; Romero Herrera and Keyson reviewed the manuscript.

Scientific book chapters

Appel-Meulenbroek, R., Colenberg, S., & Danivska, V. (2021). Towards an interdisciplinary employee-workplace alignment theory. In R. Appel-Meulenbroek & V. Danivska (Eds.), *A handbook of theories on designing alignment between people and the office environment* (pp. 272-288). Routledge. https://doi.org/10.1201/9781003128830-23

Appel-Meulenbroek and Danivska initiated the research; Colenberg, Appel-Meulenbroek and Danivska planned the research; Colenberg collected and analysed the data, wrote the methods section, and reviewed the manuscript; Appel Meulenbroek wrote the other parts of the manuscript; Danivska reviewed the manuscript.

Danivska, V., Appel-Meulenbroek, R., & Colenberg, S. (2021). Identifying the main constructs for an interdisciplinary workplace management framework. In R. Appel-Meulenbroek & V. Danivska (Eds.), *A handbook of management theories and models for office environments and services* (pp. 232-250). Routledge. https://doi.org/10.1201/9781003128786

Appel-Meulenbroek and Danivska initiated the research; Colenberg, Appel-Meulenbroek and Danivska planned the research; Colenberg collected and analysed the data and wrote the methods section; Appel Meulenbroek and Danivska wrote the other parts of the manuscript.

Colenberg, S. & Jylhä, T. (Under review). Workplace design for health and well-being: An overview of the field. In C. Zheng (Ed.), *Research handbook of work-life balance and employee health*, Edward Elgar Publishing.

Colenberg wrote the manuscript; Jylhä reviewed the manuscript.

Valorisation

An important task of scientists is to make their research accessible by publishing in popular media, presenting at symposia and practitioner's events, giving interviews, etcetera. Listed below are my activities related to this dissertation and the topic of healthy workplaces.

Articles & book chapters

Colenberg, S. E., & Jylhä, T. E. (2020). Kantoorinrichting en gezondheid [Interior office design and health]. *Tijdschrift voor Human Factors*, 45(3), 9-13. https://www.humanfactors.nl/tijdschrift/download/nummer-3-september-2020/283

Colenberg, S., & Appel-Meulenbroek, R. (2021). Sociaal welzijn in kantoren [Social well-being in offices]. *Smart Workplace Magazine 9*, 12-15. https://www.smartwp.nl/nieuws/20210624-sociaal-welzijn-in-kantoren

Colenberg, S.E. (In press). Case study B: A large office in The Netherlands. In N. Oseland, *A practical guide to Post-occupancy evaluation and researching building user experience* (pp. 126-129). Routledge.

Interviews

Round Table over inrichting hybride werken bij gemeenten [Approaches to hybrid working in municipalities], *Smart workplace Magazine* (online). https://smartwp.lingacms.nl/upload/sw_220a4a1d/26546_SWP_-_RoundTable_Gemeentehuisvesting-Deel2-DEF.pdf

Hoekjen, H. J. (2020). Meer duidelijkheid over gezondheid in kantoor [New insights on healthy offices]. *Inside Information 3*, 68-71. https://doi.org/10.1080/096113218.20.

Presentations

Human Factors NL Jaarcongres 2020: 'Zoom in-Zoom out' (Online). Keynote: Omgevingspsychologie en het post-coronakantoor [Environmental psychology and the post-covid office].

UvA Academy, Masterclass Omgevingspsychologie [Masterclass Environmental psychology], 2019-2023 (two times a year, Amsterdam): guest lectures about environment psychology in the work environment and healthy workplaces

Center for People and Buildings, Symposium Hybride werken in perspectief, April 21, 2022 (Rijswijk). Presentation: Sociaal welzijn op kantoor [Social well-being at the office].

Kiinko, Topseminar Future Spaces, August 31, 2022 (Helsinki). Keynote: Design strategies for healthy workplaces.

IFMA/FMN/EuroFM, World Workplace Europe 2023 (Rotterdam). Presentation and participation in panel discussion on positive workplace design.

Center for People and Buildings Jaarcongres, August 31, 2023 (Utrecht). Workshops on the impact of the working environment on the quality of work.

TU Eindhoven, symposium 'De toekomst van de gezonde werkomgeving' [The future of the healthy work environment], September 21, 2023 (Amsterdam). Presentation about my PhD topic.

DATA AVAILABILITY

All data collected for this dissertation and essential research records will be publicly available in the 4TU Research Data repository.

To the studies reported in Chapters 2 and 3, data sharing is not applicable as no new data were created or analysed. The script that was used for the literature search and the initial database of search results will be shared upon request.

The study reported in Chapter 4 re-used interview data owned by the Center for People and Buildings in Delft. The data files contain the de-identified statements extracted from these interview data, the sorting results, and the Python script for creating the aggregated distance matrix and performing the hierarchical cluster analysis. The dataset is available at https://doi.org/10.4121/fd8b9805-c73e-4d25-b75d-6881137bec0a.

The anonymous survey data on workspace privacy (Chapter 6) are available at https://doi.org/10.4121/d09043de-63d4-47da-9360-2a6d04d5ebd3.

The data that were collected for Chapters 5 and 7 will be published as soon as the corresponding journal articles are published. Each article features a data availability statement including the internet location where the de-identified datasets and scripts developed for the analysis can be found:

- http://doi.org/10.4121/17702273 for the social well-being data underlying the study reported in Chapter 5;
- http://doi.org/10.4121/22099883 for the interview data about the workplace design strategies reported in Chapter 7.

ACKNOWLEDGEMENTS

One day, summer of 2018, my boss invited me to a casual chat with our Delft Bouwcampus neighbour about workplace design and well-being. After exchanging ideas about the type of workplace research the world would need, this neighbour asked me: 'So you would like to do a PhD?'. Flabbergasted I answered: 'Yes, sure, why?' He appeared to be looking for a PhD candidate for the Department of Human-Centred Design and my profile matched the preferences. After a cheerful job interview and a few nights' sleep on it, I realized this was a once-in-a-lifetime opportunity I had to seize.

So thank you, Wim Pullen, for remembering that doing a PhD was on my bucket list, directing David to me, and being an ambassador of my work all along. With you and Anca in the lead, the Center for People and Buildings was a hospitable and warm place where I deepened my knowledge about offices and enjoyed collaboration with like-minded researchers.

David and Natalia, my promotors and supervisors, thank you so much for believing in me. For hiring me, waiting for me to finish my round-the-world trip, giving me the freedom to choose my topic and organize my work, and, of course, for your guidance. Without you, this PhD would never have happened, and it was the best job of my life. Also many thanks to my other colleagues[1] at Human-Centered Design and ID StudioLab for offering a delightful and diverse working environment full of creativity, and openness to new ideas and people. It is a pity that we did not meet more often due to the pandemic and my need for a quiet home office during the final stages of my dissertation. I keep good memories of our chats in the Studios, at the picnic table, and at Ianus' estate.

Rianne, thank you for introducing me to the world of transdisciplinary workplace research and for your voluntary support. For taking the time to read my writings and for your pragmatic advice and invitations to collaboration opportunities. I felt welcome to your office to discuss my ideas and always left with new inspiration and motivation. Sylvia, Margot, and Vivian, my peer psychologists, thank you for your enthusiasm and knowledgeable support in developing the social well-being at work scale and the chats over a coffee at 'Gebouw 5' and the Leidse Hout.

Tuuli, my informal mentor and friend. You re-introduced me to academic research when I was working at the Center for People and Buildings. I enjoyed it so much that I did not hesitate for long to pursue the PhD position. After writing our first article

[1] Thank you Aadjan, Froukje, Ianus, Tomasz, Marian, Makiko, Alev, Sacha, Evert, Lyè, Pelin, Xueliang, Berit, Lisa, Matthieu, Joost, Cehao, Martin, Maria Luce, Marijke, Jacob, and many others.

together, we stayed in touch and you provided me with valuable insights into academic practice, moral support, and opportunities to shine. It was a great pleasure working with you and I wish you all the luck with your professorship in Helsinki. I hope we can continue to collaborate and keep up the tradition of celebrating our successes over dinner and bubbles.

Furthermore, I am very grateful to all those participants who took the time to sort the employee statements, complete my questionnaire, and answer my persistent interview questions, thus providing me with essential data. And to Dion, Peter, Joost, Daniëlle and Jolanda who arranged the distribution of my survey within their organizations.

Finally, special thanks to my family. To my parents, who made it possible for me to go to university in the first place and taught me to seize opportunities in life, improvise and persevere, while keeping the balance between realism and optimism. And to my dear sister Stephanie, my true ally, for helping me out with testing questionnaires and acquiring participants. I am so thankful that I can always count on you.

Martijn, my dear cousin, you died in the middle of my PhD journey and it hit me hard. It made me realize again how life can surprise you, for good and for bad, and that you should not hesitate to follow your heart. I cherish the memories of our last conversation about mountain walking, small pleasures in life, and the hereafter. I hope you find new happiness in your other dimension while I enjoy chasing my dreams in mine.

And thank you, Marc, my beloved companion in life and travel, for supporting all of my 'projects' in the past thirty years. For sharing your wise reflections, keeping me down to earth, being my personal ICT consultant, and making me laugh every single day. I am looking forward to living many more adventures together with you.

BIOGRAPHY

Susanne was born on October 16, 1970 in Gouda. Fascinated by the influence of the environment on people's behaviour, she studied Social and Organizational Psychology at Leiden University. Although studying industrial design or architecture had crossed her mind, she was held back by her limited talent for technology.

After receiving her Master's degree, she worked as a policy researcher at the Public Health Services, Research voor Beleid BV, and the municipality of The Hague until a seven-year career itch made her look for a new challenge. Since working life had minimized her creative activities, she was again attracted to study design. When she turned to the Royal Art Academy in The Hague for advice about a substantial interior design course, they persuaded her to apply for the Bachelor of Interior Architecture. She passed the exam and for five years she enjoyed the art education on top of her day job. An intense but rewarding period, thanks to the inspiring teachers and the support of her wonderful classmates.

Having earned a Bachelor's degree in Design, she decided to direct her career toward the crossroads of psychology and interior design. She took the master's elective course Environmental Psychology at the University of Amsterdam, interviewed architects about their approach, and presented the results at the 9th Biennial Conference on Environmental Psychology in Eindhoven. Meanwhile, she developed guidelines for architect selections in interior design projects for the Chief Government Architect's office. Things fell into place: environmental psychology for human-centred design was her calling.

She quit her job and started as a self-employed consultant for human-centred workplaces and public spaces. After a few years, longing for teammates and long-term projects, she entered a part-time job as a researcher at the Center for People and Buildings in Delft. In this friendly team, she conducted post-occupancy evaluations and contributed to guidelines for workplace strategy and design for the central government. Next to this workplace research and together with Fiona de Vos, she taught the elective

Environmental Psychology to bachelor students of the University of Amsterdam from 2016 to 2018. In 2019 they transformed the course into a masterclass for professionals in the built environment at the UvA Academy. Due to the time-consuming PhD work, Susanne quit this teaching in the summer of 2021 but continued to participate as a guest lecturer.

When the opportunity to do a PhD crossed her path, she did not hesitate for long to embark on this journey, excited to improve her research skills and deepen her knowledge about the impact of workplace design on workers' well-being.

During her employment at TU Delft, She reviewed for Building Research and Information and the Journal of Corporate Real Estate, was a member of the scientific committee of EuroFM (2021 and 2022) and TWR (2020 and 2022), and was invited as a keynote speaker at national and international symposia. At the Department of Human-Centered Design, she supervised four master students and coached 43 bachelor groups in design research methods (2020-2023) and design for behavioural change (2022-2023).

Since she very much enjoys doing scientific research with a focus on implications for practice and coaching on the side, she aims to continue working in tertiary education or a non-profit research institute to develop and share knowledge on the design of human-centred environments.

BEYOND THE COFFEE CORNER

Workplace design and social well-being

Positive social interactions and feeling connected with people around us are fundamental human needs and crucial to our well-being. This dissertation explores how interior office design could foster workers' social well-being. The research indicates that to enhance social interactions and a sense of belonging, factors like atmosphere, diversity, and privacy may be more important than a fancy coffee corner.

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