

## A review of factors influencing employees' experience of occupancy in the office

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## Session 5

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### Session 5A: The Evolving Workplace

#### A review of factors influencing employees' experience of occupancy in the office

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## **ABSTRACT**

In workplace design and management, standards for square meters per person and average occupancy of workstations are often used to assess the fit between the number of employees and the availability of workspace and workstations. However, levels of occupancy may be experienced differently by individuals depending on the situation. The purpose of this paper is to provide an overview of factors that may influence employees' perception of occupancy at the office. This knowledge could support designers and managers in their decisions and provide a basis for further research in this relatively unexplored territory.

This study is embedded in environmental psychology and its theory about the perception of occupancy. The perception of occupancy is characterized by a perceived (mis)fit between personal demand and the availability of space. In high-density situations, individuals may experience crowding whereas in low-density situations individuals may experience isolation, depending on environmental factors, social factors, and personal factors. It is not entirely clear which and how factors influence perceived occupancy in workspaces.

Articles on the experience of occupancy in office environments were collected and analysed in a systematic literature review following PRISMA guidelines.

The preliminary results of the literature review show that environmental, social, and personal factors influence perceived occupancy in workspaces. Environmental factors include openness of workspaces, acoustics, plants, workspaces, personalization of workspace, and outside view. Social factors include territoriality, personal space, and culture. Personal factors are stimulus screening, inhibitory ability, task complexity, employee needs, and work pressure.

The experience of occupancy is a relatively unexplored topic in workspace research. By adopting a human-centered perspective on occupancy, this study contributes to a better understanding of discrepancies between organizations' measures of occupancy and the experience of occupancy by employees.

## **Keywords**

Crowding, Isolation, Occupancy, Density, Office environments, Workspaces

## **1 Introduction**

Why do office workers experience similar levels of occupancy differently in the workplace? The experience of occupancy is not exclusively caused by the number of people in a space and the availability of workstations, but also by factors from the physical work environment, the social work environment, and personal factors (Desor, 1972; Gifford, 2014; Stokols et al., 1973). These three types of factors, alongside the level of occupancy, yield a desired level of space that ultimately determines the experience of occupancy in workspaces (Altman, 1975).

Depending on environmental factors, social factors, and personal factors, levels of occupancy may lead to diverse effects. When a workplace has a high occupancy rate, employees may experience crowding (Bell et al., 2001). The term 'crowding' is used to describe a negative evaluation of high density

(Altman, 1975; Bell et al., 2001; Stokols, 1972). One may for example experience overstimulation and insufficient resources (Desor, 1972; Gifford, 2014; Stokols et al., 1973). Simply put, “*crowding refers to the way we feel when there are too many people and/or there is not enough space*” (Bell et al., 2001, p. 295).

Crowding encapsulates the sense of discomfort or unease experienced due to the perception of excessive occupancy within a given space (Altman, 1975; Bell et al., 2001; Stokols, 1972). This definition excludes a potential positive evaluation of high occupancy rates in the workplace. Studies have documented the positive effects of highly occupied workspaces (e.g. Fried et al., 2001; Szilagyi & Holland, 1980) besides the negative effects of highly occupied workspaces. (Aries et al., 2010; Oldham et al., 1995).

In addition to the effects of highly occupied workspaces, excessively quiet work environments may also negatively impact individuals. Altman (1975) argued that not having the desired level of space leads to discomfort and stress, with too little privacy causing feelings of crowding and too much privacy causing feelings of isolation. Individuals may feel isolated due to a perceived lack of interaction (Baumeister & Leary, 1995; Golden et al., 2008).

To address the above-mentioned experiences, we use the term ‘perceived occupancy’. Perceived occupancy is the perception and estimation of the number of people present in the work environment, available space, and workplaces (Bechtel & Churchman, 2002). It encompasses a perceived (mis)fit between the personal demand and the availability of space (Altman, 1975). A ‘fit’ means that the perception of occupancy is within the optimal range of stimulation (Bell et al., 2001). A ‘misfit’ means that the perception of occupancy is outside the optimal range of stimulation. This may either be an experienced shortage of space (‘crowding’) (Bell et al., 2001) or an experienced abundance of space (‘isolation’) (Altman, 1975).

Even though the difference between occupancy and perceived occupancy has been known for decennia (Stokols, 1972), in both research and practice the distinction is often not made. Thereby the subjective evaluation of occupancy by individuals and a variety of environmental, social, and personal factors influencing the perceived occupancy are not always taken into account. As a result, it is not entirely clear which and how these factors influence the experience of occupancy in workspaces. Moreover, it caused mixed results when investigating the relationship between occupancy and psychological responses (Oldham et al., 1995).

The purpose of this paper is to provide an overview of factors that may influence employees’ perception of occupancy in workspaces. In doing so, the results may also clarify some of the discrepancies in previous studies on perceived occupancy. The central question is: *how do environmental, social, and personal factors relate to the perceived occupancy of employees in office spaces?*

Research on the experience of occupancy, mainly on the relation between high-density environments and crowding, was foremost conducted in the field of environmental psychology (Bechtel & Churchman, 2002; Bell et al., 2001). This human-centered perspective on the experience of occupancy is barely used in the context of workspaces. It is valuable to conduct further scientific research into this matter, particularly concerning workplace environments, as it can provide invaluable insights into optimizing workspace design and inspire academics to further explore this topic.



## **2 Theoretical framework**

Theories on the relation between occupancy and perceived occupancy are embedded in environmental psychology. Stokols (1972) was one of the first researchers to describe the differences between density and crowding in detail. Since then, multiple theoretical approaches have been applied to study the effects of density on humans (Bell et al., 2001; Stokols, 1976). Preceding the elucidation of the theoretical approach, the concepts are described below.

### **2.1 Occupancy**

Occupancy refers to the factual amount of people in a work environment; it cannot be determined in advance whether the occupancy will be evaluated positively or negatively by employees (Bechtel & Churchman, 2002). In environmental psychology, the term density is used to express the availability of space. Occupancy can be seen as a form of density and is defined as the ratio of the number of occupied workstations in the work environment to the total number of available workstations (Brunia & Pullen, 2014).

### **2.2 Perceived occupancy**

Evans (1979) concluded already in 1979 that occupancy is not objectively perceived by office workers, which means that office workers may perceive similar levels of occupancy differently (Zoghbi-Manrique-de-Lara & Sharifiatashgah, 2019). Perceived occupancy is differently defined by scholars, where Bechtel & Churchman (2002) define it as *the perception and estimation of the number of people present in the work environment, available space, and workplaces*. In this paper, the definition of Bell et al. (2001) and others will be used who argue that perceived occupancy encompasses a perceived (mis)fit between the personal demand and the availability of space.

### **2.3 Other influencing factors**

Next to occupancy, environmental factors, social factors, and personal factors influence the perceived occupancy (Bell et al., 2001; Desor, 1972; Stokols et al., 1973). Research shows for example that perceived occupancy differs for spaces of similar size with different partitions, linear dimensions, and doors (Baum & Davis, 1980). Also, by increasing coordination, signage, and information about the supply of space feelings of crowding may decrease (Langer & Saegert, 1977; Wener & Kaminoff, 1983a). Other research shows that a mismatch between expectations of occupancy and the actual level of occupancy increases feelings of crowding (Gochman & Keating, 1980).

### **2.4 Psychological responses**

In combination with the above-mentioned influencing factors, perceived occupancy may lead to a positive or negative psychological response. The main psychological reaction to an *overly crowded* space is stress (Evans, 1979; Stokols, 1976). A study conducted in Dutch offices shows that the higher the occupancy in an office, the more physical and psychological discomfort employees experience (Aries et al., 2010). In literature, high occupancies in workspaces are also associated with increased distraction, concentration, lower (task) performance, and less job satisfaction and commitment to the organization (Oldham et al., 1995).

When space is perceived as *pleasantly crowded* – or *pleasantly quiet*, referring to the same feeling – the supply and demand of space and places match. Bell et al. (2001). Studies associate high densities with less stress, employee satisfaction, and stronger social ties (Fried et al., 2001; Szilagyi & Holland, 1980).

A workspace may also be perceived as *too quiet*. Feelings of isolation in the workspace are usually associated with working from home intensively but can also arise within the office if the personal need for connection is not met (Baumeister & Leary, 1995; Golden et al., 2008).

## **2.5 Theoretical approach**

For the most part, we follow the eclectic environment-behaviour model of Bell et al. (2001). This model suggests that high occupancies may cause inconveniences, such as too much social stimulation, loss of social control, unwanted social interaction, or a lack of privacy. Whether or not high occupancy causes inconveniences depends on the person and the situation. We argue that it depends on (1) environmental factors: physical features of the situation (e.g., layout, furniture, colours), (2) social factors: stimulation from social sources (e.g., coordination, cohesion), and (3) personal factors: individual differences between individuals (gender, age, expectations) (Altman, 1975; Desor, 1972; Stokols et al., 1973). Bell et al. (2001) use a slightly different categorisation of factors that influence perceived occupancy.

Subsequently, occupancy can be perceived as within an optimal range of stimulation, leading to no negative or even positive effects (Bell et al., 2001). Deviations from this range can result in either overstimulation (resembling crowding) (Bell et al., 2001) or understimulation (resembling isolation) (Altman, 1975).

A perceived misfit between the demand and availability of space triggers a behavioural response (Stokols, 1972). These coping mechanisms are aimed directly at reducing negative feelings (Bell et al., 2001). Examples of coping mechanisms include speaking up to colleagues, leaving the workspace, and adjusting expectations concerning the affordances of the workspace. When coping mechanisms are effective, they lead to a reduction in negative feelings, though there may be lingering aftereffects (e.g. fatigue) (Bell, 2001; Stokols, 1972).

## **3 Method**

To gather the existing knowledge about the effects of occupancy in the workplace, we conducted a systematic literature review following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The main goal is to explore the environmental factors, social factors, and personal factors that influence perceived occupancy in workspaces.

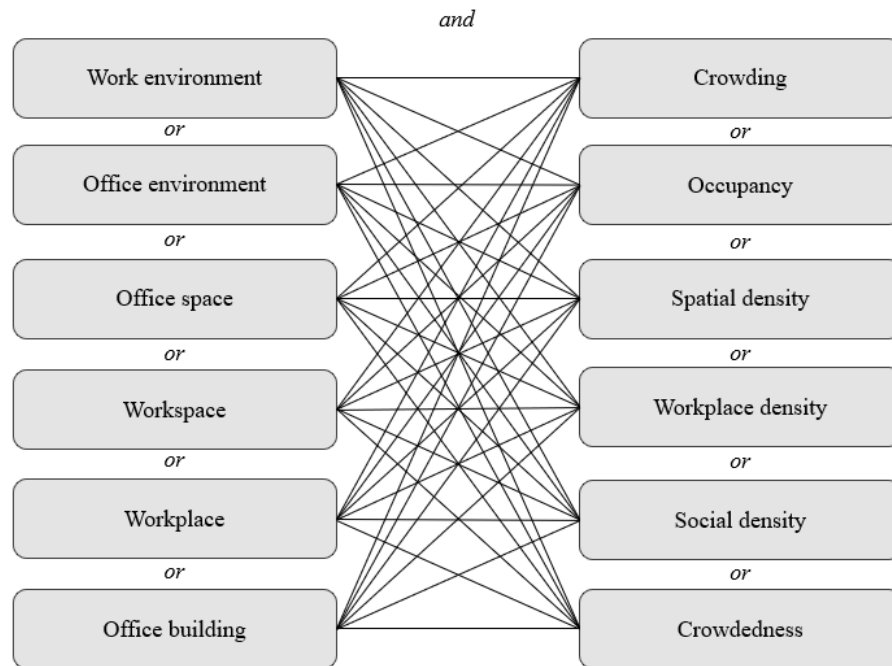
### **3.1 Search strategy**

The literature search focused on studies that investigated the psychological impact of occupancy in office environments on its users. Search terms referring to office environments were combined with terms that refer to occupancy and perceived occupancy (Fig 2). Unfortunately, isolation was not included as a search term, as we only recognized its relevance later in the research process. Since the research is not yet complete, we will incorporate articles pertaining to the term 'isolation' at a later stage.

The following databases were used to find relevant publications: Web of Science and Scopus. The databases were searched in the period December 2023 - January 2024. The search strategy included keywords related to (objective) occupancy and the office work environment. The same strategy was used in both databases.

Articles were included when they were published between 1971 and 2024 and the subject areas were sociology, psychology, & business. Articles were excluded when they used the following keywords: energy utilization, energy efficiency, energy conservation, energy use, intelligent building, sustainable development, computer simulation, or optimization.

Figure 2. Search strategy



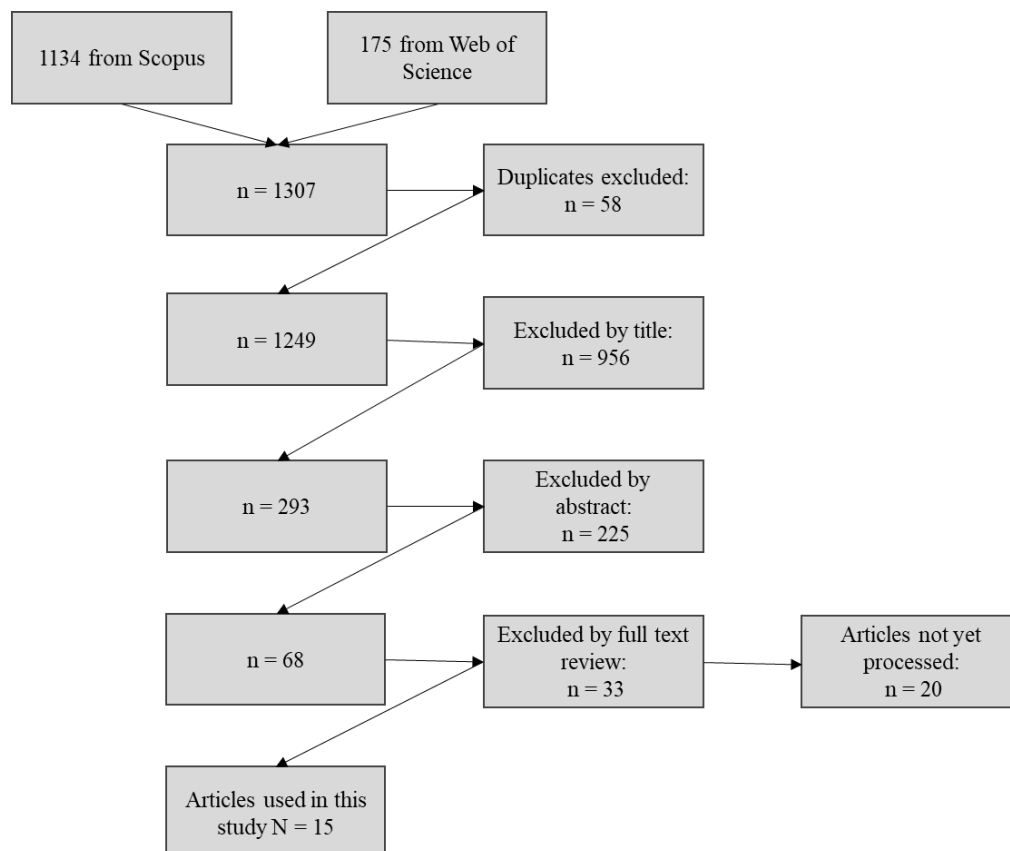
### 3.2 Selection criteria

Two reviewers independently selected and identified relevant and non-relevant articles retrieved with the search strategy. First, they screened titles and abstracts. Full-text articles were then reviewed for final inclusion. In this preliminary analysis, 48 of 68 articles were read. In each phase, the same selection criteria were used. In Figure 3 the screening process is displayed. Studies were eligible for inclusion if they met the criteria presented in Table 1.

Table 1. Inclusion and exclusion criteria

<b>Inclusion criteria</b>	<b>Exclusion criteria</b>
The studied environment is an office building or -floors.	Other environments, such as schools or dental practices.
The study is an empirical research or systematic review.	Theoretical papers, newspaper articles, etc.
The study population includes office employees or knowledge workers.	Other populations, such as prisoners, elderly people, and dentists.
The method and measures are clearly described.	When the method or analysis is not clearly described.
The dependent variables are a form of perceived occupancy or psychological responses of individuals.	Dependent variables that concern outcomes for teams or coping mechanisms.
The moderating variables are factors of the physical work environment, social work environment, or personal factors	Studies which focus on the method of measuring occupancy, without any relation to perceived occupancy or psychological responses.
The independent variables are forms of occupancy and/or perceived occupancy.	

Figure 3. Screening process.



### 3.3 Data extraction and analysis

Details were extracted from all articles by using a standardized form. Extracted data included study characteristics, outcome measures ((related concept to) perceived occupancy; psychological or physical reactions of individuals (feelings or emotions from perceived occupancy)), and key findings (factors of influence; link to additional articles and interesting findings). Related concepts to perceived occupancy variables such as the amount of privacy or personal space were also included in this study.

## 4 Results

Based on the preliminary analysis, 15 articles were identified that measured some form of perceived occupancy and psychological responses related to this. Firstly, these forms of perceived occupancy are discussed. The factors that were found to influence perceived occupancy at the office workplace are grouped into three categories: environmental factors, social factors, and personal factors. For each category, the factors and their effects are summarized.

### 4.1 Related concepts of perceived occupancy

Perceived occupancy was mostly not assessed directly in the articles. One exception is the study of Zoghbi-Manrique-de-Lara & Sharifiatashgah (2019) who measured the perception of crowding, which can be seen as a form of perceived occupancy. In other studies, constructs (e.g. privacy, distractions, and interruptions) are used that are related to perceived occupancy. Some studies use forms of (objective) occupancy, making no distinction between occupancy and perceived occupancy. In Table 1 the different constructs measured related to perceived occupancy are displayed.

Table 2. Related concepts of perceived occupancy

<b>Reference</b>	<b>Study type</b>	<b>Related concepts of perceived occupancy</b>
Bodin Danielsson & Bodin (2009)	Quantitative study	Acoustics (noise) and privacy
De Been & Beijer (2014)	Quantitative study	Privacy (satisfaction with privacy), ability to work concentrated, and acoustics.
Gonsalves (2023)	Case study	Territoriality and ability to work concentrated (unwanted interruptions)
Haapakangas et al. (2018)	Quasi-experimental analysis	Acoustics (noise sources) and privacy (visual and acoustic privacy)
Hodzic et al. (2021)	Quantitative longitudinal study	Distractions
Kazlauskaitė et al. (2023)	Systematic literature review	Occupancy (density) and privacy
Khoshbakht et al. (2021)	Quantitative study	Occupancy (number of occupants in the building)
Kim & de Dear (2013)	Quantitative study	Occupancy (workplace enclosure/proximity) and perceived occupancy (satisfaction with the amount of space)
Kropman et al. (2023)	Systematic literature review	Occupancy (number of occupants)

Laurence et al. (2013)	Quantitative study	Privacy (and architectural privacy) and workspace personalization.
Maher & von Hippel (2005)	Quantitative study	Privacy (objective privacy) and occupancy (social density)
Richardson et al. (2023)	Quantitative study	Occupancy (social density)
Vischer (2007)	Theoretical paper	Acoustics
Zoghbi-Manrique-De-Lara & Sharifiatashgah (2020)	Quantitative study	Perceived occupancy (perceived crowding) and privacy (invasion of privacy)

#### 4.2 Environmental factors

11 articles studied the relationship between environmental factors and concepts to perceived occupancy. Six papers focused on the spatial openness of workspaces. The findings suggest that openness of the workspace may increase feelings of crowding. The other articles in this category assessed the impact of noise, plants, and the availability of quiet workspaces, personalization of workspace, and outside view. In Table 2 the results are shown for these different environmental factors and their impact on the related concepts to perceived occupancy.

*Table 2: Environmental factors influencing perceived occupancy*

<b>Factor</b>	<b>Impact on (related concepts to) perceived occupancy</b>	<b>Reference</b>
Acoustics	Noise is a consequence of high-density offices and a primary source of discomfort.	Vischer (2007)
Openness of workspaces	People are most dissatisfied with open-plan offices, in which noise and privacy are the main causes.	Bodin Danielsson & Bodin (2009)
Openness of workspaces	People in combi-or flex offices are less satisfied with productivity support, privacy, and concentration compared to people in shared room offices.	De Been & Beijer (2014)
Openness of workspaces	Working in an activity-based flexible office leads to an increase in distraction.	Hodzic et al. (2021)
Openness of workspaces	Open-plan offices were most disliked and productivity decreased as the number of occupants in the building increased.	Khoshbakht et al. (2021)
Openness of workspaces	Noise and privacy loss are identified as the main source of dissatisfaction in open-plan offices.	Kim & de Dear (2013)
Openness of workspaces	A larger number of occupants has adverse effects on productivity and well-being.	Kropman et al. (2023)
Personalization of workspace	Personalization reduces the negative impacts of low privacy at work.	Laurence et al. (2013)

Plants	Many plants may be seen as disorderly or hectic, reducing comfort in the workspace, though less than having no plants at all.	Kropman et al. (2023)
Type of workspaces	The provision of quiet workspaces was associated with fewer distractions, less stress, and higher satisfaction with the environment.	Haapakangas et al. (2018)
Type of workspaces	Undisturbed workspaces could mitigate negative effects on well-being by supporting employees' auditory and visual privacy needs.	Kazlauskaitė et al. (2023)

### 4.3 Social factors

Three articles studied the relationship between social factors and their impact on related concepts to perceived occupancy. These three studies assessed whether territoriality, personal space, and culture affected different related concepts to perceived occupancy. See Table 3 for an overview of social factors that impact (concepts to) perceived occupancy.

*Table 3: Social factors influencing perceived occupancy.*

<b>Factor</b>	<b>Impact on (related concept to) perceived occupancy</b>	<b>References</b>
Culture	British participants had higher personal space satisfaction with a lower social density than Korean participants.	Richardson et al. (2023)
Personal space	Invasions of privacy by supervisors and peers trigger deviant work behaviour in crowded environments.	Zoghbi-Manrique-de-Lara & Sharifiatashgah (2019)
Territoriality	A shift from territorial space to non-territorial space afforded workers greater control over social interaction.	Gonsalves (2023)

### 4.4 Personal factors

Three articles studied the relationship between social factors and their impact on related concepts to perceived occupancy. The studies addressed the influence of stimulus screening, inhibitory ability, task complexity, employee needs, and work pressure on perceived occupancy. See Table 4 for an overview of the social factors that impact the related concepts to perceived occupancy.

Table 4: Personal factors influencing perceived occupancy.

<b>Factor</b>	<b>Impact on (related concept to) perceived occupancy</b>	<b>References</b>
Employee needs	When the need for quiet workspaces is met, employees report greater satisfaction with their work environment, fewer distractions, less stress, and improved collaboration.	Haapakangas et al. (2018)
Employee needs	Support for the need for privacy appears to mitigate negative effects on well-being dimensions.	Kazlauskaitė et al. (2023)
Inhibitory ability	Employees who are better able to inhibit distractions within their environment also perceive their workplace as more private.	Maher & von Hippel (2005)
Stimulus screening	Employees with better screening ability have higher performance and job satisfaction.	Maher & von Hippel (2005)
Task complexity	When task complexity is high, poor stimulus screening and low inhibitory ability lead to lower job satisfaction	Maher & von Hippel (2005)
Work pressure	The negative relationships between distraction work engagement and fatigue were more pronounced in situations of increased time pressure and unpredictability.	Hodzic et al. (2021)

## 5 Discussion and Conclusion

In this study, we explored the factors that influence employees' perception of occupancy at the office. Our results demonstrate that occupancy or perceived occupancy was barely the central theme in the analysed studies. Except for Zoghbi-Manrique-de-Lara & Sharifiatashgah (2019), the articles used several concepts that relate to perceived occupancy (Bell et al, 2001; Stokols, 1976), for example, privacy, acoustics, the ability to work concentrated or (objective) occupancy. In our review, we found that these concepts are often measured, while the connection with occupancy is barely made.

Our results demonstrate that multiple environmental factors, social factors, and personal factors have an impact on these related concepts of perceived occupancy in workspaces. Environmental factors are the openness of workspaces, acoustics, plants, workspaces, personalization of workspace, and outside view. Especially openness of the workspace is the most studied factor in relation to perceived occupancy. Social factors are territoriality, personal space, and culture. Personal factors are work pressure, stimulus screening, inhibitory ability, task complexity, and employee needs.

Our preliminary results have limitations because they did not include various environmental, social, and personal factors known to influence crowding outside the context of workspaces. Examples of these include linear dimensions and doors (Baum & Davis, 1980), signage (Langer & Saegert, 1977; Wener & Kaminoff, 1983), in-group and out-group effects, coordination within spaces, expectations on the level of occupancy, and goals (Bechtel & Churchman, 2002; Bell et al., 2001). Future studies could shed light on the influence of these factors in workspaces.



Another limitation of our study is that our search strategy did not include isolation as a search term as we only recognized its relevance later in the research process. Since this study is still ongoing, articles containing the search term 'isolation' will be included in the remaining analysis. Despite these limitations, we hope to have shown the value of using the perspective of perceived occupancy in the workplace setting, providing insights for practitioners and inspiring academics to further explore this topic.

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