Journal of Corporate Real Estate

Choosing where to work: an empirical study of collaborative activities' impact on workspace choice behavior

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Received 10 May 2024
Revised 30 May 2024
Accepted 31 May 2024

Abstract

Purpose – In today's rapidly evolving work landscape, the design of office spaces is a crucial concern for organizations. Companies are redefining offices as collaboration hubs to entice employees back to in-person work. However, the understanding of how employees choose their workspaces, especially for collaborative activities, and how this should inform office design is lacking. Workers' collaborative activity patterns can help better understand workspace choice behavior (WCB). In two studies, this paper aims to explore which characteristics of collaborative activities to consider when reshaping offices.

Design/methodology/approach – Data collected in a cross-sectional study design at a research institution (n = 285) and a university (n = 352) were used for confirmatory factor analyses and regression analysis.

Findings – The first study shows that collaborative activities can be classified into three distinct types: coordinative activities (planned and formal), deep collaboration (planned and complex) and spontaneous communication (informal and short encounters). The second study revalidates this classification and reveals patterns impacting WCB. Frequency and location preference of spontaneous communication and work environment satisfaction are strong predictors of on-site work. Personal characteristics like gender, age, managerial position or commute time are less consequential than assumed.

Practical implications – The results pinpoint guidelines for office designers and leaders in shaping effective workspaces and policies.

Journal of Corporate Real Estate
Emerald Publishing Limited
1463-001X
DOI 10.1108/JCRE-05-2024-0017

Originality/value – This paper provides new insights into classifying collaborative activities and personal characteristics, activity characteristics and environmental factors influencing WCB.

Keywords Office design, Working from home, Hybrid work, Collaborative activity, Work environment satisfaction, Workspace choice behavior

Paper type Research paper

Introduction

In today's work environment, fostering productivity and creativity through well-designed office spaces is crucial, particularly for knowledge workers reliant on collaboration. Creating office spaces that accommodate employees' needs is a critical concern for organizations (Hoendervanger *et al.*, 2022; Wohlers and Hertel, 2018). Amid this, the post-pandemic normalization of remote work led companies to redefine offices as collaboration spaces to attract their employees back to the office (Appel-Meulenbroek *et al.*, 2022; Ma and Cha, 2021; Gensler, 2020). Nevertheless, we lack a deep understanding of how employees choose their workspaces when collaborating. While previous studies have explored workspace choice behavior (WCB) (Appel-Meulenbroek *et al.*, 2022; Tagliaro *et al.*, 2022; Ma and Cha, 2021; Haynes, 2007b; Heerwagen *et al.*, 2004), they primarily focused on individual characteristics like gender, role and commute time. So far, workers' activity patterns have received limited consideration. The impact of collaborative activities' types and characteristics on WCB has been overlooked.

Knowledge workers increasingly engage in collaborative activities (Tagliaro *et al.*, 2022; Gensler, 2020), which in turn enhances team and organizational performance (Mathieu *et al.*, 2017; Heerwagen *et al.*, 2004; Olson, 2002). Collaboration is critical as it facilitates knowledge sharing within organizations (Heerwagen *et al.*, 2004). Thus, creating office spaces that foster collaboration has become a priority for optimizing workforce potential. However, despite the recognized significance of collaboration, empirical studies on designing offices for collaborative activities are lacking.

Previous research differentiated between collaborative and individual activities (Tagliaro *et al.*, 2022; Ma and Cha, 2021; Haynes, 2007a; Heerwagen *et al.*, 2004). To create an auspicious office environment, we should go beyond this dichotomy and better understand collaborative activities, which are crucial for optimizing office design and performance (Wohlers and Hertel, 2017). Therefore, this article explores the characteristics of collaborative activities essential for office design.

To foster office spaces for collaborative work, we need to understand the employees' reasons for working on-site. Choosing where to work is the first step toward an active task-environment crafting behavior, which has been linked to increased job satisfaction and performance (Hoendervanger *et al.*, 2022; Bäcklander *et al.*, 2021; Wohlers and Hertel, 2018). However, while studies have shown that workers prefer collaborating on-site and focused individual work at home (Appel-Meulenbroek *et al.*, 2022), it remains uncertain whether this preference applies to all collaborative activities.

This article addresses two pivotal research questions (RQs) that result in two significant contributions. First, we address the following:

RQ1. What dimensions of collaborative activities can be identified in the literature, and which models best fit these dimensions empirically?

By examining the literature on various collaborative activities and conducting two confirmatory factor analyses (CFAs), we contribute a theoretical and empirical basis to

differentiate among three distinct categories of collaborative activities based on their frequency and preferred location. Second, the article tackles the following:

RQ2. How do collaborative activity patterns influence WCB?

By exploring collaborative activities' frequency and location preferences, alongside other influencing variables like personal characteristics and environmental factors, we provide insights into office design strategies, thus enabling organizations to create environments catering to diverse collaborative activity needs. To pursue these RQs, we conducted two studies at a research institution and a university undergoing workspace redesign. The diverse work profiles and redesign efforts provided the opportunity to answer our research questions.

Toward a classification of collaborative activities

The focus on collaboration has surged, driven by its role in enhancing team and organizational performance, facilitating knowledge work, and managing complex tasks. Team and organizational performance improve with effective collaboration (Olson, 2002). As tasks become more complex and urgent, interest in collaboration has increased alongside expectations for higher productivity (Mathieu *et al.*, 2017). Recent studies have found that workers spend nearly equal time on collaborative and individual activities, with some variation for different roles, e.g. management (Tagliaro *et al.*, 2022; Gensler, 2020). Consequently, the focus on designing offices that nurture collaboration has grown.

Research on office environments considers different aspects of activities, sometimes called work behaviors or activity patterns, which can be classified along several dimensions: nature of work (individual vs collaborative), plannability (planned vs unplanned), formality (formal vs informal), complexity, duration and location (Steffen and Schulze, 2020; Appel-Meulenbroek *et al.*, 2015; Maarleveld and Been, 2011; Tabak, 2008); see Table 1 for a systematic overview.

The focus o*n individual and group activities* has overshadowed other dimensions (Tagliaro *et al.*, 2022; van den Berg *et al.*, 2020; Soriano *et al.*, 2020; Haynes, 2007b; Heerwagen *et al.*, 2004; Olson, 2002). Unfortunately, this dimension is oversimplified as merely a choice between working alone or with others with researchers focusing on either the need to work alone (Olson, 2002) or with others (Heerwagen *et al.*, 2004). Even more, individual and group activities are seen as conflicting, with employees navigating the tradeoff between focusing and socializing (Reder and Schwab, 1990).

The *planned character of activities* refers to their planned (scheduled) versus unplanned (opportunistic) character (Appel-Meulenbroek *et al.*, 2022; Hoendervanger *et al.*, 2022; Heerwagen *et al.*, 2004; Hrastinski, 2010; Kraut *et al.*, 1990; Fish *et al.*, 1990). When discussing planned activities, it is crucial to differentiate between unplanned yet intentional interactions, as 72% of unplanned meetings are intentional (Appel-Meulenbroek *et al.*, 2017).

Formality of activities is defined by their structured, ruled-governed and planned nature, contrasting with informality characterized by spontaneity, lack of planning and fluidity (Appel-Meulenbroek *et al.*, 2015; Budie *et al.*, 2019; Hrastinski, 2010; Olson, 2002). While informal activities include both work and private communication, work-related discussions are predominant (Kraut *et al.*, 1990).

Complexity, the cognitive and coordinative effort required to complete an activity successfully, has been considered by previous research (Maher and von Hippel, 2005; Soriano *et al.*, 2020). Complex tasks require increased concentration (Bedny *et al.*, 2012), highlighting the need to consider this in office design (Appel-Meulenbroek *et al.*, 2022; Hoendervanger *et al.*, 2022). Complex tasks have occasionally been opposed to

Table 1. Summary of consulted taxonomic literature

Authors	Underlying dimension	Taxonomic categories
Appel-Meulenbroek *et al.* (2014)	Individual vs group work, Formal vs informal settings	Behind the computer, writing, reading, on the phone, archiving, in a meeting, informal talk, presenting, lunch, toilet visit, coffee break
Appel-Meulenbroek *et al.* (2015)	Formal vs informal settings	Work-related activity, informal meeting, formal meeting, telephone/video, informal activity
Appel-Meulenbroek *et al.* (2022)	Planned vs unplanned activities, Individual (concentrated) vs communicative	Communication-scenario, concentration-scenario, 50 / 50-scenario
Brown (2008)	Planned vs unplanned activities	Meetings planned and scheduled in advance, on-demand meetings between a few individuals, chance meetings
Budie *et al.* (2019)	Concentration vs nonconcentration, Formal vs informal	Individual concentration work, individual non-concentrated work, formal communication, informal communication, phone calls
Fish *et al.* (1990)	Formal vs informal communication, Planned vs unplanned activities	Formal vs informal communication, planned vs unplanned activities
Hoendervanger *et al.* (2022)	Individual vs group work, Planned vs unplanned activities, Formal vs informal settings, Task complexity	Individual high-concentration work, individual low-concentration work, planned face-to-face communication, non-planned face-to-face communication, communication through phone or video, taking a break
Hrastinski (2010)	Formal vs informal communication, Planned vs unplanned activities	Formal face-to-face meetings, *ad hoc* face-to-face meetings
Maarleveld and Been (2011)	Individual vs group work, Planned vs unplanned activities, Formal vs informal settings, Task complexity	General desk work, desk work concentration, desk work interaction, planned meetings, unplanned meetings, telephone use, reading, document management
Maher and von Hippel (2005)	Task complexity	Tasks were rated regarding concentration, distractibility, and difficulty
Öhrn *et al.* (2021)	Individual vs group work, Task complexity, Planned vs unplanned activities	Individual work tasks requiring concentration, teamwork, spontaneous meetings
Robillard and Robillard (2000)	Individual vs group work, Task complexity, Planned vs unplanned activities	Mandatory collaborative activities, called collaborative activities, *ad hoc* collaborative activities, individual activities

(*continued*)

Table 1. Continued

Authors	Underlying dimension	Taxonomic categories
Steffen and Schulze (2020)	Individual vs collaborative work, Planned vs unplanned activities, Formal vs informal settings, Duration	Alone: concentrated/focused work; routine work at the computer; creative work; phone calls/video calls, With others: informal communication; co-working; formal (planned) meetings; workshop meetings
van den Berg *et al.* (2020)	Individual vs collaborative work, Formal vs informal interactions	Individual concentration work; informal interactions; formal interactions
Tagliaro *et al.* (2022)	Location Individual vs collaborative work	Mobile work, individual work, teamwork, inter-team work, intrateam work

Source: Authors' own work

communication. However, communicative tasks, especially creative ones, can be cognitively demanding.

Activity duration varies from prolonged periods, like problem-solving workshops, to shorter instances, like brief conversations (Reder and Schwab, 1990; Kraut *et al.*, 1990; Heerwagen *et al.*, 2004). The environmental design can impact social interactions' length. On average, interactions in closed offices are longer compared to bullpen or pod workspaces (Becker and Sims, 2001). Duration varies with interaction spontaneity; planned encounters last longer than spontaneous ones (Kraut *et al.*, 1990).

Location refers to where the activity is performed, typically distinguishing between office-based and home-based work. Working from home is specific to the knowledge-intensive sector (Fawcett and Song, 2009), which has higher remote work rates, primarily attributed to location-independent tasks (Felstead, 2022; Adrjan *et al.*, 2021) and better digital preparedness (Adrjan *et al.*, 2021). In flexible office studies, research typically concentrates on location choice: one's workspace on-site or elsewhere. Individual workspace are considered the primary "spatial tool for work", meanwhile collaborative spaces play a secondary role in the office as employees across the USA spend 80% of time at individual workspace (Olson, 2002). Yet, the lack of collaborative spaces might be responsible for using personal workspace as primary location for social interaction (Olson, 2002).

Despite the importance of collaboration, a systematic empirical classification of collaborative activities is lacking hindering the development of offices conducive to collaboration. To address this, we propose a classification of collaborative activities along the discussed dimensions structured to create mutually exclusive and exhaustive categories (Table 2). Similarly to Robillard and Robillard (2000), we identify three collaborative activities categories: *Coordinative activities*, characterized by their planned and formal nature, medium to long durations and moderate complexity, support processes among team members to run smoothly. *Deep collaboration activities* are planned and formal but differentiated by complexity and creative demands. They comprise problem-solving to generate innovative ideas or develop new products or solutions. *Spontaneous communicative* activities, like impromptu and casual conversations, are unplanned, informal, short and of lower complexity.

Table 2. Integrated categories of collaborative activities

Type of collaborative activities	Relevant characteristics				Examples of constructed items
	Planned	Formal	Complex	Long	
Coordinative activities	+	+	–	(+)	Meeting for two (e.g. project discussions, …) Meeting with 3–7 people (e.g., project discussions …)
Deep collaboration activities	+	+	+	(+)	Intensive collaboration (e.g. writing a report together …) Shorter working meetings/collaboration for joint creative or substantive work
Spontaneous communicative	(–)	–	–	(–)	Spontaneous and informal communication/ exchange, both work-related and private (e.g. short exchanges …) Short-term, usually short, goal-oriented exchange (e.g. quick exchange meetings … convened at short notice)

Source: Authors' own work

Collaborative activities can be considered through a dual lens, focusing on frequency and preferred location. A high frequency of certain activities might require dedicated spaces to support quick interactions. Similarly, the preference for performing certain collaborative activities on-site might require specific office designs. Therefore, we claim that collaborative activities are multidimensional and propose a structured classification that accounts for this multidimensionality:

H1. Collaborative activities can be empirically classified into three distinct types (coordinated, deep collaboration, and spontaneous) based on both their frequency (low to high) and preferred location (on-site vs at home), resulting in six unique factors.

Workspaces choice behavior

While it is uncertain which employees prefer to work remote and which on-site (Appel-Meulenbroek *et al.*, 2022), face-to-face collaboration is consistently prioritized even as workers value working from home. Several pre-pandemic studies reported the prevalence of face-to-face interaction (Gensler, 2020; Tagliaro *et al.*, 2022; Reder and Schwab, 1990). Post-pandemic studies indicate minimal changes in preferences, as workers prefer meeting, collaborating and socializing on-site (JLL, 2022a; JLL, 2022b). Most workers (70%) prefer the office for collaboration, while only 24% prefer collaborating from home (JLL, 2022a). Simultaneously, researchers question whether collaboration necessitates in-person office meetings (Tagliaro *et al.*, 2022). Amid this, the office landscape changes in its core purpose. Previously focused on individual activities, offices are now often redefined as spaces for collaboration (JLL, 2022b).

The arguments for collaborating in the office are compelling. Yet research on workers' workspace choices is still in its infancy (Appel-Meulenbroek *et al.*, 2022). Therefore, it is crucial to understand how different aspects of collaborative activities, like frequency and preferred location, interact with workers' workspace choices. Surprisingly, no previous studies have explored the impact of collaboration frequency and preferred location on workers' WCB. This paper aims to fill this research gap by examining the relationship between the frequency and preferred location of collaborative activities and WCB. We reviewed previous literature on factors influencing workers' choice and identified three categories: personal characteristics, activity characteristics and environmental factors.

Personal characteristics

Personal characteristics, encompassing gender, commute time, job function and preferences toward work location, received substantial attention. The relationship between gender and WCB has yielded inconsistent results. Appel-Meulenbroek *et al.* (2022) found that the home-workers segment contained relatively more females, whereas Tagliaro *et al.* (2022) observed that females spent less time on remote work, despite both studies noting females' tendency towards administrative tasks and individual work. These discrepancies may stem from different study contexts and methodologies. In Appel-Meulenbroek *et al.*'s (2022) study, the female workers had a longer commute, and the preference was based on choice rather than time spent in the office. Meanwhile, Tagliaro *et al.* (2022) report that organizational context limited administrative remote work opportunities, which might explain females' lower remote work engagement.

Other personal characteristics have consistent findings. Workers with shorter commutes are more inclined to work on-site (Appel-Meulenbroek *et al.*, 2022). Different job functions vary in mobile work engagement (Tagliaro *et al.*, 2022), and organizational roles are closely

associated with undertaken tasks (Tagliaro *et al.*, 2022; Olson, 2002). Specifically, managers engage in more frequent communication activities (Olson, 2002, #61530), while administrative personnel focus more on individual work (Tagliaro *et al.*, 2022). Thus, we hypothesize:

H2. Personal characteristics (gender, managerial function, age, commute time) influence the WCB.

Preferences, immediate antecedents of behavior (Tversky and Kahneman, 1981), can predict behavior in office context (Appel-Meulenbroek *et al.*, 2022; Rolfö *et al.*, 2018). At the same time, workers choose their work environment to benefit their activity (Bäcklander *et al.*, 2021; Wohlers and Hertel, 2017) with a preference for on-site collaboration (Appel-Meulenbroek *et al.*, 2015). Therefore, the location preference for collaborative activities could explain how long employees work on-site (i.e. WCB here defined as the choice between working in the office or at home). If employees prefer to collaborate in the office, they are likely to spend more time there. Therefore, we hypothesize:

H3. The preference toward the location of collaborative activities influences the WCB.

Preferences for work locations are not solely personal; task demands might influence their emergence. While personal traits like introversion may drive the preference for quiet settings, the nature of the work itself – like work requiring deep focus – might be critical for defining tasks' ideal environment.

Activity characteristics

The activity characteristics have been less researched in relation to WCB (Appel-Meulenbroek *et al.*, 2022). Little is known about how activity frequency affects WCB, which depends on the workspace preferences and planned activities (Appel-Meulenbroek *et al.*, 2022). However, collaborative work is expected to be performed more on-site than individual work (Appel-Meulenbroek *et al.*, 2022). Therefore, we hypothesize:

H4. The frequency of the collaborative activities influences the preference toward the location of the collaborative activities.

Environmental factors

Environmental factors, like environment, equipment and the weekday, are better researched and shown to impact WCB. WCB is affected by the fit between environment and task requirements (Appel-Meulenbroek *et al.*, 2022; Coradi *et al.*, 2015). Space availability and adequate equipment at home (Bockstahler *et al.*, 2022; Wütschert *et al.*, 2022) influence WCB similarly to crowdedness, availability of concentration and meetings spaces (Appel-Meulenbroek *et al.*, 2022; Bockstahler *et al.*, 2022) and poor equipment at home (Bockstahler *et al.*, 2022). Additionally, weekdays affect WCB, with Mondays and Fridays less favored for on-site work (Bockstahler *et al.*, 2022). Generally, the work environment satisfaction influences WCB (Bockstahler *et al.*, 2022). Following the propositions of the Supply-Needs and the Person-Environment fit frameworks (Wohlers and Hertel, 2017; Wohlers and Hertel, 2018), we expect that the level of satisfaction with the on-site work environment influences workers' choice behavior:

H5. The work environment satisfaction influences the WCB.

Overview of the studies

We conducted two studies to examine our hypothesis. Both studies took place in the context of workspace redesign at a Swiss research institution (Study 1) and a university (Study 2). Study 1, conducted in 2021, explored whether collaborative activities could be classified empirically based on their frequency and location preference (on-site or at home) based on CFA. Study 2, carried out in 2022, replicated the CFA and investigated the drivers of WCB.

Statistical analysis

All continuous predictors were scaled and centered before the analysis. The CFA was performed using the full maximum-likelihood estimation (MLR) i*n lavaan* (Rosseel, 2012). In both studies, the data were not multivariate normal. Therefore, a robust estimator MLR was used (Korkmaz *et al.*, 2014). The models' fit was evaluated based on following indices: 2 log likelihood chi-square value (χ^2), comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR) and Akaike information criterion (AIC).

The regression analysis was based o*n apa Tables* (Stanley and Stanley, 2022). Missing data were imputed using the *norm.predict* method (Van Buuren and Groothuis-Oudshoorn, 2011). Due to concerns about the linearity between performance and hybrid work, we checked the distribution of fitted and residual data (see Appendix Figure A1). Despite some outliers, the regression variables follow a linear trend.

Participants

Study 1: Of the 406 survey participants employed at a Swiss research institution, 285 German-speaking employees were included in the CFA. The participants had an average age of 45 years (SD = 10, ranging from 21 to 70 years old), comprising 62 females, 221 males and two other gender categories.

Study 2: A total of 352 employees of a Swiss University (48 years on average, SD = 10, ranging from 19 to 65 years old; 255 female, 92 male and five other) participated in the survey conducted in the context of an office redesign research project. A hybrid working policy was in place at the time of the study. Participants spend about 68% of their working time on-site and the other 32% working from home or elsewhere. Working alone is most frequent (41%), followed by collaborative work (30%); with large variability of WCB shown by standard deviations. The office environment had few retreats for spontaneous exchanges or phone calls. Employees with a work quota of 80% or more had an assigned workplace while those with 50% worked mainly in a desk-sharing zone. Offices were predominately for groups of 4 to 12 people. Individual offices were seldom and usually reserved for higher management.

The participants in both studies had heterogeneous jobs ranging from research to administrative. Participation in both studies was voluntary, and the participants were informed about the study's content and scope.

Measures

The items describing collaborative activities' *frequency and preferred location* were adapted from (Steffen and Schulze, 2020); see Tables 2 and 4. Examples of items include "*Meeting for two (e.g. project discussions, […])*" for coordination; "*Intensive collaboration (e.g. writing a report together, preparing and evaluating experiments)* for deep collaboration; and "*Spontaneous and informal communication/exchange both work-related and private (e.g. short exchanges […])*" for spontaneous communication.

These items were measured on two different scales. First, the participants were asked to report the frequency with which they performed the collaborative activities (*How often did they perform the following activities in the last three months?*) on a scale from 1 = never to 5 = very often. After that, the participants were asked to report their location preferences (*To what extent would you like to carry out the […] activities on-site at […] or other locations (e.g. at home) if you were free to choose?*) on a scale from 1 = 100% at home to 11 = 100% on-site. Different answer formats and scale types (5-Lickert scale for frequency and 11-Likert scale for location preference) were used to minimize common methods bias (Podsakoff *et al.*, 2012).

WCB was measured as *time spent in different working locations* based on items from the Fourth European Working Conditions Survey (Parent-Thirion *et al.*, 2007). To measure WCB, the participants were asked to report the percentage of time they typically spent at different locations on-site (individual desk, meeting room, classroom, library, other) and off-site (working from home, coworking space outside the organization, other places outside the organization): *What percentage of time have you typically spent during a work week at which location?*

Work environment satisfaction (WES) was measured using the question, *Overall, how satisfied are you with your working environment at your company's location*? (Gerdenitsch *et al.*, 2018) on a scale from 1 = very unsatisfied to 7 = very satisfied. Following (Hoendervanger *et al.*, 2019), we argue that this is acceptable because "workplace satisfaction is a sufficiently narrow and unambiguous construct."

Results

Classification of collaborative activities

To evaluate *H1*, we conducted a CFA on 12 items in both studies, see Table 4.We compared two models: The first model comprised two factors: frequency and preferred collaborative activities location. The second model had six factors: frequency of coordinative activities, frequency of deep collaboration, frequency of spontaneous communication, preferred location of coordinative activities, preferred location of deep collaboration and preferred location of spontaneous communication.

Results from both studies show that the six-factor model (Model 2) provided a better fit than the two-factor model (Model 1) (Table 3). In Study 1, Model 2 ($\chi^2(39) = 98.60$, $p > 0.05$; CFI = 0.95; TLI = 0.92, RMSEA = 0.07, SRMR = 0.05) approximates the data better than Model 1 ($\chi^2(6)=67.78$, $p < 0.01$). In Study 2, we see similar results; Model 2 ($\chi^2(39) = 93.90$, $p > 0.05$; CFI = 0.98; TLI = 0.96, RMSEA = 0.06 [0.04, 0.08]; SRMR = 0.03) approximates the data better than Model 1 ($\chi^2(6) = 14.35$, $p < 0.01$). Therefore, the six-factor model best approximates the structure of collaborative activities.

The frequency of collaboration scales had poorer *validity* and *reliability* than location preferences, likely because of the reduced response scales levels (Table 4). Study 2 has a better fit probably due to the larger sample size. Smaller range scales reduce the true variance and covariance among items, affecting the validity and reliability; therefore, for further usage of the scale for smaller sample sizes, we recommend using a larger range of answers for collaborative activities frequency.

In both studies, Model 2 met the standards of *convergent validity* for all factors regarding collaboration place. All loadings were above 0.50, considered acceptable in exploratory research or with complex constructs (Hair *et al.*, 2013). In Study 2, the *construct validity* measured as average variance extracted (AVE) was greater than 0.40 (Shrestha, 2021; Hair *et al.*, 2021) for Model 2. For Study 1, the AVE for Factor 3: Frequency of Spontaneous Communication was slightly below the standard threshold at 0.39. Despite the slightly lower

Table 3. Overall fitness of the tested models

	Study 1		Study 2	
Criteria	Model 1: Two factors	Model 2: Six factors	Model 1: Two factors	Model 2: Six factors
$\chi 2$	$\chi^2(53) = 168.76$	$\chi^2(39) = 98.60$	$\chi^2(53) = 344.35$	$\chi^2(39) = 93.90$
CFI	0.90	0.95	0.85	0.98
TLI	0.88	0.92	0.81	0.96
RMSEA	0.08 [0.07, 0.10]	0.07 [0.05, 0.09]	0.12 [0.11, 0.14]	0.06 [0.04, 0.08]
SRMR	0.08	0.05	0.07	0.03

Source: Authors' own work

AVE, all items related to this factor have significant loadings, and the composite reliability exceeds the acceptable threshold.

The reliability measured as *composite construct reliability (CR)* and ω-measure showed similar patterns for Factor 3 in Study 1. For Model 2 in Study 2, *composite construct reliability (CR)* was greater than the threshold of 0.60 (Shrestha, 2021; Hair *et al.*, 2021; Nájera Catalán, 2019; Raykov and Shrout, 2002) and ω was over the threshold of 0.65 (Nájera Catalán, 2019).

Given the significant factor loadings of the items for both studies and the strong theoretical framework, Factor 3's AVE slightly missing the conventional threshold in Study 1 is acceptable. In Study 2, Model 2 meets all validity and reliability measures. Thus, the data provide sound measurements of the measured constructs supporting *H1: Collaborative activities can be empirically classified into three distinct types based on both their frequency and preferred location.*

Workspaces choice behavior (WCB)

Examining the study variables in Table 5, we observe that spontaneous collaboration is the most frequent type of collaborative activity but not the preferred one to perform on-site. Employees prefer on-site work for deep collaboration. Further, the *WCB* shows positive correlations with most variables, especially WES and on-site preferences and activities' frequency, except for coordinative activities. The frequencies of collaborative activities (coordinative, deep collaboration, spontaneous communication) are positively associated with the preference to perform them on-site, which is nominally relatively high. On average, workers spend almost 67% of their time on site. The preference to work on-site positively correlates to the WES for all activity types. WES shows mixed correlations to collaboration frequency: negative with deep collaboration, positive with spontaneous communication and no correlation with coordinative activities, hinting at distinct requirements of these activities.

Regression analysis was performed to test *H1* to *H5* (Table 6). Personal characteristics like gender, managerial function, age and commute time yielded no significant results. Therefore, we found no evidence that personal characteristics (gender, managerial function, age and commute time) influence WCB.

The path coefficients between preference toward the location of collaborative workspace activities and WCB were statistically significant and positive for coordinative activities (b = 0.21, $p < 0.01$) and spontaneous communication activities (b = 0.16, $p < 0.01$) but not for deep collaboration. Employees who preferred on-site coordinative and spontaneous communication activities tend to spend more time on-site. Notably, the preference toward the

Table 4. Convergent validity, reliability (AVE, CR)

Factor/Item	Study 1; Model 2 Loadings	AVE	CR	ω	Study 2; Model 2 Loadings	AVE	CR	ω
Frequency of activities[1]: *How often do you typically perform the following activities in your everyday work?*								
Factor 1: Frequency of coordinative activities=~		0.47	0.63	0.63		0.53	0.69	0.70
Meeting for two (e.g. project discussions, internal discussions/meetings, working with partners and customers, phone calls)	0.78				0.73			
Meeting with 3–7 people (e.g. project discussions, internal discussions/meetings, working with partners and customers, phone calls)	0.59				0.73			
Factor 2: Frequency of deep collaboration=~		0.44	0.61	0.62		0.53	0.69	0.66
Intensive cooperation	0.64				0.67			
Shorter working meetings for joint creative or content work	0.67				0.78			
Factor 3: Frequency of spontaneous communication=~		0.39	0.55	0.55		0.65	0.79	0.78
Spontaneous and informal communication /exchange, both work-related and private	0.75				0.86			
Short-term, usually short, goal-oriented exchange	0.48				0.75			
Place preference[2]*:To what extent would you like to carry out the communication and coordination activities on-site at … or other locations (e.g. home office) if you were free to choose?*								
Factor 4: Place preference coordinative activities=~		0.72	0.84	0.83		0.69	0.80	0.81
Meeting for two (e.g. project discussions, internal discussions/meetings, working with partners and customers, phone calls)	0.86				0.82			
Meeting with 3–7 people (e.g. project discussions, internal discussions/meetings, working with partners and customers, phone calls)	0.83				0.83			

(*continued*)

Table 4. Continued

Factor/Item	Study 1; Model 2 Loadings	AVE	CR	ω	Study 2; Model 2 Loadings	AVE	CR	ω
Factor 5: Place preference deep collaboration=~		0.57	0.73	0.73		0.68	0.91	0.81
Intensive collaboration (e.g., writing a report together, preparing and evaluating experiments, etc.)	0.80				0.79			
Shorter working meetings/collaboration for joint creative or substantive work	0.71				0.85			
Factor 6: Place preference spontaneous communication=~		0.64	0.78	0.78		0.66	0.81	0.79
Spontaneous and informal communication / exchange, both work-related and private	0.83				0.81			
Short-term, usually short, goal-oriented exchange	0.78				0.81			

Notes. [1]Frequency of collaborative activities was measured on a scale from 1 = never to 5 = very often; [2]preferences for on-site collaboration was measured on a scale from 1 = 0% on-site to 11 = 100% on-site. M and SD are used to represent mean and standard deviation. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations. *indicates $p < 0.05$. **$p < 0.01$
Source: Authors' own work

Table 5. Means, standard deviations and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Frequency coordinative activities [1]	3.58	0.69							
2 Frequency deep collaboration	3.44	0.79	0.54**						
3. Frequency spontaneous communication [1]	3.62	0.88	0.38 **	0.43 **					
4. Location coordinative activities [2]	7.82	2.59	0.17 **	0.29 **	*0.29* **				
5. Location deep collaboration [2]	8.10	2.56	0.17 **	0.36 **	0.26 **	*0.70* **			
6. Location spontaneous communication [2]	7.92	2.75	0.16 **	0.24 **	0.40 **	0.62 **	*0.61* **		
7. Satisfaction work environemnt [3]	5.06	1.40	−0.07	−0.12 *	0.13 *	0.16 **	0.15 **	0.16 **	
8. Current WCB [4]	67.66	22.39	0.07	0.14 **	0.31 **	0.40 **	0.36 **	0.39 **	0.21 **

Notes: [1]Frequency of collaborative activities: 1 = never to 5 = very often; [2]preferenced location of on-site collaboration: 1 = 0% on-site to 11 = 100% on-site; [3]satisfaction with workspace environment was measured on a scale from 1 = very unsatisfied to 7 = very satisfied [4]current WCB: 0% to 100%. M and SD represent mean and standard deviation *indicates $p < 0.05$; **indicates $p < 0.01$

Source: Authors' own work

Table 6. Regression results using WCB (time on site) as criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	*r*	*Fit*
(Intercept)	0.02	[−0.17, 0.21]				
Personal characteristics						
Gender (women)	−0.02	[−0.24, 0.19]	−0.01	[−0.11, 0.08]	−0.03	
Management (yes)	−0.01	[−0.26, 0.24]	−0.00	[−0.10, 0.09]	0.00	
Age	0.00	[−0.09, 0.10]	0.00	[−0.09, 0.10]	0.04	
Commute time	−0.04	[−0.13, 0.06]	−0.04	[−0.13, 0.06]	−0.09	
Location preference coordinative activities	0.21 **	[0.07, 0.35]	0.21	[0.07, 0.35]	0.40 **	
Location preference deep collaboration	0.04	[−0.10, 0.19]	0.04	[−0.10, 0.19]	0.34 **	
Location preference spontaneous communication	0.16 *	[0.02, 0.29]	0.16	[0.02, 0.29]	0.39 **	
Activity characteristics						
Frequency coordinative activities	−0.05	[−0.17, 0.06]	−0.05	[−0.17, 0.06]	0.07	
Frequency deep collaboration	−0.01	[−0.13, 0.12]	−0.01	[−0.13, 0.12]	0.14 **	
Frequency spontaneous communication	0.18 **	[0.06, 0.29]	0.18	[0.06, 0.29]	0.31 **	
Environmental factors						
Work environment satisfaction (WES)	0.12 *	[0.02, 0.22]	0.12	[0.02, 0.22]	0.21 **	
R^2 = 0.24 **						
95% CI[0.14,0.29]						

Notes: A significant b-weight indicates the beta-weight and semi-partial correlation are significant. b represents unstandardized regression weights. Beta indicates the standardized regression weights. *r* represents the zero-order correlation. LL and UL indicate the lower and upper limits of a confidence interval, respectively. *indicates $p < 0.05$. **$p < 0.01$

Source: Authors' own work

location of deep collaboration and WCB was significant for zero-order correlations. Therefore, the data partially suggest that preference toward the location of collaborative workspace activities influences the WCB.

The path coefficients between collaborative activities' frequency and WCB are significant only for the frequency of spontaneous communication ($b = 0.18$, $p < 0.01$). In contrast, the frequency of coordinative and deep collaborative activities does not bear influence on the time spent on-site, despite the significant zero-order correlation with the frequency of the deep collaboration. Therefore, it follows that only frequency of spontaneous communication influences the WCB.

The WES was positively related to the WCB ($b = 0.12$, $p < 0.01$). WES leads employees to spend more time in the office. Therefore, we conclude that the WES influences WCB.

Discussion

In this article, we explored which characteristics of collaborative activities should be considered when redesigning or redefining future offices. For this, we theoretically identified and empirically validated three distinct types of collaborative activities: *coordinative activities* (planned and formal), *deep collaboration* (planned and complex) and *spontaneous communication* (informal and brief). These categories differ in frequency of occurrence and location preference. The empirical validation of the classification is a methodological strength of this article.

The second aim was to determine how the *collaborative activities, alongside other factors, influence WCB.* We expected WCB to be driven by personal characteristics, collaborative activity patterns, and WES. Unlike prior research suggesting user characteristics (Appel-Meulenbroek *et al.*, 2022; Tagliaro *et al.*, 2022) and roles (Tagliaro *et al.*, 2022; Gensler, 2020) affect WCB, our study found no influence from age, gender, management position or commute time. Yet, not all personal characteristics were irrelevant. Among the analyzed predictors of WCB, location preference emerged as a pivotal predictor of time spent on-site, surpassing other factors. The preference for on-site coordinative and spontaneous activities drives employees to spend more time in the office. This suggests that location preferences rather than demographics have a greater influence on WCB.

The results reveal that *activity patterns* (frequency), and personal characteristics (preferred location) influence the time spent on-site. Notably, frequent spontaneous communication correlates with an increased on-site presence. Conversely, more frequent coordination and deep collaboration activities do not necessarily predict on-site presence. Despite a higher preferences for on-site work during deep collaboration, this does not lead to increased on-site presence. This might be explained by the dissatisfaction with the work environment as employees frequently engaging in deep collaboration were less satisfied.

Nevertheless, differentiating between *types of collaborative activities* helps advance the discussion on office design beyond the dichotomy of individual vs collaborative activities. Indeed, the results show that the issue extends beyond merely whether workers collaborate. The kind of collaboration matters too. The results show that frequent spontaneous communication was more prevalent for people working longer hours in the office, while frequent coordination and deep collaboration were not. Consistent with previous findings, our findings show that frequent spontaneous communication increases on-site presence (Appel-Meulenbroek *et al.*, 2022), while coordinative and deep collaboration do not. This stresses the importance of spontaneous communication which has been previously overlooked (Meinecke and Handke, 2022).

The results show that *work environment satisfaction (WES)* directly affects time on-site, aligning with previous studies (Appel-Meulenbroek *et al.*, 2022; Bockstahler *et al.*, 2022;

Coradi *et al.*, 2015). Employees frequently engaging in deep collaboration were more dissatisfied with the workspace. Therefore, WES must be considered within the broader context of the preference for on-site work and the office space suitability for collaboration.

We make two significant contributions to the design of collaborative work in general, especially in the context of office design. First, we empirically validate the proposed classification of collaborative activities. As noted, various authors have theoretically discussed the relevance of different collaborative activity types to office design (Steffen and Schulze, 2020; Appel-Meulenbroek *et al.*, 2015; Maarleveld and Been, 2011; Robillard and Robillard, 2000), yet an empirical validation was missing. This article fills this gap by showing that collaborative activities can be theoretically derived and are empirically stable.

A noteworthy contribution of this classification is the distinction between coordinative and deep collaboration activities. Despite the widely discussed necessity of deep work for individual activities (Newport, 2016), deep collaboration was overshadowed by the emphasis on focused individual activities. Previous research, with some exceptions, has primarily overlooked this distinction (Robillard and Robillard, 2000). Yet, some results show the need for differentiated collaborative spaces. For example, workers frequently engaging in deep collaboration were less satisfied with the work environment. Given the effect of team communication on performance (Maarleveld and Been, 2011), office designs tailored to the specific needs of the deep collaboration activities could boost this relationship. By distinguishing between these forms of collaborative activities, we contribute to the dialogue on enhancing office design to support collaboration.

Second, this study expands previous research on determinants of WCB, which focused primarily on personal characteristics and environmental factors (Appel-Meulenbroek *et al.*, 2022; Tagliaro *et al.*, 2022; Olson, 2002) by considering the role of collaborative activities' characteristics. The latter have proven more impactful on WCB than personal characteristics and environmental factors.

Practical implications

The findings have practical implications for office designers and organizational leaders. By understanding the patterns of collaborative activities, organizations can design workspaces that cater to the employees' unique needs and thus foster effective collaboration. The study deepens the understanding of the WCB's determinants and informs decisions regarding remote work policies.

Office design should support collaborative and individual work. Office spaces as organizational resources can potentially changing communication patterns (Rashid *et al.*, 2006). Yet, while efforts have been made to enhance comfort and safety in the workplace, knowledge about how office design influences collaboration is still in its infancy (Elsbach and Bechky, 2007). We inform a differentiated design of physical environments for collaboration. For once, the strong preference for collaborating on-site suggests that despite the change in remote work patterns and technological advances, employees still value physical proximity, especially for deep and spontaneous collaboration.

Employees engaging more often in deep collaboration are less satisfied with the environment. While the study does not pinpoint the cause, the lack of adequate spaces for deep collaboration might be a mitigating factor. Collaborative spaces are often limited to sedentary meeting rooms, which might suit coordination but not deep collaboration. Collaborative settings need redesigning. Non-sedentary settings lead to better information elaboration and better group performance (Knight and Baer, 2014). Given the importance of collaborative problem-solving, organizations need dedicated spaces with flexible furniture

arrangements and technologies to facilitate the exchange of ideas and promote innovative thinking.

Before dramatically redesigning offices, we must consider whether transforming the office into collaborative spaces benefits all employees (Appel-Meulenbroek *et al.*, 2022). The participants in the second study spent about half their time engaged in individual activities (41%), more than the total time spent working from home or elsewhere (32%). This indicates that employees worked on individual tasks on-site. Therefore, offices need to support both collaborative and individual work. This is critical, as distractions increase exhaustion and are associated with health risks (Appel-Meulenbroek *et al.*, 2020). Moreover, designing the workspace to accommodate individual work enhances individual and team performance (Olson, 2002; Maarleveld and Been, 2011).

Implications for attracting workers back to the office. Our findings assist managers create more compelling policies for returning to the office. Changing the office to support deep collaboration and spontaneous communication could incentivize for working on-site. Remote work policies should be guided by collaboration types requiring face-to-face interaction. The of the tasks and employees' preferences should be considered when evaluating the feasibility of remote work for different collaborative activities and the appropriate balance between on-site and remote collaboration.

Limitations and future directions

This study has several limitations. The findings are based on a specific sample and context, which may not be generalizable to other industries or organizations. Replication studies across different settings are needed. The study uses a cross-sectional design, capturing data at a specific point in time; longitudinal studies could reveal changes in workspace preferences over time. Data relie on self-reported measures subject to biases, which we mitigated by reducing the common method bias (Podsakoff *et al.*, 2012). Future research should use objective measures. The study examines personal characteristics, activity characteristics and WES to explain WCB but does not consider factors like policies or resource availability like digital tools. Further research could explore collaborative technology's role impact on WCB.

Conclusion

Differentiating between various types of collaboration contributes to the discussion around WCB, offering valuable insights for improving office design to support collaboration. The results show that some patterns of collaborative activity but not all impact WCB. The spontaneous communication's frequency and location preference and work environment satisfaction are among the strongest predictors of on-site work. Personal characteristics like gender, age, managerial position and commute time do not affect WCB. Considering these results, organizations can tailor office spaces to accommodate better the needs of collaborative activities. Despite limitations, the findings provide valuable insights into collaboration preferences and workspace choice.

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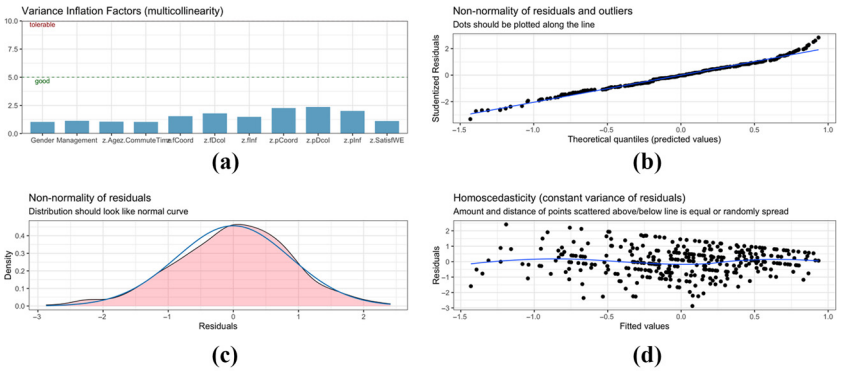
Appendix



Notes: The included factors show normal distribution of residuals, no sign of multicollinearity or heteroscedasticity. We assume a linear relation between variables

Figure A1. Assumption check for the performed regression analysis

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