Research Article

ICONARP
International Journal of Architecture and Planning
Received: 01.05.2025 Accepted: 11.09.22025
Volume 13, Issue 2/ Published: 31.12.2025
DOI: 10.15320/ICONARP.2025.341E- ISSN:2147-9380

ICONARP

User-Centered Design for Coworking Space Interiors

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Abstract

Coworking spaces, beyond being a physical space, represent a new organizational form and a new living style. Although coworking spaces have been widely studied by human sciences and managerial disciplines, academic studies on their spatial characteristics are limited and they are focused on some specific areas. This paper draws a multi-dimensional framework for spatial characteristics that play an important role in users' satisfaction and preference for a coworking space. In this context the paper aims to determine the user-centered spatial characteristics constituting a guide for interior design of coworking spaces and to introduce design considerations based on the research findings. The spatial characteristics are reclassified under technical, functional and behavioural characteristics (Post-Occupancy Evaluation method); an "user-centered design research for coworking spaces" structured with these characteristics is conducted, and design considerations based on research findings are introduced. The research reveals satisfaction and importance levels of spatial characteristics in coworking spaces; identifies the spatial characteristics with low performance that need to be improved; confirms the importance of spatial characteristics in users' preference for a coworking space and reveals that spatial characteristic preferences differ for users with different characteristics. The key findings regarding the user-centered spatial characteristics are “to consider the spatial configuration of noisy and quiet spaces according to the levels of interaction and privacy for users having different work motivations”, “to provide the arrangement of activity spaces, gathering spaces and workspaces (collaboration spaces and private spaces) allowing flexibility and individual control possibility” and “to create a cozy interior atmosphere with a strong IT infrastructure”. As a practical contribution, this paper provides useful information for owners, managers and designers of coworking space, in the process of renovating or establishing a coworking space.

Keywords: *Coworking spaces, interior design, post-occupancy evaluation, user-centered design, work environments*

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To cite this article: Karslı, U.T., & Aytıs, S. (2025). User-Centered Design for Coworking Space Interiors. *ICONARP International Journal of Architecture and Planning,* 13 (2), 688-708. DOI: 10.15320/ICONARP.2025.341

INTRODUCTION

The knowledge worker's constant digital connectivity often causes them to become increasingly isolated and deprived of the face-to-face contact that would support the creativity and innovation required by knowledge work. Face-to-face communication is powerful than other means of communication with regard to enabling " *context-specific, complex*" knowledge sharing that facilitates innovation and creativity (Stryker and Santoro 2012; Augustin, 2014), improving knowledge gained through serendipity, and triggering other forms of intimacy allowing knowledge exchange across coworkers and organisations (Mariotti, Pacchi and Di Vita, 2017). Coworking spaces characterised by social interactions, close contacts and learning opportunities based on face-to-face communication are third places where knowledge workers work outside the home and office. These spaces are innovative workplaces that respond to increasing demand by representing the most flexible form of workspace spectrum (Kojo and Nenonen, 2016), where creative or knowledge workers, often free-lancers or self-employed, share workspaces (Mariotti *et al.*, 2017). Coworking spaces are recognised as "*serendipity accelerators*" that offer a dynamic working environment for creative professionals and entrepreneurs who escape social isolation and seek opportunities for collaboration (Moriset, 2013).

Coworking spaces, which the number is increasingly growing, are frequently studied in sociology, business management, workplace psychology and geography fields. The aim of this research is to focus on the field of interior design, where the number of academic research on the subject is limited; to reveal the user-centered spatial characteristics that will determine a guide for interior design of coworking spaces and to introduce design considerations based on research findings.

LITERATURE REVIEW

Types of Coworking Spaces

Coworking spaces have been categorised by different disciplines and academic circles from different perspectives: Kojo and Nenonen (2016), in their research conducted in Finland, mention 6 types of coworking spaces: "*third places, public offices, collaboration hubs, incubators, shared studios and coworking hotels* ". Schmidt, Brinks and Brinkhoff (2014) define coworking spaces as "*innovation and creativity labs*" and categorise innovation and creativity labs under 5 types as a result of 53 case studies conducted in Berlin. These are "*grassroots labs, coworking labs, firm-driven innovation labs, academic-driven innovation labs* and *incubators and accelerators*".

"*Open coworking spaces*" can be public, semi-private or private in terms of the organisation. The term "open" here means that the coworking space is accessible to all users without any selection criteria or with low access conditions. This type of coworking space is the most common type that applies the philosophy of providing a democratic and egalitarian environment, which is the emergence and development

DOI: 10.15320/ICONARP.2025.341

philosophy of coworking culture. In this research, open coworking spaces are categorised as *third places* (Oldenburg, 1999; Kojo and Nenonen (2016), *coworking labs* (Schmidt *et al.*, 2014) and *open innovation and fabrication labs* (Schmidt *et al.*, 2014; Mariotti *et al.*, 2017).

"Academic-driven coworking spaces" are physical places that serve the university's mission to ensure the understanding, dissemination and utilisation of scientific and technological resources (Schopfel, Roche and Hubert, 2015) that will respond changing academic dynamics of the information society. In this research, academic-driven coworking spaces are classified as *learning centres* (Schopfel *et al.*, 2015) defined as a meeting space (Aabø, Audunson and Vårheim, 2010) and a social learning environment (Bilandzic and Foth, 2013), and *academic-driven innovation labs* (Schmidt *et al.*, 2014), which are candidates to replace traditional academic libraries.

"*Firm-driven innovation labs*" are often the physical spaces for innovation processes of large and multinational companies. Companies, research and development organisations, creative industries and universities are selected to use the infrastructure of the lab. In this way, users benefit from company-related resources, while the owners internalise the knowledge created in their labs (Schmidt *et al.*, 2014).

Spatial Characteristics of Coworking Spaces

A literature review is conducted in order to determine spatial characteristics of coworking spaces and they are reclassified under "technical, functional and behavioural" categories of Post-Occupancy Evaluation (POE) method, to create a multi-dimensional and systematic framework, that lacks in current literature, for user-centered design research of coworking spaces.

Lee (2018)'s research focused on preferred features of coworking space users, namely, "*consistent brand identity, access to outdoor nature, access to indoor natural elements, spatial layout and openness, availability of individual workspaces, availability of collaborative spaces, furniture-flexible arrangement, furniture quality, control of lighting, lighting quality, control of acoustic privacy, control of visual privacy* and *thermal comfort".* These features have not been categorised and have been grouped as "environmental features". Weijs-Perrée *et al.*, (2019) offered a broader perspective for characteristics that also included operational features of these spaces. According to literature review of Weijs-Perrée *et al.*, (2019), the physical characteristics of coworking spaces to prefer the space, are "*24/7 access, access to tools, resources and network, good accessibility, coworking host, atmosphere and interior aesthetics, diversity of tenants, event spaces, collaborative spaces, networking events and workshops, flexible workspaces, virtual platform, concentration rooms, flexible lease contract, kitchen spaces, meeting rooms, open layout*".

Sayers (2009)'s thematic analysis is not directly about the spatial characteristics of coworking spaces, however derives ten main themes, namely, *"informality, leisure, aesthetic, time (management), work-station,*

hospitality, innovate, transaction, escape and sociality" to explore how and why people use cafés as a third place to facilitate work and their productivity.

Waxman (2016)'s research explored the physical characteristics that support gathering behaviour and improve place attachment in coffees as a third place, and has found design considerations including "*cleanliness, adequate lighting, a view to the outside, comfortable furniture and appealing aroma*". According to Tuglu Karsli (2020), the design implications to encourage users to prefer a coworking space are, "*accessibility, sustainability, openness and permeability, flexibility, home-like spaces, collaboration spaces, concentration spaces, gathering spaces, technology-assisted spaces and activity-based spaces*". Van de Koevering (2017) researched the relation between characteristics of users and preferred coworking space features by using "*accessibility of the location, atmosphere and interior aesthetics (industrial, modern and homey), diversity in supply spaces, layout of the space, diversity of tenants, reception and hospitality, events and type of lease contract*" attributes and attributes levels.

Ondia, Hengrasmee ve Chansomsak (2019)'s research focused on "privacy", as one of the behavioural space characteristics of coworking spaces. The findings of the research demonstrate that characteristics of the physical environment including of barriers (*walls, screens, floor level changes or color changes*) and fields (*shape, orientation, size and environmental conditions*) are strong tools to regulate users' privacy within a coworking space (Ondia *et al.*, 2019). Privacy and interaction, as two sides of the same coin are two characteristics required for coworking spaces. Orel and Almeida (2019) analysed workplace ambiences in coworking spaces which encourage the possibility of interactivity between individuals and stimulating towards collaboration and their observations focused on two components of workspaces, namely, "the visual and spatial characteristic of observed workspaces (*layout of the space, commonly used functional elements and designed features*) and the mediation system operated by workplace managers (*tools that trigger the interaction, their effectiveness and responsiveness of individuals*).

Meinel, Maier, Wagner and Voigt (2017), conducted a systematic literature review on previous research on creativity enhancing workplaces. They determine categories and characteristics of the physical work environment influencing creativity as "office elements (intangible office elements: "*sound, light, colors, smell and temperature*" and tangible office elements: "*furniture, office equipment, decorative elements, plants, the presence of a window/view and materials and surfaces*"), spatial layout *(flexibility/customization/balance, privacy, office layout, complexity and office size*) and space types (*doodle, relaxing, disengaged and unusual/fun spaces)"* (Meinel *et al.*, 2017).

Remøy and Van der Voordt (2014) researched which property features are significant push and pull factors in relocation of creative organizations. In this research, building features are "*exterior*

DOI: 10.15320/ICONARP.2025.341

appearance, car parking, bike parking, routing, layout flexibility, comfort, space efficiency, interior appearance, technical state, recognisable user, building facilities, security, year of construction, energy performance and commodities logistic" (Remøy and Van der Voordt, 2014).

Categorisation of Spatial Characteristics

POE is an approach for the systematic evaluation of buildings some time after they have been constructed and occupied. POE focuses on building users' needs and provides insight into the results of past decisions related to design and the resulting performance of the space. This information provides a stable basis to create better spaces in the future (Preiser, Rabinowitz and White, 1988). Evaluation research such as POE determines the extent to which environmental features influence users' satisfaction or dissatisfaction; these studies have been conducted in offices since the 1980s (Vischer, 2008b). Vischer (2008a) defined performance categories as *physical, functional and psychological comfort*, while Sanoff (1977) proposed four performance levels: *functional, symbolic, economic and structural*. In Preiser and Vischer's (2005) book, performance criteria are stated as *physical, economic, functional, environmental and service performance*; while Lutzkendorf and Speer (2005) categorised these performance levels as *functional, social, technical, economic, environmental and process performance*. Preiser *et al.*, (1988) argue that the three main categories in building assessment are related to *technical, functional and behavioural* performance. This research uses the "technical, functional and behavioural" performance criteria of Preiser *et al.*, (1988), which are the most commonly used in the literature.

As a result of the literature review to determine a multi-dimensional and systematic framework for spatial variables for coworking spaces, the prominent spatial characteristics are reclassified under "technical, functional and behavioural" spatial variables:

- technical variables,

"daylighting, general lighting, task lighting, acoustic comfort, thermal comfort, natural ventilation, indoor air quality, cleanliness and hygiene, social distance, conservation of energy and resources, IT infrastructure, access to sockets and individual control possibility"

- functional variables,

"location, accessibility, space dimensions, circulation areas, ceiling height, flexibility, furniture dimensions, comfort of furniture, adjustability of furniture, architectural program and spatial layout"

- behavioural variables,

"openness, transparency, hospitality, encouraging serendipity, informality, visual privacy, acoustic privacy, concentration, design aesthetics, brand identity, natural elements, visual connection with nature and interior style".

RESEARCH

The research is conducted to determine the user-centered spatial characteristics constituting a guide for interior design of coworking spaces. The research aims to reveal satisfaction and importance levels of spatial characteristics in coworking spaces; to identify the spatial characteristics with low performance that need to be improved; to confirm the importance of spatial characteristics in users' preference for a coworking space and to reveal that spatial characteristic preferences differ for users with different characteristics. In this context, the research questions addressed in the user-centered design research for coworking spaces are as follows:

- What are the performance levels of spatial characteristics of coworking space?

- Is there a statistically significant relation between satisfaction levels with spatial characteristics and overall satisfaction levels?

- Is there a statistically significant relation between users' motivations to use the space and the importance levels of spatial characteristics?

The user characteristics of coworking spaces are investigated with the "demographic characteristics" of the users and the "characteristics related to users' usage of coworking space". The technical, functional and behavioural variables in the POE approach are adopted in the classification of spatial characteristics (Figure 1).

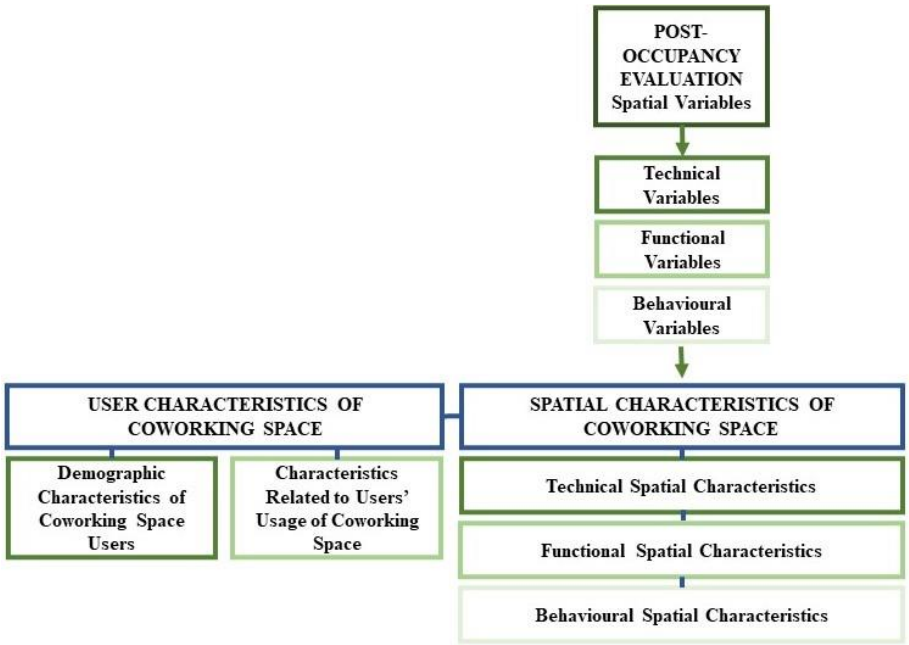

Figure 1. Conceptual model of the research.

The participants of the research are the users of the coworking spaces. The term "user" here includes not only the "customers" who receive service but also the employees (managers, business owners and employees) of the coworking space. The research is conducted based on the voluntary participation of the participants.

DOI: 10.15320/ICONARP.2025.341

Survey

The survey used as data collection tool consists of 2 sections and a total of 41 questions. In the first part of the survey, user characteristics are investigated with "demographic characteristics" (*gender, age, educational level, income status, employment status and employment sector*) and "characteristics related to users' usage of coworking spaces" (*location of coworking space, accessing mode of coworking space, type of coworking space, user role in the coworking space and user motivation for working in coworking space*) questions (Figure 2).

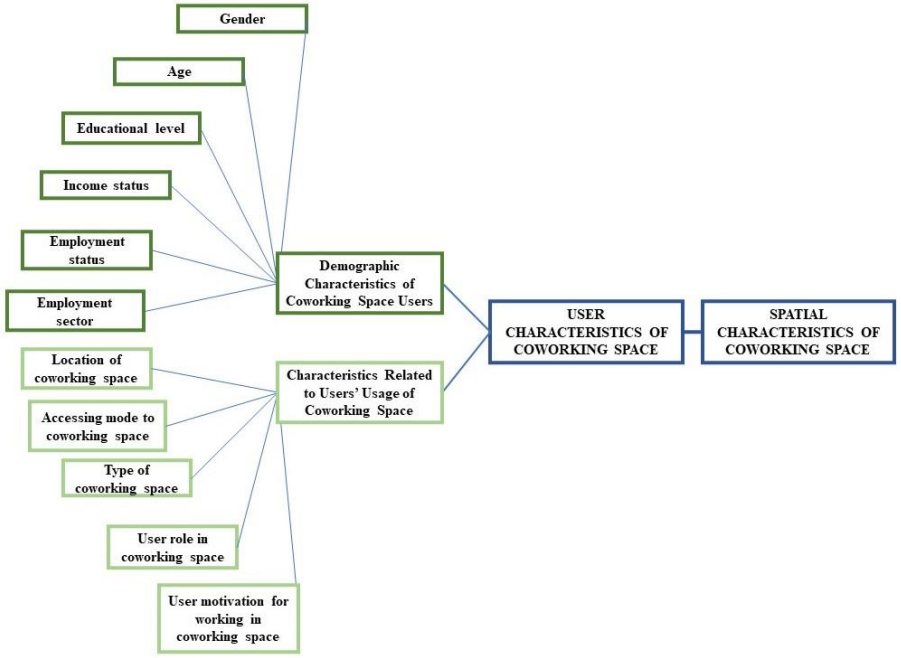

Figure 2. User characteristics.

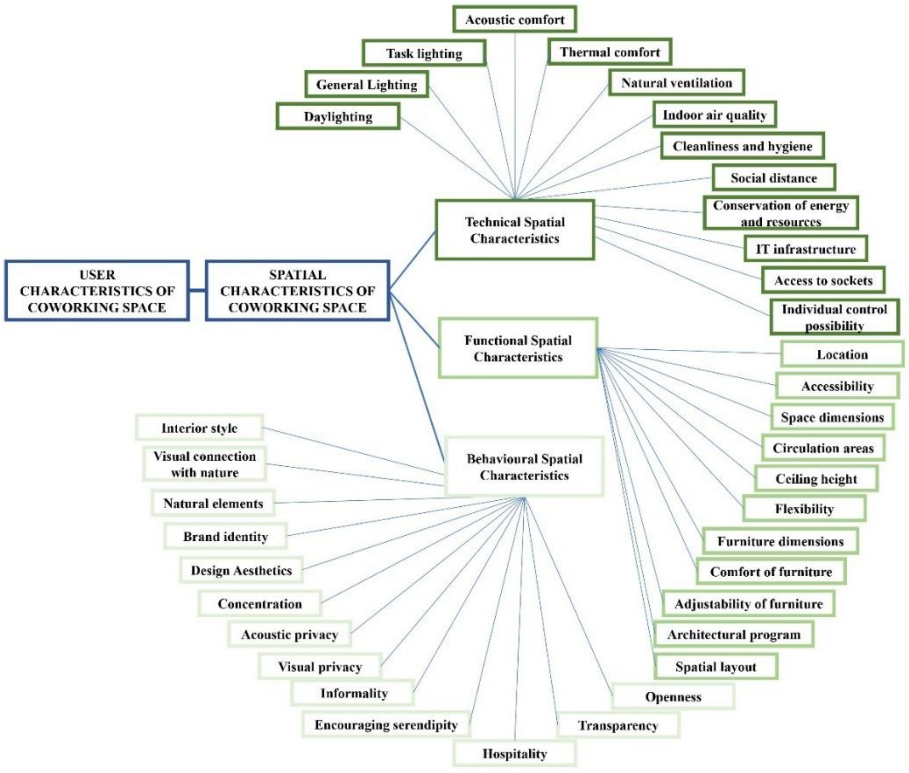

Figure 3. Spatial characteristics.

In the second part of the survey, spatial characteristics are investigated with questions under three sub-sections: technical, functional and behavioural characteristics (Figure 3).

In each sub-section, the participants are asked to rate on a 5-point Likert scale, their level of satisfaction with the spatial characteristics of their most frequently used coworking space and the level of importance of spatial characteristics of their ideal coworking space. At the end of the survey, there are questions to measure the users' overall satisfaction with their most frequently used coworking space and the level of recommendation to their friends/relatives.

Before the data collection process, the contact information of coworking spaces operating in Türkiye are searched on Google, on coworking space web sites and coworking communities web sites in order to access the survey participants, and an invitation letter requesting their collaboration for participation in the research and delivery of surveys to their users is sent to the e-mail addresses of 90 coworking spaces, along with the user-centered design research survey in coworking spaces. The survey is created and submitted online.

Analysis

The data obtained from the surveys are analysed with SPSS Statistics 28 package program. Descriptive statistical analyses are applied to the data for evaluating user characteristics and spatial characteristics. Gap analysis is performed to analyse the differences between the importance and satisfaction levels of spatial characteristics for determining the spatial characteristics with low and high performance. Correlation analysis is applied to determine whether there is a significant relation between satisfaction levels with spatial characteristics and overall satisfaction levels. Finally, correlation analyses for "motivation to use the space" are conducted to compare the importance levels of spatial characteristics according to the "characteristics related to users' usage of coworking space (motivation to use the space)" that may be determinative in coworking space interior design. Reliability analyses are performed for all scales.

User characteristics-demographic characteristics

The survey is submitted by 152 coworking space users. The gender distribution of the participants is balanced; 52.6% of participants are female and 46.1% are male. 2 participants did not want to specify their gender. The age distribution ranges between 18 and 62, with a mean age of 33.92 years and a standard deviation of 10.75.

The educational level of the coworking space users in the sample is generally high. 38.8% Of the participants are bachelor's program graduates, 33.6% are graduate program graduates, 22.4% are associate degree program graduates, and 5.3% are high school graduates.

The income status of the participants ranged between 1 and 9 on a 10-point scale, with a mean of 6.38 and a standard deviation of 1.54. Almost half (47.4%) of the coworking space users in the sample work full-time;

DOI: 10.15320/ICONARP.2025.341

24.3% are students and 20.4% are self-employed. The number of part-time (3.3%) and non-employed (4.6%) participants in the sample is small. The working sectors of the participants are very diverse. The top four most represented sectors are education (30.2%), design/art (16.4%), IT (13.8%) and marketing/consultancy (13.8%).

User characteristics related to coworking space use

The most frequently used coworking spaces are located in 21 different cities in Turkey. More than half (54.6%) of these places are located in Istanbul, the most populous city in Turkey, 11.2% in Ankara, the capital city, 7.2% in Izmir and 4.6% in Antalya. 35.5% of the participants access the place by public transport, 33.6% by car and 21.1% on foot. Only 1.3% of the sample users access the venue by bicycle.

The most frequently used coworking space types of the users in the sample are coworking labs (30.9%), third places (28.9%) and learning centres (22.4%), respectively. The number of users of firm-driven innovation labs (7.9%), open innovation and fabrication labs (5.9%) and academic-driven innovation labs (3.9%) is lower. 68.4% of the 152 participants are customers/members who receive services in the space. 21.7% of the participants are employees, 5.9% are place owners and 3.9% are place managers.

The last questions aimed at determining the characteristics of the users regarding the use of coworking space are related to the motivations of the users to work in the coworking space (5-point Likert scale). The highest mean values among these seven motivations are group work motivation (M=4.20, SD=1.13) and individual work motivation (M=4.03, SD=1.24). Access to technology motivation (M=2.80, SD=1.45) and engaging in hobbies motivation (M=2.81, SD=1.49) are below the average.

FINDINGS RELATED TO THE RESEARCH QUESTIONS AND DISCUSSION

Research Question 1: What are the performance levels of spatial characteristics of coworking space?

The level of satisfaction of the users with the spatial characteristics of the coworking space they most frequently use and the level of importance of spatial characteristics of their ideal coworking space (5-point Likert scale) are analysed and the performance of these characteristics is determined depending on the difference between the importance and satisfaction levels (gap analysis).

The level of satisfaction with the spatial characteristics

Participants are generally satisfied with the space characteristics of the coworking space they most frequently use. Among the **technical characteristics**, the characteristics with the highest level of satisfaction are "IT infrastructure (M=3.93, SD=1.12)", "access to sockets (M=3.89, SD=1.20)" and "cleanliness and hygiene (M=3.81, SD=1.19)", while the characteristic with relatively lower satisfaction level is "acoustic comfort (M=3.40, SD=1.17)". Among the **functional characteristics**, the

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characteristics that users are most satisfied with are "ceiling height (M=4.32, SD=.95)", "accessibility (M=4.20, SD=.99)", "location (M=4.10, SD=1.09)" and "space dimensions (M=4.07, SD=1.07)", while characteristics that are above average but have relatively lower satisfaction levels are "adjustability of furniture (M=3.48, SD=1.18)" and "architectural program (M=3.07, SD=1.18)". Among all the spaces evaluated under the "architectural program" characteristic, the most satisfied spaces are *wc* (M=4.04, SD=1.13), *outdoor space* (M=4.02, SD=1.32), *large open workspace* (M=3.91, SD=1.18) while the spaces with low satisfaction levels are *recording studio* (M=2.63, SD=1.41), *fun space* (M=2.78, SD=1.43) and *meditation room* (M=2.85, SD=1.48). The **behavioural characteristics** that users are most satisfied with are "openness (M=3.99, SD=1.11)", "interior style (M=3.90, SD=1.01)" and "transparency (M=3.81, SD=1.10)". Although the level of satisfaction is above the average, the characteristics that are lower than the other characteristics are "visual privacy (M=3.07, SD=1.20)" and "acoustic privacy (M=3.07, SD=1.21)".

Participants are generally satisfied with the "spatial layout (M=3.95 SD=1.01)", which is one of the functional characteristics of the coworking space. An analysis of the differences of the satisfaction levels of the participants according to the spatial layout of the space shows that the satisfaction levels of the users of the combi-plan layout (M=4.28, SD=.86) are significantly higher than those of the users of the open-plan layout (M=3.73, SD=1.07).

When the satisfaction levels of all spatial characteristics are examined, the most interesting relation is that the technical characteristic with the lowest satisfaction levels is "acoustic comfort" and the lowest behavioural characteristics are "acoustic privacy" and "visual privacy". This may be due to the fact that more than half of the participants are users of coworking spaces with open-plan layout (54.6%), which are disadvantageous in terms of visual and acoustic privacy. The fact that the satisfaction of the users of combi plan layout is higher than that of open-plan layout may be due to the acoustic and visual privacy variable. These findings support the organisation of open collaboration spaces as well as workspaces with different levels of silence and privacy in coworking spaces.

The level of importance of spatial characteristics

For the participants, all spatial characteristics of the ideal coworking space are generally important. The high level of overall importance supports the fact that the spatial characteristics questioned in this survey are important issues to be considered.

Among the **technical characteristics**, the characteristics with the highest level of importance are "access to sockets (M=4.59, SD=.73)", "IT infrastructure (M=4.54, SD=.77)", "cleaning and hygiene (M=4.53, SD=.68)" while the characteristics with a relatively lower level of importance compared to other technical characteristics are "conservation of energy and resources (M=3.99, SD=.91)" and "social

DOI: 10.15320/ICONARP.2025.341

distance (M=4.11, SD=.93)". The fact that the three most satisfied technical characteristics and the three most important technical characteristics are the same, positively supports the assertion that users prefer spaces with the spatial characteristics they attach importance to.

Among the **functional characteristics**, the characteristics with the highest level of importance are "accessibility (M=4.66, SD=.67)", "location (M=4.52, SD=.80)", "comfort of furniture (M=4.51, SD=.77)", "spatial layout (M=4.47, SD=.65)" and "space dimensions (M=4.47, SD=.77)". Among all the spaces evaluated under the "architectural program" characteristic, the spaces that users find the most important are *wc* (M=4.64, SD=.68), *outdoor space* (M=4.45, SD=.87), *kitchen+café* (M=4.32, SD=.91), *open private workspaces* (M=4.30, SD=1.06) and *large open workspace* (M=4.28, SD=1.08). Among all the spaces evaluated under the characteristic of "architectural program", the spaces that the users find the least important are *recording studio* (M=2.37, SD=1.41), *fun space* (M=2.51, SD=1.38) and *meditation room* (M=2.70, SD=1.42). These three spaces are also the spaces with the satisfaction levels of the users are the lowest. Analysis of the relevant responses of the spaces with the lowest satisfaction level shows that the "not available/no idea" option (*recording studio* (93/152), *fun space* (94/152), *meditation room* (91/152)) is in the majority. The importance levels may be low due to the fact that these spaces are specific spaces that users use for hobbies, recreation, reflection and relaxation, and that these spaces are not sufficiently functionally arranged in the types of coworking spaces most frequently used by the most represented users in the sample (coworking lab, third place, learning centre) or that users consider these functions other than the working function as secondary needs.

For the participants, "spatial layout (M=4.47, SD=.65)" among the functional characteristics of the coworking space is generally very important. In the research, the users preferred coworking spaces with combi-plan layout (70.4%) rather than open-plan (19.7%) in their ideal coworking space. The reason for this may be that they prefer the freedom to move from large open workspaces that encourage collaboration to private rooms that provide visual and acoustic privacy when needed.

Among the **behavioural characteristics**, the characteristics with the highest level of importance are "interior style (M=4.41, SD=.74)", "concentration (M=4.35, SD=.99)" and "design aesthetics (M=4.34, SD=.88)". Although important, the characteristics with a relatively lower level of importance compared to the other characteristics are "encouraging serendipity (M=3.76, SD=1.24)" and "brand identity (M=3.82, SD=1.28)".

The most popular interior styles of the coworking spaces used by the participants are "modern (n=74)", "cozy (n=70)" and "industrial (n=37)". However, the most preferred interior styles for the ideal coworking space are "cozy (n=105)", "modern (n=76)", "green (environmentally friendly) (n=51)" and "home-like (n=43)". "Industrial (n=29)", which is often referred to as one of the most cited interior styles in the coworking space

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literature, has lower rates. “Historic (n=19)", “vernacular (n=12)" and “rustic (n=6)" are the least preferred interior styles. In their ideals, most of the participants prefer to work in a coworking space that creates a sense of home comfort and intimacy rather than a formal office or an isolated home. This motivation may be the reason why "cozy" and "home-like" interior styles, where comfort and convenience are at the forefront, are most preferred.

The performance levels of spatial characteristics

An analysis of the differences between the importance and satisfaction levels of the spatial characteristics (gap analysis) revealed that all of the technical, functional and behavioural spatial characteristics have relatively low performance as the difference is above 0 and these characteristics should be improved.

Among **the technical characteristics**, "acoustic comfort (M=.95, SD=1.23)", "individual control possibility (M=.95, SD=1.38)", "natural ventilation (M=.92, SD=1.18)" and "indoor air quality (M=.91, SD=1.16)" are the characteristics that require the most attention due to their lowest performance.

Among **the functional characteristics**, "comfort of furniture (M=.70, SD=1.19)", “adjustability of furniture (M=.65, SD=1.33)" and "architectural program (M=.65, SD=1.00)" characteristics show lower performance compared to other characteristics. Among the spaces evaluated under the architectural program characteristic, the spaces with relatively low satisfaction despite the high importance levels of the users are found to be *enclosed and separate private rooms* (M=.90, SD=1.32), *personal storage area* (M=.84, SD=1.70), *open private workspaces* (M=.67, SD=1.11).

Among **the behavioural characteristics**, "acoustic privacy (M=1.14, SD=1.44)", "visual privacy (M=.89, SD=1.48)" and "concentration (M=.88, SD=1.38)" are the characteristics that require the most attention due to their lowest performance among other behavioural characteristics.

According to gap analysis, the most remarkable relations are between the technical (acoustic comfort and individual control possibility), functional (enclosed and separate private rooms, personal storage area and open private workspaces) and behavioural (acoustic privacy, visual privacy, and concentration) characteristics with the lowest performance. Suggestions to improve the performance of all of these characteristics may include organizing open large working environments supported by enclosed and separate private rooms and open private workspaces that would also meet the visual and acoustic privacy needs of users, and that would facilitate concentration and focus by minimising noise and distraction. To design workspaces providing more individual control over indoor conditions and equipped with personal storage areas would also allow users to personalise their workspace according to their needs.

DOI: 10.15320/ICONARP.2025.341

Research Question 2: Is there a statistically significant relation between satisfaction levels with spatial characteristics and overall satisfaction level?

Participants are generally satisfied with the coworking space they use (M=3.89, SD=0.94) and generally recommend it to their friends/relatives (M=3.86, SD=1.01).

Correlation analysis is performed to investigate the relation between the users' satisfaction levels with spatial characteristics and their overall satisfaction levels with the coworking space. In the analysis, Pearson correlation coefficient *r* and significance value *p* values are calculated and compared. There is a significant and positive relation between the satisfaction levels and overall satisfaction levels. The strongest relation is observed between "individual control possibility (r=.51, p<.01)", "IT infrastructure (r=.50, p<.01)" and "cleaning and hygiene (r=.46, p<.01)" in **technical characteristics** and "spatial layout (r=.65, p<.01)" and "flexibility (r=.62, p<.01)" in **functional characteristics**. The strongest correlation is observed between the satisfaction levels for *lobby-cozy seating area* (r=.59, p<.01), *personal storage area* (r=.58, p<.01)" and *large open workspace* (r=.57, p<.01) spaces questioned under the characteristic of architectural program among **the functional characteristics** and the overall satisfaction level. In **behavioural characteristics**, the strongest relation is observed in "interior style (r=.69, p<.01)", "hospitality (r=.65, p<.01)" and "design aesthetics (r=.61, p<.01)". Accordingly, the level of satisfaction of the users of the coworking space with these characteristics increases, the overall level of satisfaction with the space increases. With a larger sample, these correlational trends may become more evident and provide more information about the characteristics that should be considered in future design decisions.

Research Question 3: Is there a statistically significant relation between users' motivations to use the space and the importance levels of spatial characteristics?

One of the most important objectives of user-centered design research for coworking spaces is to investigate the differences between user groups in terms of their spatial characteristic preferences, which have a high potential to be determinant in the interior design of these spaces. In this regard, the significant relations between user's levels related to 7 motivations to use the space and importance levels of spatial characteristics are analysed with correlation analysis and the findings are discussed separately for each motivation:

Individual work motivation

Analysing the relations between the participants' individual work motivation levels and their importance levels of spatial characteristics, the most significant and strongest relations with respect to other characteristics are observed to be "access to sockets (r=.30, p<.01)" within **technical characteristics**; "spatial layout (r=.31, p<.01)" within

functional characteristics; *open private workspaces* (r=.28, p<.01) and *phone booth* (r=.28, p<.01) among the spaces evaluated under “architectural program” and, "interior style (r=.39, p<.01)" within **behavioural characteristics**. These findings emphasise that users which use the coworking space for individual work prefer to work in an open and personalised workspace while feeling the presence of others, with a pleasant atmosphere, equipped with easily accessible sockets, and with a phone booth that provides acoustic privacy.

Access to technology motivation

Analysing the relations between the participants' access to technology motivation levels and their importance levels of spatial characteristics, the most significant and the strongest relations with respect to other characteristics are observed to be the "IT infrastructure (r=.29, p<.01)" "access to sockets (r=.27, p<.01)" and "individual control possibility (r=.29, p<.01)" within **technical characteristics**; *makerspace* (r=.28, p<.01) and *reception* (r=.28, p<.01) among the spaces evaluated under “architectural program” and "spatial layout (r=.34, p<.01)" within **functional characteristics** and "interior style (r=.28, p<.01)" within **behavioural characteristics**. These findings emphasise that users which use the coworking space for accessing technology care about quality of IT infrastructure, individual control possibility, the presence of a cozy makerspace that contains technological equipment and devices such as 3D printer, CNC machine, etc., and a reception where they can receive consultancy about the activities and devices.

Creating job opportunities motivation

Analysing the relation between the participants' creating job opportunities motivation level and their importance levels of spatial characteristics, the most significant and the strongest relations with respect to other characteristics are observed to be "IT infrastructure (r=.27, p<.01)" and "individual control possibility (r=.28, p<.01)" within **technical characteristics**; *seminar area* (r=.39, p<.01) and *lobby-cozy seating area* (r=.39, p<.01) among the spaces evaluated under the “architectural program” and "space dimensions (r=.35, p<.01)" within **functional characteristics**; and "encouraging serendipity (r=.35, p<.01)" and "brand identity (r=.36, p<.01)" within **behavioural characteristics**. These findings can be interpreted as a user with a high level of motivation to create job opportunities cares that the coworking space has a large lobby-cozy seating area that acts as a mediator in meeting, chatting and developing new business ideas with other co-workers, and a seminar area with a strong IT infrastructure and teleconferencing facilities that host various activities that increase communication between users. If this type of user is a freelancer, may care about the professional environment and brand identity offered by the space in terms of strengthening the sense of belonging to the coworking space.

DOI: 10.15320/ICONARP.2025.341

Access to activities motivation

Analysing the relations between the participants' access to activities motivation level and their importance levels of spatial characteristics, the most significant and the strongest relations relative to other characteristics are observed to be "IT infrastructure (r=.28, p<.01)" and "individual control possibility (r=.39, p<.01)" within **technical characteristics**; *seminar area* (r=.40, p<.01), *photocopier-printer* (r=.40, p<.01) and *workshop area* (r=.39, p<.01) among the spaces evaluated under "architectural program" and "space dimensions (r=.40, p<.01)" within **functional characteristics**; "brand identity (r=.29, p<.01)" and "encouraging serendipity (r=.28, p<.01)" within **behavioural characteristics**. These findings may indicate that a user with a high level of motivation to access activities prefers a coworking space that hosts events (workshops, conferences); that has a seminar area and a workshop area with sufficient dimensions; that has a strong technological infrastructure and that offers individual control. This type of user also attaches a high level of importance to the fact that the coworking space has spatial characteristics that encourage serendipity and knowledge sharing with other coworkers having common interests.

Group work motivation

Analysing the relation between the participants' group work motivation levels and their importance levels of spatial characteristics, the most significant and the strongest relations relative to other characteristics are observed to be the "IT infrastructure (r=.21, p<.01)", "access to sockets (r=.21, p<.01)" and "individual control possibility (r=.35, p<.01)" within **technical characteristics**; *seminar area* (r=.30, p<.01) and *photocopier-printer* (r=.31, p<.01) among the spaces evaluated under "architectural program" and "spatial layout (r=.40, p<.05)" within **functional characteristics**; and "visual privacy (r=.19, p<.05)" within **behavioural characteristics**. These findings may support the suggestion of organising also seminar/group working spaces for coworking space users with high group working motivation, which are equipped with up-to-date technological equipment and devices, and supporting visual privacy that ensure the confidentiality of the group project.

Engaging in hobbies motivation

Analysing the relations between the participants' engaging in hobbies motivation levels and their importance levels of spatial characteristics, the most significant and the strongest relations with respect to other characteristics are observed to be the "individual control possibility (r=.23, p<.01)" within **technical characteristics**; *makerspace* (r=.38, p<.01) and *workshop area* (r=.27, p<.01) among the spaces evaluated under "architectural program" and "flexibility (r=.22, p<.01)" within **functional characteristics**; and "encouraging serendipity (r=.25, p<.01)" and "interior style (r=.21, p<.01)" within the **behavioural characteristics**. These findings may support the suggestion of organising a makerspace and/or workshop area within the coworking space, for users who are highly motivated to engage in their hobbies, that provide

individual control possibility. These findings also emphasise that this type of user prefers a friendly/cozy coworking space that is arranged with flexible/transformable spaces that support meeting with users having common interests.

Working in an informal environment motivation

Analysing the relation between the participants' working in an informal environment and their importance levels of spatial characteristics, the most significant and the strongest relations relative to other characteristics are observed to be the "IT infrastructure (r=.35, p<.01)" and "individual control possibility (r=.27, p<.01)" within **technical characteristics**; "*lobby-cozy seating area* (r=.36, p<.01)" and *kitchen+café* (r=.34, p<.01)" among the spaces evaluated under "architectural program" and "adequacy of circulation spaces (r=.28, p<.01)" within **functional characteristics** and "encouraging serendipity (r=.39, p<.01)", "informality (r=.39, p<.01)" and "transparency (r=.39, p<.01)" within **behavioural characteristics**. These findings support the organisation of an informal coworking space for a user who is highly motivated to work in an informal environment with spacious circulation spaces, a lobby-cozy seating area and a kitchen+café, which encourages communication and encounters between users thanks to transparent dividers that provide clues about the activities carried out inside the coworking space.

DESIGN CONSIDERATIONS FOR COWORKING SPACE INTERIORS

The user-centered design research reveals that the user is one of the most significant factors in design. The spatial characteristics, structured as a data collection tool in the research, can be used to collect user feedback to improve spatial performance of an existing coworking space or to design a new coworking space according to most important spatial characteristics for users.

As another contribution of the research, although there is no one design solution for all types of coworking spaces and for all types of users, the principles and design considerations put forward by synthesising the research findings can serve as a quick start guide for owners, managers and designers of coworking space, in the process of renovating an existing coworking space or establishing a new coworking space. According to the research findings, the high level of importance of all spatial characteristics of the ideal coworking space for the participants supports that the spatial characteristics questioned in this research are important issues to be considered. In this context, the technical, functional and behavioural variables in user-centered design research for coworking spaces are classified under 12 design principles that can be used for coworking space interior design (Figure 4):

Design principles based on **technical variables** include:

- Visual, acoustic and thermal comfort (daylighting, general lighting, local lighting, acoustic comfort, thermal comfort, individual control possibility),

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- Health and indoor air quality (natural ventilation, cleanliness and hygiene, social distance, indoor air quality),
- Sustainability (conservation of energy and resources) and
- Technology infrastructure (IT infrastructure and access to sockets).

Design principles based on **functional variables** include:

- Location and accessibility,
- Ergonomics of the space (space dimensions, circulation areas, ceiling height, flexibility),
- Ergonomics of the furniture (furniture dimensions, comfort of furniture, adjustability of furniture) and
- Architectural program and layout.

Design principles based on **behavioural variables** include:

- Collaboration and coworking (openness and transparency),
- Social interaction and communication (hospitality, encouraging serendipity, informality)
- Privacy and concentration (visual privacy, acoustic privacy and concentration) and
- Interior atmosphere (design aesthetics, brand identity, natural elements, visual connection with nature and interior style).

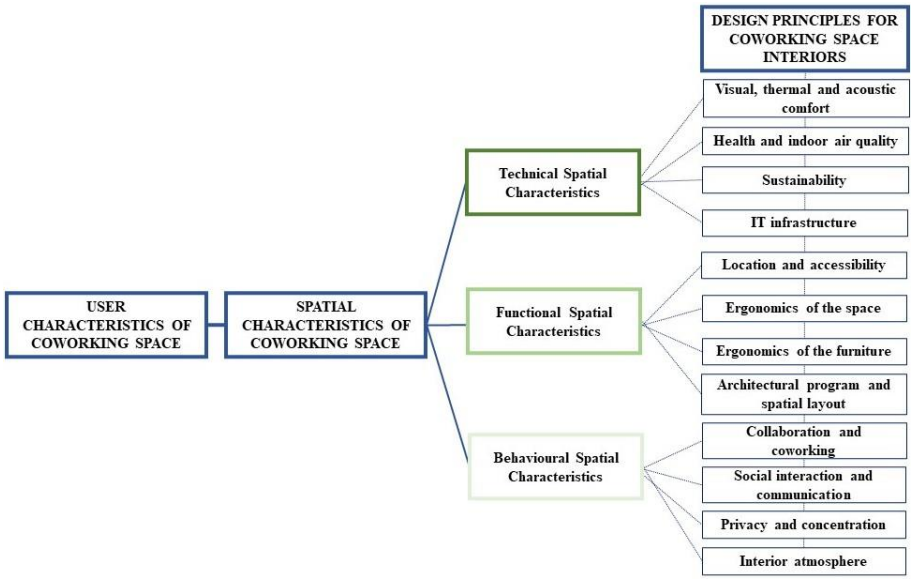

Figure 4. Design principles for coworking space interiors.

According to research findings coworking spaces are proposed to be designed with respect to different interaction and privacy levels that different users need (Figure 5). As privacy and interaction are considered as two sides of the same coin, “activity spaces”, “gathering spaces”, “collaboration spaces” and “private spaces” may be arranged at different levels between these two sides. Configuring the noisy and quiet spaces according to these levels and creating a cozy interior atmosphere with a strong technological infrastructure and individual control possibility over indoor comfort conditions can help the coworking space to be more preferred by the users. While organising spaces with different levels of privacy/interaction, the flexible, reconfigurable nature of the spaces (flexible space dividers, adjustable furniture, etc.) largely eliminates the

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need for organising separate spaces for each level; spaces can be reshaped according to different requirements in a short time and ensure that users can easily switch between these spaces according to instant task changes.

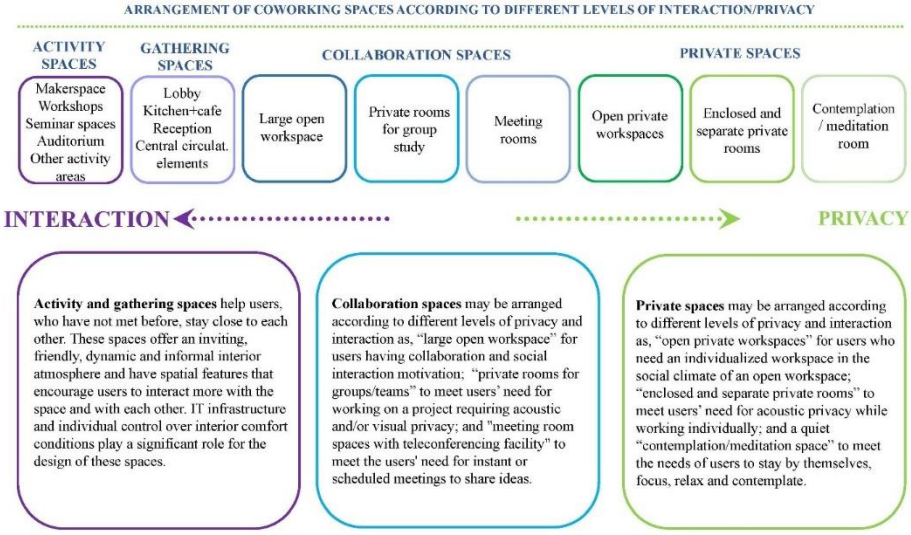

Figure 5. Proposal for organising coworking spaces according to different levels of interaction/privacy.

LIMITATIONS

The research is limited to using non-interactive methods (e-mail and online surveys) instead of interactive methods (on-site observation, face-to-face interviews and surveys) in coworking spaces. A total of 152 people participated in the online survey. Given the relatively small sample size, the research only provides information about the research participants. With a larger sample, the relational trends identified in the research may become more apparent and provide more information about characteristics that should be considered in future designs.

SUGGESTIONS FOR FURTHER RESEARCH

Coworking is a multifaceted fact and further research on coworking space design can be conducted through interdisciplinary collaboration. Interdisciplinary research can be conducted with teams of designers and social scientists to analyse the multidimensional nature of these spaces and to better understand user expectations and motivations.

CONCLUSION

The research revealed satisfaction and importance levels of spatial characteristics in coworking spaces; identified the spatial characteristics with low performance that need to be improved in users' coworking spaces; and confirmed the importance of spatial characteristics in users' preference for a coworking space by showing a significant relation between satisfaction levels with spatial characteristics and overall satisfaction levels. The findings also revealed that importance levels of spatial characteristics differ for users with different characteristics. In terms of practical use, the research makes two important contributions: "providing a quick multidimensional start guide for owners, managers

DOI: 10.15320/ICONARP.2025.341

and designers of coworking spaces" and "providing a research model base".

Representing a new way of work organisation and lifestyle today, coworking spaces are likely to remain popular in the coming years, but like all other workspaces, they will continue to evolve according to new information and collaboration technologies and changes in work organizations. The most important fact that will not change is that the most important source of inspiration and design data in the evolution of spaces is the users of the space. Although the data source will not change, it is obvious that user-centered design research models, strategies and tools will become more widespread and evolve with the support of technology.

NOTES

This article is based on the original research which is a part of Umut Tuğlu Karslı's PhD Dissertation Thesis supervised by Saadet Aytıs in Interior Architecture Program at Mimar Sinan University of Fine Arts in 2022.

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DOI: 10.15320/ICONARP.2025.341

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ICONARP – Volume 13, Issue 2 / Published: 31.12.2025