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# A spatial design guideline for supporting creativity at architectural firms

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**ABSTRACT**

In recent years, creativity has become a major focus in organizations competing to develop new products and offer new solutions to the community. Since then, the achitectural firms' workplace have been extensively studied as well as modified to support user creativity, productivity, and satisfaction by offering unique environments that create a social space which encourages collaboration, inspiration, and motivation. These changes are a response to the new connection employees have with their surroundings and how the spatial design facilitates the users' work performance and process. This new focus has played a major role in insuring the organizations' creative success and attracting selective employees. Investigation into the development of the office workplace designs reveals that certain spatial design features have been documented to have different effects on users. Spatial designs features such as colors, light, layout, furniture, plants, etc. become specific components that designers use to construct the workplace. By studying the layout qualities, tangible an intangible elements that compose the spatial environment in three architecture firms, this paper aims to investigate how the spatial design affects the users and how designers can improve the users' workplace experience through observations, interviews and questionnaires. A Post occupancy evaluation reveals that there are certain key features that designers and organizations must consider when designing new workplace environments for creative users.

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## Introduction

In an everlasting and developing community, people's behavior continues to change and adapt to new mentalities. The shift in how the community behaves, communicates and develops is caused by different factors such as economic, political and technological changes [1]. As a result, the workforce also adapts by offering creative ways to compete with new demands.

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Creativity itself emerges from the needs of the people and the economy that has changed the uneducated working-class, or physical laborers, and pushed the minds of millions toward the need to innovate and create in order to compete with new demands and trends [2].

Just as creativity is the new driving trait of the new workforce, it is necessary to find the architectural adaptation and response to the new needs of employees [3–5]. The workplace spatial design has been studied as well as modified to support user creativity, productivity, and satisfaction by offering a new environment to create a social space that encourages collaboration, inspiration, and motivation [6–10].

Since the starting point of built environments starts from architects, the aim of this research is to draw a comprehensive review into the existing research concerning the personal, social and spatial elements surrounding a creative architectural firm workplace (AFW) Figure 1. Therefore, the research will investigate the creative users and office environments and then highlight key differences found to be specific to the AFWs. The research will conduct a post-occupancy evaluation (POE) on selected case studies to investigate how spatial design elements impact user creativity in the workplace.

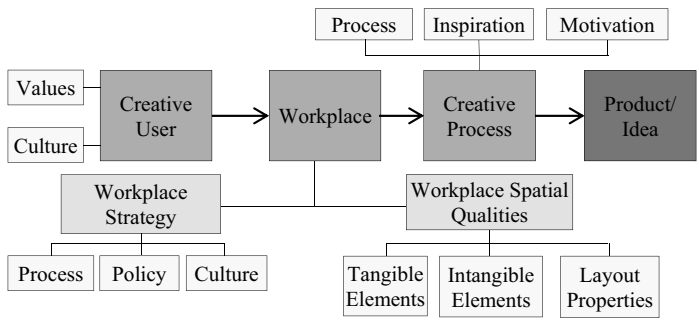



**Figure 1.** Creative workplace environment factors (by author).

## *The architectural firms' workplace*

Architectural firms can start from simple ideas that bring together like-minded people. These ideas can push a leader or partners toward the professional envelope and begin growing in employees, departments and office spaces.

According to Hietbrink [11], the firm goes through three types, firstly becoming a young growing firm with around five equal members, secondly, a medium growing firm that grows to around 30 employees with an established portfolio. Then, finally becoming the traditional firm that has between 30 and 100 employees with various departments and functions [11,12].

Previous research does not identify architectural design firms as a separate category from other design offices (media, marketing, graphics, product, fashion, etc.). However, several studies concerning the architectural students' design studios have successfully highlighted certain elements specific to architects' spaces that can hinder or enable their work process and in turn their creativity [4,13–15].

Architecture design studio has a unique material character – the space includes larger working surfaces, sketches, physical models, prototypes, etc. that help users express and collaborate their ideas [16]. Shaqour (2021) [17] conducted research on 42 students that attempts to highlight certain key features and their importance to architecture students. The research conducted an investigation by observing the case studies and then implementing a questionnaire that identifies the importance index for the layout, colors, noise, light, furniture, materials, etc.

### *The creative user*

The sole instinct of humans proposes a pursuit of creativity in our lifestyle. Creativity is a phenomenon that 'involves many people from differing disciplines, working together to deconstruct problems, and create effective solutions. The creative process involves filtering through mass amounts of ideas to produce a series of cohesive ideas, resulting in some form of creative output' [3,10].

Florida refers the creative users as the creative class community. The creative class is users who are professionals in engaging through complex problem solving that require independent judgment and education to function, achieve and solve issues according to their field. The creative class prospers in places of economic development which involves three main characteristics – technology, talent and tolerance [1–3].

The environment, social activities and personality characters – or values – are codependent variables that encourage creative users [18]. A diverse, rewarding, flexible, stimulating and secure environment that encourages communication, collaboration, peer review and offers focus zones to users to adapt to different individual values or moods such as being open, motivated and challenging [19–22].

## The workplace strategy

The workplace strategy is what defines the management of the workplace. The relationship between the organization and the employees directly influences their behavior, satisfaction and work process [23–25]. Such strategies include the workplace culture and the work process [26].

Leaders are challenged to resolve critical issues that encompass employee work processes and general working conditions to create a work environment

that boosts morale [27]. Actions that revolve around the workplace culture refer to surveillance of managers on users, peer review between users, reward given for accomplishment, freedom to work according to users' preference, and the challenges given by the organization [10,24,28–30]

Haynes (2008) [31] establishes four metaphors that help understand different office work processes in project-based organizations: socialization, externalization, combination and internalization. Users are spending more and more time on individual work while the percentage of time collaborating decreases. Peter (2018) [32] further discusses the types of interaction and how the sharing of knowledge occurs in each through the time spent in the workplace and the 4 metaphors previously mentioned by [33].

A private research agency that examines how users spend their time in the workplace revealed that users consume most of their time in socializing, learning, collaborating or working alone. Figure 2 These activities become important considerations to the spatial design of the workplace [34].

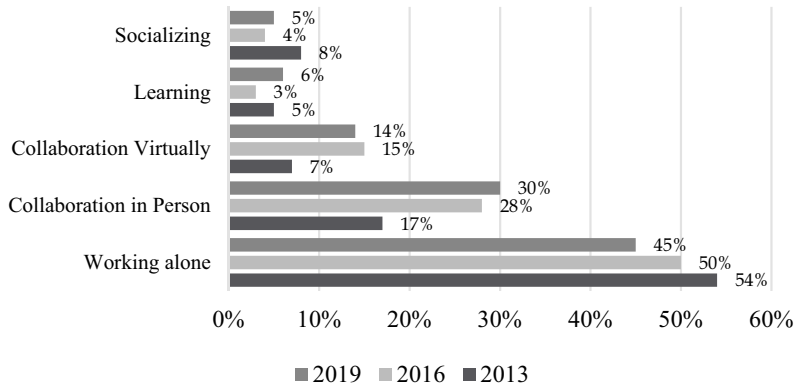



**Figure 2.** Creative workplace environment spaces [36].

## Spatial qualities

The AFW spatial environment surrounds the elements that compose the user perception and behavior. The study of the effect of spatial design on users allows architects to determine what materials, light settings or even acoustic people tend to prefer in certain places such as their workspace and why they favor, for example, wood in the interior. This, in turn, creates a whole different perspectives as to the spatial design of any interior. Previous research examines the workplace through three criteria; layout properties, tangible elements and intangible elements [35].

### Layout properties

Layout qualities underline the situation of the office plan. The qualities refer to the character, form, circulation, flexibility and spaces that are in the layout. The elements were found to be crucial to understanding how the shape of the layout orients, locates, expresses, and adapts to the creative users [35].

### Character

The office environment can be used to establish brand character and style, as well as a tool to attract and retain quality staff [36]. Studies report that personalization of space for the sake of user satisfaction allows for high levels of well-being and therefore enhances productivity [37]. This individualization further expresses the sense of belonging and freedom by creating a personal imprint that identifies the users' existence in the workplace [38].

### Layout form

A survey that examines user preference to the workplace layout form revealed that environments that are mostly open but provide ample private space enhance effectiveness and spatial experience [34] Figure 3. The ability to transition between private and public shared spaces allows the layout to accommodate and align with the users' preferences and work processes. Creating different activity spaces allowed the office to different user emotions.

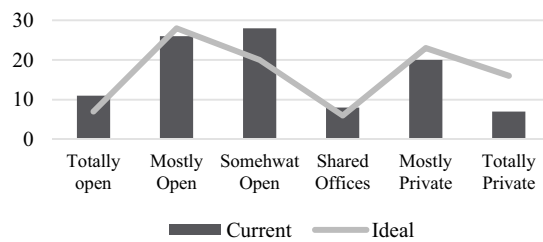



**Figure 3.** Ideal and current space ratio [34].

### Flexibility

Considerations to the spaces and layout of the office must satisfy cultural, personal, cultural and social needs [39]. The adaptability of spaces allows and encourages unique work processes specific to new targets as well as extending the functionality and, for example, the size of a space [35,40].

### Tangible elements

Tangible elements are the physical properties of a spatial design which resemble visible elements that, combined, create the environment in which we live. This segment discusses crucial elements in the workplace and how they express certain characteristics that induce creativity.

### Furniture

Furniture in the office workplace can be used to resemble homes to create a more casual and comforting expression. Soft materials and geometry increase user well-being and productivity in achieving tasks by allowing users to spend more time using the furniture [41]. Unconventional furniture is also utilized in new office spaces with an aim to stand out and surprise employees and clients. These types of furniture often utilize unfamiliar materials, shapes, and colors in inappropriate uses in order to expand the visual expression of the furniture as well as create a unique artistic element in the space [10].

### Plants

Environment and behavior researchers have found that exposure to natural elements can have a positive psychological benefit to users [42]. Due to their colors and geometry, natural materials resemble mostly positive memories to users and enhance the cognitive experience [9,40,43]. Using plants has been proven to reduce stress and enhance the positive mood that leads to creativity in the workplace in several studies implemented on 81 participants [44–46]. Results revealed that performance and productivity only increased in an office that utilizes a moderate number of plants to avoid over congestion.

### Tools and equipment

Office equipment refers to tools that are utilized by users to help facilitate their work process and achieve tasks. This equipment can be low- or high-tech objects that can encourage the expression of ideas in a collaborative setting or help users to a specific activity [6]. Although the type of equipment is subjective to the organization, work process, and tasks required, it is important that appropriate tools and resources are offered to the users [47,48]. Access to high-tech equipment improves user efficiency; however, it is more economic that organizations provide shared equipment to reduce costs [40]. Low tech tools can refer to recreational or expressive tools such as Lego, physical exercise, puzzle or even model making [10,24,49].

## Materials

In correlation to user experience and studies regarding creativity, a study [27] indicates the importance of carefully choosing materials that suit the workplace design and intended expression of the space. Research shows a positive correlation between natural materials (left unhindered by external finishes) to be more enhancing to creative performance [3,35,48,50]. Lee et al. (2007) [43] also found that a creative workplace design strategy should include natural materials such as wood, stone, and copper as they have a more 'appealing visual textural property than typical smooth surfaces of manufactured materials' [51].

## Intangible elements

Tangible properties define how all the components are manipulated to affect the human experience and behavior. These abstract/meta-physical properties include the identity of the space, colors, light, etc. This chapter discusses how these intangible elements affect space.

## Light

Research highlights that natural daylight is favored over artificial light in office spaces [52]. This allows a more even illumination of space where materials can reflect light [9,27]. In some cases, it is the distance to the windows that has a more positive effect on users who reported adequate lighting and views [53]. It has also been suggested that windows should cover at least 20% of the wall area [54].

In terms of artificial light, a study [55] concluded through an examination of user logical reasoning, verbal communication, and memory solving capabilities that certain settings were most suitable; Table 1 '*analytical thinking, including calculation and echoic memory skills, was facilitated by cool color and normal illuminance lighting (300 lx, 6000 K). The warm color at the normal illuminance level (300 lx, 3000 K) and bright cool color lighting (2000 lx, 6000 K) induced a higher positive mood than did bright warm color lighting (2000 lx, 3000 K)*' [55].

**Table 1.** Light setting variation research results.

| Source | Lighting parameters | # | Results |
|---|---|---|---|
| Baron et al. (1992) | ILL: 150, 1500 lx; CCT: 3000, 3600, 4200, 5000 K | 15 | Dim warm light enhanced positive mood while dim cool, and bright warm light induced more negative affect |
| McCloughan et al. (1999) | ILL: 300, 800 lx; CCT: 3000K, 4000 K | 16 | Cool light, high illuminance level increased negative mood |
| Knez (1995) | ILL: 300, 1500 lx CCT: 3000, 4000 K | 24 | Cool light increased negative mood of females and decreased negative mood of males |
| Hsieh (2015) | ILL: 75, 150, 780, 1500 lx; CCT: 2700, 3000, 4000, 6500 K | 20 | 2700 K induced more positive mood |

### *Colors*

McCabe, a research-based design architect, stated that 'bright colors evoke and stimulate excitable behavior while other darker colors will subdue these emotions [56]. Ceylan et al. (2008) states that the combination of cool colors, in a brightly lit room with plants, is associated with a space with high creative potential. "Users did not prefer offices with mainly warm colors; such environments may be too stimulating" [35]. Offices with high creativity potential had more cool colors; cool colors are calming'. Contradicting studies, on the other hand, stated that cool colors had a significant negative correlation with creative potential [50]. Environments with a primarily cool color temperature were not perceived to be conducive to creativity [27]. It is evident that color expressions are circumstantial to the user perception and psychology, yet any sterile environment without colors has a negative effect on creativity [35].

### *Noise*

In office locations, studies reveal that noise, the 'inharmonious combination of numerous sound components', can also be the cause of negative mood that hinders concentration and increased stress [57,58] Table 2. The noisy environments are mostly caused by the open office plan and the absence of walls, barriers and privacy to increase communication and circulation [33,59]. Zhang (2011) [60] conducted a study on 223 participants in office workplaces, reveals that exceeding 45 dB can also be appropriate. In a study of two office workspaces that have noise levels above 55 dB, only 30% of the survey participants reported dissatisfaction with the noise levels. The researchers further explain that the human brain and body can become accustomed to noise levels helping them 'discriminate and de-emphasize background meaningless noise'.

## Method

The research adopts a qualitative approach through observations and questionnaires to gain multiple perspectives and a more detailed understanding of social, spatial, and emotional phenomena that occurs in the AFW [61].

The research adopts the literature review findings of local case studies to confirm, validate and explain how users are reacting to different workplace environments and how different elements have different effects that can be used to create a successful work environment.

**Table 2.** Noise effect on users [58].

| User Disorders | Noise level, [dB] |
|---|---|
| Threshold of hearing | 0 |
| Quiet area | 20–30 |
| Inconvenience to the rest and physiological effects | 40–50 |
| Intellectual working capacity decrease | 50–60 |
| Decreased routine work capacity | 60–70 |
| Failure to focus and little intellectual work | 70–80 |
| Unable to work, psychophysiological disorders | 80–90 |

Architectural office compromised of architects in Egypt provide a suitable pool of participants that have background knowledge of spatial design [62]. Three local case studies located in Cairo, Egypt, are selected according to the following: (1) participant number greater than 30. (2) Not less than 250 $m^2$. (3) Recently designed – up to 5 years. Case studies that meet these criteria are Mimar ($n = 36$), Studio Five ($n = 32$) and Dar Al Mimar Group ($n = 42$).

As such, the research utilizes a POE as a suitable research method to implement an analysis and investigation of the built environment through data collection and surveys using interviews and questionnaires.

## Data collection

The data collection process is composed of three different observations of the case studies. The first part examines the aim, vision and history of the organization to give a brief introduction of the workplace environment in perspective. The second part of the observation notes the given spatial design elements that compose the workplace; The properties and types of spatial design elements are examined and referenced to the literature review and analytical case studies implementations using designated equipment placed at key locations; lux meters are placed on desks and the average measurements are calculated, decibel meters are placed throughout the day and average measurements are gathered. Several other recording devices are used for observations such as photographs, drawings, annotated diagrams and videos. Third part of the observation focuses on the behavior, movement, interactions, work process, time consumption, etc.

## Survey

The research conducts two survey methods to ensure data quality; a face-to-face interview and a questionnaire directed toward all users of the AFW. The face-to-face interview serves as a pilot study to ensure the quality and adequacy of the questionnaire. These questions are in accordance to the parameters and categories found to be variables to the users' work environments previously used by researchers [7,10,51]. The parameters help map and probe the user experience in the workplace setting and determine affecting factors according to the literature review.

The role of the questionnaire is to (1) document how each environment affects users differently, (2) verify answers found in focused interviews, (3) measure user rating to elements of the environment and (4) identify common reactions among users from the social and spatial environments.

## Case studies

### *Mimar*

Mimar is a leading construction and design company established in 1997 in the Gulf region. In 2016, it opened its first office in Cairo which consists of 100 employees in a 375 m2 workplace. The new headquarters in Egypt are in Waterway Mall, New Cairo. Mimar's office is located on the second floor of Waterway, a shopping complex, that overlooks Mohamed Nagib Axis and intersects several other main streets. The office is mostly composed of an open space with rows of workstations occupied by 32 users. The office utilizes mostly formal furniture except for the reception area that contains red, blue, and green chairs. These chairs contrast the mostly neutral color scheme of the offices that is composed of gray, white, and black colors (Figure 4). There are no plants and regular equipment such as printers, projectors, TVs are similar to standard offices. The main materials are carpet (used for flooring), glass reflective surfaces, and laminated tabletops.

*Light* intensity throughout the space was measured at 5000k and 700 lm with natural light coming from the south direction throughout the day with the main source being ceiling fixtures (Figure 4). Colors varied throughout three locations in the office. A vibrant red, blue, yellow and green set of furniture welcomed users and contrasted the gray, white and black color scheme of the open office (Figure 4).

The ceiling encompassed red steel beams which were further reflected in the enclosed rooms which had red meeting tables and chairs surrounded by black reflective walls. Placing a sound level meter throughout the day at the open office space measured through the between 50 and 55 dB and peaking at 60 dB unlike meeting rooms which – empty – were at 40–45 dB. In terms of scale, the height of the recessed ceiling was the same throughout all the rooms; however, in the open office space, the black ceiling is exposed at a height of 3.5 m.




**Figure 4.** (Left to right) open workstations, reception space, lighting plan analysis (by authors).

### *Studio five*

Studio Five is an architectural firm established by five designers that came together in 2013. Studio Five headquarters in Egypt aim to tailor customer identity; the firm focuses on creating a unique character design emergent from a concept consistent with the customer's vision and aim. The organization creates a combined form of structural hierarchy that insures an egalitarian workplace among the users at the office.

Studio Five office is located on the fourth floor in Zamalek that overlooks the Nile River. For circulation, the entrance leads users to reception marked by a sitting area which leads to a long corridor that directs users to several rooms. The largest room is designated to the open workplace which consists of 32 workstations. Other spaces in the office include a small kitchen, a meeting room, and a lounge that is used for various activities (Figure 5). Furniture at Studio Five is divided into two categories; formal furniture found at the workstations that have no partitions and informal furniture found at the reception and lounge (Figure 5). The office does not include plants or low-tech equipment except for walls that are used as whiteboards for task coordination. High-tech equipment includes standard TV, WIFI and desktop PCs. For materials, soft black curtains are placed in front of the reflective black walls in all rooms except for the open-office space. Marble is used for the corridor, kitchen and reception, while carpet is used for the lounge and meeting rooms unlike the natural wood flooring of the open-office space.

The lighting at office is composed of spot-light fixtures from the ceiling at 2700k with variable intensity that can be controlled via a smartphone application to be set at 100, 200, 400, 800 lm (Figure 5). There was no natural light able to enter the space as all the windows were tinted black. The office uses the same color scheme throughout the office. Black and gray were used differently throughout the office; however, this contrasted the open office space where white walls and brown wooden flooring are used. The noise measurements were around 50–60 dB throughout the day in the open office space and 40–50 dB throughout the rest of the office.




**Figure 5.** (Left to right) lounge, open workstation area, lighting plan analysis (by authors).

The maximum height of the ceiling was 3.2 m, while concrete beams dropped to 2.6 m accordingly. The maximum height reflected the exposed ceiling infrastructure which composed the wiring, fixtures, HVAC and fire extinguishers. The meeting room and lounge areas composed a recessed ceiling of perforated steel panels at a height of 2.9 m.

### *Dar Al mimar group*

DMG was established in the 1990s as an engineering and contracting company in the Middle East. Most known for the construction of Mountain View, the company also strives toward innovative and unique designs with the help of its 900+ employees. The company's innovative and development department, which resembles the source of its concepts which later become designs, is in its office building in New Cairo.

The innovative and development department is situated on a separate floor in the 7-story building. The layout consists of the main office space surrounded by enclosed rooms for managers, meeting spaces and utilities. The character is mostly formal and carries elements consistent with the cubicle office space in the 1970s – the gray carpet flooring, white walls and ceiling, glass and cool lighting. However, the main office space attempts to transcend the generic design by introducing four unique spaces; the heart, body, soul and mind zones are spaces where the 50 employees can use during the day in the workplace. These zones are characterized by different colors, textures, and furniture.

Workstations which measured 1.2 m × 0.6 m with partitions on all-neighboring sides up to 1.4 m height resemble the formal furniture contrasted by informal furniture found at the 4 zones in the office. Sofa, high tables, and benches resemble unconventional furniture in the office at the heart, body, soul and mind zones (Figure 6). Only Artificial plants are used in highlighted areas such as the body zone (Figure 6) and reception area. High-tech equipment includes the standard TV, printers, workstation PC but




**Figure 6.** (Left to right) mind zone, body and meeting zone, lighting plan analysis (by authors).

also offers a training bicycle at the body zone. Low tech includes string puzzle games and book shelves surrounding the mind zone. Materials in the office space surrounded similar materials used in the standardized 1970s commercial workplace; textured carpet flooring, laminated workstations, ceiling panels and transparent glass with aluminum profiles. However, contrasting materials were used in each of the four zones such as natural wood, soft fabrics and artificial grass.

The lighting fixtures are placed among the ceiling panels and create an evenly lit environment for all workstations at around 600 lm and around 3700k. Natural light penetrated the side of the floor and used active shading devices to reduce glare. On the other hand, the four zones use different light settings; the heart and soul zones use less intensity at 500 lm, while the body and mind zones have brighter light fixtures of 900 lm at 3200k (Figure 6). The color scheme used at DMG uses a range of neutral and warm colors in the main elements of the open office. Gray and white can be found to compose the main objects in the space while contrasting yellow, green, blue, and pink are used only at the four previously mentioned zones.

The noise level varied between 45 and 55 dB in the open spaces while increased to 60 dB in the closed rooms when there were activities taking place. The ceiling scale throughout the floor varied according to the space; workstation spaces had higher ceilings while the four zones and corridors had lower ceilings.

## Results

After Analyzing information gathered from the literature review, observations, POE questionnaires and interviews, the following data was highlighted.

### *Layout properties*

The layout properties were a dominant trait that all users referred to when expressing their spatial design experience. Users directly stated their opinion on the arrangement of workstations and always preferred the availability of spaces (zones) for different activities.

### *Character*

During the focused interviews, all users struggled to express the character of the space. However, certain keywords for each office were gathered; users stated Mimar is clean, simple, elegant and contemporary; Studio Five is innovative, comforting, home-like or conspicuous; DMG is a modern environment, fun, creative, home-like, dynamic and comfortable. When comparing these keywords during interviews, the research found that contrasting and unconventional spatial elements expressed these keywords. For example, the light setting combined with the colors in Studio Five expressed conspicuousness and creativity.

### *Layout*

All offices included an open office space. However, it is noteworthy to mention that Mimar and Studio were constrained by the architectural plan of the office. Therefore, web form in Mimar, chain form in Studio Five and hub form in DMG are a result of adapting the provided office plan with the appropriate work process, strategy and space. More so, only users in Studio Five and DMG stated that the open office space was useful to the work process although users at Mimar found it disturbing due high noise correlated to the user per area ratio of 8 $m^2$ unlike the Studio Five with 13.7 $m^2$ and DMG with 17.1 $m^2$. DMG's office layout ranked highest according to users; interviewees stated '[I] liked the flexibility and size of the places I work … [I] can work outdoors, alone, in groups, while exercising … each space has a different mood'.

### *Flexibility*

Flexibility was not a significant element in large spaces when considering the number of users in the office. In spaces where area per user was significantly less, flexibility was much more important such as Mimar's foldable projection screen or Studio Five's multi-use lounge.

Eighty-six percent of users in Mimar stated that they have no specific place to go to for a break and did not change location where they work which is important to creative spaces [63].

### *Spaces*

Spaces within the offices were a crucial element all users in each case study cared for. Through the questionnaire, it was evident that users wanted missing spaces according to the literature review. Users in Mimar and Studio Five reported not having spaces for thinking, collaborating, connecting and stimulating which are important to the user experience and creative process.

## *Tangible elements*

The tangible elements were considered by most users as a more intimate spatial element that users most felt when engaging with the space individually. These elements required more attention from users to evaluate and express their opinion during the interviews.

### *Furniture*

Furniture characteristics relied mostly on two elements, the comfort and design. Through the focused interview, the research found different comfort levels that can exist in the workplace such as a couch and an office wheelchair. The design of the furniture also contemplated the colors and shapes of the rest of the office. Users were more attracted to colorful blue, yellow and

red furniture sets such as Mimar and DMG as well as comfortable furniture for social and meeting areas such as Studio Five and DMG.

User in DMG ranked furniture qualities the highest with a mean of 76% compared to 46–47% in Mimar and Studio Five. Table 3 They found various flexible furniture to be supportive to their needs and moods. DMG Interviewee stated, 'It's nice to use the sofas for an occasional talk and sometimes [we] use the colorful bean bags for long tasks because using the wheelchairs can be exhausting for our backs and necks over a long time'.

Workstations that had no partitions proved to have a lower probability of encouraging users to add personal items. Users found these personal items important to increase sense of belonging to the space. Partitions can also add focus according the face-to-face interview with DMG users.

### *Plants*

All users preferred having plants in the office space. However, certain spaces required more plants than others. During the focused interview, users mentioned they did not want to place these plants in the center but only at the entrance, corners, and surroundings.

Users in DMG were most satisfied with the number of plants in the office with 45% satisfaction rate Table 4.The type of plants did not create much difference; artificial plants created the same satisfaction rate as natural plants such as the grass wall in DMG.

### *Tools and equipment*

Mobile equipment and tools proved to play an essential role in the workplace. Laptops and tablets, for example, in DMG, encouraged users to move freely to different locations even working in the outdoor terrace. Other case studies were restricted to mostly desktop workstations and could only use TVs to present their work in designated areas. Games also encouraged users greatly

**Table 3.** Furniture positive qualities found by users.

| Answer Choices | Mimar (*n*=36) | Studio Five (*n*=32) | DMG (*n*=48) | Mean | Sd |
|---|---|---|---|---|---|
| Ergonomic shape | 55.56% | 47.62% | 80.95% | 61.38% | 12.49 |
| Comfortable | 45.00% | 76.19% | 76.19% | 65.79% | 10.25 |
| Flexible | 50.00% | 42.86% | 57.14% | 50.00% | 7.02 |
| Colorful | 38.89% | 19.05% | 90.48% | 49.47% | 19.67 |

**Table 4.** User satisfaction to plants in the office.

| Answer Choices | Mimar (*n*=36) | Studio Five (*n*=32) | DMG (*n*=48) | Mean | Sd |
|---|---|---|---|---|---|
| Extremely satisfied | 5.56% | 0.00% | 19.05% | 8.20% | 4.81 |
| Very satisfied | 11.11% | 9.52% | 45.24% | 21.96% | 10.51 |
| Neutral | 30.56% | 19.05% | 19.05% | 22.88% | 2.48 |
| Very dissatisfied | 41.67% | 47.62% | 9.52% | 32.94% | 6.09 |
| Extremely dissatisfied | 11.11% | 23.81% | 7.14% | 14.02% | 2.27 |

such as the foosball in Mimar and the string puzzle game in DMG. Users were able to release tensions, contemplate and socialize over such games on their free time. Low-tech equipment improved collaboration and coordination greatly; whiteboards were used in Studio Five and DMG to track progress and state ideas that invite peer review.

### Materials

Each office attempted to use matching materials and textures to contemplate the expression of the space. Carpets were a common material used to absorb sound and tolerate heavy traffic. Wood flooring in Studio Five contrasted the hard materials in the office to give priority and significance to the open office space which in turn reflected the more social environment. Reflective surfaces also encouraged the extensions of space such as Mimar's and Studio Five's walls. Users reported during the focused interviews that softer materials such as curtains and fabric used in social areas encouraged comfort like in DMG's heart and soul zones. In Studio Five, materials are left in their natural state which raised the ranking of materials as a significant highlighting element to the character of the space. On the other hand, DMG used negative impacting materials in dishonest states that still gave a positive impact because of the way it was used, such as the mind zone.

## Intangible elements

The intangible elements were easily evaluated by users as they were a background object that was continuously affected the human senses. Users were eager to express how their mind subconsciously and constantly receives the light, sound, colors, and noise.

### Light

DMG combined several light settings in the office which encouraged users to move more Adaptive light was very important in Studio Five and DMG which offered the customizable and flexible light setting according to users' preference and results in over 80% of users being satisfied or very satisfied Table 5.

Bright settings in cool temperatures caused users headaches and visual discomfort combined with the natural light exposure according to interviews and questionnaires in Mimar. Fifty percent of users were not satisfied Table 6

**Table 5.** User satisfaction to light settings.

| Answer Choices | Mimar (*n*=36) | Studio Five (*n*=32) | DMG (*n*=48) | Mean | Sd |
|---|---|---|---|---|---|
| Very satisfied | 8.33% | 47.62% | 50.00% | 35.32% | 10.55 |
| Satisfied | 16.67% | 38.10% | 33.33% | 29.37% | 5.05 |
| Neutral | 25.00% | 14.29% | 11.90% | 17.06% | 2.3 |
| Dissatisfied | 36.11% | 0.00% | 4.76% | 13.62% | 6.94 |
| Very dissatisfied | 13.89% | 0.00% | 0.00% | 4.63% | 2.89 |

**Table 6.** Users preference to light color temperature.

| Answer Choices | Mimar (*n*=36) | Studio Five (*n*=32) | DMG (*n*=48) | Mean | Sd |
|---|---|---|---|---|---|
| Warm (>4400k) | 61.11% | 9.52% | 66.67% | 45.77% | 14.71 |
| Cool (<4400) | 25.00% | 71.43% | 11.90% | 36.11% | 9.1 |
| Both | 13.89% | 19.05% | 21.43% | 18.12% | 2.79 |

Warmer settings in Studio Five reduced visual strain, however, and may have caused glare because they were mostly spot lights.

### *Colors*

Each case study attempted to use a certain color scheme according the designer's character of the space; black in Studio Five, neutral in Mimar and DMG. However, contrasting colors are introduced into highlighted – sometimes significant – elements; red in Mimar, white in Studio Five, and yellow in DMG. Colorful elements were very attractive to users in Mimar and DMG, but that did not conform with Studio Five which required more neutral grays or whites. The common color in all case studies was gray which was mostly used for carpet, concrete, or ceramic flooring.

Users were most satisfied with the various colors found in DMG with over 50% satisfaction rate Table 7; users stated that ' . . . the best thing is that there is a color for everyone- there are spaces that use certain accents like the mind space that has a lot of yellow'.

Studio Five also had a high satisfaction rate due to the calmness and continuity of the black scheme. Users stated 'its very surpising at first, but eventually you begin to understand how nice having a black scheme is . . . it's comforting, modern, and very flexible'.

### *Noise*

Noise was a major issue in Mimar because of the low sound absorbing materials (only carpets) combined with the user/area ratio of 8 m2. Other areas included similar noise levels, but the source and frequency of the sound were different. Songs in Studio Five became keynote sounds that were relaxing or motivational to users according to 74% of interviewees Table 8.

Offering different sound levels in different spaces is extremely important as found by questionnaires in all three case studies. Having spaces to focus, socialize, collaborate and meditate improves user comfort and

**Table 7.** User satisfaction to colors.

| Answer Choices | Mimar (*n*=36) | Studio Five (*n*=32) | DMG (*n*=48) | Mean | Sd |
|---|---|---|---|---|---|
| Very satisfied | 13.89% | 33.33% | 52.38% | 33.20% | 10.39 |
| Satisfied | 30.56% | 42.86% | 35.71% | 36.38% | 3.08 |
| Neutral | 41.67% | 4.76% | 7.14% | 17.86% | 7.29 |
| Dissatisfied | 8.33% | 14.29% | 4.76% | 9.13% | 1.17 |
| Very dissatisfied | 5.56% | 4.76% | 0.00% | 3.44% | 1.04 |

**Table 8.** User report to noise level.

| Answer Choices | Mimar (*n*=36) | Studio Five (*n*=32) | DMG (*n*=48) | Mean | Sd |
|---|---|---|---|---|---|
| Very Quiet | 0.00% | 9.52% | 14.29% | 7.94% | 3.44 |
| Quiet | 5.56% | 23.81% | 42.86% | 24.07% | 9.52 |
| Normal | 19.44% | 52.38% | 23.81% | 31.88% | 4.89 |
| Noisy | 47.22% | 14.29% | 14.29% | 25.26% | 6.62 |
| Very Noisy | 27.78% | 0.00% | 4.76% | 10.85% | 5.24 |

**Table 9.** Considerations to AFW design concepts.

| Considerations | | |
|---|---|---|
| Layout | Character | The character of the space is not always clear to users. However, different ranked elements highlight the style of the space differently. |
| | Form | Open office spaces facilitate collaboration however certain guidelines must be considered for noise, lighting, air quality and privacy. |
| | | One space divided into several zones with different spatial characteristics is preferred. |
| | | The mostly egalitarian positioning of users in web and hub formations adapts to teams and the work process of club and den model. |
| | Flexibility | Flexibility in small office area ratio to users is important to facilitate more activities (lounge in Studio Five and Projector in Mimar). |
| | Spaces | Spaces for stimulation, connection, thinking and sharing are required to improve the work process. |
| | | Spaces for eating, phone |
| Tangible | Furniture | Formal furniture for workstations should provide adequate privacy with partitions and enough space that can encourage adding personal items. |
| | | Informal Furniture invites social interaction with couches, armchairs and bean bags. These contrast the rest of the office with colors as well. |
| | | Ergonomic, design, flexibility, comfort should be considered to all furniture with respect to office design character. |
| | Plants | Plants are very important to reduce stress and should be located at certain areas indoor and outdoor according to the layout where users have clear sight from their workstations. |
| | Equipment | Mobile high-tech equipment encourages users to move more in the workplace with laptops and tablets. |
| | | TVs and a projector with easy sharing access allows presenting work for meetings or peer reviews. |
| | | Low tech equipment like whiteboards is important to facilitate sharing of information whether intentional or unintentional. |
| | | equipment like games, gyms, coffee machines, etc. offer services that can increase time spent at the office. |
| | Materials | Materials are circumstantial to the character of the space. Soft materials in social spaces are important. Wood is always preferred in significant areas to highlight importance. |
| Intangible | Light | Maximizing natural light is important to users but can cause glare. Majority of users prefer warm light temperature although some say it makes them sleepy. |
| | | Spaces with different light intensity and temperature is important. |
| | Color | Colors scheme should reflect the concept of the office design. |
| | | White colors can be used when combined with other contrasting colors to highlight elements or spaces. |
| | | Stimulating and relaxing colors are attractive to users. |
| | Sound | Sound varies according the source; whether it is keynote, signal, or landmark sounds. |
| | | Headphones are used in loud noise environments to increase focus. |
| | | Users want spaces with different noise levels. |

satisfaction as found in DMG. Users at DMG had the highest noise satisfaction rate, least disruption and lowest noise levels.

## Conclusion

Evidence from literature review indicates that the office design has an impact on user performance, satisfaction and in turn creative potential. Considerations to the creative user values, factors, and thinking process are affected by the workplace strategy and the spatial design. The workplace strategy considers the policies, work process and work culture which in turn create the social environment upon which the spatial design is based. The spatial design environment consists of three main points; the layout qualities, tangible elements and intangible elements.

Through observations, face-to-face interview, questionnaires and an evaluation, the research found different characteristics for the AFW environment that effect user creativity, satisfaction and productivity. Creating a flexible, free and collaborative social workplace environment by the organization through policies and activities to promote user communication and task engagement. Using spatial qualities that complement each other to express a certain character/mood and uplift user experience. Using different properties for the layout form, tangible and intangible elements can provide users with the workplace that promotes user creativity.

Results revealed various spatial qualities affecting the creative users' performance. Certain qualities were widely preferred to improve the workplace setting such as introducing plants at certain locations, specific light settings, preferred colors and furniture. The following table summarizes findings and considerations to construct the workplace environment according to in-depth analysis of the literature review and POE conducted on case studies Table 9.

### *Considerations to designers*

As firms' organization refer to designers to create the appropriate workplace, it becomes the designers responsible to carefully study several factors previously mentioned. The designer must construct a research-based design to ensure the success of the office throughout its lifetime. However, there are specific challenges to such a process; designs are based on styles which in turn are mostly based on trends. As trends are a temporary product, it is difficult to ensure the lifetime success of a peculiar office design. Therefore, designers must create temporary, adaptive and flexible office designs through access ceilings, raised access floors, gypsum walls, modular partitions, etc. which allow room for alterations, expansions and redesigns.

Designers must also work on the design closely with the users that are going to utilize the space; carefully understanding the demands, desires, processes and mentality of users should give the designer an image of how the office workplace is going to function as users move, think and collaborate through it. Designers must also leave room for personal additions that have been proven to add loyalty and comfort to users. Most importantly, designers must not prioritize the number of users over the quality of the space; each user should have the appropriate space required at the workstations, and the office should offer appropriately relevant activity spaces that are decidedly important for the work process.

- Create a research-based design based on users, organizations and office environment.
- Considerations to future expansions and adaptations in the office.
- Allow user input to the office design planning process to improve satisfaction and work process.
- Creating questionnaires to understand the users' specific needs
- Prioritize space per user over the number of users in the space
- Adding relevant spaces for decidedly important activities for the work process

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