

# In Search of Design Parameters for Well-Being and Creativity in Knowledge Work Environments

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*Contemporary knowledge working environments are rapidly evolving alongside the digital and virtual technologies used for knowledge work. Contemporary offices range from cellular offices with assigned desks to activity-based offices with shared-desk policies and location independent blended working. Furthermore, advanced technologies, such as intelligent and adaptive lighting, are being implemented in our everyday surroundings, including working environments. The changes require adaptation from both knowledge workers and architectural elements of the environments. We propose that knowledge work environments should be explored from user-centric point of view and we aim to elucidate how the physical design of the workplace enhances well-being, creativity and innovation of their users. The various parameters of knowledge work environments should be specified through architectural design process but also through ethnographic methods, which enable us to retrieve the parameters of knowledge work environments users deem important. Using both spatial design and functional design approach we will challenge the multidimensional problem field of designing collaborative knowledge work environments.*

**Keywords:** *knowledge work, creativity, well-being, collaborative knowledge sharing, activity-based office*

## BACKGROUND

Simply put, knowledge work requires surroundings that support both *concentration* and *communication*. However, combining those two features in the same environment has proven to be extremely difficult as, for example, low noise levels suitable for concentration differ from the level that is generated from face-to-face communication and collaboration. Finding solutions to combine the complex needs of various knowledge work character types and multiple ac-

tivities while maintaining communication landscape that supports collaboration is critical for the next generation knowledge work environment design. Also, understanding personal needs for environmental factors that support individuals' outcome. Holistic understanding of knowledge work environment is critical because perceived lack of privacy, acoustic problems and decreased confidentiality may affect users' satisfaction negatively and thus, instead of promoting well-being, creativity and collaborative

knowledge creation, perceived productivity and efficiency is decreased (Vishcer 2008; Van Yperen 2014)

Sharing creative ideas and implicit knowledge is often instrumental for generating successful innovations in organizations and enterprises. This, in turn, is dependent on well-being and sense of comfort the workspace generates for its users. Interaction, teamwork, creative goals and recognition of creative ideas are part of the social-organizational arrangement of knowledge work environment. Therefore, rather than designing a space for workstations; architects and organization heads should aim to construct environments that serve as *implicit knowledge mediums*. The physical settings of the space can encourage *exploration, collaboration and discussion*. Alternatively, the space can also carry *unspoken message of silence*, which may be critical enabler for concentration intense working. The space for communication and collaboration itself should support listening, sharing, presenting and comprehending knowledge, thus supporting the *flow of knowledge* through the space and its users (Aznavorian and Doherty 2011; Turner et al. 2013). In this article, we aim to approach the features of contemporary knowledge work environments from the point of view of well-being and creativity, which, in our opinion, are the critical enablers for innovation and sustainably successful organizations varying from small scale growth-oriented companies to large, established enterprises.

## CONTEMPORARY KNOWLEDGE WORK ENVIRONMENT TYPOLOGIES

One of the current paradigms of knowledge work environments is their mobilization alongside with the state-of-the-art virtual and digital mobile technologies. We are now free to move with our laptops and tablets into any nearby café, or choose to work at home. Contemporary offices take into account the blended working (i.e. time-independent and location-independent working) practices through non-assigned desk policies and activity-based workstation configurations (Van Yperen et al. 2014). Interestingly, and in total contrast to increased individual

freedom of choosing our desk location either on-site or off-site, several organizations value teamwork and collaboration. The teamwork practices typically involve different work phases requiring both collaboration and individual, high-concentration demanding tasks. The individual users' needs for collaborative environment and more private, distraction free environment has been critical paradigm work experts from various backgrounds have tried to solve.

The characterization of four different knowledge worker characters by Greene and Myerson (2011) describes contemporary knowledge work culture through knowledge workers' different need for their organizations' physical environment. The work tasks require different levels of mobility, communication and autonomy and thus, office environment should be able to respond to that. Shortly, Greene and Myers categorized four characters (presented in Figure 1): Anchor, Connector, Gatherer and Navigator. It is important to understand that all the four characters require workstation in the office either on daily basis or only occasionally. Therefore, creating a shared environment is a complex organizational and architectural design task.

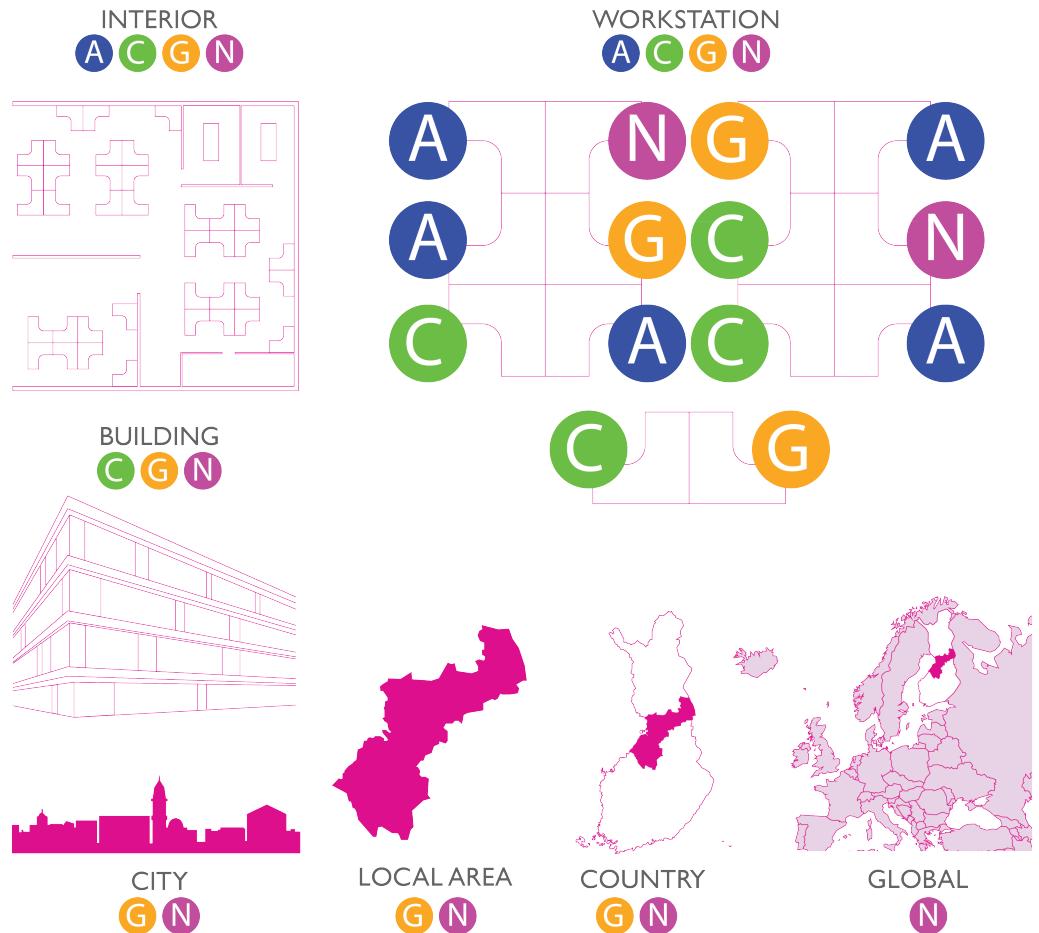
- **Anchor** - iconic office worker who is constantly present in the office. Low mobility and high need for comfort. High interaction. Anchor has vital role in knowledge transform in organization. Tasks often require concentration.
- **Connector** - spends only part of his days at his desk and interacts with people within the organization a lot. Work environment changes a lot during the day. Connectors often needs more visual tools to support their work and its creative processes than the clean-desk policy permits.
- **Gatherer** - interacts with people outside the office and brings back information into organization. Depends on off-site working through mobile and wireless technologies. Uses office for concentration and face-to-face collaboration. Gatherers' presence in of-

office requires good shared-desk opportunities, otherwise they rely on off-site blended working.

- **Navigator** - Rarely in the office, but highly experienced and beneficial for the organization. For organization and team to benefit from Navigators' presence requires good shared-desk opportunities and perceived feeling of being welcome.

To respond to the varying needs of collaborative knowledge sharing and teamwork, one knowledge work environment solution is the multi-space office typology, developed by Boutellier et al., which offers versatile selection of spaces, such as teamwork area, quiet zones, meeting rooms and informal hang-out areas (Boutellier et al. 2008). In essence, one concept provides high diversity of workstations for different activities that support transfer of tacit knowl-

Figure 1  
The four worker character types work on-site and off-site with different mobility levels: Anchor (A), Connector (C), Gatherer (G) and Navigator (N)  
Modified from Greene and Meyers, 2011.



edge by enabling more face-to-face interactions between researchers. Importantly, users have also the opportunity to withdraw into quiet areas for high-concentration tasks or alternatively feel free to collaborate and discuss without disturbing others (Boutellier et al. 2008). Further variations are office environments with non-dedicated desks, such as activity-based offices (Appel-Meulenbroek et al. 2011) or flex-offices (Bodin Danielsson et al. 2014). Fundamentally, activity-based and flex-office types aim for same workstation variety as multi-space offices in order to support different and changing work tasks. Furthermore, these two types of offices respond better to more mobile knowledge worker types, such as *gatherers* and *navigators*.

The most recent layer in contemporary knowledge working environment is use of various mobile and digital technologies. Several technologies have for long been routinely used in knowledge work, including *collaboration technologies* that enable on-site video-mediated distributed meetings and mobile technologies that enable off-site blended work (Van Yperen, 2014). On-site collaboration technologies usually require various sized screens for virtual face-to-face interaction. In addition to interactive, collaboration supporting, context, the collaboration technologies support online sharing, analysis and documentation (Issa et al. 2006). One of the emerging research fields related to knowledge sharing and collaborative work is *distributed user interfaces*. In this kind of user interface architecture, the components of knowledge or other material are distributed across different hardware devices in space and time. To support various peer-to-peer communication situations, Fisher et al. (2014) have envisioned scenarios of, for example, a display wall of multiple screens and multiple computers interacting with digital media, or alternatively, envision a situation where information is transferred from private device to a shared public display (Fischer et al. 2014). Subsequently, collaboration technologies set different needs for privacy in shared working environments and spaces and their current and future needs should be taken

into account while designing new working environments. There is very limited amount of research of how collaboration technologies are used in knowledge work environment. Virtual status updates, information sharing, brainstorming and presentations have different needs for both communication and information sharing (Marlow et al. 2016).

## WELL-BEING IN KNOWLEDGE WORK ENVIRONMENT

In knowledge work environments, sharing creative ideas and implicit knowledge is often instrumental for success of the organization. This, in turn, is linked to the well-being and sense of comfort the workspace generates for its users. Well-being and perceived job satisfaction in work environments can be assessed through physical environment and social environment, which includes both psychological and organizational aspects. Our *personal environment*, which we experience in our own unique manner, is comprised of and affected by both *social and physical environment* (Jaakkola 1998). There are several indoor conditions that have a direct effect on our health, comfort and productivity. It is essential to remove possible external physical and psychosocial stressors from working environment to support users' well-being (Bluyssen et al. 2011). Furthermore, improving the conditions in a manner that users' satisfaction for their environment is improved supports well-being and productivity in working environments. Understanding how ambient conditions (noise, lighting, air quality, thermal comfort), furniture layout and ergonomics (workstations, offices and shared amenities), and process issues affect comfort and satisfaction of the knowledge worker is important in studying and designing new knowledge work environments.

Figure 2  
Environmental comfort model presents how users' satisfaction and well-being can be divided to different levels of comfort. At the psychological comfort level occupants' satisfaction to their environment is highest and thus increases well-being and efficiency. Modified from Vischer 2008 and interpretations of comfort for lighting in the environment modified from Markkanen 2014.



### **Functional and psychological comfort in knowledge work environment supports well-being**

Users perceive their feelings of personal work environment through feelings, such as *sense of territory*, *ownership* and *belonging* (Vischer 2008). Discomfort affects negatively on satisfaction levels and decreases perceived productivity and knowledge sharing. Vischer (2008) defined in her *environmental comfort model* of workspace quality different levels of occupant satisfaction and well-being (presented in Figure 2) and their effect on working: In a working environment, where the physical conditions meet the level of functional comfort, users are able to conserve their attentions and energy for their work tasks. Elevating the user satisfaction and sense of control in their own environment (e.g. adjusting the level of lighting), users reach psychological comfort level, which has positive effect to the knowledge sharing and creativity through decreased territoriality (Vischer 2008).

We consider ambient factors, such as noise, privacy and lighting, important parameters in designing knowledge work environments that promote users' well-being. For example, *lighting* has central effect on the atmosphere of the space. During the office hours, the prevailing lighting conditions are typically an outcome of both natural daylight and artificial light. Daylight is typically perceived as a positive health-promoting factor in the knowledge working environments (Leslie 2003). The daylight varies in both color and intensity and thus, its dynamic nature positively influences on mood and stimulation (Van Bommel and Van den Beld 2004). When artificial lighting is considered through environmental comfort model, well designed lighting can fulfill both functional and psychological comfort levels and through increased aesthetic appreciation and satisfaction to the environment, lighting can increase workers' engagement to work and productivity (Veitch et al. 2013, Vischer 2008). When different parameters of lighting design are placed in the environmental comfort model (Figure 2) (Markkanen 2014), we can argue that rec-

ommended lighting levels of 500 lux (Van Bommel and Van den Beld 2004) ensures that working environment provides physical comfort for its user. Furthermore, favorable lighting for individual users affects positively works structure, complex cognitive appraisal and through work engagement, users' motivation towards work (Veitch et al. 2013).

## CREATIVITY AND INNOVATION IN KNOWLEDGE WORK ENVIRONMENT

Knowledge work tasks range from mundane tasks, such as storing and retrieving information, to tasks such as planning, analyzing, processing information and developing and designing products, which require high cognition level (Heerwagen et al. 2004). *Dynamic knowledge* and creation of new knowledge are continuous processes of increasing and updating the existing, personal or organizational, knowledge base and problem solving (Tyagi et al. 2015). *Knowledge creation processes* are indispensable for innovation and creation of new or improved variations of products and services are essential for sustainable competitive advantage of organizations (Esterhuizen et al. 2012). It is important to understand that creativity has different levels. *Eminent creativity* is relatively rare and the products of it have a major impact. *Everyday creativity* is daily problem solving and individuals' ability to adapt to change. Construction of personal knowledge and understanding is also defined as a creative process (Hennessey and Amabile 2010). *Innovation*, on the other hand, can be defined as the successful implementation of creative ideas and the number and frequency of creative ideas and innovations can be seen as the outcome of knowledge work. *Communication* is considered highly important action for creativity and innovation, which are eminently linked with each other: creativity is essentially idea production, which is a crucial stage preceding innovation. Innovation can be seen as a process, where the idea is implemented into product, service or a problem solution that is valuable for individual or a larger social group (Zhou and Hoever, 2014).

The layout of the work environment is highly

important because it affects interaction and subsequently knowledge sharing through peoples' movement and interaction in the space and through their co-presence. Cellular offices provide private spaces that support knowledge work that requires high levels of concentration in a distraction free environment. However, cellular office do not support interaction as efficiently as open-plan offices, where same space is shared by larger group. On the other hand, open-plan office does not support concentration (Rashid et al. 2005). Even though communication and collaborative problem solving is important for ideation, innovation and product development in organizations, knowledge workers often need privacy to think, to analyze and to reflect in order to build upon their existing knowledge (Heerwagen et al. 2004; van Sprang 2012). The interaction has been shown to be important also in different stages of product development. Weak ties created in an interdisciplinary multi-space office environment through chance encounters was shown to promote creative thinking and idea production and increasing productivity in early stages of discovery. Subsequently, strong ties formed by frequent encounters and communications increased tacit knowledge transfer in a dedicated workspace devoted for a team work during later phases of product development (Zoller and Boutellier, 2013)

### ***Knowledge sharing and creation of new knowledge***

SECI knowledge creation model is linked to both organizational structure and spatial architecture of knowledge work environment (Nonaka and Konno 1998, Boutellier 2008). SECI is an abbreviation of following four phases of knowledge transformation from tacit to explicit knowledge: *socialization*, *externalization*, *combination* and *internalization* (Nonaka and Konno 1998). When situated in multi-space environment, the steps of knowledge conversion can be considered as follows:

1. **Socialization** and face-to-face interactions enable sharing tacit knowledge between individuals. This occurs during interactions in

- spaces such as teamwork and break areas.
2. **Externalization** of the knowledge requires converting tacit knowledge into explicit to make it transferrable on peer-to-peer level in meeting rooms.
  3. **Combination** of knowledge occurs when the explicit information is shared on organizational level.
  4. **Internalization** of the new explicit knowledge into tacit knowledge occurs as the final phase of knowledge conversion, and this often requires concentration and silent working environment.

Sharing the knowledge appears to be vital for innovation and thus, it is important that architecture and atmosphere of working environments support interaction. Integral part of SECI model is also the concept *'Ba'*, which refers to specific time-space nexus that can occur in physical, virtual or mental space during interaction when new knowledge is created or bridges gaps in information (Nonaka and Konno 1998; Tyagi 2015). *'Ba'* lays foundation for all four SECI modes for informal, simultaneous and dialectical dialogues between individuals and among groups. For new knowledge creation to occur, it is vital to commit to spend time and energy on activities and interactions in *'Ba'*.

## **PERSPECTIVES OF KNOWLEDGE WORK ENVIRONMENT DESIGN PROCESSES AND EVALUATION**

Copious information on knowledge work environments has been published from the point of view of organizational knowledge creation and employee satisfaction, such as large self-reported research studies or review analyses of existing studies (Bluyssen et al. 2016; Wohlers and Hertel, 2016). Designing a workplace that enhances the performance and creativity is challenging. Understanding the requirements of workspace for creative thinking and collaboration gives designers more tools to aid the workspace design process. Nevertheless, from a de-

signer's perspective, the existing research does not give direct answers how to design a working environment that promotes both well-being and creativity, thus, providing a landscape that promotes privacy, concentration, communication and control over personal environment. Although we are not able to answer such complex design problem within this publication, we aim to elucidate tools to design innovation supporting knowledge work environments in growth-orientated companies within our research project InnoStaVa [1].

In our project we will use user-centric approaches to generate information of knowledge work processes and user experiences in their current workspaces. This information will be analyzed and design goals are defined to design new concepts of knowledge work environments, which better support creativity and well-being. These concepts will be tested 'in-the-wild' by constructing pilots in the premises of startup companies to evaluate the user experiences. The gathered information will be implemented in subsequent rounds of concept design and piloting. Through this interventionist manner, we will bring the test-bed of enhanced knowledge work environment to users.

Alongside the research-by-design approach for generating new concepts for creativity and well-being supportive work environments, we intend to generate a network of workspace parameters in order to understand how individual factors and their combinations affect to the knowledge work environments and their functional use. These parameters will be generated during the design phase of workspace concepts and also from the user experience data generated from the pre-analysis and evaluation of the current workspaces and pilot test environments of local startup companies.

## **WHAT CAN WE ACHIEVE THROUGH PARAMETRIC ANALYSIS OF KNOWLEDGE INTENSE WORK ENVIRONMENT?**

In the beginning of this paper we simplified the requirements of knowledge work environment into



Figure 3  
Network of  
parameters for  
well-being and  
creativity  
supporting  
knowledge work  
environment.

two words: *concentration* and *communication*. We also discussed briefly of well-being in knowledge work environment, creativity and knowledge sharing. In our research project we approach design of knowledge work environments in a holistic manner while acknowledging the impact of individual users' personal preferences regarding knowledge work supporting factors. One view of network of key parameters that affect well-being and creativity is presented in Figure 3.

In order to use contemporary knowledge work environment most efficiently and in a manner that supports both well-being and creativity, their users should demonstrate more choice-making, control and active workstation switching according to task-requirements. Users should also be able to adjust

ambient factors in the environment (lighting, level of privacy, noise) to their individual preferences and be able to work in distraction free environment when needed.

Activity-based offices with desk-sharing and multispace offices provide opportunities to switch workstation to meet the requirements of the work task. Surprisingly, not all knowledge workers use the opportunity to switch the workstation and thus their satisfaction to their environment is decreased. However, the individuals who switch several times a day have significantly higher satisfaction to their work environment. (Hoendervanger et al. 2016). Furthermore, regardless the desk-sharing policy, people tend to claim workstation with personal items while not using those (Appel-Meulenbroek et al. 2015). It

appears that negative effects of open-office environments with activity-based workstations could be reduced by informing how to use them in a manner that supports the working.

We propose here that analyzing how individual office environments are being used and understanding the users' personal and task-related needs could be used to organize the desk choosing and switching to support both concentration and communication and consequently increase both well-being and creativity in knowledge work environment. Knowledge workers use different digital applications daily to document their work tasks and meetings. Daily activities, such as meetings, are typically planned in digital calendars. Knowledge workers would benefit from an application, *smart office grid*, that would understand the requirements of different tasks and would propose a specific workstation. In the most simplified manner, the smart grid could propose a silent area for concentration intense work, meeting room for meetings and teamwork area for collaboration, similar to what a user could choose in a multi-space office. Even this level of guiding might benefit individuals who do not switch workstations according to task and increase their satisfaction to their environment. Also, this would benefit knowledge workers whose activities are location-independent and who use blended working environments - an application would ensure an available workstation with good collaboration opportunities with other team members.

Organization might have certain perception on individuals' worker character type that does not apply to the person and assigned workstation or enabled working does not necessarily support individual's performance (Greene and Myers, 2011). Hence, extending the application to contain personal information, such as self-perceived character type, personal preferences on level of privacy for concentration or collaboration intense work tasks and environmental factors, such as lighting, noise, physical proximity and accessibility. More advanced level of intelligence to smart office grid would obtain feed-

back from the users of the space in relation to work task and interactions. The application would enable designers and heads of organizations to plan prior building or acquiring new facilities. In larger organizations with activity-based work environment with shared-desk policy is a risk of team members scattering outside communication range. Assigned desk-policy, on the other hand, promotes less chance encounters. Matching interactions, setting up new collaboration opportunities and following up positive communication and knowledge sharing experiences would enhance interaction and innovation landscape in organizations. Furthermore, the most mobile knowledge work characters, such as gatherers and navigators, would effortlessly find suitable workstation while working on-site, but they would also find communication opportunities with people they need to interact with. All things considered, we propose that organizations and designers should generate a location- and user-dependent database of task-related and interaction-network supporting parameters to enhance well-being through personal environment and organizational creativity through communication and collaboration.

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