

Topics for Human Factors and Ergonomics Research and Interventions in Future Workplace

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Short Communication

Megatrends such as demographic change, technological breakthroughs, global economic power shift, climate change, rapid urbanization [1], and their interactions are driving some significant changes in business, society, as well as the built environments as their physical manifestations. Workplace, as a fundamental space type, continues to evolve, responding to socioeconomic forces as well as changes in lifestyle. Headquarters of a company are now seen not only as real estate, but as a powerful communication means and a strategic tool for growth [2]. Several trends can be observed in workplaces.

First, there is continuous discussion on the future mode of work and the affordance of office or workplace as a dedicated building type. A shift away from a supply-side dominated delivery system and culture has been taking place for decades and the Taylorist type of workplace that focused on efficiency and standardization has finally phased out. The dominant type now, viewing office as “ba” [3] borrowing the Japanese word for “place”, orients to the individuality of knowledge workers and emphasizes collaboration. A strong feature of this idea is that, in order to enhance performance, various types of spaces are provided so that individuals can choose settings that they think is best facilitating their tasks and most comfortable for them the so-called “activity-based workplace” [4,5]. Meanwhile, a new view angle is emerging, which looks at workplace in a more flexible and diverse way as platforms for value generation and branding both internally and externally, rather than as an architecture that is complete and self-evident (Figure 1). The symbolic meanings of workspace for status and seniority are fading; design goals for workplaces increasingly center on human beings rather than on capital; the language communicating features of work settings are increasingly dominated by terms about human experience and potential.

Second, changes in how people work are widely observed and seem to be progressing at an accelerating rate. The typical pattern of shifting between concentrating and convening for individuals at work is altered by the fact that a lot more work is done collectively on shared virtual platforms through new technologies. Though the support for both individual work and collaborative work is still a common requirement for workplace design [6,7], collaboration and interaction are often the major drivers for design and management decisions, when the key motivation of going to the office is for interpersonal connection and human networks. On the other hand, the term “personalization” is no longer about having family photos in the office, but about how individual work environments, which may not always link to ownership, can be tailored to individual needs, in physical, ambient and technological dimensions. Also changing are the meanings of many other phrases frequently used in workplace strategy context,

including mobility, flexibility, and individual control over personal environment. These changes and new demands open up a lot of opportunities for human factors and ergonomics research and interventions.

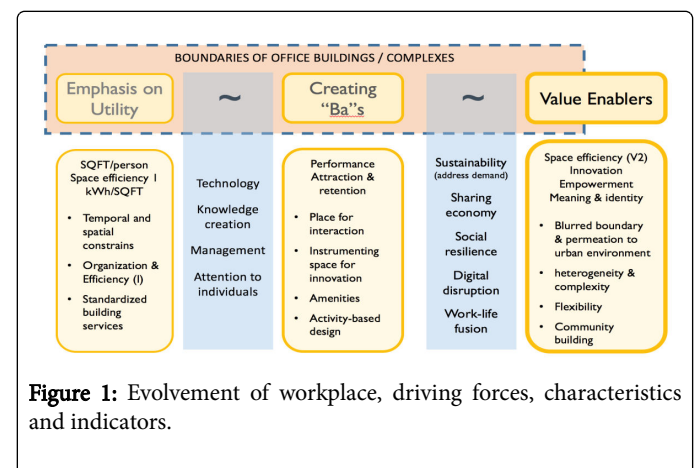


Figure 1: Evolvement of workplace, driving forces, characteristics and indicators.

Another strong trend in workplace is the increasing level of attention on health and well-being [8], in addition to the pursuit of productivity, innovation and collaboration performance. A more holistic understanding of health and well-being and its association with aspects of work environment at multiple scales moved our focus from simply avoiding work injuries and sick building syndromes (SBS) (e.g. IAQ-induced irreversible health problems) to both the physical health and mental health of knowledge workers, and further extended to the cultivation of a healthier lifestyle. The improved awareness by both management and employees, supported by better data and stronger evidence, has led to many workplace designs with highly-visible staircases, quick adoption of standing desks or even treadmill workstations, and wide use of ergonomic furniture. While tasks at work continue to evolve, enabled by technology (e.g. the shift from typing to voice-based input technology), people are less tied down to their desks and chairs or to specific locations in workplace. The line between indoor and outdoor is also blurred. There is a particular area highly promising for integrated workplace strategy and human factors research, for interventions that are above product or element level. This includes biophilic solutions that allow office workers to benefit from connections and immersion in nature [9,10].

A lot of the aforesaid issues were reflected in my recent work with the RAND Corporation a leading public policy consulting organization to evaluate the outcomes of its Future Workspace (FWS) pilot project. The pilot space, designed by Herman Miller, features

openness and high visibility achieved through layout change and interior material choices, the equipment of collaboration setting in all individual offices, multiple informal collaborative spaces, and hoteling for social density and space utilization efficiency. Empirical evidence was collected in both the pilot space and control groups at three major locations of RAND, through multiple rounds of data collection at different time points after the pilot group moved into the new space. A robust dataset was generated for understanding the effects of the new design, the new technology, and the new space management approach on employees' perception of their work environment, solo and collaborative work behavior, and work engagement and experience.

Within the creative design solutions to support work in the future, there is a promising space and a series of exciting topics for ergonomists to contribute, with attention that goes beyond individual users and stand-alone products.

Topic 1: As network technology continues to free people from co-locating, the gap is closing between virtual collaboration and face-to-face interaction from a teamwork efficiency point of view. It will be more challenging to attract people to the office to benefit from the social density. The desire to work healthier could be among the major reasons people coming to office to work. At the office they can find better ambient environment quality and better ergonomic support for work, than they can find working from home or at a coffee shop.

Topic 2: Design interventions should look at multiple scales for different magnitudes of impact: element-level interventions which we can find quite a lot examples of in workplaces now, including furniture and devices; floor- and building-level, i.e. layout interventions (for example, whether elevator or staircase is presented to building users as the "default" vertical transportation mode depending on their relative location to building entrance); and beyond building level (i.e. viewing workplace as an integral component of urban system and urban life, which include things to learn from third places to inspire the design of the next generation work environments). The diversification of scales also includes possibilities for wearable devices and on-body technology to be introduced and integrated into work environments.

Topic 3: New programming software introduces use of artificial intelligence (AI) to workplace design. It presents an opportunity for a finer-grained match between work settings (including both physical space with ambient services and ergonomic support, as well as work technology) and user needs to be facilitated continuously, and for everybody at work. The concept of "smart building" should go beyond the narrow focus on automated controls over building systems for creating satisfactory indoor ambient environment for occupants, but also should have a component of spatial quality about optimal support for user activities. New indicators, new data, and new methods can effectively support the pursuit of delivered performance.

With fast advancing technology, workplace and workplace elements are no longer static, particularly for the field of human factors and ergonomics. Attention is shifting from supporting individual's typing speed and accuracy to support collaboration and innovation, and from focus mainly on individuals to focus on interactive behavior and social dynamics. Work surfaces and media, such as computer screens, white

boards, desk surfaces, and pieces of paper are being unified under the impact of technology and will be integrated into the office's physical setting in the future. Reconfigure ability will get to the next level, redefining flexibility to go beyond rearranging furniture. More kinetic building applications are being adopted in the design of building structure and façade systems and will soon have applications in a building's interior spaces calling for human factors and ergonomics studies for support. Continuous breakthroughs in material sciences and network technology may result in further reduction in physical barriers in the workplace made of dry walls and partitions there will be new interfaces to define individual and group spaces for the optimal visual and acoustic support for various tasks, as compared to current limited solution of phone booths in open plan. More health data and well-being related feedback will be collected and used to create a more interactive and supportive work environment.

Topic 4: Responding to the aforesaid challenges and opportunities, new scope and new skillsets are demanded for researchers and professionals in workplace design and ergonomics. As the boundary of projects is changing, the expertise needed for projects is increasingly cross-disciplinary and multi-level. What is expected from space solutions is more demanding, and often includes measureable performance outcomes and more [11,12].

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