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# Active Office: Towards an Activity-Promoting Office Workplace Design

**Kathrin Probst**

Media Interaction Lab,  
FH OÖ - University of Applied  
Sciences Upper Austria  
mi-lab@fh-hagenberg.at

**Jakob Leitner**

Media Interaction Lab,  
FH OÖ - University of Applied  
Sciences Upper Austria  
mi-lab@fh-hagenberg.at

**Florian Perteneder**

Media Interaction Lab,  
FH OÖ - University of Applied  
Sciences Upper Austria  
mi-lab@fh-hagenberg.at

**Michael Haller**

Media Interaction Lab,  
FH OÖ - University of Applied  
Sciences Upper Austria  
mi-lab@fh-hagenberg.at

**Andreas Schrempf**

Medical Technology,  
FH OÖ - University of Applied  
Sciences Upper Austria  
andreas.schrempf@fh-linz.at

**Josef Glöckl**

aeris-Impulsmöbel  
info@aeris.de

**Abstract**

Work-related musculoskeletal disorders have become one of the most common chronic diseases of modern society. In this paper, we address the problem of physical inactivity in the context of office work and we introduce a new concept of working "in-motion" with high potential to reduce prolonged sedentary behavior and related degenerative phenomena. We promote a paradigm shift in workplace design towards an integrated supportive environment that provides opportunities for office workers to seamlessly change between different work environments. Based on that, we discuss associated opportunities and challenges for HCI design to encourage people for the adoption of a physically active work process in a more natural way.

**Keywords**

Workplace health promotion, physical activity promotion, workplace design

**ACM Classification Keywords**

H5.2 [Information Interfaces & Presentation]: User Interfaces---ergonomics; K4.1 [Computers & Society]: Public Policy Issues---computer-related health issues

**General Terms**

Human Factors, Design



## Introduction

For our ancestors, movement was a question of survival: only those who could move far and fast were able to hunt, defend themselves, or collect enough seeds and fruits to survive. Running, jumping, bending, stretching, stooping, or crouching: from an evolutionary perspective, this is what the human body is originally made for. Today, however, these natural behavior patterns have largely been replaced by sedentary behaviors. Over the past centuries, there has been a large shift in the types of activities we do every day and our lives have become inactive for the most part. The consequence is that our complex musculoskeletal system remains unchallenged and many of our highly specialized body functions become stunted because they remain unused. As a result, modern society has to deal with classic diseases of civilization – first of all musculoskeletal disorders, heart disease, and obesity.



In this context, the World Health Organization (WHO) recently identified the workplace as important area for the setting of health-promoting and preventive measures [1]. Given the fact that an average adult person spends approximately half of his waking hours at work, there is high potential to utilize this time for the encouragement of increased physical activity. Moreover, work-related musculoskeletal disorders have become one of the most common chronic diseases, often resulting from years of poor posture and sedentariness at the workplace (e.g., office jobs) [7]. For example, a typical office worker spends the majority of his working day sedentary: sitting in the car on the way to work, sitting while working in front of the computer, sitting during meetings, sitting while having lunch – consequently, prolonged sitting has become a predominant element of our lives.



In contrast, a physically active work process has high potential for the avoidance of prolonged sedentary behavior and related degenerative phenomena [2]. In this paper, we introduce the *Active Office*, an activity-promoting workspace environment that supports the integration of light activities into the predominately sedentary office workflow. We promote a *paradigm shift in workplace design* for sustained prevention of work-related musculoskeletal disorders and propose a new concept of working “*in-motion*”. By smoothly interconnecting workspace furniture with hardware- and software related structures, we provide opportunities for seamless changes between different work environments and encourage people for the adoption of a physically active work process. Based on that, we discuss the opportunities and challenges of HCI design to enable and encourage the sustained adoption of a dynamic, active office workflow.

## Related Work

To counter the critical development towards increased physical inactivity, companies have come to initiate workplace health promotion (WHP) programs to improve the health and overall well-being of their employees. Targeting the reduction health-related risk factors, programs include efforts to raise awareness for health-related topics, improve physical activity and dietary habits, or reduce alcohol consumption and smoking [1]. However, despite the growing evidence for the benefits of WHP, interventions have proven to be limited because most of them pose high demands on workforce commitment (e.g., gym classes) and require employees to leave their desks for exercising. Moreover, in the context of otherwise sedentary lifestyles, physical exercises are unlikely to be sufficient to reduce risk factors for chronic diseases [7].



Height-adjustable desks ([heightadjustabledesk.co.uk](http://heightadjustabledesk.co.uk)) and active seats ([swopper.de](http://swopper.de)) for activity promotion within an office environment.

To overcome these limitations, recent research has focused on more implicit methods of WHP that are integrated into the daily workflow and keep people moving during the workday: taking the stairs instead of the elevator, walking and talking to colleagues rather than sending e-mails, standing during meetings instead of sitting at conference tables [3][2]. Demonstrating the creation of supportive environments for physical activity in the workplace, structural elements such as active seats [5], standing desks [3], stepping devices [6], or “walk-and-work” workstations [4] have been integrated directly into the office environment. Motivated by that, we want follow a similar approach, and go one step further towards the development of a supportive workplace environment that additionally takes into account the opportunities of software-related support for activity promotion.

### Active Office Workplace Design

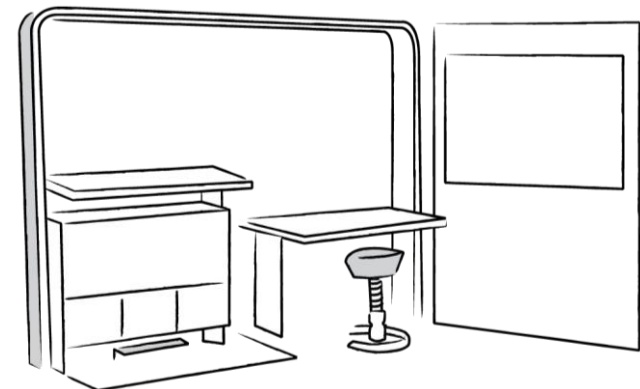
To promote physical activity at the workplace, we suggest a *paradigm shift in workplace design* that involves the smooth integration of hardware- and software-related structural elements to provide opportunities for office workers to seamlessly change between different work environments. With the *Active Office* workplace design concept, we propose an integrated supportive environment, which aims at the reduction of sedentary behaviors and promotion of a physically active work process that is characterized by regular changes between different work-related tasks, workstations, and working postures.

### Ergonomic Workplace Design

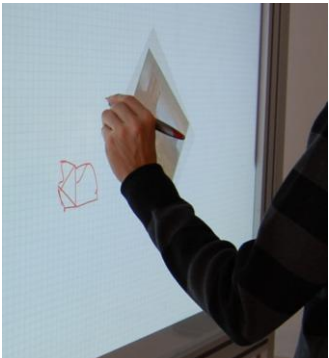
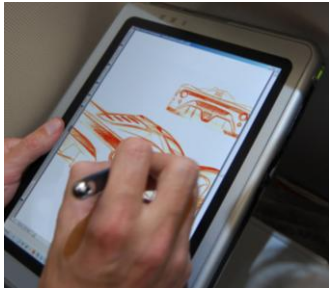
In the first step, our design concept involves an ergonomically designed workspace that integrates traditional office furniture with elements such as active seats,

height-adjustable standing desks, and whiteboards to form an interconnected workplace environment that automatically associates the daily office workflow with a subtle increase in physical activity (e.g., dynamic sitting, standing, walking). Active seats, for example, support dynamic sitting by adapting to the natural dynamic processes of the human body [5]. Height-adjustable desks promote increased standing and offer the opportunity to work in a variety of postures that can't be achieved while sitting [2][2]. The interaction with vertical surfaces (e.g., large-scale whiteboards) has the potential to promote activity through spontaneous movements such as stretching and bending.

With respect to individual work-related requirements, we propose an *Active Office* environment that incorporates the elements depicted in figure 1: (1) a traditional desk workstation, (2) a standing table workstation, and (3) a whiteboard workstation that allow for execution of work-related tasks in sitting or standing posture.



**figure 1.** A workplace design concept that provides opportunities for seamless changes between different work environments: standing desk, traditional desk, and whiteboard.

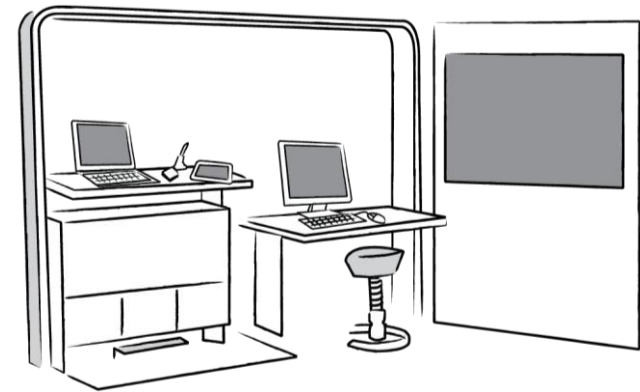


Integration of pen and paper (anoto.com), tablets, and interactive whiteboards within an office environment.

### *Workplace Media Support*

Although an ergonomically designed workspace forms an excellent basis, stationary use of communication media (e.g., computer, phone) may counteract the adoption of a physically active office workflow. For example, many work-related tasks such as reading and correcting documents are nowadays primarily performed directly on the PC, although many people would probably prefer to perform corrections on a printed sheet (maybe even in standing posture) with familiar pen and paper. To overcome this limitation, our workplace design concept furthermore involves the smooth integration of office furniture with hardware-related structural elements such as desktop computers, notebooks, tablets, smartphones, or large-scale interactive surfaces that extend the design with media support to create both an ergonomic and interactive workplace environment illustrated in figure 2.

Consequently, the *Active Office* environment seeks to interconnect workplace furniture, communication media, applications, and traditional media in a way that makes it easy for the user to change between different work environments. For example, while a traditional desk workstation is for the main part appropriate for individual work that involves the simultaneous use of multiple applications (e.g., research activities, browsing, data acquisition), the standing desk workstation can be used for the execution of work-related tasks in standing posture using digital or analogous media (e.g., e-mail correspondence, telephone conversations, document correction). Additionally, a workstation integrating a large-scale interactive whiteboard is suitable to provide special support for a variety of individual or collaborative activities (e.g., information structuring, sketching, brainstorming, presentation).



**figure 2.** Smooth interconnection of office furniture with hardware-related structural elements.

### *Task-centered Distribution of Work*

Based on the combination of an ergonomic workplace design with media support, the goal of the *Active Office* is then, to motivate users to draw full benefit from the provided structure, which means that they regularly change between different work environments and therefore different working postures. To achieve this, the basic idea is to associate each workstation with particular types of work-related tasks. Different workstations are characterized by the availability of different hardware- and software-related structural elements, thus making them well-suited for particular tasks, e.g., desktop PC for text-heavy interaction, traditional pen and paper for natural note taking, large-scale interactive whiteboard for free-form sketching.

Ideally, this leads to the development of workstation-characteristic interaction patterns that associate changes in posture with added value for the user. For example, performing document corrections at a standing table workstation can be encouraged by providing me-



dia support through a digital pen that automatically digitizes handwritten notes and synchronizes them with the corresponding digital document. Users can benefit from making telephone calls in standing posture, if informal notes taken with a digital pen are automatically integrated with their digital calendars or address books. Idea-finding processes can be just as well done in standing posture, supported by a sketching interface on an interactive whiteboard that combines freehand drawing with integration of digital content. By this principle, we promote a new way of working "in-motion" with users continuously switching between different tasks, workstations, and postures as shown in figure 3.



**figure 3.** Task-centered distribution of work introduces a new way of working "in-motion".

### HCI design implications

Concluding, the support of a sustainable behavior change among users towards a physically active office workflow through the proposed *Active Office* design concept brings along a number of challenges and opportunities for the field of HCI design.

### Ergonomics

Activity promotion in the workplace involves the creation of an ergonomic work environment that integrates a variety of office furniture elements to provide opportunities for execution of work-related tasks in different postures. From an HCI perspective, ergonomics is considered a key factor influencing the productivity of work, and it has only been recently that the results of bad ergonomics are showing up in large segments of the population e.g., as Repetitive Strain Injury (RSI). In the light of these developments, the concern for the physical characteristics of an office work environment is a major topic to be addressed, and an ergonomically designed workspace serves as the first basis to provide opportunities for increased activity in the workplace. Main challenges in this context are (1) the identification of office furniture feasible for the support of a physically active office workflow, and (2) the combination of these to form an activity-promoting office environment.

### Task-Centered Design

Increased integration of information technology into the workplace is associated with the introduction of various technology types, thus a variety of different interfaces to deal with. On the one hand, this means that different interfaces provide specific possibilities for information presentation and I/O modalities, though on the other hand brings along the need for data distribution, synchronization, and maintenance. Associated with that are questions of (1) which interfaces, media, and devices are suitable for the execution of certain work-related tasks, (2) how the interaction can be designed to associate the execution of work-related tasks with physical activity, and (3) how data can be distributed and synchronized among devices to allow a user to seamlessly shift between different work environments.



### *Evaluation*

Another relevant concern is the evaluation of physical activity promotion at the workplace to find out if a physically active work process is associated with health-related benefits, compared to a reference workplace within a traditional office environment. According to that, the focus is on the investigation of (1) which "improvements" can be achieved through a dynamic work process, and (2) how they can be measured in terms of cognitive and biomechanical parameters.

### **Conclusion and Future Work**

In this paper, we have proposed the *Active Office* environment, an integrated activity-promoting office workspace environment. We introduced a new concept of working "in-motion", and identified opportunities and challenges for HCI design arising in this context.

Future work will include investigations to understand how people work, identify different work patterns, and find out how these can be adapted to support a physically active work process. Along with that, a prototype will be developed that implements the proposed Active Office workplace design concept. To address HCI design issues, different approaches for the combination of office furniture, media, and devices will be implemented, and their effect on the physical activity of the user will be investigated. The concept of task-centered distribution of work will be put into practice and evaluated for its potential to encourage the sustained adoption of a physically active work process.

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