

Public summary of PhD thesis of Xipei Ren
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Work or workout? Designing Interactive technology for workplace fitness

Sedentary behaviors and physical inactivity at work increases the risks of developing metabolic disorders, mental illnesses, and musculoskeletal injuries, threatening office workers' physical and psychological well-being. Many strategies have been proposed to facilitate workplace fitness initiatives, yet persuading individuals to keep up fitness levels in office settings remains a challenge. Human-computer interaction and 'sensing technologies' detecting the physical states of office workers might be used to engage office workers in physical exercises in the short-term as well as encourage their long-term behavior. The doctoral dissertation of Xipei Ren explored this new perspective of office vitality, namely the design of interactive technology to facilitate workplace fitness promotion. His work involved the design and evaluation of novel fitness-promoting systems using motion-based interactions and health informatics, which confirmed the effectiveness of these interactive systems in supporting fitness breaks as a new workplace technology.

The rapid development of labor-saving devices and task-oriented workplace norms have substantially reduced physical exercises while increasing sedentary behaviors in many offices. To tackle such issue, many strategies have been proposed to facilitate workplace fitness initiatives, such as public policies, organizational wellness programs, promotional materials, and socioenvironmental changes. However, it is challenging to reach the goals of these top-down strategies, as their applications fail to blend physical activity into everyday work and persuade individuals to keep up fitness levels in office settings. The emerging fitness-promoting technologies may be leveraged to support active lifestyles in the workday context. Through integrating ubiquitous sensing and human-computer interaction (HCI), interactive technologies could be used which can sense physical states of office workers and use that information to engage them in office exercises in the short-term as well as encourage their systemic behavior change in the long-term.

In his PhD project, Xipei Ren investigated a strategic framework for workplace fitness promotion, based on the work routine pattern. In this framework, Ren proposed combining self-interventions within the work period (namely: micro-break) with group-interventions at the work intermission (namely: booster break) for improved office vitality. Based on this framework, Ren identified design opportunities of interactive technologies for workplace fitness promotion in three aspects: 1) facilitate moderate physical exercise during booster breaks; 2) facilitate low-effort fitness training during micro-breaks; 3) support adherence to fitness practices among office workers.

In response to these opportunities, Ren designed an interactive system *ShuttleKicker* is a motion-based interactive system designed to facilitate a leisure physical activity called shuttle-kick as a group-intervention in the workplace. Shuttle-kick is a unisex collective exercise, where players coordinate their feet, knees, hips, or torso to pass a shuttlecock to each other for keeping it in the air. Ren carried out two user studies, based on two iterations of *ShuttleKicker*, to explore the role of social interactions and digitally augmented feedback in facilitating shuttle-kick as a booster break activity. Ren demonstrated that personalizing social interfaces and mapping game elements to digital augmentations can support participation and engagement in fitness-boosting.

Beside the *ShuttleKicker*, Ren designed a posture-based interactive system called *HealthSit* which is meant to promote a short lower-back stretching exercise. *HealthSit* comprises a sensor mat embedded into an office chair to measure users' sitting postures, and a software that uses audio-visual feedback to facilitate the exercise flow. The *HealthSit* was used to investigate the system capability to enhance the quality of such micro-exercise and the user experience. In addition, the *HealthSit* effectiveness in providing emotional benefits and mental task improvements was evaluated. His study showed the positive effects of the *HealthSit* interactive system in improving exercise quality (the amplitude of stretch motion and the time of stretch hold), user experience (enjoyment, perceived competence, and importance of effort), and arousal state.

In the second part of the thesis, interactive technologies to support adherence to workplace fitness were also explored. In a first project, Ren analyzed three design cases of peripheral displays for introducing and inserting fitness micro-breaks into the office work routine. He showed that the data visualization, system interaction, and aesthetics of peripheral displays should be designed following the characteristics and dynamics of office settings to support self-regulated fitness behaviors at work. In a second project, Ren used cooperative fitness tracking between two co-workers to promote mutual physical activities. He evaluated the effectiveness of such intervention and the impact of proximity between co-workers on its adoption. Based on the study, Ren found that cooperative fitness tracking between two co-workers can promote physical activity, and that close physical proximity at work can facilitate their adherence to the cooperative fitness tracking regime and improving their fitness performance.

The research of Ren proposes multidisciplinary strategies based on human-computer interaction that blend self- and group-interventions into the working context for fitness initiatives. The developed technologies facilitate micro-exercise and booster-exercise amongst office workers.

Xipei Ren is a PhD candidate in the group of Systemic Change at the Department of Industrial Design, TU/e. His research is supported by China Scholarship Council. On February 18th, Ren will defend his PhD thesis entitled "Work or Workout? Designing Interactive Technology for Workplace Fitness Promotion", with Dr. Yuan Lu as the 1st Promotor, and Prof. Aarnout Brombacher as 2nd Promotor.