Let’s Walk and Talk: A Design Case to Integrate an Active Lifestyle into Daily Office Life

Abstract
Prolonged sitting time in adults has become a major societal issue with far-reaching health, economic, and social consequences. The objective of this study is to reduce sedentary behaviour in office workers by integrating physical activity with work. In this case study, we present Workwalk, a concept to encourage and facilitate office workers to have a walking meeting. This idea arose by merging a traditional health research approach with an iterative design process. With this method, it was possible to integrate behaviour change techniques effectively into an interaction design process.

Author Keywords
Physical activity; intervention; intervention mapping; sedentary lifestyle; sitting; office workers; behaviour change; living lab

ACM Classification Keywords
D.4.7; H.5.2; H.4.1

Introduction
Prolonged sitting time in adults has become a public health risk in recent years [31]. Kohl et al. (2012) talk about a pandemic of physical inactivity, that is considered the fourth leading cause of death worldwide. Physical inactivity accounts for 6% - 10% of all deaths.
from non-communicable diseases [14, 26] and high levels of physical inactivity are associated with poor health and with the development of diseases such as type II diabetes, cardiovascular diseases, colon- and breast cancer, increased morbidity and premature mortality [5, 18, 22, 27, 31, 33, 34, 35, 38].

The necessity to lead a physically active life has reduced considerably over the past decades due to advancing technologies and automation of services, travel and labour [14]. Recent studies with accelerometers have shown that adults in developed countries spend 55-70% of their waking hours in sedentary position [21, 28]. A substantial part of this sedentary behaviour displays during work hours, where a typical office worker sits the vast majority of his or her workday [23, 36].

Interventions and designs to reduce sedentary time during work can have significant positive health effects. In addition to the reduction of the previously mentioned illnesses, physical activity can have positive impact on mental health [8] and economic benefits, such as reduced sickness absence [29]. Furthermore, physical activity during work can have a profound beneficial effect on well-being, happiness [12, 37] and creativity [32].

Several health promotion programmes and technology-based interventions have been developed to target prolonged sitting hours at work. Examples are smartphone-based interventions [9, 19], online personal activity monitors [7] and prompting software [13, 15]. Although we can find beneficial effects in these existing workplace interventions and designs, they have two significant drawbacks. The first drawback is that they often do not take context and personal preferences into account. For instance, prompts to get a cup of coffee are given irrespective of the tasks at hand, causing inopportune moments of intervention. Furthermore, these programmes or designs mainly aim at awareness of the amount of sitting time, without providing clear motive to be physically active. Awareness does not automatically lead to action. The second drawback the vast majority of interventions have is that they consider physical activity as a break from work. These approaches add to the workload by adding physically active intermissions from work to reduce sedentary time, lacking integration of physical activity and work.

One exception of an intervention that integrates physical activity with work is the Brainwolk Walking Meeting App of Ahtinen et al. (2017). They designed a mobile app to facilitate walking meetings. Users have to use their phones to look at the route during the walking meeting, which disrupts the meeting [3]. However, other forms of technologies may be able to support walking meeting more fittingly.

In this case study, we focus on human-centred design interventions to improve the integration of physical activity with day-to-day work. To this end, we investigated the support and persuasion of office workers to have walking meetings, without the use of an app. We use the intervention mapping protocol of Bartholomew et al. (1998) as a theoretical guidance tool to strengthen the design process. The goals of this case study are twofold: (i) give insights into the use of the intervention mapping protocol in a human-centred design process and (ii) provide design insights of our recently developed Workwalk.
**Steps of Intervention Mapping Protocol**

1. Specify Programme Objectives
2. Choose Theoretical Methods and translate into Practical Strategies
3. Formulate Programme Design
4. Develop Adoption & Implementation Plan
5. Develop Monitoring & Evaluation Plan

Table 1: Simplified overview of intervention mapping protocol by Bartholomew et al. (1998)

**Methods**

In this case study, we combine an intervention mapping approach [6] with interaction design research [39]. The intervention mapping protocol describes five steps that helped guide the development of the design. This combined approach integrates theory and practice to address the complex design challenge, which leads to more physically active ways of working.

First, literature was reviewed to identify which intervention strategies and designs are used in physical activity programmes targeting office workers. In addition, individual and environmental factors to engage employees in physical activity at work were identified. Next to the literature search, we used the preliminary results from seven focus groups. These focus groups are part of a more extensive study in collaboration with the VU University Amsterdam to gain insights into design opportunities for office vitality.

Sixty-five employees from four different organizations took part in these focus groups. Each focus group lasted approximately 150 minutes and was transcribed verbatim. Transcriptions of the focus groups were coded and analysed in MAXQDA and Nvivo.

During the first two steps of the intervention mapping protocol a needs assessment was conducted, and intervention objectives were formulated. The desired programme outcomes were identified on a psychosocial, contextual and technological level. Subsequently, these desired outcomes were divided into related behaviour determinants and environmental conditions. These sub-segments detailed what should be targeted by the intervention design.

In a second theoretical exploration, behaviour change models and intervention methods were matched to the programme objectives. These methods were derived from literature describing empirical research on behaviour change techniques [30]. To translate the methods into practical strategies to deliver the intervention design, a selection of behaviour change techniques was made that seemed applicable for a walking meeting intervention design. This selection was based on the preliminary results of the literature study and focus groups. This list was made as a preference list to guide the design process. Based on these insights, the design requirements for the delivery and the production of the design intervention were formulated.

A first design concept was developed in a multidisciplinary team setting at the Dutch Hacking Health hackathon, a design sprint-like event where technology, design, entrepreneurship, healthcare and patients are brought together during a weekend. At this hackathon, the methods and strategies were operationalized into a design concept to realise the proposed programme objectives. This was done by several brainstorm sessions and explorations of useful technologies, processes and designs. In addition, field experts provided feedback on this first design.

Based on the results of the hackathon and theoretical explorations, iterations were made on the design. Five short semi-structured interviews were conducted with secretaries, to receive feedback on the second design iteration. The interviews lasted 15-25 minutes, were recorded and transcribed verbatim. In addition to the semi-structured interviews, the concept was proposed
to a wide variety of office workers at the living lab setting to obtain first impressions about the idea.

The fourth and fifth steps of the intervention mapping protocol describe the adoption, implementation and anticipation of process and effect evaluation. A plan was formulated for the programme adoption, implementation, and sustainability. In this plan, the mechanisms to involve users in the intervention design were described by linking specific adoption and implementation performance objectives to corresponding determinants. For example, one of the hypothesized determinants of adoption was social acceptance among colleagues to use the design intervention. If the programme offers opportunities for intervention by making it part of the organizational objectives, users will be more inclined to use the design intervention.

For the process and effect evaluation, survey and interview protocols were developed. Both quantitative and qualitative measures were selected to measure the process and effect of the intervention design. Based on the needs assessment and the programme objectives, evaluation questions were formulated for the surveys and interviews. Subsequently, a planning was made for the process evaluation, including a plan for the baseline testing.

**Results**

*Design intervention objectives*

Based on the theoretical explorations, a matrix (Table 2) was created to present all programme objectives and related changeable behavioural and contextual determinants. Each cell shows one or more specific change objectives that should be targeted by the intervention design. The table presents the intervention programme objectives in the first row, with the related behavioural outcomes in the consecutive rows. These outcomes are divided into intention, self-efficacy, attitudes & belief, social norms and knowledge outcomes.

The theory of Planned Behaviour by Ajzen (1991) was adopted as the theoretical model in this case study. This theory was chosen because of its predictive power from intentions to action. The theory of Planned Behaviour fits well with the intervention mapping approach since it links beliefs and behaviour in a fairly effective way. By breaking down the programme objectives into changeable behavioural and contextual determinants, it was possible to specify the attitudes and beliefs that need to be targeted with the walking meeting intervention design.

The literature study showed several intervention strategies and designs that aim to reduce sedentary time in office workers [1,2,7,9,11,15,16,17,19, 20, 25, 29]. Interestingly, one study used intervention mapping to develop a theory-based worksite physical activity intervention [29]. This intervention targets awareness, motivation and environmental factors to increase moderate physical activity during work. The results of this research were used to formulate the behavioural and environmental factors in this case study.

Another interesting outcome of the literature study was the paper by McEachan et al. (2008). This study identified ten barriers to engaging in physical activity.
<table>
<thead>
<tr>
<th>OB1: Have intention to have a workwalk</th>
<th>OB2: Identify possibilities and opportunities for a work walk</th>
<th>OB3: Overcome barriers of a work walk</th>
<th>OB4: Create implementation interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intention</strong></td>
<td>Increase motivation to identify possibilities and opportunities to engage in a workwalk</td>
<td>Be willing to integrate a workwalk in daily work routine</td>
<td></td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
<td>Express confidence in ones capabilities to have a workwalk</td>
<td>Express confidence in identifying appropriate opportunities to have a workwalk</td>
<td>Demonstrate ability to plan for a workwalk</td>
</tr>
</tbody>
</table>
| **Attitudes & Beliefs**                 | Believe that there are benefits to a workwalk  
Positive feelings about a workwalk  
Believe that it is important to be physically active at work | Believe that moderate physical activity can be part of daily work routine | Believe that barriers to engage in a workwalk are not insurmountable |
| **Social Norms**                        | Recognising that the employer provides the opportunity to have a workwalk  
Believe that it is socially accepted to have a workwalk  
Identify oneself as a person who wants to try a workwalk | Recognise when colleagues go for a workwalk | Believe that using the design intervention will help to integrate workwalks in daily work routine |
| **Knowledge**                           | Describe the health benefits of a workwalk  
Describe the personal short term benefits of a workwalk  
Describe the risks of prolonged sedentary behaviour | Know appropriate opportunities to have a workwalk | Know what possible barriers there are to have a workwalk |
|                                        | Know how to use workwalk |

**Table 2:** Programme objectives and related changeable behavioural and contextual determinants
The two most common barriers that were mentioned were 'I don't have any time' and 'I'm too tired by the time I get home from work'. Three other interesting barriers were 'It is more important for me to relax when I'm not working', 'I have too many other commitments' and 'my manager and colleagues would frown on me taking a break'. Interestingly, these barriers indicate a belief that physical activity is something that cannot be undertaken while working.

In addition to the literature review, several relevant themes are identified from analysis of the focus groups and interviews. Preliminary results show three categories that have an impact on the vitality of employees, namely personal factors, organisational factors and environmental factors. Personal factors that have a positive impact were sleep quality, relaxation, and nutrition. Another reported personal factor was sufficient physical activity during work. Sufficient was not quantified in this respect and deemed highly personal. Organisational factors that recurred throughout the dataset were autonomy and responsiveness of employers to the needs of the employees. A common view amongst interviewees was that an inspiring work environment with sufficient amount of vegetation, fresh air and sunlight had a positive influence on the vitality of office workers. Another environmental factor that was mentioned is the possibility to adapt the working place to the changing needs of the workers. For example, the ability to find a quiet room if an employee needs to concentrate to read or write a piece.

Workwalk
The creation of the design intervention was an iterative process. The first design concept was developed at the Dutch Hacking Health hackathon. At this hackathon, the elements of the matrix in Table 2 were linked to the list of selected behaviour change techniques by Michie et al. (2013). The main behaviour change techniques used in the design of the Workwalk are restructuring the physical environment, restructuring the social environment, reframing beliefs and habit formation. Secondary behaviour change techniques that are taken into account are social support, exposure, modelling of the behaviour and identification of self as the role model. These behaviour change techniques are applied in the Workwalk concept to address the desired psychosocial, contextual and technological programme outcomes.

A first brainstorm session on the specific programme objectives and design requirements was prepared based on the gathered insights from the literature search and the preliminary results from the focus groups. Second, exploratory fieldwork was done to gain insights into the possibilities for walking meetings on the campus of the Eindhoven University of Technology (TU/e). The campus served as an exploratory study environment or living lab [10]. This living lab setting was chosen because of its high number of sedentary workers, who spend more than 70% of their work hours in sedentary position. Therefore, the main target group that was selected for the exploratory fieldwork were knowledge workers of the TU/e, who are assumed to have an interest in new technologies and healthy ways of working. A second argument for the TU/e living lab setting was the practical considerations such as the speed at which interventions can be operationalized in this living lab.
The concept Workwalk consists of three elements;

1) A visible, physical, line that serves as a guide for the walking meeting

2) Outdoor signs to mark meeting points and additional information of the Workwalk

3) The integration of a Workwalk within the room booking system

The route was created with the help of an existing app 'blokje om', field explorations and route tracking. The 'blokje om' application generates routes based on a pre-set time. Using this app, several options for ± 30-minute walks were explored. After several explorations and based on the requirements listed, a first route of 25 minutes was mapped out. The 25 minutes are based on a slow walking pace, since it is assumed that work conversations during walks slow down the walking pace of people compared to the 'normal' walking pace. Furthermore, the pace should be at a comfortable pace for all participants. For the first test, the route was set-up as a minimal viable product with the use of a 1.8 km dotted line of blue tape.

In addition to the line, two types of signs were made to inform and persuade potential users: meeting point signs (fig 1) and information signs (fig 2). The meeting point signs explained the ‘use’ of the Workwalk and are placed at the entrance of a faculty building. The information signs, placed along the route, showed information about Workwalk such as the duration, explanation on how to book a Workwalk and a quote related to possible benefits of a walking meeting.

The third element of the Workwalk consists of the integration of the Workwalk in the planning system of the university. In the initial testing phase a functional mailbox was set up in order to ‘book’ the Workwalk. By adding the Workwalk email address to the meeting, users were able to book the Workwalk. The mailbox was set up so that all invitations from users were automatically accepted. The researchers managed this mailbox and were able to see the number of bookings and the users that booked the Workwalk. For the first pilot test the workwalk will be integrated into the room booking system of the university, bookmyspace¹.

The Workwalk concept will help office workers to integrate walking into their daily workroutine. The concept is expected to enhance the ‘normality’ of walking whilst working by making it an integral part of the office environment of the Eindhoven University of Technology. When scheduling a meeting, employers of the university can book the Workwalk as the location of their meeting instead of a normal meeting room. They meet up at the meeting point sign at the entrance of their building and can start their meeting by following the blue line. The line that guides them around the campus will help with the time management of the meeting and eliminates the need to plan a route.

¹ Bookmyspace is the platform used to reserve rooms at the Eindhoven University of technology. Bookmyspace uses the Integrated Workplace Management Solution of planon software, see https://planonsoftware.com
Conclusion & Discussion
The Prolonged sitting time in adults has become a major societal issue with far-reaching negative consequences. Intervention strategies and designs to reduce sedentary behaviour have serious flaws in the way they address this problem. Often, they do not take context and personal preferences into account. Furthermore, the vast majority of interventions aim to reduce sedentary time by imposing breaks upon traditional working routines.

This study set out to reduce sedentary behaviour by integrating physical activity in a daily working routine and transforming the way we can work. In this case study, we present Workwalk, a concept to encourage and facilitate office workers to have a walking meeting without the use of additional applications that disturb a walking meeting. The objective of Workwalk is to provide a more healthy, happy or ever more creative way to have a meeting at work. Workwalk provides a simple way to integrate physical activity into daily office life, providing clear guidance and structure for a work meeting. The concept consists of three elements; 1) a visible route marked by a physical line, 2) meeting and information signs and 3) the integration within the room booking system.

An essential aspect of the Workwalk concept is the visibility in the work environment, both physical and digital. The route provides clear guidance and structure to a walking meeting, designing out the need to give directions and keeping track of time. Furthermore, by making Workwalk a visible part of the outdoor work environment and technological infrastructure (booking system) it is expected to gain social acceptance. The visibility of the Workwalk is an example of how restructuring the physical and social environment can help to change behaviour at work. Additional behaviour change techniques that are used in the development of Workwalk are: behaviour substitution, habit formation, exposure, health consequences, action planning, modelling of the behaviour, identification of self as role model and reframing.

Workwalk is developed by merging a traditional health research approach, the intervention mapping protocol of Bartholomew, with an iterative design process. The five steps of the intervention mapping protocol are used to effectively formulate programme objectives and select the appropriate methods and strategies to design the Workwalk intervention. All programme objectives are related to specific changeable behavioural and contextual determinants. The use of the intervention mapping protocol within the design process also made it possible to create a structured plan for the adaption, implementation and monitoring and evaluation of Workwalk. This approach enabled effective integration of behaviour change techniques into an interaction design process.

Future trials will assess the impact of Workwalk. This will be done with a first exploratory test at the campus of the Eindhoven University of Technology. The adoption and implementation plan will be used to set out the intervention, and the evaluation plan will be implemented to measure the impact of the design intervention. In terms of directions for future research, further work could examine the facilities that can be added to Workwalk. For example, places or services to take notes, presentation spots or the creation of various routes for different meeting purposes could be usefully explored in further research.
Acknowledgements
We thank Rhys Duindam, Roy van den Heuvel, Ezgi Aytekin, Reka Magyari, Britt Smulders, Sophie van den Hurk, Jos Raijmakers and Tom de Jong for their collaboration on various stages of the Workwalk project.

This research was supported in part by an EIT grant to improve Vitality at the workplace, "ProVITA" [17288].

References


30. Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Wood, C. E. 2013. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of
behavior change interventions. Annals of Behavioral Medicine, 46(1), 81–95.


