Let's Walk at Work – Persuasion through the Brainwolk Walking Meeting App

Full Paper

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ABSTRACT

Contemporary knowledge work is typically characterized by sedentary work habits, which in turn have an impact on workers' well-being and creativity. Persuasive technologies can be designed as a means for reducing the amount of sitting at work. Here, we discuss the results from our research to gain design knowledge and insights on persuasive technologies that encourage physically active ways of work. We introduce "Brainwolk", a walking meeting concept that is mediated with a mobile app. As a part of a broader design research process, we present the user experience (UX) findings based on a one-month field study (N=11) of Brainwolk. We utilize our findings in the design of an improved application concept (Brainwolk 2.0) to support and persuade walking meetings. We also confer insights for persuasive design to encourage physically active ways of work at knowledge work context, e.g., focusing on the discreet persuasion. Finally, we discuss the potential of combining digital and non-digital elements to form powerful persuasion techniques.

CCS CONCEPTS

• Human-centered computing → Ubiquitous and mobile computing systems and tools • Human-centered computing → Empirical studies in ubiquitous and mobile computing

KEYWORDS

Walking meeting; physically active ways of work; well-being; mobile app; user experience; persuasive design; knowledge work.

1 INTRODUCTION

Contemporary work culture promotes sedentary ways of performing work since it requires interaction with a desktop computer. Many knowledge workers spend much of their day sitting or with limited need for mobility [21,32]. Many of these knowledge workers would likely benefit from integrating some physical activity to their ordinary workday. In the workplace, physical activity can have a positive effect on well-being and health [7], happiness [36], creativity and cognitive capabilities [27], and sociability [37]. Several tools and technologies have been harnessed to enable and motivate physically active ways of work, (e.g. [6,24,35]). Persuasive design, e.g. [26], play a strong role in the design of technologies that aim at changing people's behavior. To be able to design a successful tool for workers to encourage physically active ways of work, it is important to study and understand a user's motivation, needs, and experiences. Studies focusing on people's experiences with the technology help researchers and designers understand why or why not their system is working [23].

To explore the user needs, experiences and suitable persuasion techniques in the area of *persuasive technology that encourage physically active ways of work*, we designed a walking meeting concept called Brainwolk. This concept is paired with a related mobile application prototype to mediate and motivate the walk-along meeting. Walking meetings are not a novel innovation as such – they have been utilized before without technology-based components, e.g. "walk and talk" tutorials and one-on-one meetings [11,12], a walk and talk strategy [28] and Walkshop method [37]. Recently, also a mobile walking meeting application prototype, Walking metro, has been introduced [2], as well as an online service for walking meetings (i.e. Weetings) in certain Dutch cities, (https://www.weeting.nl/). However, this previous research lacks longer-term user experience (UX) studies of technology-mediated walking meetings. We present the findings and insights from a one-month field study, which revealed user experience aspects that are not easy to perceive in short term user tests [2,23]. The research presented in this paper is a part of a broader design

research process in the area of persuasive technology to encourage physically active ways of work. The goals of this paper are to:

1. Present long-term UX findings of technology-mediated walking meetings gathered in a field study (Section 5).
2. Describe an improved concept to support and persuade walking meetings based on the gathered design knowledge (Section 6).
3. Provide design insights for persuasive technology that encourage physically active ways of work (Section 7).

This research knowledge and insights can be used in the human-centered design of persuasive technologies to mediate and motivate physically active work habits for the improved workplace wellness. The knowledge also supplements the current knowledge of persuasive design in general.

2 RELATED WORK

2.1 Towards Physically Active Ways of Work

Frequently, contemporary work habits support sedentary lifestyles by allowing too much inactivity in a typical day [21,32]. Tobiasson et al. [33] states decisively: "*Many of us more or less leave our physical bodies behind as we step inside our modern offices – we work with our brains and leave the rest of our body at rest*" (p. 130). They also report workers' explicit wish for physically active ways of work. In their study, the participants (office workers) expressed the desire to be more physically active during the work tasks. Opportunities to add light-weight activity during the workday would introduce great benefits to the well-being of the individuals. An active lifestyle has known physiological and mental health benefits; moreover, it can also have positive effects on work-related aspects, such as creativity [27] and enriched interaction [37]. Researchers have found walking to be a potential way to increase physical activity and reduce sedentary behavior in the workplace [13]. The effects of two walking strategies were studied: brisk, route-based walking during breaks, and incidental walking during work tasks in the form of walking and talking to colleagues, and standing and walking in meetings. Both strategies increased physical activity by white-collar employees. [13] Walking meetings are popular among a small part of employees but they still have not taken their place as a mainstream work habit. There is still much unused potential in increasing daily activity level by walking while working. We assume that walking meetings need to be accepted as an ordinary way of work, and that appropriate technological tools can help in fostering acceptance as well as persuade workers to try them out.

Walking meetings utilize the natural settings that exist in proximity to the workplace, as work environments. Spending time in natural settings has a positive impact on cognitive tasks, e.g. directed-attention abilities [4]. It also has restorative and recovering effects [15], and the overall mood and self-confidence improves after the physical activity conducted in nature [3]. The restorative effects of nature provide improvements in mood and the replenishment of attention following stress and/or mental fatigue, because it is situated in or observes the natural environment [15]. Being in or near nature has also physiological effects, such as a measurable decrease in blood pressure and heart rate after stress [14, 34]. The largest measurable changes in mood can occur after spending a short time, e.g. five minutes, in nature [3]. Those effects would be desirable in the hectic conditions of knowledge work.

2.2 Technologies to Support Physical Activity at Work

Technology has been harnessed to overcome the sedentary challenge in workplaces. Examples include technology-mediated walking meetings [2], playful sharing of steps at work [38], active workstations [6,24,31], smart furniture to prompt a break from sitting [5] and timely prompts on a computer to take a break from sitting [35]. Additionally, there is research on utilizing bodily interaction as a novel input modality [29], where a flexible office chair is used as an input device. Other future-based solutions include a robot that encourages office workers to take a break from their sedentary work [30]. There are many solutions for making sedentary work towards physically more active but these solutions need to be accepted as ways of performing productive knowledge work.

Positive expectations and user experiences have been reported related to some of the above-mentioned solutions. It has been demonstrated that the concept of a technology-mediated walking meeting called Walking metro was well received by users, although some challenges were found that took the attention from work-related tasks to the use of the application too often [2]. An online intervention study to increase walking in university employees reports promising results in the increase of workday walking. There, a six-week intervention was arranged with the pedometers. The steps were entered to an online service called Walk@Work, which also utilized some motivational strategies. This increased the daily workday walking by 25% [11]. In another study, the SitCoach application prompted users to take a break from work decreased sedentary behavior [35]. The results reveal that for the SitCoach users, the preferred way to be reminded about the activity was unobtrusively and discreetly. Challenges such as the social acceptability of the above-described solutions remain [33]. The suggested solutions may also cause a decrease in perceived work performance in certain work tasks, such as interference when typing on a keyboard or using a mouse [8]. Thus, one needs to carefully consider the user needs and experiences when designing technologies to encourage physically active ways of work.

2.3 User Experience and Persuasive Design

To be able to introduce acceptable technologies to support physically active ways of work and thus change the sedentary work culture, it is important to focus on the human-centered design and pleasant UX of the solutions. UX can be defined as follows: *"A person's perceptions and responses that result from the use or anticipated use of a product, system or service"* [20]. For the design of systems that aim at motivating and persuading people, both pragmatic UX factors (e.g. easy and smooth to use, efficient, easy to learn, suitable for the work task) as well as hedonic UX factors (e.g. positive emotions obtained by using the solution, increased engagement, a stronger sense of relatedness) play a role [16,17].

In the design of technologies that encourage physically active ways of work, we can utilize knowledge from persuasive design [26] and design of motivational wellness technologies [1,9]. Persuasion can be considered a key element in promoting sustained use of self-management apps, such as wellness and health apps. Fogg [10] defines the concept of persuasion as "*an attempt to shape, reinforce, or change behaviors, feelings, or thoughts about an issue, object, or action*" (p. 225). Persuasive technologies aim at changing people's thinking and behavior with different techniques. Different theories present numerous persuasion techniques. For example, the Persuasive Systems Design model proposes 28 principles for persuasive design [26] and the model of design strategies for motivational applications includes 34 different principles [1]. Many persuasion techniques are frequently utilized in the design of persuasive technologies, such as wellness apps. For example, *social facilitation, goal setting, rewarding* and *playful elements* are some of the most popular ones. There exist both pragmatic and hedonic persuasion techniques. Pragmatic persuasion techniques include e.g. *reduction* (making information and users' actions with the system as simple as possible) and *tunneling* (leading the users of the system through the predetermined path to achieve certain target). Hedonic persuasion techniques include, e.g. the principles of *praise* (positive feedback for the user about her actions through the system) and *cooperation* (users proceeding towards their goals together).

Different application contexts require different approaches for persuasion. Previous research has suggested design implications specifically for persuasive mobile walking meeting apps divided into three categories: 1) *Re-design the concept for acceptability*; 2) *Use non-interrupting guidance and instructions*; and 3) *Utilize discreet motivating and stimulating elements* [2]. There, the important aspect about the persuasion is to utilize it discreetly; i.e. persuasion that happens in the background. We utilize those implications in our walking meeting app prototype design, which we describe next.

3 THE BRAINWOLK WALKING MEETING CONCEPT AND APP

3.1 The Brainwolk Concept

We have developed the Brainwolk concept, *a meeting for focused thinking and talking about work topics while walking outdoors*. We named our concept as Brainwolk, referring to simultaneous "walk" and "work". Brainwolk is not a formal meeting that requires specific meeting facilities and manners, such as presenting material or extensive note taking. Rather, it is a discussion or thinking session that provides freedom for thoughts, new perspectives and relaxed atmosphere for the transformation of thoughts. Brainwolk also aims at increasing workers' creativity and provides possibilities to enjoy physical activity and outdoor settings at work.

In practice, Brainwolk is best conducted within a small group of walkers, but it can be used alone as well for own reflection or structuring thoughts. Prior to taking a walk, the participating walkers define the targets of Brainwolk, e.g. 2-3 concrete topics for which they wish to find a solution or answer during the walk. They are encouraged to write the topics down in a small notebook and glance at them during the walk. During the walk, the participants focus on the topics. Keywords of the discussion can be written down in the notebook by having short breaks along the walk when needed. The length of Brainwolk depends on the participants, the available time and the depth of these topics. After Brainwolk, a short wrap-up of the topics is recommended and the proper notes about the meeting can be written down and shared.

3.2 The Brainwolk App

The Brainwolk mobile app (see Figure 1) was developed for supporting the Brainwolk walking meeting method. Based on the previous research [2], we believe that mobile applications can have a potential role in introducing and motivating these walking meetings and encouraging workers to move more.

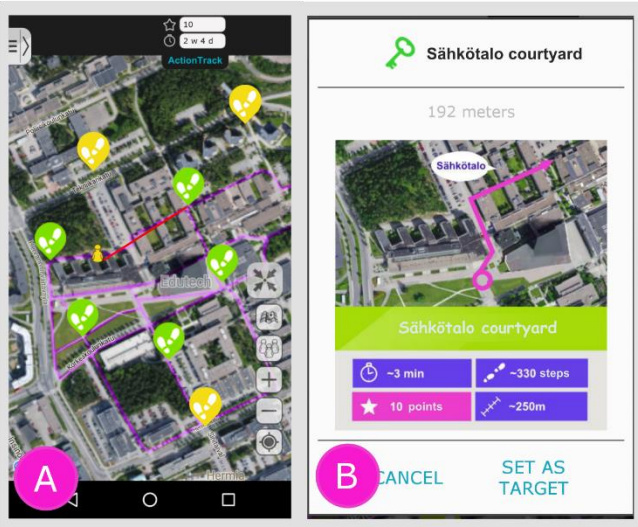

Figure 1: Screenshots of the Brainwolk application: A) the map view with checkpoints, avatar and route suggestions, B) manual setting of the checkpoint target.

The Brainwolk app template was built with the ActionTrack web editor tool [18]. The ActionTrack platform provided us a possibility to build a route-based walking meeting app with guidance and checkpoints. The idea was to be able to build a research prototype in a relatively simple way without programming, and then quickly get into the research phase. Next, we describe the design of the Brainwolk app prototype.

When opening the app, a short introductory screen explains the basics of the Brainwolk walking meeting concept. The introductory screen provides tips for conducting a successful Brainwolk. Next, the user is provided with a map of the university campus (our study location) and nearby areas (see Figure 1A), which the user can zoom in and out to see details. An avatar points the current location on the map. The map includes outdoor walking route suggestions, marked with thin pink lines. There are five checkpoints that initially appear on the map.

The user can set the checkpoint target manually (see Figure 1B) or just walk to the checkpoints without setting them as targets. After walking to some of the initial checkpoints, additional checkpoints appear. There are a total of 19 checkpoints, clustered into four different zones based on distance. Checkpoints in different zones are marked with different colors. When reaching a checkpoint, the user can open content (such as information or specific tasks, which can be set to appear randomly from a database). In our research case, the contents of the checkpoints included suggested physical exercises for breaks at the checkpoints and motivational messages about walking, e.g. the benefits which may be obtained by walking. Upon reaching the checkpoints and activating the content, the users earn points, which are visible on the app. In our study, the points were also tallied and shared with all participants with weekly newsletters by email.

In the Brainwolk app design, we utilized the knowledge from previous research concerning the design of mobile walking meeting apps. Per the design implications, the walking meeting application needed to be discreet and it should not distract from the topic or discussion at hand [2]. Our design decision was to allow users to put the phone in the pocket during the meeting and provided them only with suggestions of routes that they could view prior to the meeting. We also provided the freedom to choose their own paths to walk to each checkpoint. In practice, participants could see the checkpoints on the map and they could decide which checkpoints they wanted to visit beforehand or decide the route as they walked. They were not required to look at their phones during the walk since points were awarded automatically upon reaching the checkpoint. To include some motivational playful and gamified elements which would not be too distracting [2], we automatically granted points upon reaching each checkpoint, allowed users to open randomized content at the checkpoints to earn additional points, and sent a high score list to the group once a week via email. The participants could initially see only five checkpoints (with hints of possible routes) on the map, but when a minimum threshold of points was obtained, participants were then able to see additional checkpoints. We anticipated that this would make the first walks easier to handle and also provide motivation for participating in future Brainwolks.

4 METHODOLOGY

4.1 Research Process and Data Collecting

The Brainwolk walking meeting concept and application prototype were evaluated with 11 participants in the field study of one month in April 2016. The focus of the study was to discover the type of experiences Brainwolk would bring about. We were particularly motivated to study the user experiences and acceptability of the mobile app designed to mediate the walking meeting. Our study took place in a Finnish university campus area. The data were collected with:

- Two online questionnaires (initial, final) including, e.g. UX statements based on AttrakDiff [16].
- Semi-structured interviews for qualitative in-depth experiences.
- Paper diaries, which acted as a report of the conducted Brainwolks and the users could also write their thoughts and experiences there.

The study started with the initial introductory session, where the group of participants were introduced with the Brainwolk concept and app. The Brainwolk app was either downloaded to their own mobile phone (N=6) or they were offered a phone with an app preloaded if they did not have a suitable phone (N=5). The app worked on Android and iOS platforms, so the Windows users were provided with a suitable phone. A short test walk was conducted together. A link to the initial online questionnaire was delivered by email after the session. The questionnaire dealt with, e.g. the demographics, activity level, and expectations towards Brainwolk. During the following month, the participants were asked to conduct as many Brainwolks as would be suitable for their work and to use the Brainwolk app during the walking meetings. They were playfully named as "Brainwolk messengers" and advised to invite appropriate colleagues to join the meetings. A paper diary was asked to be filled in about each conducted Brainwolk.

Each week we emailed a motivational newsletter to participants concerning different aspects related to Brainwolk. It included information that we envisioned to be a part of the Brainwolk app but which, with the current platform, were not possible to implement. For example, one newsletter included a weather forecast for the following five days and a reminder to participate in upcoming Brainwolks. All newsletters included a table presenting the current order of the participants according to the points collected during Brainwolk sessions.

At the end of the field study, a link to the final online questionnaire was sent to the participants. The questions concerned the use of the Brainwolk concept and app, and the effects and experiences of them. The UX of the app was measured with eight statements that were selected from the AttrakDiff UX questionnaire [16] based on their appropriateness. The participants were also interviewed in the semi-structured interviews (length 30 minutes/person) to get qualitative in-depth data about the experiences. The themes on the interview concerned, e.g. the ways to use Brainwolk app, the perceptions, and experiences of the Brainwolk app and concept, and suggestions for improvement.

4.2 Participants

Eleven voluntary participants (F=8, M=3) from a Finnish university campus took part in the field study. The average age was 38 years. Occupations varied from a university lecturer and research assistant to coordinator and educational counselor. All were considered knowledge workers. They were recruited through advertisements in the university magazine and social media. Their daily physically active time (standing or moving) at their ordinary work varied from 30 minutes to almost the whole day, per their subjective assessment. Nine participants conducted physical exercises 1-3 times/week while two participants exercised more than 4 times/week. Six of them used an exercise app or device, e.g. sports tracker or heart rate monitor. Seven participants had some previous experience in walking meetings.

4.3 Data Analysis

The qualitative data (open-ended data on online questionnaires and the interview data) was analyzed by the means of qualitative content analysis [19] conducted digitally on Excel sheets. The transcribed data were categorized based on the pre-defined themes on the discussion guide, e.g. perceived effects of the Brainwolk walking meeting, the experiences of the mobile app on mediating walking meetings, and the suitability of the concept to different work tasks. New emerging themes were also found, e.g. the importance of nature experiences. Altogether, 24 main themes were discovered based on the content analysis. The quantitative data on the online questionnaires was analyzed in Excel using descriptive statistic techniques.

5 FINDINGS

In this section, we describe how active participants were while conducting Brainwolk walking meetings in the study. Next, the UX findings related to the mobile app are provided. Last, participants' overall experiences of the walking meeting concept are reported.

5.1 Brainwolk Activity in the Field Study

Based on the diary data, our 11 participants conducted a total of 43 Brainwolks during the 4 weeks. Participants averaged 3.9 Brainwolks/person or nearly one Brainwolk/week/person, with a range of between 3 and 5 Brainwolks/person. The typical length of a Brainwolk was 30 minutes, but they varied from 15 minutes to one hour depending on the topics and participants of the meeting. Typically, Brainwolk was conducted by two people together, but it was also conducted in bigger groups (3-10 persons) and alone. Users commented in the interviews that Brainwolk worked best with 2-3 people, but two said that it worked well alone for self-reflection. Two users indicated the inability to concentrate when participating in Brainwolk alone and they missed communication and social interaction. We found out that Brainwolk could be utilized in very different ways – its flexible format allowed participants to easily discover how they could utilize Brainwolk in their own work. Brainwolk was used for different kinds of work tasks, such as ideation, seeking new perspectives, refining ideas, making summaries, and talking about sensitive topics. On the final questionnaire, all participants stated that they would continue the use of Brainwolks and would recommend it to others as well.

5.2 User Experience of the Brainwolk App in Mediating Walking Meetings

According to the interviews, the participants' perceptions of the Brainwolk app seemed to vary a lot. It seems that the app did not yet manage to fully respond to the users' needs, but on the other hand, it was perceived to have a lot of potential for the further development. Overall, the participants' experience of the app was worse than the experience of the walking meeting concept itself. On the final questionnaire, the participants gave a grade **6.8** for the app (scale: 4-10), while the Brainwolk walking concept itself got a better grade of **8.5.** The eight AttrakDiff [16] statements about the app reveal that the users rated the Brainwolk app quite neutrally when it comes to its user experience (see Table 1).

Table 1: Users' mean responses and standard deviations (N=10) to the AttrakDiff statements about the UX of the Brainwolk app, filled in on the final online questionnaire (scale: 1-7).

Human (1) - Technical (7)	M=4.5, SD=1.0
Pleasant (1) - Unpleasant (7)	M=3.4, SD=1.2
Practical (1) - Impractical (7)	M=4.7, SD=1.1
Likable (1) - Disagreeable (7):	M=3.7, SD=1.2
Cumbersome (1) - Straightforward (7)	M=3.6, SD=1.3
Rejecting (1) - Inviting (7)	M=4.3, SD=1.0
Dull (1) - Captivating (7)	M=4.3, SD=1.3
Motivating (1) - Discouraging (7)	M=3.4, SD=0.8

The positive aspects of the current app included the ability to **plan the walking meeting route** beforehand (i.e. before the meeting). For seven participants, the application provided good support in route planning; some liked to plan the route according to where they would earn the most points. In addition, walking a certain route with the help of the app taught the route and afterward they could use the same route even without taking a look at the app. It was also commented that the app was useful in **getting instructions and tips** on how to conduct a Brainwolk walking meeting. An additional aspect that was perceived positively was the **social pressure** caused by the points earned at each checkpoint and the corresponding leaderboard delivered to all participants in the weekly newsletter was perceived as somewhat motivational.

As a downside, the interviews revealed that **the app was not motivational enough** in its current form. The checkpoint contents (positive thoughts about walking and small physical exercises) were considered uninteresting and did not fit well with the walking meeting concept. Also, there were concerns that checkpoints were too physically close to each other, causing the user to arrive at the checkpoints too often. **The use of the application caused too much disruption** and the users were not able to concentrate on the meeting itself – holding the phone in hand (this is how they used the application initially), looking at the phone's screen, following the route and figuring out where to go next was perceived to disturb the flow of work-related discussion: *"During the walk I would like to release my brain for interaction with others and thinking. I don't want to focus on the phone screen while walking and working."* (female, 45 years). On the checkpoints, the phone vibrated and made a small sound, which also irritated some users. Moreover, at the time of the study, the app did not provide any features for note taking; many participants commented that some sort of easy **note taking would be necessary** in the app.

The current Brainwolk app that had a route guidance and checkpoint-based approach, did not please the users well enough (too much disturbance, not enough motivational aspects). However, the participants envisioned many ideas and approaches, how to further develop the walking meeting app. First, the application could act as **a walking meeting guide**. It could suggest the walking meeting in the opportune moments when the user is about to arrange a meeting, and introduce different ways of doing it, i.e.

visualize concrete descriptions of how to do it, for what tasks it is suitable for, and what is needed to do it. The application could have, different themes from which to select the most proper one, and the application would introduce that themed walking meeting. Also, the application could provide examples of routes with different lengths, and the user could choose the one that would fit into her purpose and schedules. In the end, the application would tell the user their achievements from the walking meeting – how many points were earned, how many steps were taken, etc.

Second, the participants talked about the potentials of the application to act as **a work community motivator** within work teams or workplace communities. The points that were earned on the checkpoints were considered interesting and motivational in case the application was used within a working team. Thus, the application might have a great role in supporting the walking meeting through playful competitions. The application could be used also for sharing experiences related to the walking meetings, and the positive experiences shared could make others in the community to try out the walking meeting.

The third potential approach suggested by the participants relates to the application's possible support during the walking meeting, i.e. the application could act as **a meeting moderator**. At the moment, the contents on the checkpoints were considered quite irrelevant, because they did not support the meeting itself, but included external things like stretching exercises. The contents and tasks of the checkpoints would need to be editable by the user. In the simplest form, the users could just enter their topics to be discussed during the walk to the checkpoints – and the new topic would appear when reaching the checkpoints and that could be talked until the next checkpoint.

Fourth, **measurable physiological and psychological effects** of the walking meetings could be shown through the application for the user, to provide evidence about the benefits of the walking meetings. The participants felt that there were subjective positive effects of doing the Brainwolk, but they also wanted to know if there is evidence for the physiological effects, such as heart beat increase and physiological recovery. The physiological evidence-based effects could potentially act as a motivational factor towards walking meetings. Thus, the application could act as a measurement tool and promote walking meetings through measurable effects.

5.3 Participants' Experiences of the Brainwolk Walking Meetings

According to the interviews, all participants considered the Brainwolk walking meeting concept as a very positive experience. The participants liked the idea and experience of walking and going outdoors during their suitable work tasks. All participants perceived positively the benefits of being lightly active when compared to sitting still all the time. The challenging weather conditions, however, sometimes limited the willingness to go out. According to the content analysis of the interview data, the main experiences related to the Brainwolk walking meeting method were:

- Restoration and recreation from nature
- Energy, refreshment, and creativity
- Enriched social interaction

All 11 participants described Brainwolk as **a refreshing, empowering and energy-giving experience**. Brainwolk brought positive feelings to the workday and **provided a possibility to escape** from the stressful sector for a while. Going out and facing **views, elements and experiences of nature** was considered to affect positively to the mood and restoration – eight users reported some restorative effects from experiencing nature elements, such as weather, trees, and beautiful views, as one of the users commented: *"Sometimes while walking my thoughts were interrupted by a surrounding element. But I did not feel bad about it, to concentrate for example to the leaves on the trees for a while. It restores. There is a peace in that."* (female, 32 years). On the other hand, sometimes the elements of nature, such as cold weather, negatively affected the participants' moods.

Some interviewees mentioned that when feeling tired they could **better concentrate** on the topic in Brainwolk than in a normal indoor setting. Typically, Brainwolks were conducted in the afternoon after lunch and were considered best suited to afternoons because conducting Brainwolk provided **an extra boost** for remaining productive for the rest of the day. Also, during the Brainwolk, the participants felt **thinking was smoother and quicker** when compared to sitting indoors. They reported that their **thoughts usually got clearer** which affected their work productivity and the number of new ideas. Brainwolk, according to some comments received, is suited well for **ideation**; participants felt that idea creation was more effective while walking as compared to sitting indoors, thoughts appeared smoothly without significant effort. Walking through different paths during the Brainwolk provided additional **stimulation** for thoughts. In most cases, Brainwolk was considered to be effective for work; however, it was not considered suitable for all work tasks.

With the exception of one interviewee, all reported strong experiences in **enriched interaction** between the Brainwolkers. Ten users described Brainwolk as a **more personal and devoted way to meet** another person. Six talked about devoting some time for another person, like in the following comment: *"It felt like a more personal way to meet the student, the feeling of really taking the time and leave with her. I think that the student also felt it was more personal."* (female, 38 years). A general opinion was that Brainwolk turned the **atmosphere on the meeting towards more relaxing and informal**. One user commented that it was easier to approach another person in Brainwolk than in normal meeting setup, and it encouraged the persons to get closer with one another: *"There is a positive effect on social interaction, it makes us become closer. It is informal in a good sense, and makes colleagues getting closer. Like, let's have a walk together. I think that the suitable number of persons is two."* (male, 28 years).

Brainwolk provided a suitable setting to talk about **sensitive topics**. Five users talked about how it made easier to constructively discuss sensitive issues and also provide negative feedback, and how the environment and walking made the situation less rigid compared to office meetings. Brainwolk was considered to provide **more privacy** to the meeting than a normal office meeting.

6 BRAINWOLK 2.0 – AN IMPROVED CONCEPT DESIGN

Brainwolk 2.0 concept is an improved version of the original Brainwolk research prototype (Brainwolk 1.0, which was described in Section 3.2) and it was designed based on the knowledge gathered in the field study (Described in Section 5). During the study, it was found out that walking meeting itself was perceived as a great opportunity to work in an active way, but the current app, which had a route guidance approach with checkpoints, did not respond well enough to the users' needs. However, the study also illustrated the potential for the further design. During the research process, we learned that the initial user needs and expectations gathered during the first user studies [2] differed at least partly from the user needs and requirements that were collected during the longer-term study. This is also the reason why it was seen necessary to design a new concept of the app that matches the users' needs in the long-term use rather leaving the design on the stage where the app was based on results from the short-term user tests [2].

6.1 Main Design Drivers for Brainwolk 2.0

Based on our findings gathered on the field study, we formulated the following design drivers for the improved Brainwolk app 2.0 (BW 2.0) design. Here, we also explain the difference between the former (BW 1.0) app and the improved one.

• **BW 2.0 plays the role of a motivator/introducer** of the walking meeting method. It introduces walking meeting method in a persuasive way and encourages users to try it out. BW 1.0 focused mostly on the routes and checkpoints, and provided only small hints on how to conduct walking meetings.

• **BW 2.0 utilizes discreet persuasion**. Most interaction and support for the walking meeting takes places before and after walking. Meeting time is dedicated for walking and talking – there is no interruption from the app. Usage of the app is voluntary while walking. In practice, there are different modes supposed to be used for walking and non-walking activity. BW 1.0 provided support mostly during the walking activity, which was considered disruptive. BW 1.0 did not provide enough persuasion during the time not spent walking.

• **BW 2.0 uses social motivators** to encourage walking meeting activity, such as walking meeting community creation, route sharing, sharing of walking meeting wellness data. BW 1.0 did not include social features, but the study revealed that those are very strong motivators towards the walking meeting activity.

• **BW 2.0 collects data**. It automatically collects walking meeting wellness data, e.g. steps, route, distance, to be shown to the user after the walking meeting. With external devices, it is also possible to collect physiological data during the walks, e.g. heart rate and galvanic skin response for viewing changes in stress and recovery. BW 1.0 did not collect data but the users wished it had.

• **BW 2.0 provides pragmatic support related to work**, e.g. easy note taking and goal/topic settings for the meeting. In BW 1.0, those were done on the notebook outside of the application.

• **BW 2.0 adopts a positive approach** – it acknowledges users and communities for their walking meetings, encourages them to do more and build a habit. BW 1.0 granted points, which was liked by the users, but it did not have any other encouraging features.

• **BW 2.0 is personalized** based on the user's behavior. It learns users' habits and provides smart notifications and information based on that. BW 1.0 was not personalized for the user.

6.2 The Brainwolk 2.0 App Concept Description

BW 2.0 is a mobile app concept (see Figure 2) consisting of two modes: 1) **still mode**, which is more versatile and provides persuasion and motivational features for the user and 2) **walk mode**, which offers a user an option with minimal interaction and disturbance during the walks, or if desired, encounter interaction in a form of meeting topic notifications and taking notes.

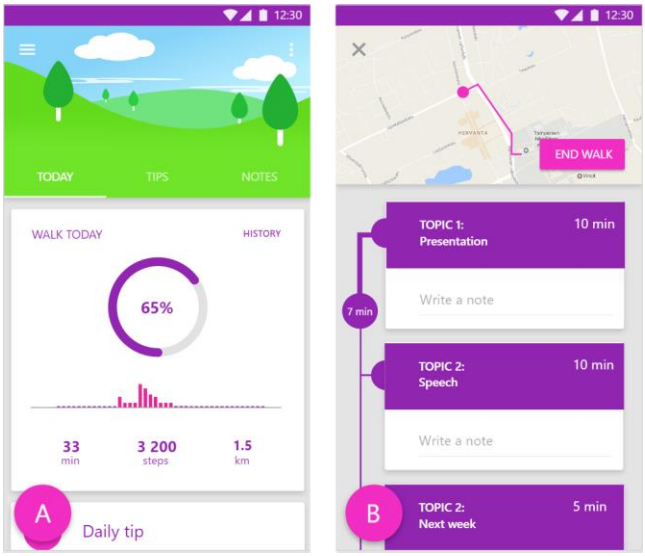

Figure 2: The Brainwolk 2.0 concept pictures. A) Application landing page with a daily overview, tips, and other daily information. B) A planned walk with topics, a note taking option, and information on progress.

Still mode: The features on the still mode are designed to be used mostly before and after the walks. In the still mode the application provides the following features: 1) persuasive tutorials to introduce and advise the walking meeting activity 2) persuasive notifications that are timed according to the user's location, time of the day, and user's personal preferences and settings, 3) data diagrams and other information about daily/weekly/monthly walks and steps during the work day, 4) planning tool for users to design their own Brainwolks including topics, route and topic notifications sent based on the time or location during the walk, 5) social share/like/invite option for taken walks, sharing of notes and walking results inside the app with the selected walking group or people, 6) achievement system to support long term persuasion and goal setting.

1. On the app, the users can access persuasive, interactive tutorials to learn how to conduct walking meetings, and to get the best tips for them. The app provides test walks with

different themes, and the user can literally walk and learn different ways to do walking meeting, with many tips and hints provided along the way. By conducting the test meetings, the user obtains points. There is an avatar that guides the test walking meetings in a playful manner.

2. Since the users felt that phone sounds and vibration were too disturbing during the walk and took the thoughts away from the work topic it seems that the best time to encourage and notify users is after and between the walks. To keep the notifications relevant to the user it is was also decided to notify users only during the working hours and when the user is in the workplace. The notifications can be, e.g. suggestions on conducting Brainwolk or information on current activity level.
3. Step and distance counter is also something that was requested by many of the field study participants. Measuring and keeping the track of the activity can help users to visualize and learn their current habits and it also provides an easy way to see the change and progress over the time. Thus, we see this as an important part of the walking meeting app. As one is trying to change his or her way to do things they can, at the same time, see in a concrete way the actual change they are making. By using external devices, it is also possible to get evidence about, e.g. decrease of stress during the walk.
4. The walk planning tool itself is something that may not be used by all users, but as making a list of the topics and taking a look at the route in advance were requested features, they were combined in the planning tool. The idea of the planning tool is to offer the user a chance to create their own walk structure by putting in their own topics, the time they want to walk - or if they prefer using a map, they can pin the topic notification points on the map. We discovered that some users were very confident with reading a map and following the route but there were also many participants who found it hard to use and read a map. Based on this finding it is better to offer users a possibility to either plan the walk on the map or based on the time they want to spend walking.
5. The social sharing of walked routes, experiences and measurements is part of the creating a community inside a working place for the walking meetings. The idea is to share the data to a closed group of co-workers and colleagues. That allows playful competitions of conducting walking meetings and the app can help to create a work environment where people feel they can leave their desks for and work while walking.
6. The final feature on the still mode is an achievement board that includes trophies you can collect. It can be also seen as a gamification element in the application. The achievements are labeled to be something like "the first Brainwolk achievement" or "took four Brainwolks in a month". These are more personal goals and they can provide meaningful content for the users who are not so into social interaction features.

Walk mode: The walk mode can be used in two different ways: 1) a user can actively use the app during the walk by first designing the walk structure in the app beforehand and taking notes during the walk, or 2) a user can put the phone in the pocket and it will serve only as a measurement gathering device during the walk. This way the application provides each user a different means to utilize Brainwolk for work based on their personal preferences. Making notes and having the list of topics in the application was requested by the users both after the initial user tests [2] and the field study. Even though we feel that notes can also be taken as soon as the walk is over in the form of a short summary, the note taking feature was mentioned frequently and thus seemed an important feature to include. Notes can be either in written form or recorded voice notes. They can be shared via email or inside the app to the other participants. On the other hand, as some people would like to take notes and have a planned structure for the walk others found it too disturbing to handle the phone during the walk, so it seems important to provide different options for a different user. Regardless of the way the phone is used during the walk, the walk measurements are recorded on the phone and they are present on the app after the walk. The app also records automatically the activity during the working hours and a user does not have to remember to start or stop the measuring when it is time to walk.

Overall the Brainwolk 2.0 app concept is built on the design drivers presented in Section 6.1. In comparison with Brainwolk 1.0, it does not rely so heavily on route guidance during the walk -the guidance and information sharing happens more outside the walks and more based on users' preferences and interests. One goal of the Brainwolk 2.0 is also to support different types of users that we discovered during our studies and to give users more freedom to discover the most suitable form of walking meetings for them.

7 DISCUSSION

We have presented the Brainwolk walking meeting concept and a mobile app prototype that was developed to mediate and motivate the walking meetings. The Brainwolk walking meeting is meant for encouraging physically active work habits in a sedentary knowledge work context. According to previous research, this aim is relevant because workers would benefit from the physically active work habits as they bring in health and well-being effects [7,36], as well as potential creativity effects [27]. The findings of our one-month field study indicate that the Brainwolk walking meeting is a pleasant experience and suits for many work purposes. It also seems to have potentials to increase workplace wellness. However, the UX findings of the Brainwolk walking meeting app revealed several challenges. Based on the findings, we re-designed the mobile walking meeting app (called Brainwolk 2.0) to better respond to the users' needs.

7.1 Design Insights for Persuasive Technology to Encourage Physically Active Ways of Work

The design research process provided us with an understanding of persuasive design on boosting physically active ways of work, and more generally, persuasive design in the context of knowledge work. Next, we discuss the main design insights that we have synthesized throughout the research process.

• **Discreet persuasion is a relevant design target in the knowledge work context.** On the design of persuasive technologies that are supposed to be used during the work tasks, the persuasion need to be utilized in discreetly. Our research confirms the earlier discussion of discreet persuasion, i.e. subtle persuasion [2]. The technology should not disturb the work task by requiring user's attention, but it should stay in the background. The persuasion and other interaction from the technology need to take place during the appropriate moments, e.g. in our case before and after the walking meeting. This is well in line with the former results showing that the best way to be reminded of physical activity during the workday is unobtrusively [35], as well as with the main design principle of unobtrusiveness on persuasive technology design [9,26]. In the work context, the design principle of unobtrusiveness gets much stronger emphasis than e.g. in the leisure physical exercise context, where direct and continuous persuasion can be used, e.g., in the form of playfulness. However, sometimes even in the work context, the direct persuasion can be a powerful strategy for persuasion, e.g., playfulness during a group task for improving group cohesion [22]. Even in the work context, different tasks can require a different type of persuasion.

• **Persuasive technology can act as an enabler towards persuasive real-life experiences.** The technological tool (e.g. app) can take a strong role as an enabler and pusher towards the change (here, adoption of physically active work habit). It can introduce the target activity in a motivational and persuasive way. The tool can, in a way, admit a mental permission to try out something that is not yet common (here, a work habit that is not commonly in use). The tool can provide a first kick and motivation towards the change by persuading the user to try it out. It can also "spread the message". By providing a first kick towards new activity, the tool can act as an enabler for new pleasurable experiences (e.g. great feelings due to the physical activity at work or relaxation due to being in nature). Pleasurable experiences encourage participation in the same activity again. The persuasive technology can thus open a gate towards real life experiences. Thus, the role of the persuasive technology could be to push to experience an even stronger type of persuasion – persuasion from real life experiences.

• **Social aspects are strong persuaders towards the new work habits.** People who are involved in the walking meetings generate motivation and the acceptance towards it. Involved people include those who invite others, those who walk together, those with whom the experiences are shared etc. In our study, the walking meetings were perceived to enrich social interaction between the walkers by bringing in more personal and devoted social interaction when compared to the meetings that take place in the office. Our findings confirm the findings obtained in previous studies, e.g. [37, 38]. Social support is one of the main design principles in persuasive and motivational technologies [1,26]. Again, the app can persuade people to conduct walking meeting together, but in rooting of the habit, the good social experiences (towards which the app can be an enabler) play a stronger role in persuasion than the the app itself.

• **Persuasive technologies have potentials to encourage the restorative nature experiences at work.** The restorative effects of nature could be utilized more broadly in the persuasive technologies that support workplace wellness. In our study, the users reported the effects of nature to improve their wellness during the walking meetings. This falls in line with environmental psychology research [3,15,34]. Even a short stay in nature brings about positive effects such as restoration [3]. Future research could thus inspect more of the potentials of the natural places as work environments for boosting wellness, and how technology could act as a mediator or persuader of these new work habits and environments.

To conclude our design insights, we make an argument about the powerful combination of digital and non-digital (real life experience) persuasion (see Figure 3). The technological tool with digital elements of persuasion (such as goals, rewards, community creation, playful elements etc.) can well act as an initial motivator, spreader of the message, introducer of the certain activity, and admit a mental permission to try it out. However, towards the real work habit change, the non-technological aspects probably play an even stronger role. By those aspects, we mean the real life experiences and feelings provided by the behavior or activity itself. In our research case, the walking meeting was followed by creativity experiences and increased energy, the restorative effects of nature, and the enriched interaction with the co-walkers. We call these non-technological aspects as "*non-digital persuasive experiences*".

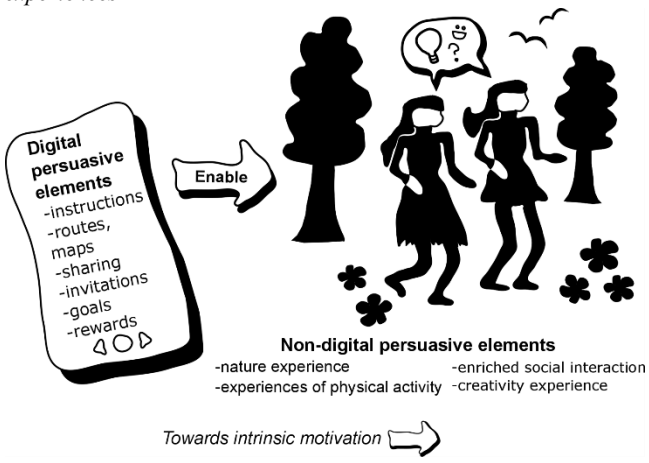

Figure 3: Digital persuasion can act as an enabler to experience the non-digital persuasive aspects.

With the means of technology, we can motivate people to take the first steps towards the physically active ways of work, but the technology probably cannot act as an ultimatel motivator to change the work habit. Apps and technologies usually do not manage to motivate for a very long time. **The combination of the digital and non-digital persuasion may provide the most powerful setting towards the long-term intrinsic motivation** (see Figure 3). Initially, the technology uses digital elements to persuade people to try out and experience the non-digital real life aspects that ideally begin acting as persuaders towards the long-term motivation and behavior change. The importance of combining both digital and non-digital objects in service design has been discussed earlier e.g. in [25].

7.2 Limitations and Conclusion

Our study has limitations which leave room for future research. The mostly qualitative and explorative nature of the study produced design insights on encouraging physically active ways of work through persuasive technologies. Due to the limited number of the participants, the lack of diversity in their demographics, and the limited timeframe of the study, we are cautious to generalize these findings to a larger population. Future research needs to validate the design insights and the re-designed concept in a study with a larger number of users. In addition, the sedentary lifestyle is a global problem and touches a great portion of people globally. Thus, the future research has to investigate the needs and experiences of proposed solution(s) in cross-cultural settings. The present research contributes on the disciplines of human-centered design and persuasive design. More specifically, this paper provides design insights on three areas of persuasion: 1) persuasive technology to encourage physically active ways of work, 2) discreet persuasion in the knowledge work context and 3) combination of digital and non-digital persuasion. By developing solutions to support physically active ways of work, researchers and practitioners can help motivate sedentary workers towards to become more active, thus boosting people's well-being, creativity, and sociability at work. So, *let's all walk at work!*

This study was conducted as part of the Pop Up – Knowledge work productivity -project. The project was financed by Tekes, two universities and three companies. We would like to thank the representatives of the companies and the participants.

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