Walk as You Work – User Study and Design Implications for Mobile Walking Meetings

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ABSTRACT
People's sedentary lifestyle is connected with serious health threats. The goal of our research is to gain novel insights on ways in which movement during knowledge work can be increased. We propose and study *mobile technology mediated walking meetings*. In this paper we present the results of a design research project with a two-phase qualitative user study, in which we first explored users' expectations towards walking meetings (N=15) and designed the *Walking metro* mobile application concept. We then evaluated user experience of the concept in field tests (N=14). Based on the findings, we propose 10 design implications for mobile walking meetings in three categories: *designing for acceptability*, *non-interrupting guidance,* and *discreet persuasion and stimulation*.

Author Keywords
Walking meeting; knowledge work; well-being; wellness; mobile application; UX; design implications; persuasion

ACM Classification Keywords
H.1.2 User/Machine Systems: Human factors. H.5.2 User Interfaces: User-centered design.

INTRODUCTION
"Please have a seat!" is an often heard request when people meet. Contemporary life is characterized by knowledge work and sitting. A typical office worker sits half of the workday [18] or even four fifth of the daily working time [31]. Even doing physical exercise in free time does not necessarily compensate for the sedentary time of the workday [18]. The sedentary lifestyle is connected with serious health concerns and threats, such as overweight, cardiovascular diseases and diabetes 2 [8]. Physical activity possesses several benefits for health. Even *light-intensity activity*, such as slow walking and standing, has many benefits for health [8]. In addition to health benefits, being physically active may improve happiness [34], performance and creativity of knowledge workers [20, 24]. Moreover, the employee who feels well and satisfied at work is usually more productive [25, 28]. Several types of traditional physical activity interventions, e.g., education, health checks and physical activity programs, have been conducted to increase physical activity of the workers, but they have not been very effective [22, 8]. Thus, new innovative techniques to beat the challenge of sedentary work are needed. *Walking meetings* (i.e. determined work-related "walk and talk" sessions with colleagues) are one way to increase movement during the workday. Walking meetings have gained popularity as many leaders of famous companies, especially in US, have publicly told that they do walking meetings. On web sites, YouTube videos and in articles one can find practical instructions for arranging a walking meeting, e.g. [26]. However, walking meeting has not become an ordinary way of working for the mass of knowledge workers. In addition, as far as we are aware, mobile technologies have not been harnessed to support walking meetings, although they have good possibilities to do that. The mobile technology is always on, always along and easily spreadable.

The goal of our research is to study ways to increase movement during knowledge work, *specifically by utilizing mobile technology mediated walking meetings*. A well-designed mobile tool to support walking meetings can make it possible for the sedentary workers to integrate light-intensity physical activity to their workdays, thus leading to better well-being, creativity and productivity. Following a design research approach, we explore the opportunities of and the user needs to mobile technology mediated walking meetings (henceforth, *mobile walking meetings*), design concepts from the human-centered perspective, and evaluate them in situ with real potential users. The research questions were formulated as follows:

1. What are the users' expectations and needs for walking meetings?
2. What are the user experiences of the mobile walking meetings?
3. What are the design implications for persuasive mobile walking meetings?

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Our research has a multidisciplinary approach combining human-centered design, psychology and knowledge management. Our work contributes to human-centered design by resulting in novel design knowledge produced by the design research approach. We conducted walking workshops (henceforth, *walkshops*) [35] to explore the participants' expectations towards walking meetings, designed a mobile walking meeting concept (called Walking metro) based on the user study findings, and evaluated the concept in the field tests. Based on the user studies, we drew 10 design implications for persuasive mobile walking meeting applications. The implications add knowledge on the design of motivational and persuasive applications on the domain of wellness [1, 13, 10] and constructs design relevant knowledge in the intermediary territory between design practice and theory [11].

RELATED WORK

Physically Active Ways of Working

Although the drawbacks of sedentary work life have been widely recognized, the current ways of working and traditional work environments do not support physical activity at work. In this paper, physically active ways of working do not aim at conducting physical exercise as such, but can be defined as *light- or moderate intensity activity and moving around* rather than making an actual exercise. Height-adjustable workstations are good examples of reducing sitting at work [29], but in most cases they are not used proactively but only when physiological problems have already occurred. Moreover, they only increase standing but do not provide the benefits of moving around.

Various new means and technological solutions for adding physical activity to the workday have been introduced in the recent research, including activity trackers such as pedometers [30], smart furniture that recognize pose and activity levels [7], as well as treadmill desks, stepping devices and cycling workstation [19, 24, 21]. Thus, the role of technology for activating people seems to be increasing also at workplaces. The dynamic workstations seems promising to increasing active time during daily office work without compromising work performance but having actual positive influence on workplace stress and overall mood [19, 21]. The research shows that creative thinking improves when thinking and walking are combined, and the effects remain for some time after the walking activity [24]. Walking at lunchtime has been found to improve perceptions of health, subjective vitality and work performance, and also decrease in fatigue at work has been observed [32]. According to [20], walking while working with the use of a treadmill desk has a beneficial delayed effect on attention and memory. However, worker's perception of decreased performance, for example while typing or using mouse, might complicate acceptance and therefore, time for learning to use new workstation is needed [9]. On the other hand, the lack of social acceptance of the devices to increase physical activity may be an obstacle to use such equipment or technologies at work [33].

People wish they could sometimes spend time in nature settings even during the workday [3]. Nature experience is linked to the mindset of recovery in work [3]. Harnessing the near existing nature places as temporary workplaces while conducting a walking meeting can be seen as a novel approach to add physical activity to the ordinary workday. Spending time on nature has been proven to have positive effects on cognitive tasks such as directed-attention abilities [5] as well as on restoration and recovery [14]. The mood and self-confidence improve after the physical activity conducted in nature [4]. It has been found out that the strongest changes in mood took place after spending short time, e.g. five minutes, in nature [4]. Thus, it can be stated that the healing effect of nature is ecological and harmless "medicine", and could possibly come up with huge benefits for the people doing knowledge work, if it was utilized more during the workdays.

UX and Persuasive Design as Approaches for Behavior Change

Taking a new work habit into use, in this case a walking meeting is a challenging behavior change. Current knowledge work culture implicitly states that effective work is done by sitting on the desk in front of computer. According to the well-known Transtheoretical Model [27], the behavior change process consists of several phases. It starts from pre-contemplation, when an individual is not considering any behavioral change and is not aware of the problems. Through three initial phases she proceeds to the stages of action and maintenance, which include the actual and visible actions of the changed behavior. However, adopting the walking meeting as an ordinary work habit does not only depend on the individual workers, but also the leaders of the organization need to accept and support it in the strategic level [22].

Technological solutions, especially mobile applications and wearables that can be carried along all the time, provide good opportunities to support behavior change due to, e.g. their possibilities for providing effective prompts and feedback at the right time and place. Masses of mobile phone apps have been developed for supporting wellness, for example physical exercise, and the most popular ones have millions of users. It can be assumed, that mobile technology could also support the behavior change related to the adoption of a new work habit, walking meeting, and making it as an ordinary way of working.

When designing an application that aims at initiating behavior change as well as support the maintenance of the change, it is important to take into account both pragmatic and hedonic factors of user experience (UX) [15]. Pragmatic factors refer to the functional usability and usefulness of the product, while hedonistic attributes relate to the non-instrumental and emotional attributes, e.g. stimulation, identification and evocation. Hedonic attributes form strong

potentiality for the pleasurable user experience. Without tempting and motivating UX, the application is probably abandoned. In the case of a walking meeting app, the pragmatic attributes may relate to, for example, guiding the practicalities such as ways to do the walking meeting and dressing properly. Hedonic attributes, then, may relate to the design elements that create users' motivation towards conducting walking meetings in the first phase as well as keeping the interest high after the initial enthusiasm.

Persuasive design of technology aims at changing peoples' behavior or thinking, [12, 23]. Models present different techniques for persuasion, such as tailoring, rewards and social comparison [23]. In addition, design strategies for motivational exercise applications have been studied extensively and they are at least partly applicable to the design of mobile walking meeting apps. For example, the flower model [1] introduces 34 design strategies divided to six categories: Support my exercise, Be my advisor, Grow with me, Utilize my sociability, Keep me engaged and Visualise my exercise. It is interesting to explore if there are any differences in persuasive design of work-related technologies where physical activity comes as a positive side effect, when compared to apps that focus straight on physical activity increase.

METHODOLOGY

Table 1 summarizes our design research process, where we explored the expectations, designed a mobile walking meeting concept, evaluated its user experiences and formulated design implications for persuasive mobile walking meeting applications.

Exploration of Users' Expectations

In the first phase we explored the expectations, motivations and needs of the potential users towards the walking meetings. The study was conducted by applying walkshop approach, i.e. group discussions done by walking [35]. Discussion while walking was a natural method for studying walking meeting user needs, as the method allowed for the participants to authentically walk and think about the focal topics.

Phase	Method and N	Focus
1.Expectations	Walkshops N=15	Explore the expectations and user needs of potential users towards the walking meeting
2. Design	Iterative design	Design concept of mobile walking meeting (Walking metro) to meet the user needs from the previous phase
3. Experiences	Field tests and interview N=14	Evaluate the user experiences concerning the walking meeting concept
4. Implications	Synthesis of the user study findings	Formulate the design implications for the further design of mobile walking meeting applications

Table 1. The four phases of our design research process.

We arranged four walkshops with 15 university workers (F=11, M=4), including researchers, teachers, coordinators and secretaries, who were recruited through advertisements. There were 3-5 participants per group. The age range of them was 25-65 (mean=41). All participants were sedentary workers. The estimated average sitting time was 70% of their workday. Most did leisure physical activities for 3-5 hours/week. 10 participants were using some exercise app or device, e.g. Sports Tracker.

The walkshops were arranged in the Finnish university campus in September 2015. They included an initial discussion in a meeting room, and walking both outdoors and indoors. Each walkshop lasted about 1,5 hours. There were pre-defined topics to be discussed during the walk, and four checkpoints on the route. The participants walked in pairs between the checkpoints and discussed the provided topics. On the checkpoint, new topics were introduced, and the topics provided on the previous checkpoint were wrapped up. The topics included, e.g. current practices of walking meetings (if any); the work tasks suitable to be done by walking; motivations for the walking meetings; the properties of the desired routes; ways to promote walking in campus. Two researchers were present in the walkshops –a facilitator and note taker.

The discussions were audio recorded and transcribed. The content analysis [17] was utilized in the interpretation of the data. The content analysis adapts an inductive approach, where the raw data are compressed into categories through the examination of the researcher. We carried out the content analysis digitally in Excel by classifying the data to the pre-defined themes of the discussion guide. New themes that emerged during the discussions were added on the analysis framework.

Design of the Walking Metro Concept

The concept of mobile walking meeting was designed and implemented during the next 2,5 months after the user study. The first step was to get a good insight to the study findings and start to explore the different concept ideas for the mobile walking meeting. The basic concept behind was a walking meeting, i.e. *a meeting or discussion that takes place by walking*. The findings from the user study guided the design of the mobile walking meeting concept. The Walking metro idea was chosen from the pool of the ideas generated by the participants to be the theme of the overall concept. It allowed adding walking lines with different themes and lengths, and it seemed to add a little bit of fun and imagination to the basic walking meeting idea. The next step was to generate ideas to create our walking metro lines. From five initial lines we chose two for the further development and evaluation. We also considered the experiences of before and after the mobile walking meeting. A sketch was drawn to visualize the steps before starting the walking meeting for the first time (see Figure 1).

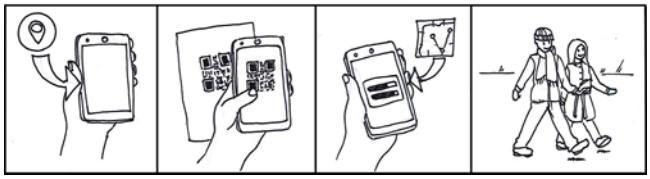

Figure 1. A sketch of how to get started with the mobile walking meeting.

When the structure of the concept was clear we started to create the content and implement the lines to the ActionTrack platform [16] as well as selecting the physical locations of the lines and stops. ActionTrack consists of a web editor tool and a mobile application to build location-based activities. The web editor is used for creating the routes and other content and the actual users will access the content by using the mobile application. Overall, ActionTrack is designed for different outdoor and indoor activities where people move between checkpoints by navigating with a map or by other instructions. Among the other things, it has been used for team building and educational purposes [16]. ActionTrack was chosen for our purposes because it offered a relatively easy way to implement the walking meeting concept on mobile platform without any programming work. Usage of ready-made tool allowed us to concentrate more on the structure of the concepts, and on the research.

Evaluation of User Experience

The Walking metro concept was evaluated in the field tests in the university campus in December 2015. The focus of the study was to evaluate the user experiences of the Walking metro concept. 14 sedentary university workers (F=10, M=4) were recruited through advertisements. Their average age was 35 years (range 26-57). Their most common amount of physical activity 1-2 hours/week, and 8 were using exercise applications. Their estimated average daily sitting time was 80%.

The field tests were conducted in pairs to raise natural dialog between the users concerning the use of the concept as well as testing the idea of having an actual meeting while walking. The pairs consisted of individuals who were working together e.g. in the same project or team, so they had authentic topics to be discussed during the walking meeting.

In the beginning, the system and test setup was explained to the pair, and initial expectations towards a mobile-mediated walking meeting were collected. Then, the pair selected one of them to act as a meeting moderator who would use the application. The second person got the role of a secretary, who made notes of the meeting if needed. Thinking aloud during the test was encouraged. In the first task the participants were supposed to conduct an introductory walking line, located inside the campus buildings. In the second task they conducted the actual walking meeting line, located outside. During the walking meeting line, they were asked to discuss their self-defined work-related topic. During and after each walking line, the participants were interviewed about the experiences, e.g. how they felt about the routes and concept; how did they found walking and having a meeting; how did they find the use of the concept; what did they like about the metaphor; and for what kinds of tasks the concept would be suitable. During walking, the behavior and actions of the users were observed. One test session took about 1,5 hours, and we had seven sessions in total. The weather conditions varied between the tests (-4 to +5 Celsius, from rainy to sunny).

The sessions were audio recorded, and photos and video clips were taken. The audio file was transcribed verbatim and the data was analyzed collectively with the affinity wall technique by categorizing the data notes according to their relations with each other [6].

Formulation of Design Implications

The design implications were drawn as a synthesis from the findings of the user studies. The design implications are a summary of the design insights revealed from our studies and factors that need to be taken into account in the further design of mobile walking meetings applications. Most design implications were reinforced with the findings from both studies. Table 2 presents a summary of the design implications.

Figure 2. The Walking metro concept presented with screenshots and pictures. (A) Introduction line indoors (B) Metro map poster presenting all walking lines (C) Walking meeting line outdoors

THE WALKING METRO CONCEPT

The Walking metro features, e.g. the routes, duration times of the routes, checkpoint content and motivational methods, like surprises and collecting points, were mainly built on the user needs and expectations. The Walking metro metaphor was presented as an idea by one of our study groups. However, we also added some features based on our own ideas. The Walking metro was visualized to the users with a map that resembles a metro map - colorful lines with the stops marked along them with the circles (see Figure 2B). The concept consisted of several walking lines, out of which *Introduction line* (Figure 2A) and *Walking meeting line* (Figure 2C) are on the focus of this paper. The walking lines were drawn on the original campus map that was edited to be a bit more colorful and playful. The Introduction line was an indoor route that introduced the concept of walking meeting, and the Walking meeting line was an outdoor route for conducting actual walking meetings. Each route had a certain number of checkpoints, or stops as we call them that must be visited to complete the walk. The stops were automatically activated outdoors and the content of them was revealed to the users when they had walked to the right place within a certain range of GPS coordinates. Indoors, where the GPS data is not usually very reliable, the content of stops was revealed after the user scanned a QR-code on the checkpoint.

On the stops users got information about the walking meeting practices or encouraging messages to keep on going. At the end of each line they were told the number of steps taken. The stops also included visual material that somehow related to the stop. There were two surprise messages along the outdoor walking meeting line to add some fun and playfulness to a meeting. Overall we tried to avoid too many interruptions during the walk, to keep the lines away from the busy routes and to limit the walking time to 20-25 minutes, but also include some surprises along the routes to answer to the needs for stimulation that we found out in the first study.

FINDINGS

This section summarizes the findings related to the research questions. From the main findings of RQ1 and RQ2 we drew design implications for persuasive mobile walking meetings (RQ3). The summary of the implications and their explanations is presented in Table 2.

Expectations and Needs towards Walking Meetings (RQ1)

Here we present the findings for RQ1, analyzed from first user study. We briefly describe what work tasks the participants thought would suit for walking meetings, and what kinds of benefits they expected from them. We explain the perceived challenges related to the walking meetings, as well as the pragmatic and hedonic needs towards the walking meeting application.

Suitable work tasks. There were several work tasks that were perceived suitable to be conducted by walking. These tasks were mostly generative and creative rather than strictly focused. The *ideation* and *initial planning* was the most mentioned work task, and participants commented that changing the physical location gives different perspective. *Thinking, reflecting and discussing* were considered to be easy to do while walking. Also, *familiarizing with new people, foreign language immersion, talking on phone* and *listening to work related podcasts* were perceived to be possible to do while walking. As the walking meeting was actually preferred in *informal* rather than formal meetings, our first design implication (DI) is stated as: **"Re-design the walking meeting concept" (DI-1).** The walking meeting application could introduce a fresh approach for walking meeting, and focus on generative and creative part of the work instead of formal meetings.

Expected benefits. The most obvious benefits expected from the walking meetings were *being outdoors*, *being active* and *feeling well*. The participants explained how important it would be to be able to *enjoy a beautiful weather* and *fresh air* during the workday, and to be able to *experience nature* instead of just sitting inside. They commented that being able to *collect steps* during the workday would be appreciated a lot because otherwise all the pressure for doing physical activity is put on the evenings. They also talked about the expected effect of the walking meetings on *feeling refreshed*, and turning a stressful work task *less stressful*. Walking meeting was also connected with *variety* and getting *new stimulus* by moving in different spaces and seeing things. Taking new routes was expected to bring about *new perspectives* for thought, and more *insight*. Actually, we could observe that as the participants started walking and discussing, their positive thinking towards the potentials of the walking meeting increased a lot when compared to the expectations that were initially asked in the meeting room. Finally, there were expectations that walking meeting can have positive effects on *social interaction*. According to the participants, walking can lower hierarchies and the threshold to talk, break ice, make people closer and make it easier to talk about sensitive or embarrassing topics. The walking meeting application can utilize the positive effects of walking by promoting them explicitly. Thus, we propose the following design implication: **"Promote and emphasize the positive effects" (DI-9).**

Challenges. The participants expressed certain challenges towards walking meetings. First, *work culture change* would be needed to accept the walking meeting as a normal and recommended work habit. Currently, the culture support sedentary knowledge work. The walking meeting needs to beat the current, customary ways of work. It needs to be stated clearly what are the benefits, positive effects and potentials of the walking meetings to initiate the attitude and culture change. It must be explained for what kinds of work tasks walking meeting is suitable – one should not claim that everything can be done by walking. These findings relate to **DI-1** and **DI-9.** More pragmatic challenges were *making notes* and *viewing and showing material* that is needed, e.g. documents, calendar, slides and web. On the other hand, the

participants also discussed about how easy it would be to write keywords about the relevant things on a small notebook, and also, how empowering it would be to be able to work sometimes freely without being bound to the computer. Based on the findings above we suggest the following design implication: **"Enable the walking meeting to become an accepted way of work" (DI-2).** Designing an "official" tool, i.e. application especially for walking meetings, may support the acceptance. This implication is connected to **DI-1.**

Pragmatic needs. The participants wished for guidance on how to conduct the walking meeting, i.e. a sort of "*ABC of the walking meeting*". The instructions should include e.g. correct *outfit and equipment* for the meeting, information of the proper amount of persons to be included, and information about the routes. According to the participants, *1-4 persons* would be optimal amount of participants, and there should be *routes with different lengths*, from 5 minutes to even one hour. There should be *pre-defined routes* available as well as a possibility do *own route*. Indoor routes were wished in case of bad weathers, but *outdoor routes were preferred*. There should be checkpoints with *standing desks* along the route to provide setting for standing for a while and making notes. The routes should be peaceful and not very crowded with people. The walking meeting should include a work-related *goal or target*. Based on these pragmatic needs, the next design implication is stated as: **"Instruct about the practical matters" (DI-4).** The application should provide a concise introduction to the practical side of the walking meetings

Hedonic needs. From the perspective of emotional and motivational attributes, i.e. ways to stimulate the use of walking meetings, the following aspects were suggested. The system should provide *feedback on physical activity*, e.g. steps taken during the meeting, and provide *positive encouragement* to do it again. It could present *surprising content* every now and then to maintain the curiosity. The routes and destinations could *evolve* along the use. By conducting walking meetings, the users could be able to earn *points*, and a *challenge or competition* between teams could be set up. The group collecting points together was perceived as a collaboration aspect. Also, enthusiastic individuals could be used as *messengers* of the walking meeting, and they could suggest a walking meeting for others to spread the message. The tool could also give right-time *prompts and reminders* to do the walking meeting to introduce an alternative way of work. Our next implication is, based on the findings above: **"Stimulate and motivate with the discreet use of playful elements" (DI-10).** In addition, we suggest the implication: **"Suggest conducting a walking meeting instead of sitting" (DI-5).**

User Experiences of Mobile Walking Meetings (RQ2)

This section covers the user experiences of the walking meeting application based on the evaluation of the Walking metro concept. We concentrate on 1) the experienced *benefits* of the walking meetings, 2) the ways how the application can *persuade* for walking meetings, and 3) how the application can support the *concentration* towards the walking meeting topic.

Experienced benefits. The walking meeting was perceived as a very *positive experience*. All participants commented that they have work tasks that could be conducted by walking. Similar to the first study, the most suitable task was free-form ideation and planning, where structured meeting format was not needed. Thinking and talking while walking was done successfully throughout our user study. The users said that walking meeting felt good and refreshing. It was also perceived to provide *freedom*. Without the usual office tools (desk and computer) one gets *more space for thinking and concentration* to the actual topic. One gets freedom from all additional stimuli and multitasking with the computer. The key words of the discussion were perceived to be easy to write down on a notebook during the walking meeting. Related to the experienced freedom, the perceived benefit was also that the users are able to choose the ways how to do the walking meeting once the general guidance and motivation to do it is provided by the application. Therefore, our next design implication is: **"Support the freedom of the user" (DI-3).**

The walking meeting was perceived to *improve cognitive tasks*. The users felt that walking meeting is beneficial especially when they are stuck with some thoughts. The walking meeting was perceived to open and activate new perspectives for thought. It was mentioned that walking can affect positively to the memory, as some people attach things to certain places and they are easy to remember afterwards by mentally returning to that place. In addition to cognitive tasks, the walking meeting was perceived to have positive effect on *social interaction*. It was considered to be a good way to get people out of their cubicles. It was observed that in the walking meeting, the participants could also talk about confidential topics as we left the official workspace and went to the outdoor route. One user commented that walking may decrease the hierarchies between people.

As a main benefit, the walking meeting was considered as *physically active and relaxing* way of working, but not as exercise performance. The users liked to work actively and see that they move and collect steps while working. They mentioned that it is nice to be able select their speed, depending on their mood and other factors. The walking meeting was considered as a relaxing experience. One user explicitly told that the stressed feeling disappeared in the walking meeting. *Being outdoors and experiencing the elements of nature* as a part of an ordinary workday was considered as a benefit. The users preferred outdoor route to indoor route, and they liked to get fresh air and experience nature. Examples of nature experiences during the walks were beautiful pink glow in the sky and fresh snow. Some users imagined how lovely it would be to have especially

beautiful spots of nature along the walking route, as well as experience the different seasons.

The perceived benefits and experiences can be turned to motivational factors towards walking meetings. The walking meeting application can utilize the benefits as motivational factors by explicitly emphasizing them. These findings strengthen the implication already presented: **DI-9.**

Motivational factors. The study revealed many possibilities for the application to persuade and motivate people to do walking meetings. One of the most important aspects on motivation is that a useful tool (application) can increase the acceptance towards walking meetings. An "official" tool can turn walking meeting to *an acceptable way of work*. The users commented that without the tool and carefully designed practices, they feel that they are not actually working, and that others would think that they are not working. It is very important to design the walking meeting concept carefully and provide an "official" and useful tool to make it acceptable, as was already introduced in **DI-2.**

The application can also provide motivation towards walking meeting by *utilizing the factors of environment*. Different kinds of routes with different lengths act as a motivator. The users can be motivated with interesting places around the route. Providing various routes brings *variety* to the conduction of walking meetings. There could also be new routes appearing along with the use. However, the route that some participants preferred familiar and "safe" routes that could be accessed and learned quickly without hardly any focus on the route. Accordingly, we suggest the following design implications: **"Provide different readymade as well as user-defined routes" (DI-8)** and **"Utilize digital UI features and physical objects" (DI-7).**

An additional factor of motivation is *viewing the health and wellness related information* on the application. The participants were fascinated about knowing, in a factual level, what positive effects walking had on them. They wanted to see the steps taken during the walking meetings, and how much that was from the daily recommendation. Some users also wished for more analysis based on the steps taken, e.g. how the increased amount of steps is supposed to effect on the overall health. These findings give support for **DI-9**.

Social aspects were also perceived as motivational factors towards walking meetings. Some users did not like to compete against others about taking walking meetings, but for some users collecting points and competing against other teams seemed to be an important motivational factor. For example, earning points based on the length of the routes taken as well as the frequency of taking a walking meeting, and competing in small teams in the campus or department, and showing the order of the team on a public score board could motivate. In addition to receiving honor and reputation, some participants commented that extrinsic,

Category	Design Implication	Explanation
1) Re-designing the concept for acceptability	**DI-1. Re-design the walking meeting concept**	•Walking meeting suits best to generative and informal work tasks, e.g. ideation •Re-designing and renaming the concept of walking meeting and introducing that in the app could lead users to see the value of walking meetings
	DI-2. Enable the walking meeting to become an accepted way of work	•People have prejudices towards walking meeting, e.g., not acceptable in workplaces •Designing an "official" tool may support the acceptance
	DI-3. Support the freedom of the user	•Freedom is a key element in walking meetings: freedom of moving, freedom from computer, freedom of thoughts •The app should provide a frame but users are allowed to create their own meeting habits and style
2) Non-interrupting guidance and instructions	**DI-4. Instruct about the practical matters**	•Users need information about how to do it •The app should provide a concise introduction, e.g. how to start, setting the targets, equipment needed, and tell users what kind of work tasks it is especially suitable for
	DI-5. Suggest walking instead of sitting	•The option for the walking meeting should be present when planning a meeting •Allow "messengers" to promote walking meeting and send invitation to others
	DI-6. Guide but do not interrupt	• Users want to get instructions, see the destination or a route, and get feedback from the app • The support and guidance should not interrupt talking and thinking
3) Discreet persuasion and stimulation	**DI-7. Utilize digital UI features and physical objects**	•Both digital features (map, guidance, playful elements) and physical world objects (routes, locations, nature, weather, fresh air) can motivate and support users •The app can utilize both for persuasion
	DI-8. Provide different readymade as well as user-defined routes	• Different routes needs to be provided for safety, variety and freedom of choice •The app can provide different types of walks: determination, break, exploration..
	DI-9. Promote and emphasize the positive effects	•There are many positive effects, e.g. increase in creativity, mental and physical health, fresh air •The app can explicitly promote positive effects of the walking meeting and turn them into motivational factors
	DI-10. Stimulate and motivate with discreet use of playful elements	•Evolvement of the routes, surprising content and competition can motivate people •Playful elements should be utilized discreetly in the app

Table 2: Summary of the design implications for persuasive, mobile walking meetings.

needs to be simple enough without a need for special equipment such as trekking shoes. It must be also noticed, *concrete rewards* could work. Free coffee seemed to be enough for taking a walking meeting. Whatever the

rewarding method would be, *positive feedback* should definitely be part of it. The participants especially liked the small nuanced reward from the Walking metro – a short fanfare that was heard after completing the walking route. The users liked to be thanked for. All these findings provide support for **DI-10**.

Supporting concentration. It was found out that, obviously, the walking meeting topic is the main point and the walkers should be able to concentrate on that during the walk. This can be done by designing the routes, guidance and the motivational factors to support concentration. In user study we found that the Walking metro provided directions and messages for the users too frequently. The intermediate messages and the notifications on checkpoints that were designed to act as guiding and rewarding elements disturbed and annoyed users, because they took their attention from thinking the meeting topic to the application. Searching and finding of checkpoints was not considered an appropriate idea for walking meetings, but that approach would suit better for breaks, where the aim is not on working but relaxation. The guidance of the route should be designed as non-disturbing as possible, still giving the user an experience of being on the right way and prevent from losing the way. The main point on doing the walking meeting should not be on orienteering but on proper concentration on the discussion topic. The design implication derived from these findings is: **"Guide but do not interrupt" (DI-6).**

Concerning the routes, they should be designed to be *long enough* and *straightforward* to support concentration. Our 20-minutes long walk was considered to be too short for the walking meeting. The Walking metro required too much concentration on following the route and orienteering. The users wanted to see the route prior to the walk to become familiar with the route. The routes should be safe to walk, and there should be a possibility to select a route that is in a near distance and familiar. It was commented that discussion is easier outdoors than indoors because at outdoors there is more space and silence, depending on the location for sure. A couple of participants commented that if the surroundings are too interesting it may interrupt the walking meeting, but it was not an issue for most of the participants. The majority thought that walking on beautiful or interesting surroundings is one of the key benefits of the walking meetings. These findings give support for **DI-6** and **DI-8**.

As it is already clear, the application and motivational features on it should not disturb the concentration on the actual meeting topic. The user should not need to finger the application during the meeting. The application should disturb the user as little as possible during the meeting. So, the motivational elements should be presented either before or after the actual meeting. For example, if the user can collect points by using the application, those should become automatically while walking and the user could take a look at those afterwards, thus supporting **DI-10**.

Design Implications for Mobile Walking Meetings (RQ3)

The design implications (Table 2) are a summary of the lessons learned during the design research process of the walking meeting application, and simultaneously, guidelines for the further design of persuasive mobile walking meetings tools. In total, 10 implications are presented in this paper. They are divided into three categories: *1) Re-designing the concept for acceptability, 2) Non-interrupting guidance and instructions,* and 3) *Discreet persuasion and stimulation*. The design implications include both pragmatic guidelines as well as guidelines related to persuasion and motivation towards conducting walking meetings.

DISCUSSION AND CONCLUSION

Nowadays, the knowledge work is characterized by hectic workdays, high demands and multitasking, often in the cost of the employee's well-being. Walking meetings, where the users are free from sitting on their desktops, can support concentration towards thinking and discussing about the specific topic that is selected to be a target of the walking meeting. Providing also positive side-effects from walking (activity) and being in the nature (relaxation), walking meetings can potentially increase the well-being and satisfaction and thus, productivity of the workers. *Technology mediated walking meetings provide good potentials to introduce the concept of 'walking and working' to the large masses of people* and increase physical activity in workplaces.

In this paper, we have presented ten design implications for persuasive, mobile walking meetings. Based on our findings, a persuasive app that introduces the walking meeting technique and guides walking discreetly is needed *to turn walking meetings as an official and socially accepted way of work for the great masses* **(DI-2)**. The lack of social acceptance is one of the challenges related to the adoption of technologies that support physically active ways of work [33]. Another important design factor is the possibility to invite others to the walking meeting. The enthusiastic human messengers could *lower the threshold of doing the first walking meeting* **(DI-5)**. The concept of walking meeting should be introduced for the users not as a formal meeting with the formal meeting practices, but merely as *a creative and generative discussion or thinking session* that gives another perspective for thinking, freedom for thoughts and well-being as a positive side-effect **(DI-1, DI-3)**. In the world of multitasking and hassle, the walking meeting can be an empowering experience. Mobile technology can help in guiding the new habit.

The walking meeting app needs to include guidance and motivational triggers to initiate and continue with walking meetings, but they should be presented discreetly **(DI-6, DI-10)**. The walking meeting app is not supposed to be a game, but it can be slightly playful. The persuasive elements, like guidance, motivational content, competitions and rewards need to be designed to be non-interrupting, and the users' concentration needs to be focused on thinking and discussing

the actual topic of the walking meeting. This differs from the design of actual exercise applications in sense that in exercise apps, the persuasive features and elements can be designed to be more visible and dominant [1, 23]. When it comes to the design of the walking meeting app, we would like to talk about *discreet persuasion,* i.e. persuasion that happens on the background. Discreet persuasion does not take the user's attention from the work task. In addition to the persuasion provided by the app, the persuasive elements from the physical world are present in the walking meeting in the form of nature experiences, weather and physical locations **(DI-7)**.

We found both pragmatic and hedonic user needs [15] towards the walking meeting app. The pragmatic needs related to, e.g. introducing the practicalities and guiding the route **(DI-4)**, while the hedonic attributes related to, e.g. the feelings of freedom, the willingness to be discreetly stimulated towards conducting walking meetings, and the feelings of well-being to act as motivational factor. The walking meeting app may act as an initial behavior change initiator by providing pragmatic support in the *initial phase of use*, i.e. while taking the first steps of behavior change [27]. Competition between walking meeting teams can also be utilized in the beginning. However, the app should also support the *later phases of the behavior change* and aim at the adoption of walking meetings to become an ordinary work habit. In the later phases of behavior change, i.e. action and maintenance [27] the walking meeting app can keep up the motivation by providing variety for the routes and places **(DI-8)**, and by telling about the positive effects of walking in a longer time period **(DI-9)**.

In the design implications that we have presented, there is more general value than just for designing walking meeting apps. The implications may be also applicable to the design of other semi-serious digital tools or services, where the focus is neither purely on the pragmatic side of the task conduction nor playing a game. The possible areas of applying are for example education and learning. The learning applications need to be motivational and attractive in order to be able to efficiently serve for learning, and physically active ways of learning are already utilized [16]. Also, digital tools for improving one's mental well-being may at least partly benefit from the design implications presented in this paper. Similar design guidelines concerning gentle guidance and focus on meaningful experiences have been presented on the domain of mental well-being apps [2].

As the number of participants and the length of the use of the concept were limited in our qualitative research, broad generalizations based on the results presented here are not relevant in this phase. However, most of the design implications got support from the findings of both user studies, which strengthen the validity of the results. Encouraged by the positive user experiences of the walking meeting concept called Walking metro, we will continue our research by further design and evaluation of a mobile tool especially for the walking meeting purposes, as we see it as a potential tool to change the sedentary work habits of knowledge workers towards physically more active. The name of the concept that we are focusing on in the future work is *Brainwolk*, which means literally brain awakening. We also wish to validate the design implications presented within a longer usage period. We would also like to explore the needs towards the walking meeting app in different cultures, as the attitudes and work cultures differ between the cultures. By designing human-centered tools to support physically active ways of work we want to reformulate the phrase "Please, have a seat!" to *"Let's have a walk!"*

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