Exploring the Embodied Experience of Walking Meetings through Bodystorming – Implications for Design

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ABSTRACT

Walking meetings are a promising way to reduce unhealthy sedentary behavior at the office. Some aspects of walking meetings are however hard to assess using traditional research approaches that do not account well for the embodied experience of walking meetings. We conducted a series of 16 bodystorming sessions, featuring unusual walking meeting situations to engage participants (N=45) in a reflective experience. After each bodystorming, participants completed three tasks: a body map, an empathy map, and a rating of workload using the NASA-TLX scale. These embodied explorations provide insights on key themes related to walking meetings: material and tools, physical and mental demand, connection with the environment, social dynamics, and privacy. We discuss the role of technology and opportunities for technology-mediated walking meetings. We draw implications for the design of walking meeting technologies or services to account for embodied experiences, and the individual, social, and environmental factors at play.

KEYWORDS

Walking meetings, Bodystorming, Embodied Interaction, Sedentary Behavior, Design Research.

CCS Concepts

• Human-centered computing~Human computer interaction (HCI)~Empirical studies in HCI • Human-centered computing~Collaborative and social computing~Collaborative and social computing design and evaluation methods

ACM Reference Format:
Mélodie Jacob, Ida Damen, and Carine Lallemand. 2023. Exploring the Embodied Experience of Walking Meetings through Bodystorming – Implications for Design. In Seventeenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '23), February 26–March 01, 2023, Warsaw, Poland. ACM, New York, NY, USA 14 Pages. https://doi.org/10.1145/3569009.3572795

TEI '23, February 26-March 1, 2023, Warsaw, Poland

ACM ISBN 978-1-4503-9977-7/23/02.
https://doi.org/10.1145/3569009.3572795

Examples of bodily experimentations meant to unveil the embodied experiences of walking meetings

INTRODUCTION

Office work is characterized by physically inactive behavior, with office workers spending most of their working hours sitting [11]. Sedentary behavior has become a major public health risk [33,34], motivating the World Health Organization to draft a global action plan to reduce physical inactivity by 15% by 2030 [46]. The importance of digital technologies and innovation to accelerate the development of effective solutions aimed at reducing sedentary behavior is highlighted. Designing supportive tools for active office work can significantly contribute to this endeavor [7,14,24,47]. In fact, a myriad of digital tools and interventions have been developed over recent years [14,22,30] to reduce sedentary behavior at work. Most of these design concepts encourage workers to take more breaks during the day [14], which competes with the need for productivity. Very few interventions or concepts are based on the principle that physical activity and office work are not mutually exclusive. Walking meetings, professional meetings that one attends or hosts while walking, are a promising way to integrate physical activity within work. They also offer additional benefits in terms of wellbeing, creativity or collaboration [6,7,36]. While the business world shows a growing interest in such a practice [10], walking meetings remain rather underexplored in academia. A few studies only in HCI have investigated walking meeting practices, providing empirical findings into drivers and barriers encountered by users [4,16,19,25]. In addition, a handful of technological concepts or interventions supporting walking meetings have been developed and studied [2–4,12,15,16,19]. Further research needs to be done on how technology can support the practice of walking meetings to overcome barriers and strengthen opportunities for users. Design research can thereby contribute to investigating the embodied experience of walking meetings as a source of inspiration to open the design space. This is a timely topic that the HCI community can address to contribute to future and healthier ways of working.

In this pictorial, we take the readers on a lively journey exploring unusual walking meeting situations. Through this visual account of our bodily experimentations, we illustrate the valuable insights gained into the embodied experience of walking meetings. Thanks to the use of bodystorming, this study offers a new perspective on walking meetings by eliciting and reporting on embodied aspects which are otherwise under-investigated in the literature.
We structure our contributions around five key themes, as documented in previous work [4,15,16,19,25,39]: material and tools, physical and mental demand, connection with the environment, social dynamics, and privacy. As a transversal lens, we consider and discuss the role of technology in the practice of walking meetings. We draw implications for the design of walking meeting technologies or services to account for embodied experiences, and the underlying individual, social, and environmental factors at play.

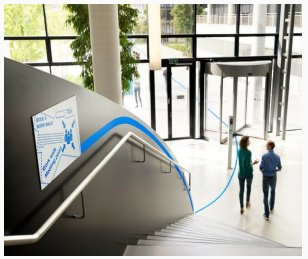
Example of a Workwalk meeting point [12,16]

RELATED WORK

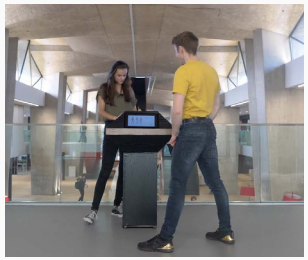
Walking meetings appear as a promising way to encourage physically active ways of working [24,47]. They are however not yet common practice, due to several obstacles to their adoption [4,16]. Drivers and barriers to the practice of walking meetings have been studied in-situ [4,15,16] or via online questionnaires [19,25]. Common factors identified as barriers includes *environmental factors* such as unpredictable weather, *practical factors* such as the lack of possibilities to take notes or present material, *social and cultural factors* such as acceptability of the practice within an organization or the awkwardness to walk with someone from a different hierarchical level, *motivational factors* such as the difficulty of integrating walking meetings into daily routines, or *cognitive factors* such as focus and distraction [4,15,16,19,25].

Technology and Interventions Supporting Walking Meetings

Walking meetings emerged has a low technology practice, whose benefits mostly arise from the connection with the natural environment [5,32]. In the past few years, a few researchers within HCI community have explored how technology can support the practice of walking meetings to overcome barriers and strengthen opportunities for users.
In early research around technology-mediated walking meetings, Ahtinen et al. [2–4] researched the use of mobile technology. Their smartphones apps 'walking metro' and 'Brainwolk' aimed at introducing the concept of walking meeting at work to increase its social acceptance [3]. The Brainwolk app provided gamified features including a map, suggestions for walking routes, checkpoints with short visual break exercises and motivational thoughts about walking. The main downside observed by the researchers was the disruption caused by the technology to the flow of the meeting, with "users not able to concentrate on the meeting itself" (p. 5).
The service design concept Workwalk [12,16] consists of a 25-min physical route with meeting point signs. Its technological component is limited to the integration of the Workwalk as a bookable "meeting location" in the room booking system. The authors used this concept as a design research artefact to study walking meetings. Drawing on empirical findings highlighting the lack of notetaking and presentation tools as the main obstacle to walking meetings, Damen et al. [15] later designed a tangible device placed along the walking route. The Hubs support notetaking and presentation, and include many features that employees would use during a sitting meeting. In their survey study involving N=186 office workers, the research team [19] explored how this network of connected stand-up meeting stations can support different scenarios of walking meetings.
Finally, Haliburton et al. [25] created four design fictions to explore possible technological futures, where walking meetings are supported by technology. Their scenarios included a ubiquitous recording system generating personalized summaries, the use of augmented reality (AR) and holograms of the meeting partners, and a GPS-tagged trail in a park for asynchronous and even geographically distributed seminar attendance. The authors derived requirements and constraints for technology-supported walking meetings.
Overall, we see that technology is used to support different aspects of the walking meeting experience, from the discovery and incitation to adopt this practice along with navigation support [4,16], to a functional support accommodating work-related task [15,19]. On the speculative side, other creative uses of more advanced technologies are foreseen to facilitate notetaking, increase the sense of presence, or support new forms of collaboration [25]. There are many design opportunities to further explore the role of technology to foster the adoption of walking meetings.



Workwalk, a 25 minutes walking meeting path [12,16]



The Hubs, network of devices supporting note taking and information sharing during walking meetings [15]

Bodystorming as an Embodied Ideation Method

Bodystorming (or embodied storming, [40]) is considered an embodied ideation method that researchers and designers use to understand physical and social interactions with technologies in simulated situations [29]. It consists of acting or role playing situations, for instance of use of a product or service, as a physical performance of activity [40]. Used in the (pre-)ideation phase, it creates experiential awareness and allow to identify gaps and opportunities [40]. The goal of this technique is to understand a problem through the embodied experience of the situation on-site [37]. It is a way of "reenacting everyday peoples' performances and living with data in embodied ways by performance and improvisation" (p.126) [37]. Bodystorming helps to "access, articulate, and harness embodied experiences in ways that can inform the design process." (p. 193) [41]. It has been used as a method to challenge the status quo around sedentary behavior at office work [18].
To collect data from embodied experiences [29], it is essential to get the individuals to self-reflect on their physical sensations. Introspection, which consists in "tracking, experiencing, and reflecting on one's own thoughts, mental images and feelings" (p.719), enables the analysis of the bodily experience [23,48]. Introspections aim to intensify participants' attention and direct it towards one part or area of the body at a time [43]. This method can be applied to both participants and researchers [48]. By taking part in their own experiments and practicing self-observation, researchers train their sensibilities and become aware of the whole interaction [35].

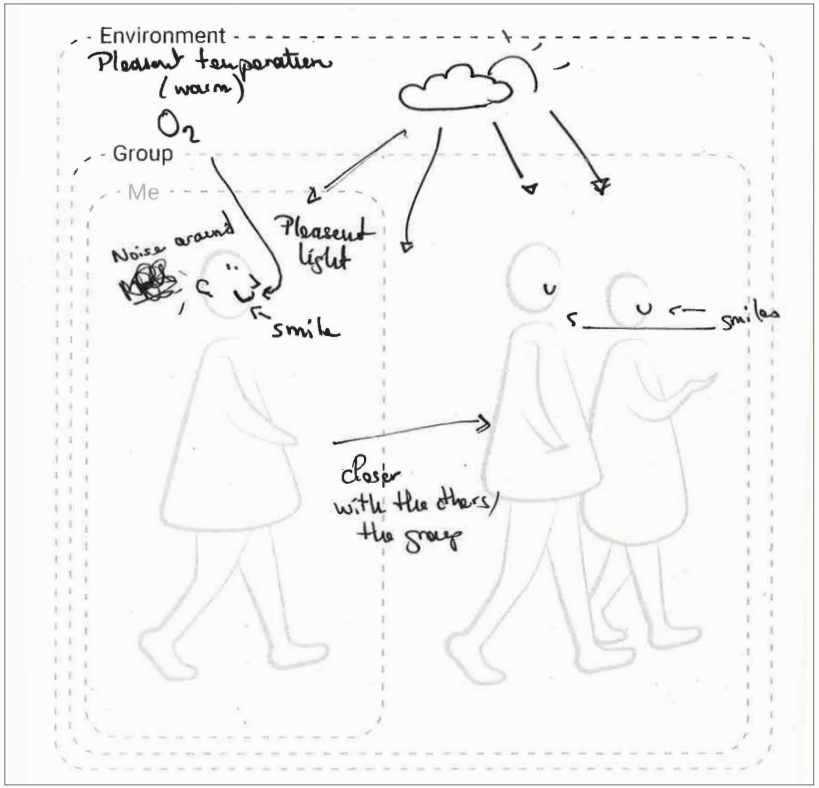
To the best of our knowledge, bodily experimentations and introspection methods have not yet been used to explore the topic of walking meetings. Except for a few studies investigating the practice of walking meetings in-situ [4,15,16], insights into the embodied experience of walking meetings are scarce. The present study contributes to a better understanding of individual, social, and environmental factors around this practice, along with their implications on the design of relevant technologies or services.

Synthesis of the methodology

METHOD

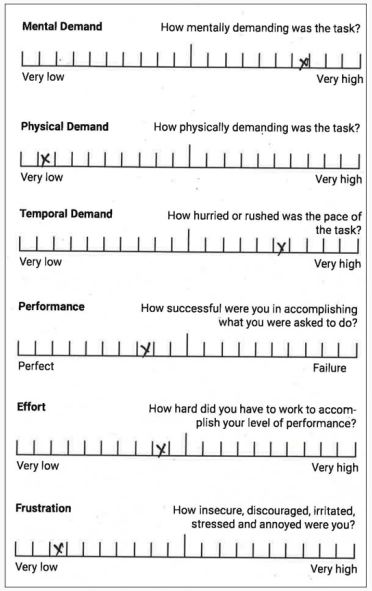
We conducted a series of 16 bodystorming sessions, featuring unusual walking meeting situations. The situations were chosen based on their ability to confront participants with key aspects of walking meetings, documented in previous work [4,15,16,19,25,39]: material and tools, physical and mental demand, social dynamics, connection with the environment, and privacy. Bodystorming was selected as a method of investigation as it enabled the participants to experiment situations emphasizing different social or physical aspects of walking meetings, thereby identifying gaps and opportunities [40]. We initially ideated a list of 62 bodystormings and selected 16 situations for the participants to experience. Forty-five participants took part in the sessions (13 office workers and 32 students), including two of the authors adopting a first-person perspective approach. Some participants had previous experience with walking meetings (n=11), others were novices (n=34). Walking meeting situations were usually conducted by groups of 2 to 4 participants, except for a group presentation involving 9 participants.

We organized 6 sessions, where each group did 1 to 4 bodystormings. Each session lasted between 4 and 15 minutes. Most sessions were conducted in an urban environment, featuring large pedestrian areas. Some sessions also took place in an urban park. Besides favorable weather conditions, we did not consciously attempt to predict factors influencing the walking experience.
First, participants were instructed to do a brainstorming about a given topic, enabling them to interact together while having a shared goal. They had to do a walking meeting while following one of the aforementioned bodystorming missions. They were then bodystorming the situation for 6 minutes on average. With participants' informed consent (including for publication), we video recorded the sessions.



Example of body map completed by a participant after a bodystorming session

Right after each session, participants filled in an introspection form composed of:
a) *a Body map*, enabling us to capture conceptual reflections and non-explicit emotions or physical sensations [35]. The Body map also incites them to question their connection to the group and their awareness of the environment.
b) *an Empathy map*, engages questioning regarding the perception of the context, what the users said, did, or thought, and how they felt. Its goal is to increase empathy for the users by understanding their perception of the world [21].
c) *the NASA-TLX scale*, used to evaluate the workload of each walking meeting according to 6 dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration level [26]. The scores are presented on each page in a side bar.
These exercises aimed to guide the participants in their reflection, focusing on their embodied experiences within the social and physical environment [43].



NASA-TLX workload scale completed by a participant after a bodystorming

Empathy map completed by a participant after a bodystorming

We organized focus groups to collect additional qualitative data regarding participants' experiences. During the focus group, participants were asked to describe their experience during the bodystorming and reflect on what insights we learned that could be transferred to a real-life walking meeting scenario. We also asked them to critically discuss the potential role of technology to address the challenges they faced. We derived design implications to reduce the barriers and reinforce enablers to walking meetings.

The body maps and empathy maps consist of handwritten notes, and drawings. The audio recording of the focus groups has been transcribed verbatim. Each verbatim and sketch has been coded by the first author based on a deductive coding approach using MaxQDA Analytics Pro 2020. The codes were derived from the literature and used mostly to sort the data into five relevant and broad topical categories. Discussions were conducted between the authors to resolve issues. In this pictorial, we present the 16 bodystorming sessions according to 5 key themes: material and tools, social dynamics, connection with the environment, physical demand, and privacy. Some bodystorming sessions addressed several of these aspects, which are therefore not mutually exclusive. We first share the insights gathered during each session before drawing up design implications for walking meetings technology and services.

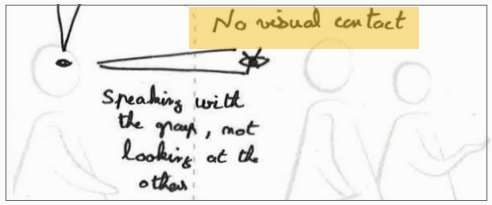
BODYSTORMING - MATERIALS AND TOOLS

Taking notes of everything

3

Participants were instructed to brainstorm and take notes of all their ideas. The experience was mentally demanding (73%): writing, listening, and walking simultaneously required too much effort. The participants retrospectively "had the feeling that it was useless to take note of everything all the time" and that they wrote redundant ideas. A curation of key ideas was thought of more adequate. P15 "felt isolated" and found it "uncomfortable to constantly hold a notebook". It impacted the dynamic pace of the brainstorming.

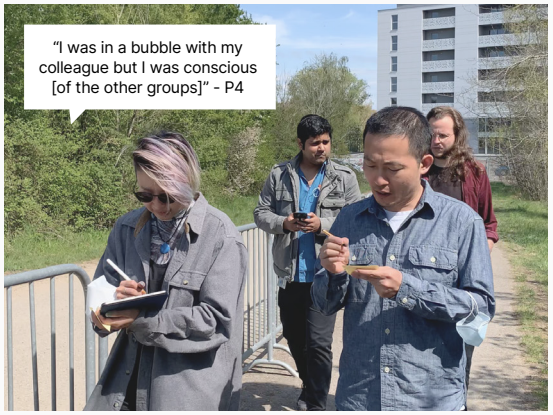
During the focus group, participants pointed that the urban environment can be dangerous (e.g., obstacles, differences in ground level) if one is distracted by note taking. P2 found the nearby park way more friendly, "there is a defined path, it's very nice and we don't waste time wondering which direction to take". Others (P1, P15) mentioned the natural tendency to adapt their position as they made space for others to walk besides obstacles. Mobile or wearable technology was envisioned for navigation purposes, to remove this burden from the meeting.



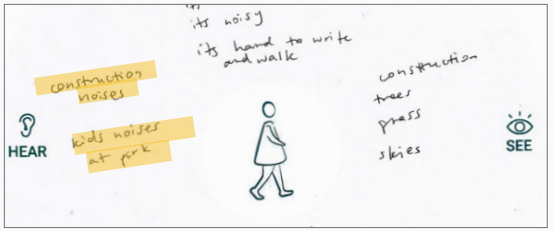
Body map showing the lack of eye contact during the session

Typing on phone or a tablet

3x2



Three duos brainstormed while typing key ideas on their phone/tablet. Mental demand was rated as the most critical dimension (57%). This may be explained by the effort to stay focused on a conversation in a complex and heterogeneous environment. P4 for instance heard distracting "construction noise and others' conversations". Another was focused on the conversation and only noticed "wind and sun in his eyes". Half of the participants found that "taking note is a bit difficult" (P5). P17 suggested "to take note afterwards, to use voice notes or to walk when a meeting does not require intense note-taking". Another proposed solution was to stop to type an idea. P17 challenged others to walk and write simultaneoulsy. Yet, P17 did not want to cease walking because "we walked as a group and it felt as if you have to follow the group".



P17 noticed construction noise and kids in the park

Audio-conferencing

3

Participants walked alone, communicating with another by phone. The mental demand (52%) and frustration (45%) scored the highest. Some team members truly enjoyed the freedom to navigate the environment according to their preferences rather than needing to coordinate the path with others. The group found the communication difficult; P3 "tried not to interrupt the others". Technology was a source of anxiety; it became an obstacle and negatively impacted the social dynamics of the team. P15 had a poor internet connection, "I have lost [the group] for 15 seconds and I was very stressed". During the focus group, P15 realized that she tried to not walk too far apart from the others, because she was aware she had to join them after a few minutes of bodystorming, "I knew I couldn't walk 15 min in a direction because I'd be late to come back to the meeting point".

Participants talking to each other on the phone

P3 worried about the group communication (Body map)

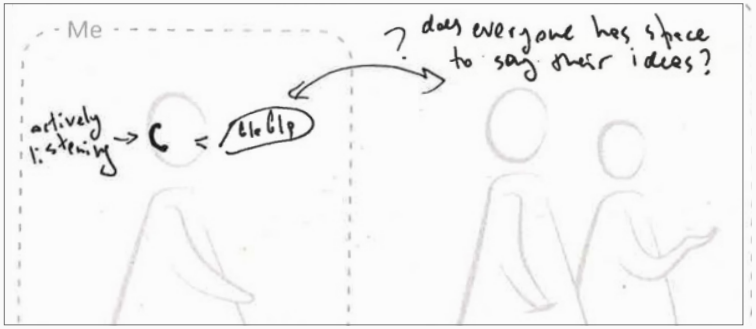
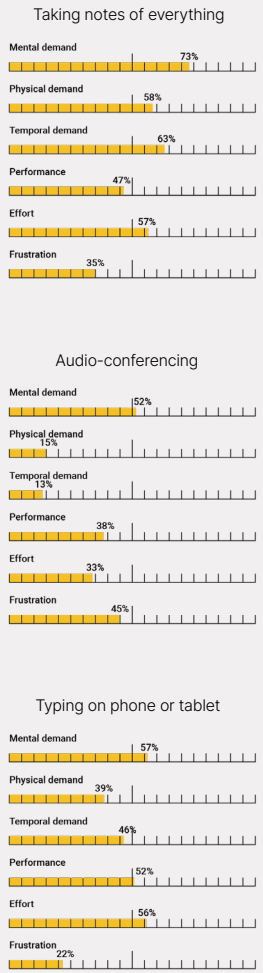


Figure 1. NASA-TLX results (average of each group)



GPS art: walk an artpiece

4

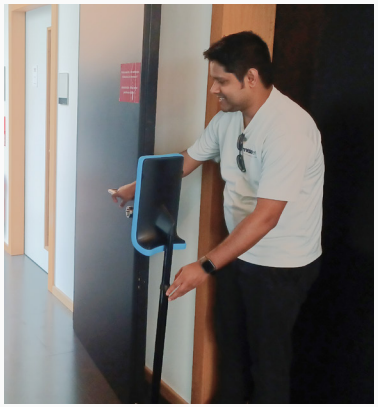
Participants getting closer to look at the map, and choosing a path together

Four participants had to create a GPS art (i.e. a shape based on their geolocalized path) during their meeting. This bodystorming constrained them to first agree on a specific path and to pay attention to the directions. It was based on the idea of using technology to select a predefined path with the constraint to stick to this choice. All the participants were aware of the surroundings and the passersby. P4 noticed "people working" and a "noisy environment". However, because they were sometimes focused on their chosen virtual path, the group "did not realize" how many stairs they took during the session. The noise level and the linear formation of the group disrupted communication. "It required too much effort to listen to what was happening" (P4). The mental demand had the highest score (60%). On their body maps, a few participants also drew their perception of their colleagues. Being further from the conversation center (here the person holding the phone and checking the path), P4 felt tired and had the impression that his teammates had more energy and were having fun.

Telepresence robot

3

Three colleagues participated in an indoor meeting, where one teammate virtually accompanied the group using a telepresence robot. Frustration was the highest scored dimension (83%). All the participants considered the environment as "limiting" (P5). P7 controlled the robot and struggled with the navigation: "it was tough" because of "the doors and obstacles". She admitted feeling "quite disconnected", "very helpless" and "not having the presence that [she] wanted at that moment". The colleagues on-site similarly felt a lack of connectedness. Technology had a significant role in the session, along with the environmental acting as a major constraint, both being detrimental to the content of the meeting. P5 explained that he was "more focused on the robot than walking or brainstorming".



Participant behaving with the robot as he would with a colleague

Body map illustrating the awareness of a participant about the passersby

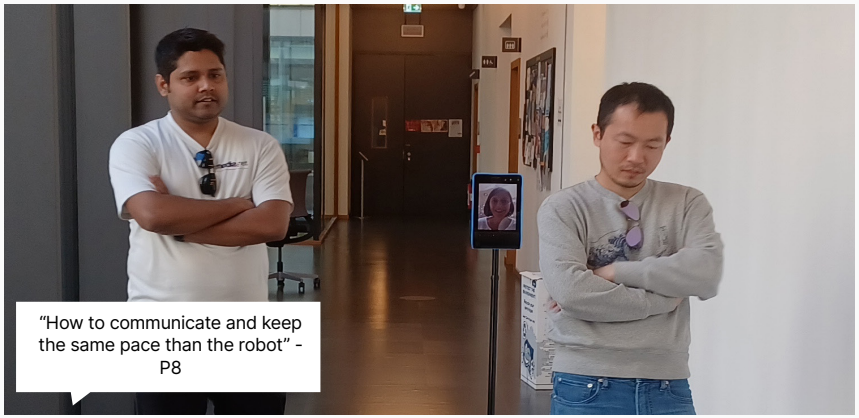
Low tech presentation

9

A participant made a walking group presentation, using no technology. They distributed paper booklets to each participant and placed numbered landmarks in the environment to create a path to follow. At each landmark, they would present ideas and interact with the group. Participants were focused and eager to find the next landmark. In between the landmarks, they discussed the points presented and walked in a large 'squad formation'. At one point, the booklet of a participant fell and was dragged by the wind.

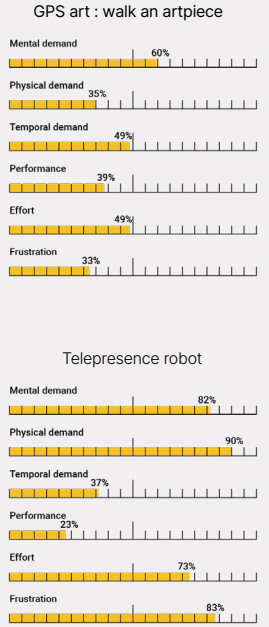
Due to a noisy environment, participants expressed some difficulties to follow the speaker's presentation, "the thing that I had trouble with was often hearing you. There is just so much noise, it's incredible. I could have gotten closer but since it's a whole groupe it's weird" (P45). Reflecting after the session, they envisioned technological solutions "this could be mitigated through an audio assistant like in museums" (P8), "devices used in city tours" (P15) or simply "private bluetooth earphones" (P4). P45 however said that earphones "would make him feel less connected to the people and speaker", and remove "a bit of the low tech aspects of walking meetings" (P1). Privacy concerns were emphasized when P45 joked about the possible use of a megaphone. Participants imagined other alignments of a big group to walk "around the speaker" (P5) or the idea to "start the meeting in a quiet area" (P15). The speaker explained that she had trouble anticipating which areas would be quiet as she defined her path earlier. P8 wondered whether walking meetings could also be done indoor, yet team members saw tricky privacy concerns to "have a walking meeting while passing by offices or coffee spaces" (P15).

The group unites around the presenter, forming a circle. They consult the material while walking and standing



Two participants talking to their colleague through the telepresence robot

Figure 2. NASA-TLX results (average of each group)



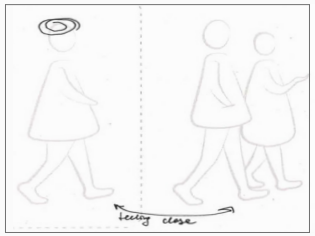
Due to time constraints, participants did not fill out the NASA-TLX scale for this session

BODYSTORMING - CONNECTION WITH THE ENVIRONMENT

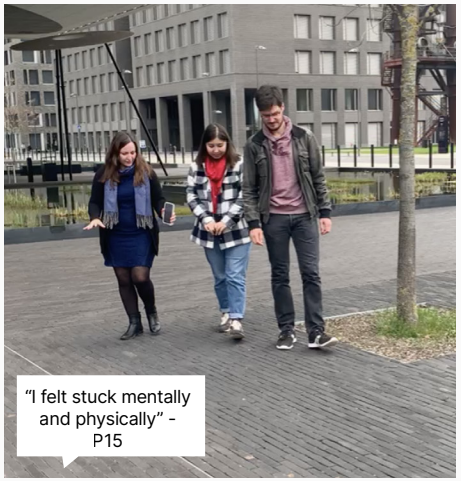
Going in small circles

3

Three participants had to follow a small and limited path. The workload rating shows frustration as the highest (47%). Two teammates complained about the repetitive and monotone environment. P1 had to "focus on the path to stay close to the limits defined by the environment". After a few minutes, P1 asked to change direction, which also triggered a change in the position of members within the group. In the focus group, participants mentioned how restrictions in the environment were bringing narrowness, "not only in the path but also in the thoughts" (P15). P1 attributed this phenomenon also to the fact of multitasking and mental workload.



P3's perception of her body and the group



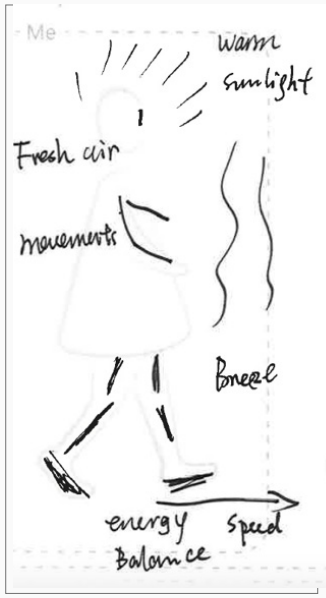
One of the participants asked to change the group position after the direction changed

Using the urban furniture

3

The group was invited to use the urban furniture as a source of inspiration. As the participants actively engaged with their environment, the physical demand scored the highest (75%). P7 described the session as "excitement, energy, creativity". The group experienced the environment in different ways. P5 "needed to focus a bit" due to the "many sounds". Yet P8 "who is [usually] very cautious about [his] surroundings... was not even conscious this time". P7 tried "to identify objects" that could enrich the conversation. The atmosphere was "casual" (P8). Thinking of other work scenarios, P8 realized that this format is "not very suitable for a meeting with a supervisor". During the focus group, participants reflected on the potential of urban furniture to support functional needs during a walking meeting (note-taking, shelter from rain or wind, breaks).

Participants engaging with the urban furniture



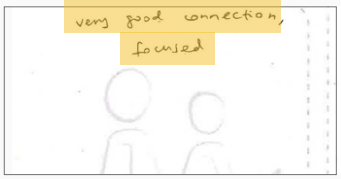
Body map illustrating physical demand

Inspired by the environment

3x2

Two groups looking for inspiration in the environment

This session invited duos of participants to get inspiration from the environment to enrich their brainstorming. The mental demand had the highest score but stayed reasonable (42%). Two participants forgot the instructions and did not pay attention to the surroundings. Most participants found the environment inspiring (P4, P8, P16, P18). The surroundings were "sometimes difficult to relate to the meeting content", "but there were some new perspectives" (P18). The majority of participants (P4, P16, P17, P18) reported a good connection: the "one-to-one [format] makes us more focused on the conversation" (P5).



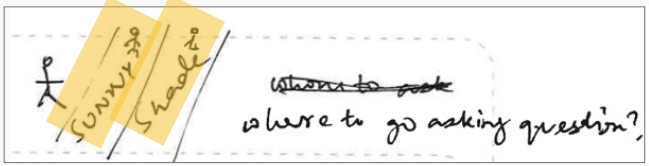
Body map describing the group connection

Ask a stranger for ideas

3

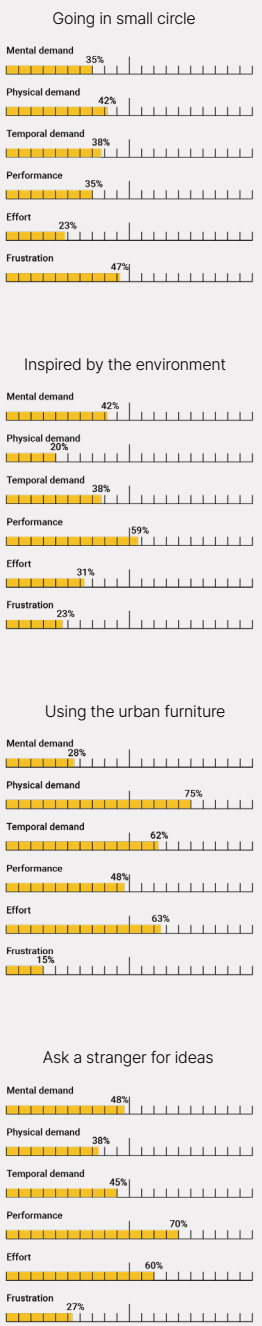
Participants talking with a passerby

The group needed to ask strangers for creative ideas. The objective was to create a different connection with the environment. Participants found this session collaborative, "you need to go out and ask other people" (P8). However, P7 was "a little bit anxious" and struggled to choose one passerby. Regarding the environment, the group was disturbed by the brutal changes along the path, such as wind, shade and crowded areas. "It is a bit less control than a meeting in a room" (P7). P8 thought that the communication could have been improved if the group position would have been different "we don't see each other like in the meeting room". P7 suggested to walk backwards so they can face each other.



Body map illustrating the environment awareness

Figure 3. NASA-TLX results (average of each group)



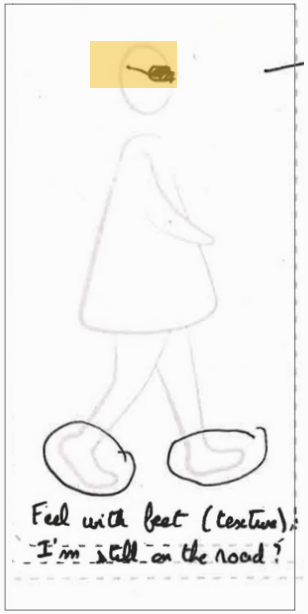
BODYSTORMING - SOCIAL DYNAMICS

Blindfolded walk

3

Two participants were blindfolded, the third guided them during the walking meeting. Mental demand was rated as the highest dimension (83%). The blindfolded participants mainly relied on sound to navigate their surroundings. P15, who guided her teammates, became more aware of the environment "mostly obstacles, dangers... and ground textures". She watched over them and felt like "producing way less ideas than usual". She explained how she initially held their arms tight, before leaving them free of movement, guiding them with her voice and subtle haptic feedback (tapping on their arms) to indicate the need to steer away from an obstacle. During the focus group, she related this behavior to haptic technologies (e.g., vibrations on a smartwatch). She felt very connected to them and admired the level of trust they put in her. P1 explains how being blindfolded made him feel "more connected and focused on the task, not being interrupted by a tool to look at".

Participants doing a meeting, while being blindfolded



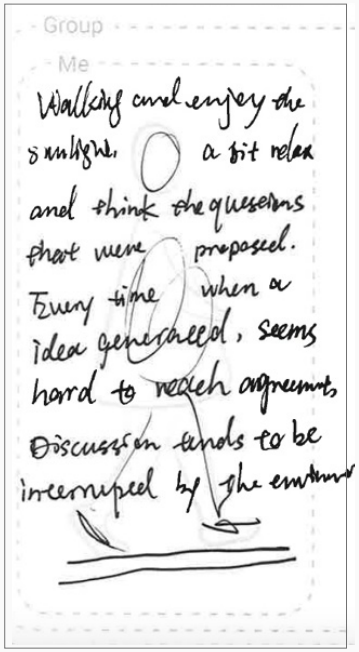
Body map illustrating an increased awareness of the environment

Agree...then disagree

3

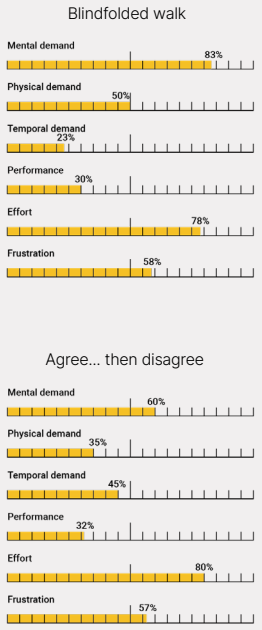
This session focused on the content of the meeting. The group first had to agree before being asked to make contradictory comments. The effort was rated as the most critical dimension (80%). The constraint directly impacted the group connection. "It was a lack of synchronisation... a lack of agreement" (P8). The participants found the "task a bit confusing", which influenced the content of the meeting "we didn't really brainstorm" (P7).

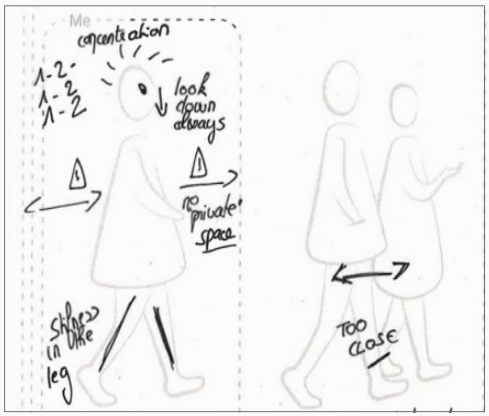
The group agreeing on the path



Body map representing the difficulty to hold a conversation

Figure 4. NASA-TLX results (average of each group)



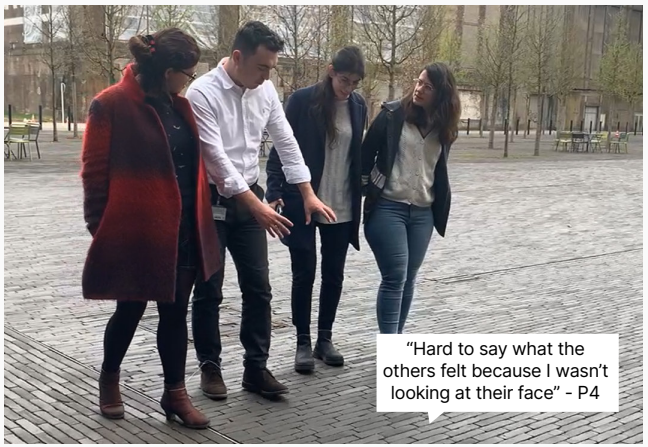


Body map illustrating mental and physical demand

Tied together

4

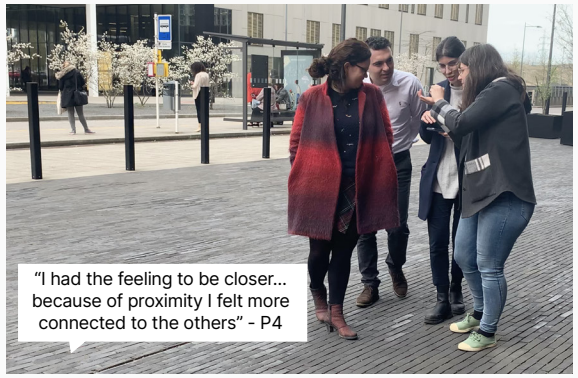
Four participants met with their legs attached. The mental demand was the highest dimension (88%). The group had to find a strategy to be synchronized. Three out of four members (P2, P4, P10) "didn't pay attention to the surroundings" (P10), but two noticed (P10, P16) "the passerby looking at [them]" (P16). One participant expressed being disturbed by the forced proximity with a colleague and reclaimed his "personal space" several times. The participant on the right side struggled to keep the pace and did not focus on the brainstorming. This created a split in two duos. The position of the group "forced to walk in a line of four played a huge role in the social dynamics" (P16). The awkwardness of the situation made them laugh and triggered relatedness but "was not the most efficient meeting" (P10). The group reflected extensively on organisational culture, hierarchical relations and how both can impact the acceptability of walking together. "It is easier with colleagues with a close relationship, I would have more troubles with my boss" (P10). P3 wondered whether "walking meeting as a work practice can improve the relation with colleagues, removing formal barriers progressively". The size of the group was debated. For P1, walking with four can be acceptable with close colleagues (where one can get closer) but harder to keep a formal distance. P2 and P16 evoked the sometimes embarrassing intimacy of 1:1 walking meetings.



The group walking with tied legs

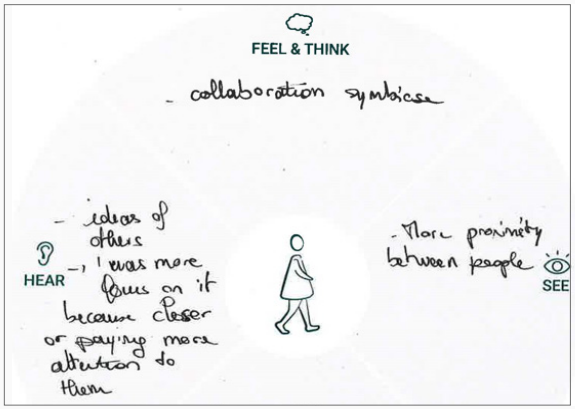
BODYSTORMING - PRIVACY

James Bold meeting, everything is secret 4



Whispering incited the group to be physically close and use gestures

This session challenged the aspect of privacy by ensuring that the passerbys could not hear the conversation. The effort was rated as the most demanding dimension (56%). This bodystorming constrained the team to stay as close as possible, united around their secret mission. P8 noticed that "the group made a circle instead of a line". P4 had the impression that he was in an "inner circle", which increased the feeling of "intimacy". Because they whispered, the participants were physically very close. Despite being a group of 4, nobody felt excluded. According to P4, previous bodystormings did not allow him to "be seen" by his team members but here his colleagues "noticed when [he] wanted to speak", which improved the group communication. The pace of the group was impacted, "the pace was very slow" (P16), "we didn't walk a lot". Whispering also increased eye contact, which was beneficial for turn taking. The group was more aware of others' will to speak because of the visual contact. Participants reported a very positive experience of relatedness triggered by the mindset of the mission to accomplish.



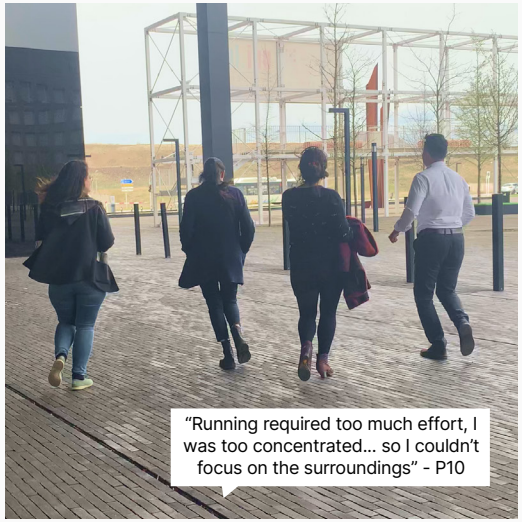
Empathy map comparing the connection of the group to the notion of 'symbiosis'

BODYSTORMING - PHYSICAL AND MENTAL DEMAND

Running meeting 4

This walking meeting has been held by running. It was one of the most demanding, with a physical demand rating of 86%. All the participants were aware of their bodies ("out of breath", "sweat", "legs hurting") but also of the objects carried (e.g., coat or phone). The differences in pace between people impacted their position and synchronisation. "It was hard to stay close to the group" (P10). The energy provided by the activity seemed to inspire the conversation. P10, "focused on her body in action", used it to illustrate her ideas and jumped while running. The group later reflected on the impact of physical demand on the efficiency of the meeting. According to P2, "walking and moving is energizing and positive, yet there is a threshold above which it decreases the focus on the task".

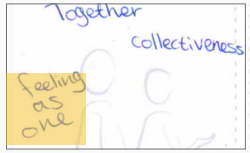
Body map illustrating the physical discomfort of a participant



Physical distance created during the running meeting

Body synchronization 32 (in small groups)

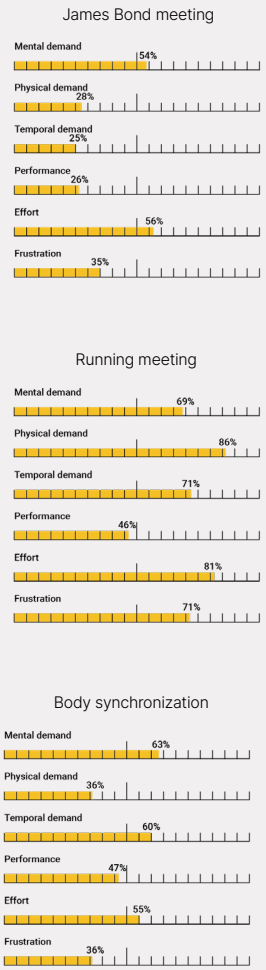
A group perfectly synchronized



Body map illustrating the feeling of connection within the group

Group members were asked to synchronize their steps while walking. The task aimed at sharing ideas while getting to know each other. The mental demand (63%) rated the highest. Participants were mostly focused on their body and synchronization rather than the conversation. The majority (28 out of 32) were aware of bodily sensations (e.g., "neck constantly bent"), as well as the environment "I felt embarrassed if people would see us" P25. P19 was less aware of the synchronization when "too deep in the conversation". The empathy maps show a lack of eye contact between team members, focused on their feets and hands. The synchronization still had a positive impact on the group connection (for 15 participants out of 32), "I had a feeling of fun and focus" (P9), "there was a slight irritation but we were bonding and laughing" (P10). Synchronizing increased togetherness and the idea of "feeling as one" (P19).

Figure 5. NASA-TLX results (average of each group)



The bodystorming sessions and accompanying introspection and discussion tools allowed us to gather insights into the embodied experience of walking meetings. We summarize these insights visually under the form of users' needs according to our five lenses, before discussing them in the next section. The dimensions are used for synthesis purposes, yet do not account for the natural overlaps between themes.

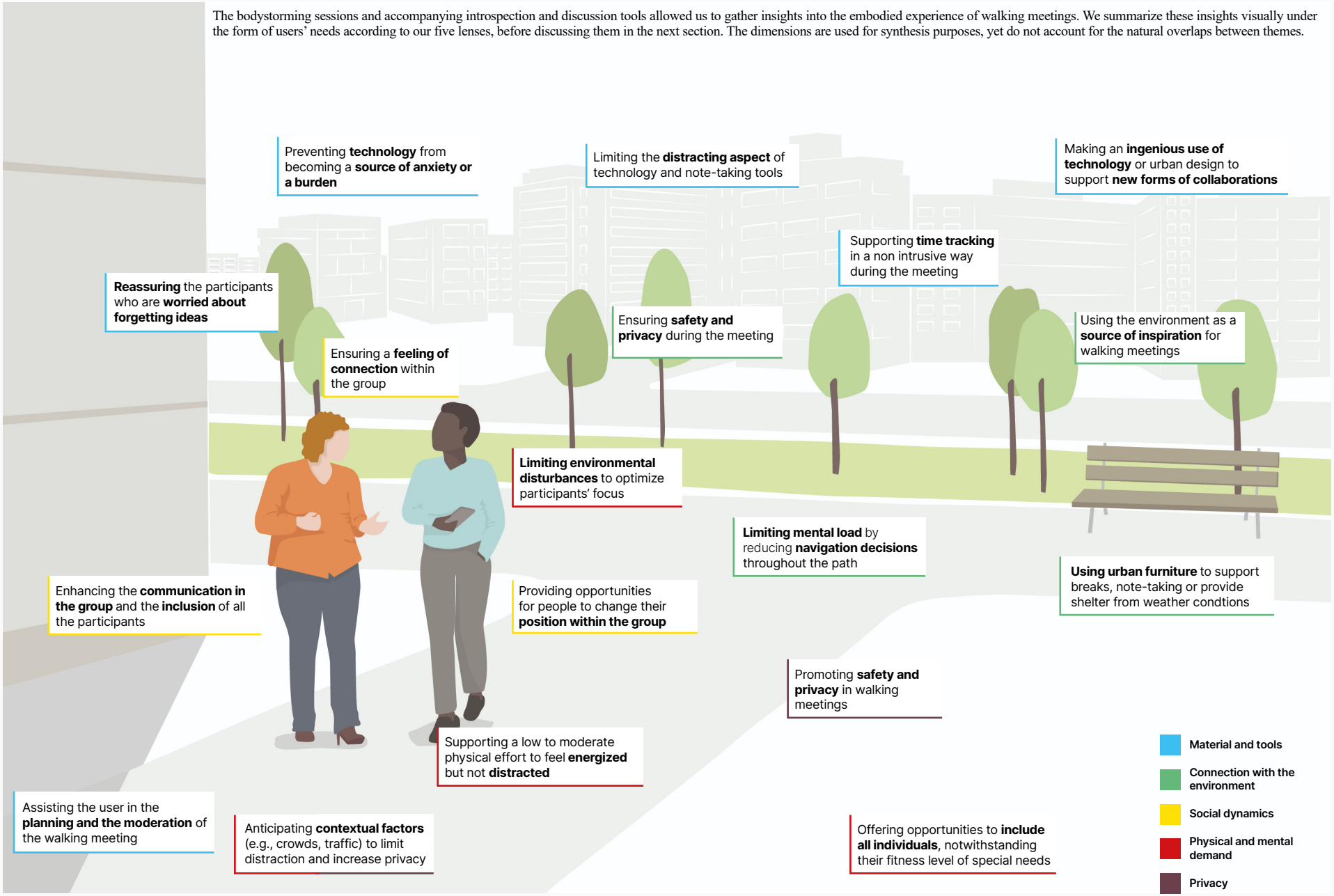


Figure 6. Visual summary of the design Implications gathered throughout the study

Participant interacting with their colleague through a telepresence robot

DISCUSSION

In this pictorial, we used bodystorming to explore the experience of walking meetings. Inviting office workers to act out unusual meeting situations allowed us to gain insights into the embodied experience of walking meetings in order to draw implications for design. These insights complement previous empirical findings about walking meetings and contribute to further inform the design space for technologies and services supporting this healthy work practice.

We discuss our findings according to the five main topical dimensions explored. Figure 7 presents the mean ratings of workload on the NASA-TLX scale for each categories of bodystorming.

The Use of Material and Tools during Walking Meetings

Several bodystorming sessions triggered insights about supportive material and tools needed during a walking meeting.

The need for note-taking is consistently mentioned in previous work as one of the main obstacles to the acceptability of walking meetings ([4,15,16,19]). Although participants worried about forgetting ideas, most of them noted that writing in a notebook or typing on a phone while walking, was inconvenient. They also realized (e.g., during [taking notes of everything"] that it is a false belief that one must take intensive notes during most meetings. It mostly seems to act as a reassuring function, freeing mental space, "what one has in the hand, we don't have in the head" (P1). Alternative solutions such as voice recording, or occasional stops to write down key meeting points, were highlighted. They resonate with the concept of the walking meeting Hubs [15,19], which act as reassuring checkpoints along the way to take notes or present material. During the group presentation session, participants enjoyed the paper booklet distributed by the speaker, which was considered "sufficient to follow and engage with the content" (P18). The use of the environment (numbered waypoints) was deemed ingenious. Similar ideas were envisioned in previous work by Haliburton [25] and realized by Damen et al. during a "walkshop" [13].

Participants also identified the need for a tool that supports the planning and the moderation of the meeting. A team highlighted the importance of tracking time because, contrary to sit-down meetings, people do not have a permanent way of monitoring time. Time management is made more complex also because one should plan to walk back to the office building, and incorporate that segment smoothly within the walking meeting. Technical solutions of route planning or solutions using the environment for time management (e.g., defined paths and waypoints) were mentioned. We elaborate on the role of technology further at the end of the discussion.

Participants carrying technological devices or tools during the bodystorming

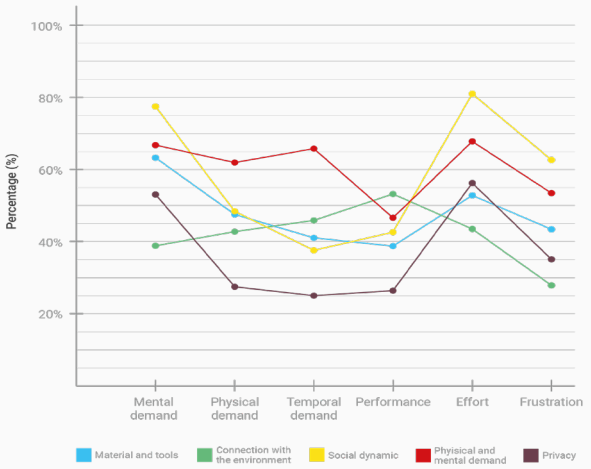


Figure 7. Mean ratings of the workload on the six subcategories of the NASA-TLX scale, for each category of bodystorming

Physical and Mental Demand: What is the Right Balance?

Through our focus on the embodied experience of walking meetings, we gained insights on the influence of the physical and mental demand on participants' experience. Walking in a complex environment while discussing work-related topics requires physical and mental effort. Our findings identify three main factors increasing the workload, and thereby reducing the focus on the content of the meeting: physical demand, multitasking, and distractions from the environment.

Intense physical activities (e.g., running, body synchronization) required too much effort, making cognitive tasks more challenging. Of course, some of the situations acted out during our bodystormings have exacerbated this aspect: one would not be expected to run during a walking meeting. Nevertheless, staircases, differences in ground levels or textures, obstacles in the environment, or weather conditions are increasing the physical demand. Individual differences between team members such as walking pace or participants' height can also create an imbalance [16]. It is also not excluded to see different forms of "meetings in motion" [25] emerge beyond walking meetings. As noted by our participants, some level of physical effort felt "activating" or "energizing", as opposed to the lack of activation often felt during sitting meetings which also decreases the focus on the task. Walking meetings are proven to be energy-giving experiences [4]; the energy gained through the activity is likely to become a source of inspiration for the meeting content. Finding a balance between feeling energized or distracted by physical effort is a necessary endeavor. Including all employees, no matter their level of fitness or special needs is also essential [25].

Besides physical activities, the need for multitasking (e.g., intense note-taking, decision-making related to navigation) was perceived as disturbing the focus of the meeting. Walking meetings are in theory less prone to the issue of electronic multitasking during sitting meetings [9,45], provided that no phone or tablet is used. Other tasks compete for the teams' attention, particularly the navigation within the environment.

The environment was mentioned as a welcome source of "distraction" when it stimulated creativity and relatedness. Natural elements are inspirational and contribute to wellbeing [5,31]. The environment can also include disruptions that are detrimental to the task (e.g., noise, obstacles, weather conditions, presence of passerby). Some are structural and can be anticipated (e.g., by choosing a specific route), whereas some are contextual and less predictable (e.g., crowdedness). In line with previous work, we found that decision-making about navigation can also induce mental demand and be distracting [4,16,25]. While most people interviewed by Haliburton et al. [25] practice walking meetings in a spontaneous manner with unplanned routes, the Workwalk of Damen et al. [12,16] with a defined 25-min path was successful in reducing mental load.

Change of group position triggered by a participant

Change of group position caused by technology

The Environment in Walking Meetings: Source of Inspiration or Constraints?

Our explorations confirmed previous findings and brought new insights into the importance of the environment in the experience of walking meetings. We discussed earlier how it can for instance influence the content of the meeting and its focus. Wellbeing and creativity are increased when people walk outside [5, 31, 32, 36]. Thus, by intentionally focusing their attention on the surroundings, our participants came up with new ideas. The park was preferred over the urban environment, both for the presence of natural elements and because of the single path making navigation easy. The short commute to the park was however perceived as a degraded experience due to construction sites and roads (e.g., in session "Typing on Phone or Tablet"), described by [25] as "full of distractions". Participants' focus was impacted by unpredictable and uncontrollable aspects, such as brutal changes in the weather or disturbing sound level. Some participants wore inadequate clothes (e.g., painful shoes, too warm coat).

Bodystormings that emphasized environmental awareness, such as "Going in small circles" and "Inspired by the environment" highlighted the impact of the path on the group. Participants' mood was altered: they felt stuck physically and mentally on restrictive paths. Constraining paths also revealed pain or discomfort among a few participants, making them aware of their bodies. The indoor environment, which is a specific use case for walking meetings, brought concerns about navigation within corridors, stairs, and doors (in session "Telepresence Robot").

During the focus groups, participants reflected on how architecture and urban design could support the practice of walking meetings and increase their acceptance. Just like urban parks often include sports or leisure equipment, they envisioned specific areas where the pathways, signage, and urban furniture could support walking meetings. Think for instance about defined pathways indicating the duration of the walk, equipment providing shelter from the wind or rain, or dedicated surfaces to take notes or have a break. The Workwalk [12, 16] and the Hubs by Damen et al. [15, 19] are the first steps in this direction. Privacy and safety were also discussed as important considerations (e.g., in "James Bond" or "Low tech presentation").

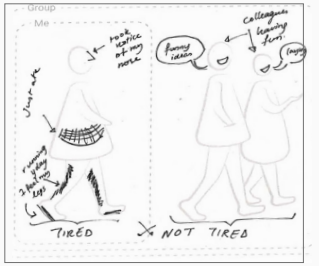
In summary, the environment presents challenges and opportunities to the practice of walking meetings. There is a need to design environments that entail qualities of walkability [1, 42, 44], and reduce constraints and factors of unpredictability detrimental to walking meetings. Thinking of whether and how technology can be integrated into such environments is a further step for the community, which can be inspired by recent work on the design of InterActive urban environments [38].

The Social Dynamics in Walking Meetings

Walking meetings are primarily a social work situation, with documented benefits in terms of social dynamics and relatedness [4, 6, 16, 39]. Several factors influenced the feeling of connection between group members during our bodystormings. The body maps enabled us to understand participants' perceptions, but also their perception of their teammates who were sometimes sketched too.

On the positive side, all participants reported enjoying the informal aspects of walking meetings, bringing a special sense of relatedness and intimacy, as well as a more casual or fun way to address work topics. The attitude and body posture in walking meetings is less confrontational than in sit-down meetings [16]. Walking in a therapeutic setting informed that walking side by side helps shift 'stuckness' and can promote a collaborative way of working [6, 39]. Some bodystormings triggered more relatedness than others, e.g., "James Bond", "Using the Urban Furniture" or "Blindfolded Walk", probably due to the unusual and playful missions. In the literature, walking meetings are often mentioned as more suitable for creative types of meetings, or more intimate 1:1 discussion [16, 19]. Focus group reflections revolved around the casual nature of walking meetings, and whether this would also be suitable for more hierarchical relations. According to [4, 25], the feeling of hierarchy diminishes when people walk together. However, previous work also shows that more junior employees might not dare ask their superiors to go on a walking meeting in the first place [16].

Body map showing a participant's perception of his teammates



The variations in the group position were described as positive in terms of inclusion or comfort, but unfortunately, they were not spontaneous, and very rare across all bodystorming sessions. When position changes happened, they were usually caused by a change in the activities. One participant for instance suggested switching places with a colleague during "Going in small circles" but she waited for an opportunity to do so in a non-disturbing or polite fashion. The use of technology (e.g., gathering around the person holding the phone in "GPS art") or the environment (e.g., staircases or crossroads) also offered opportunities for change. Communication is directly related to the group position, which may impact the inclusion of the team members in the meeting. When a group of 4 walked in line (as in "Tied together" or "GPS art"), at least one person (usually at the extremity) had more difficulties talking or felt excluded. Sometimes, two distinct sub-groups were formed. This is a reason why previous work advised limiting walking meetings to 3 participants [10, 16, 19]. In the presence of a group of 4 or more, changing the group position throughout the meeting may increase the feeling of inclusion and gives the opportunity to all the members to share their ideas. The role of the moderator was discussed, with the idea that it should be redefined and possibly accompanied by tools. Being a sub-group within a group also imposed constraints on participants, who felt the need to follow the group: "you couldn't stay behind (to take notes)" P17 in "Typing on phone or a tablet". Additionally, the session "Tied together" created forced proximity between the participants. It showed that people have different perceptions of their personal space: there is no right or wrong distance between the participants. This can be influenced by personal, cultural, or organizational factors [27].

The feeling of connection was also often altered by the presence of technology or tools. During the sessions "Telepresence robot" or "Audio-conferencing", technology hindered the communication within the group. Participants reported less relatedness when they had to take care of the technology as an additional actor in the meeting or had to focus on digital or paper support. Turn-taking also proved harder in some situations, especially when the meeting was mediated by technology as in "Audio-conferencing". Regular visual contact was described as essential for relatedness, yet hindered by the use of notebooks or phones or the fact of walking in a line.

Privacy Concerns

Walking meetings are known to induce more intimate social dynamics, making it easier to discuss sensitive issues [4]. Yet, privacy in walking meetings has already been emphasized as a matter of concern, e.g., for indoor meetings [15]. As stated by P45, "privacy is constantly something that you need to be aware of". The notion of privacy was explicitly explored in our "James Bond" session. As expected, participants were more aware of their surroundings, especially of the presence of passersby. As they whispered, participants created a semi-circle. Their reduced pace however made the situation look theatrical, which created the undesired effect of attracting attention. Overall, bodystormings that were more theatrical or unusual (including the group "low tech presentation", the "blindfolded walk" or intense note-taking) attracted passerby's attention and even created embarrassment at times. Sessions that look like a regular walking meeting (without tools) did not seem to be noticed by the passerby. Remote meetings using audio-conferencing increased the privacy for the person remote (using headphones) but reduced it for the person on-site who tended to speak louder. Reflecting on privacy, participants spontaneously thought of less crowded areas as optimal for walking meetings. One could however also make the opposite assumption: a discussion in a crowded place will be blurred into the background. Considering the sensitive nature of work-related discussions, privacy (and to some extent IT security) should be a matter of interest for designers.

Figure 8. Design Opportunities for Technology-Supported Walking Meetings

The insights collected in this study show opportunities to integrate technology at several points throughout the walking meeting journey. Solutions can also be low tech, including for instance urban or service design concepts.
The need for supporting tools and technology should be questionned and balanced with the expected benefits and limitations.

Meeting planning
Weather forecast, tailored route planning (taking into account participants' preferences)

Navigation
Wayfinding and navigation assistance, live route information and recommendations

Meeting tools
Functional support in terms of note-taking, presentation, sketching, information search, etc

Time management and moderation
Keeping track of time, agenda points

Meeting structure and activities
Supporting different types of meeting (e.g., ideation, decision-making) or group composition

Social interactions
Fostering turn-taking, change of the group position, stimulating playfulness

Hybrid meeting contexts
Supporting hybrid meeting formats (online, on-site, synchronous, asynchronous)

Privacy and safety
Taking into account contextual factors to support privacy and safety

Organisational culture
Increasing the acceptability of walking meetings or developing a culture and best practices around walking meetings

Motivation and nudging
Removing barriers and inciting people to integrate more walking meetings in their work routine

The Role of Technology in Walking Meetings: Enabler or Barrier?

The role of technology to support walking meetings has been discussed by our participants, during the bodystormings and the focus groups. According to Haliburton et al. [25], there is an "unexplored opportunity to harness technology to support users in overcoming some limitations inherent to meetings in motion" (p.6). Figure 8 summarizes the design opportunities for technology-supported walking meetings.

In the bodystormings, the use of technology often resulted in some burden for the participants. It was for instance not convenient to type on a phone or tablet while walking and was even mentioned as potentially dangerous, distracting from paying attention to hazards in the environment. Technological devices also become an obstacle or source of anxiety when potential issues of connectivity or battery were not anticipated (e.g., one participant lost connection in the "audio-conferencing" bodystorm). Even promising technology meant to include people in a collaborative situation (e.g., "telepresence robot") ended up a burden to the participants on-site (watching over the robot and helping it navigate). On the positive side, audio-conferencing allows to meet by walking "alone but together" and supports remote meetings. In the future, augmented reality (AR) could be used to give a sense of co-presence [25].

Reflecting on how to improve some unsatisfying aspects of the experience, participants mentioned some technological solutions. These could solve issues related to note-taking and presenting, time management, navigation, and planning. Voice recording was cited several times, as one of the most obvious ways to take notes in a non-intrusive manner. This reflects well the current market of technologies for walking meetings, including an ever-growing number of dedicated speech-to-text apps. It also echoes the ubiquitous recording system depicted in the design fiction F1 of Haliburton et al. [25]. Applications supporting time management during the meeting, audio devices for large groups to connect outdoors, or wearables using haptic feedback to support navigation were also mentioned. In any case, participants agreed that technology should be seamless and not become an additional burden. Ahtinen et al. [3,4] for instance showed that navigation through an app causes distraction. Our findings also show that phone use hindered visual contact, which is essential to the connection within the team.

Facing the difficulty to envision suitable mobile technologies to be used during the walking meeting, participants suggested focusing the technological component on the planning of the meeting: "perhaps using technology before the meeting, as a planning tool e.g., for the route, tailoring it to the needs of people" (P1). This was deemed useful to assess factors that cannot be anticipated accurately, for instance, live information about the crowdedness of a place (which can be detrimental to privacy) or the noise level (detrimental to focus). "There are a lot of things we can't anticipate, and this unpredictability has a lot of impact on the experience of walking meetings" (P16).

Low-tech solutions were also often brought forward as alternatives. This also resonated with the idea that a walking meeting provides benefits because it is low-tech, away from screens and the normative office environment. The issue of note-taking for instance could be resolved by taking regular breaks during the walking meeting to write down the main points discussed. The urban furniture could be supportive in this regard, or devices like the Hubs by Damen et al. [15]. One could also limit the walking meeting format to meetings that do not require note-taking; e.g., in the classification by [19], group presentations, status updates, or 1:1 meetings.

Finally, our participants also attempted to think of how technology could support positive social interactions, such as moderation and turn-taking in the absence of eye contact, or the change of position within the group which provided benefits but did not happen spontaneously. Not convinced by the technological solutions ideated by her teammates, P10 reflected, "I have the impression that by thinking about tech to regulate social interactions we are trying to get rid of this notion of humanity, of empathy". Aversion to technology and the dichotomy between a need for technological support combined with a desire to experience nature was already described in previous work [25].

Limitations and Future Work

Our study entails several limitations. First, the choice of the situations (16 out of the 62 we brainstormed) to bodystorm surely has an impact on the topics elicited by our participants. Our situations covered a wide range of contexts, but a different selection could have brought forward further insights. From our initial list, bodystormings related to special needs (e.g., wheelchair users), remote work and work-life balance (e.g., walking with a stroller or with one's dog), specific contexts (e.g., at night), specific meeting types (e.g., walking with hundred people), or motivational barriers (e.g., when one really does not feel like it) could possibly have triggered worthwhile discussions. Second, to simulate an actual meeting, participants had to brainstorm on a topic, which was not related to their work. This can reduce the ecological validity of the situation. The privacy concerns were for instance only simulated, which has different implications [20]. Similarly, the motivational dimension and time experience were not addressed. Third, most of the groups were composed of people used to working together. Conducting this test with employees who have different relations (distant collaborators or different levels of hierarchy) may lead to different outcomes. Third, although the workload ratings are only indicative (the qualitative feedback being our main source of insights), we analyzed the workload mostly at an aggregated level for each group, yet inter-individual differences in the perception of workload can be high [26]. Finally, because each bodystorming created specific constraints, the sequence of the sessions may bias the perception of the following activity. We possibly observed this limitation in the "Audio-conferencing" session. The group experienced a feeling of freedom which may have been exacerbated by the restrictive path imposed during the previous session.

Several research questions can be addressed in future work. First, we invite the community to address topics that were not explored extensively in the present work and are underexplored in the literature, despite their high relevance (e.g., motivational barriers, accessibility, privacy). Second, most of the existing work on walking meetings has been conducted in rather favorable environments such as university campuses. More work is needed to understand how to promote walking meetings, or any form of meeting in motion, in different urban environments, and with different populations. The unpredictability of optimal conditions (including individual, social, contextual, and environmental aspects) to conduct a walking meeting has also been documented as a major obstacle to their wide adoption [4,16]. There is a design space for technology or tools to reduce this uncertainty.

CONCLUSION

To understand the embodied experience of walking meetings, we conducted a series of 16 bodystorming sessions, featuring unusual walking meeting situations. After each bodystorming, participants completed three tasks: a body map, an empathy map, and a workload assessment on the NASA-TLX scale [26]. These embodied explorations provided insights on key topics related to walking meetings: material and tools, physical and mental demand, connection with the environment, social dynamics, and privacy. Overall, this work offers a new perspective on walking meetings by eliciting and reporting on embodied aspects which are otherwise under-investigated in the literature.

Drawing on the opportunities we identified for technology-mediated walking meetings, we encourage the community to reflect on the creative use of technology to support new scenarios of use and to challenge the status quo, promoting less sedentary ways of working and new forms of collaboration. This can be supported for instance using data-enabled design [8,28], or speculative and critical design methodologies [17,18,25] to provoke change and envision new possible futures of work.

ACKNOWLEDGMENTS

This research has been supported by the Luxembourg National Research Fund (FNR) IPBG2020/IS/14839977/C21. The authors would like to thank the HCI research team at the University of Luxembourg for their contribution to this work.

REFERENCES

[1] Arlie Adkins, Jennifer Dill, Gretchen Luhr, and Margaret Neal. 2012. Unpacking Walkability: Testing the Influence of Urban Design Features on Perceptions of Walking Environment Attractiveness. Journal of Urban Design 17, 4 (November 2012), 499–510. DOI:https://doi.org/10.1080/13574809.2012.706365

[2] Aino Ahtinen, Eeva Andrejeff, Christopher Harris, and Kaisa Väänänen. 2017. Let's walk at work - Persuasion through the brainwolk walking meeting app. In Proceedings of the 21st International Academic Mindtrek Conference, AcademicMindtrek 2017, Association for Computing Machinery, Inc, 73–82. DOI:https://doi.org/10.1145/3131085.3131098

[3] Aino Ahtinen, Eeva Andrejeff, and Kaisa Väänänen. 2016. Brainwolk – A Mobile Technology Mediated Walking Meeting Concept for Wellbeing and Creativity at Work. In Proceedings of the 15th International Conference on Mobile and Ubiquitous Multimedia, ACM, New York, NY, USA, 307–309. DOI:https://doi.org/10.1145/3012709.3016062

[4] Aino Ahtinen, Eeva Andrejeff, Maiju Vuolle, and Kaisa Väänänen. 2016. Walk as You Work - User Study and Design Implications for Mobile Walking Meetings. In Proceedings of the 9th Nordic Conference on Human-Computer Interaction, ACM, New York, NY, USA, 1–10. DOI:https://doi.org/10.1145/2971485.2971510

[5] Andrew W. Bailey, Garrett Allen, Josh Herndon, and Christian Demastus. 2018. Cognitive benefits of walking in natural versus built environments. World Leisure Journal 60, 4 (October 2018), 293–305. DOI:https://doi.org/10.1080/16078055.2018.1445025

[6] Agnes E. van den Berg and Femke Beute. 2021. Walk it off! The effectiveness of walk and talk coaching in nature for individuals with burnout- and stress-related complaints. Journal of Environmental Psychology 76, (August 2021). DOI:https://doi.org/10.1016/j.jenvp.2021.101641

[7] Anna Bornioli. 2022. The walking meeting: opportunities for better health and sustainability in post-COVID-19 cities. Cities and Health (2022). DOI:https://doi.org/10.1080/23748834.2022.2050103

[8] Tjeu van Bussel, Roy van den Heuvel, and Carine Lallemand. 2022. Habilyzer: Empowering Office Workers to Investigate their Working Habits using an Open-Ended Sensor Kit. In Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems (CHI EA '22), ACM, New York, NY, USA. DOI:https://doi.org/10.1145/3491101.3519849

[9] Hancheng Cao, Chia-Jung Lee, Shamsi Iqbal, Mary Czerwinski, Priscilla N Y Wong, Sean Rintel, Brent Hecht, Jaime Teevan, and Longqi Yang. 2021. Large Scale Analysis of Multitasking Behavior During Remote Meetings. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, ACM, New York, NY, USA, 1–13. DOI:https://doi.org/10.1145/3411764.3445243

[10] Russell Clayton, Christopher Thomas, and Jack Smothers. 2015. How to Do Walking Meetings Right. Harvard Business Review. Retrieved May 4, 2022 from https://hbr.org/2015/08/how-to-do-walking-meetings-right

[11] Pieter Coenen, Nicholas Gilson, Genevieve N. Healy, David W. Dunstan, and Leon M. Straker. 2017. A qualitative review of existing national and international occupational safety and health policies relating to occupational sedentary behaviour. Applied Ergonomics 60, 320–333. DOI:https://doi.org/10.1016/j.apergo.2016.12.010

[12] Ida Damen, Rens Brankaert, Carl Megens, Pieter van Wesemael, Aarnout Brombacher, and Steven Vos. 2018. Let's walk and talk: A design case to integrate an active lifestyle into daily office life. In Conference on Human Factors in Computing Systems - Proceedings, Association for Computing Machinery. DOI:https://doi.org/10.1145/3170427.3174353

[13] Ida Damen, Aarnout Brombacher, Pieter van Wesemael, Rens Brankaert, Carine Lallemand, J.G. Brombacher, and Steven Vos. 2019. WorkWalk: a case study to integrate an active lifestyle into daily office life. In Walk21 Conference.

[14] Ida Damen, Hans Brombacher, Carine Lallemand, Rens Brankaert, Aarnout Brombacher, Pieter van Wesemael, and Steven Vos. 2020. A scoping review of digital tools to reduce sedentary behavior or increase physical activity in knowledge workers. International Journal of Environmental Research and Public Health 17, 2 (2020). DOI:https://doi.org/10.3390/ijerph17020499

[15] Ida Damen, Anika Kok, Bas Vink, Hans Brombacher, Steven Vos, and Carine Lallemand. 2020. The hub: Facilitating walking meetings through a network of interactive devices. In DIS 2020 Companion - Companion Publication of the 2020 ACM Designing Interactive Systems Conference, Association for Computing Machinery, New York, NY, USA, 19–24. DOI:https://doi.org/10.1145/3393914.3395876

[16] Ida Damen, Carine Lallemand, Rens Brankaert, Aarnout Brombacher, Pieter van Wesemael, and Steven Vos. 2020. Understanding Walking Meetings: Drivers and Barriers. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, Association for Computing Machinery, New York, NY, USA, 1–14. DOI:https://doi.org/10.1145/3313831.3376141

[17] Ida Damen, Daphne Menheere, Carine Lallemand, and Steven Vos. 2020. Ivy: Reading a critical design for sedentary behavior in the office context. In DIS 2020 Companion - Companion Publication of the 2020 ACM Designing Interactive Systems Conference, Association for Computing Machinery, New York, NY, USA, 7–12. DOI:https://doi.org/10.1145/3393914.3395893

[18] Ida Damen, Ingmar Nieuweboer, Hans Brombacher, Pieter van Wesemael, Steven Vos, and Carine Lallemand. 2021. The Office Jungle: Exploring Unusual Ways of Working through Bodily Experimentations. In DIS 2021 - Proceedings of the 2021 ACM Designing Interactive Systems Conference: Nowhere and Everywhere, Association for Computing Machinery, New York, NY, USA, 466–477. DOI:https://doi.org/10.1145/3461778.3462062

[19] Ida Damen, Steven Vos, and Carine Lallemand. 2021. The Hubs: Design Insights for Walking Meeting Technology. In Book Series: Lecture Notes in Computer Science, Springer International Publishing, 610–629. DOI:https://doi.org/10.1007/978-3-030-85610-6_35

[20] Verena Distler, Matthias Fassl, Hana Habib, Katharina Krombholz, Gabriele Lenzini, Carine Lallemand, Lorrie Faith Cranor, and Vincent Koenig. 2021. A Systematic Literature Review of Empirical Methods and Risk Representation in Usable Privacy and Security Research. ACM Transactions on Computer-Human Interaction 28. DOI:https://doi.org/10.1145/3469845

[21] Bruna Ferreira, Williamson Silva, Edson Oliveira, and Tayana Conte. 2015. Designing personas with empathy map. In Proceedings of the International Conference on Software Engineering and Knowledge Engineering, SEKE, Knowledge Systems Institute Graduate School, 501–505. DOI:https://doi.org/10.18293/SEKE2015-152

[22] Sarah Forberger, Frauke Wichmann, and Chiara Nicoletta Comito. 2022. Nudges used to promote physical activity and to reduce sedentary behaviour in the workplace: Results of a scoping review. Preventive Medicine 155. DOI:https://doi.org/10.1016/j.ypmed.2021.106922

[23] Stephen J Gould. 1995. Researcher Introspection as a Method in Consumer Research: Applications, Issues, and Implications. Source: Journal of Consumer Research 21, 4 (1995), 719–722. Retrieved from https://about.jstor.org/terms

[24] Luke Haliburton and Albrecht Schmidt. 2020. Technologies for Healthy Work. Interactions, 64–66.

[25] Luke Haliburton, Pawel W. Wozniak, Albrecht Schmidt, and Jasmin Niess. 2021. Charting the Path: Requirements and Constraints for Technology-Supported Walking Meetings. Proceedings of the ACM on Human-Computer Interaction 5, CSCW2 (October 2021). DOI:https://doi.org/10.1145/3476088

[26] Sandra G Hart and Lowell E Staveland. 1988. Development of NASA-TLX (Task Load Index)" Results of Empirical and Theoretical Research. In Human Mental Workload, P. A. Hancock and N. Meshkati (eds.). North Holland Press, Amsterdam, 239–250.

[27] Heiko Hecht, Robin Welsch, Jana Viehoff, and Matthew R. Longo. 2019. The shape of personal space. Acta Psychologica 193, (February 2019), 113–122. DOI:https://doi.org/10.1016/j.actpsy.2018.12.009

[28] Roy van den Heuvel, Ida Damen, Rens Brankaert, and Steven Vos. 2021. Advancing Digital Behavior Change Interventions by Exploring a Calendar-Based Suggestion System. In European Conference on Cognitive Ergonomics 2021, ACM, New York, NY, USA, 1–7. DOI:https://doi.org/10.1145/3452853.3452866

[29] Kristina Höök, Baptiste Caramiaux, Cumhur Erkut, Jodi Forlizzi, Nassrin Hajinejad, Michael Haller, Caroline Hummels, Katherine Isbister, Martin Jonsson, George Khut, Lian Loke, Danielle Lottridge, Patrizia Marti, Edward Melcer, Florian Müller, Marianne Petersen, Thecla Schiphorst, Elena Segura, Anna Ståhl, Dag Svanæs, Jakob Tholander, and Helena Tobiasson. 2018. Embracing First-Person Perspectives in Soma-Based Design. Informatics 5, 1 (February 2018), 8. DOI:https://doi.org/10.3390/informatics5010008

[30] Yitong Huang, Steve Benford, and Holly Blake. 2019. Digital interventions to reduce sedentary behaviors of office workers: Scoping review. Journal of Medical Internet Research 21, 2 (2019), 1–19. DOI:https://doi.org/10.2196/11079

[31] Mary Carol R. Hunter, Brenda W. Gillespie, and Sophie Yu Pu Chen. 2019. Urban nature experiences reduce stress in the context of daily life based on salivary biomarkers. Frontiers in Psychology 10, APR (2019). DOI:https://doi.org/10.3389/fpsyg.2019.00722

[32] Paul Kelly, Chloë Williamson, Ailsa G. Niven, Ruth Hunter, Nanette Mutrie, and Justin Richards. 2018. Walking on sunshine: Scoping review of the evidence for walking and mental health. British Journal of Sports Medicine 52, 800–806. DOI:https://doi.org/10.1136/bjsports-2017-098827

[33] Harold W Kohl, Cora Lynn Craig, Estelle Victoria Lambert, Shigeru Inoue, Jasem Ramadan Alkandari, Grit Leetongin, and Sonja Kahlmeier. 2012. The pandemic of physical inactivity: global action for public health. The Lancet 380, 9838 (July 2012), 294–305. DOI:https://doi.org/10.1016/S0140-6736(12)60898-8

[34] I-Min Lee, Eric J Shiroma, Felipe Lobelo, Pekka Puska, Steven N Blair, and Peter T Katzmarzyk. 2012. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. The Lancet 380, 9838 (July 2012), 219–229. DOI:https://doi.org/10.1016/S0140-6736(12)61031-9

[35] Kristina Mah, Lian Loke, and Luke Hespanhol. 2021. Towards a Contemplative Research Framework for Training Self-Observation in HCI: A Study of Compassion Cultivation. ACM Transactions on Computer-Human Interaction 28, 6 (December 2021). DOI:https://doi.org/10.1145/3471932

[36] Marily Oppezzo and Daniel L. Schwartz. 2014. Give your ideas some legs: The positive effect of walking on creative thinking. Journal of Experimental Psychology: Learning Memory and Cognition 40, 4 (2014), 1142–1152. DOI:https://doi.org/10.1037/a0036577

[37] Antti Oulasvirta, Esko Kurvinen, and Tomi Kankainen. 2003. Understanding contexts by being there: Case studies in bodystorming. In Personal and Ubiquitous Computing, Springer-Verlag London Ltd, 125–134. DOI:https://doi.org/10.1007/s00779-003-0238-7

[38] Loes van Renswouw, Steven Vos, Pieter van Wesemael, and Carine Lallemand. 2021. Exploring the Design Space of InterActive Urban Environments: Triggering physical activity through embedded technology. In DIS 2021 - Proceedings of the 2021 ACM Designing Interactive Systems Conference: Nowhere and Everywhere, Association for Computing Machinery, Inc, 955–969. DOI:https://doi.org/10.1145/3461778.3462137

[39] Stephanie Revell and John McLeod. 2016. Experiences of therapists who integrate walk and talk into their professional practice. Counselling and Psychotherapy Research 16, 1 (March 2016), 35–43. DOI:https://doi.org/10.1002/capr.12042

[40] Dennis Schleicher, Peter Jones, and Oksana Kachur. 2010. Bodystorming as embodied designing. Interactions 17, 6 (2010), 47–51. DOI:https://doi.org/10.1145/1865245.1865256

[41] Elena Márquez Segura, Laia Turmo Vidal, and Asreen Rostami. 2016. Bodystorming for movement-based interaction design. Human Technology 12, 2 (2016), 193–251. DOI:https://doi.org/10.17011/ht/urn.201611174655

[42] Rob Shields, Edmar Joaquim Gomes da Silva, Thiago Lima e Lima, and Nathalia Osorio. 2021. Walkability: a review of trends. Journal of Urbanism (2021). DOI:https://doi.org/10.1080/17549175.2021.1936601

[43] Richard Shusterman. 2008. Body consciousness : a philosophy of mindfulness and somaesthetics. Cambridge University Press.

[44] Michael Southworth. 2005. Designing the Walkable City. Journal of Urban Planning and Development, 131, 4 (2005). DOI:https://doi.org/10.1061/ASCE0733-94882005131:4246

[45] Keri K. Stephens and Jennifer Davis. 2009. The social influences on electronic multitasking in organizational meetings. Management Communication Quarterly 23, 1 (August 2009), 63–83. DOI:https://doi.org/10.1177/0893318909335417

[46] World Health Organization. 2018. Global action plan on physical activity 2018–2030: more active people for a healthier world. Geneva. Retrieved June 6, 2022 from https://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf

[47] World Health Organization. 2021. Planning healthy and sustainable meetings A practical guide Third edition. Geneva. Retrieved from http://www.who.int/about/licensing.

[48] Haian Xue and Pieter M.A. Desmet. 2019. Researcher introspection for experience-driven design research. Design Studies 63, (July 2019), 37–64. DOI:https://doi.org/10.1016/j.destud.2019.03.001