

# Ivy: A Qualitative Interface to Reduce Sedentary Behavior in the Office Context



**Figure 1:** Ivy: visualizing sedentary behavior through a growing ivy plant on an office chair

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## Abstract

This paper describes Ivy, an office chair that represents sitting time of an office worker through growing ivy strands. The longer one sits, the more strands will grow onto the chair. By means of a qualitative interface called Ivy, we illustrate a design approach that is currently underrepresented in sedentary behavior interventions. With this approach, we counter the current trend of digitalization and quantification of health interventions. Instead of graphs and numbers, Ivy uses data physicalization as a qualitative interface that represents sitting. We describe the design, the process, and future research steps of Ivy as a critical perspective on sedentary behavior interventions. We aim to spark discussion amongst designers and researchers in the field of Human-Computer Interaction to use qualitative interfaces as a promising approach to deepen the user's relationship with the targeted behavior and enrich the ability to construct meaning from the feedback.

## Author Keywords

Office work; Data Physicalization; Qualitative Interfaces; Sedentary Behavior

## CSS Concepts

• **Human-centered computing** ~ Human computer interaction (HCI); Interactive systems and tools



**Figure 2:** Pitching the proposal at a 2.5-day hackaton ©Ivar Pel



**Figure 3:** Brainstorming 25 ideas with the multidisciplinary team ©Ivar Pel (top picture)

## Introduction

Our increasing sedentary lifestyles are a growing health risk, with physical inactivity being the fourth leading cause of death worldwide [5]. A large part of our sedentary behavior takes place in the office, with office workers spending up to 71% of their working hours in sedentary position [1]. This makes the office an important environment to target sitting time. However, a current trend is that everything is transformed into numbers and graphs to show how one can adopt a healthier lifestyle [6]. The underlying idea of this approach is that quantifying the behavior would increase the awareness of –unhealthy– behavior and can therefore contribute to a healthier lifestyle [3, 7].

Although this quantified approach seems widely adopted in health interventions [3], Lockton et al. state that people tend to construct meaning through the qualities of phenomena and their relationships with them [6]. Our body, for instance, essentially acts as a qualitative interface. As we bathe, the skin of our fingertips is a good indication of how long we have been in the water. When integrating these relations in a design we speak of a qualitative interface: “a qualitative display as being a way in which information is presented primarily through representing qualities of phenomena” [6, p2]. Qualitative interfaces are commonly used in the design of data physicalization, a physical representation of data to help people explore, understand and communicate data [4, 6]. Although data physicalization is an emerging research area in the field of Human-Computer Interaction (HCI) [4], it is rarely applied in sedentary behavior interventions for the office context [3]. In this paper, we propose a new design approach for sedentary behavior interventions by using a qualitative interface. We exemplify this by

introducing Ivy, a contextual artifact that represents sitting behavior through data physicalization.

## Design Process

The two first authors proposed a challenge during a 2.5-day health hackathon to design a qualitative interface for the office environment (Figure 2). A group of six persons was formed consisting of two industrial design PhD candidates, one data analyst, one design consultant, one communication manager and one accounting consultant. During ideation, 25 ideas were produced (Figure 3), amongst which 3 were selected because they best represented a qualitative interface and were filling gaps in the current landscape of artefacts addressing sedentary behavior at work. These ideas were deepened, after which a second vote took place to select the final idea of Ivy.

## Design Concept: Ivy

Ivy is an office chair that aims to increase awareness of the sedentary behavior of office workers by measuring sitting time and visualizing this behavior through a growing ivy plant on the office chair (Figure 1). The longer one sits on Ivy, the more ivy strands will grow on the handrails and legs of the chair and ultimately immobilizes the chair after two hours of prolonged sitting (Figure 4).

As an office chair, Ivy is an object that is already part in the office environment and therefore does not require an additional object to interact with while working. This unlike the majority of sedentary behavior interventions [3]. By using a chair, a more direct reflection is made between the intervention and the targeted behavior. Since the functionality of a chair is sitting, no additional abstraction is needed to link the



**Figure 4:** Growing stages of Ivy

feedback of Ivy with the input data (sitting). Linking the form of the intervention to the targeted behavior may deepen the understanding and underlying values of the design [6].

Although Ivy uses a direct link between the targeted behavior and its representation, it also uses several metaphors to enrich the ability to construct meaning from the feedback. A first metaphor can be found in the materiality of Ivy. By choosing the plant ivy, we hint to somebody being stationary for a long time, since these types of plants will only grow on something when it has been at the same spot for a long time. The second metaphor is integrated in the interaction modality. When sitting too long, the user will eventually be rooted to the chair and is thus restricted in their movement. This restriction can be seen as a prodrome to stiffening, a result from sedentary behavior. Finally, we use an analogy between prolonged sedentary behavior and the characteristics of an ivy plant. A well-known type of ivy plant is called poison ivy, emphasizing the negative health consequences.

### Realization of Ivy

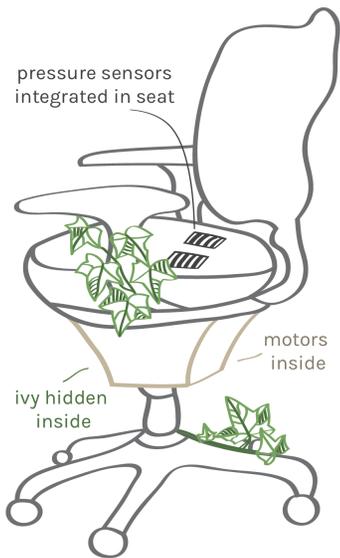
For the technical realization of Ivy, we integrated two pressure sensors (Taiwan Alpha MF02-N-221-A01), two stepper motors (NEMA17), a microcontroller (Uno R3), and motor driver (TB67S109) in the seating area of the office chair (Figure 5). By connecting these sensors to the microcontroller, we are able to collect posture information from users, thereby inferring the sitting behavior. We used artificial ivy plants connected to fabric wires (Figure 6) to physicalize the sitting time. Whenever a person is sedentary for a prolonged period, the ivy is brought in motion. The prototype uses one of two stepper motors to move the ivy out of the hidden

compartment which is located under the seating area. The wires are pulled through the tubes and guide the ivy around the contours of the chair until the plants are fully extended. When someone stands up for at least 5 minutes, the ivy plant will move back again with the use of the same principle yet in the opposite direction with the second motor.

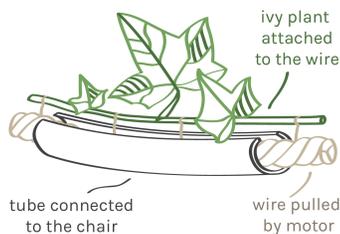
### Conclusion and Future Work

This paper set out to present a new design approach to sedentary behavior interventions and tools for the office context. We illustrate this approach by means of Ivy, an office chair that represents sitting time through growing ivy strands. Ivy was created by a multi-disciplinary team during a health hackathon in the Netherlands. This approach ensured rapid exchange of ideas and close collaboration of people with different backgrounds, skills and expertise areas.

With our design we address a gap we see within the current design of sedentary behavior interventions. Ivy counters the present trend of digitalization and quantification of health interventions and tools. Inspired by the approach of Lockton et al. [6], we adopted a qualitative perspective to represent sitting behavior by using growing ivy strands. In an attempt to deepen the understanding of the feedback, Ivy provides a direct connection between the measured input and the physicalized output. Making this direct connection challenged us to integrate existing office tools into our design concepts. Using this integrative approach is rarely used in current interventions targeting sedentary behavior [3], and could thus provide a new design landscape for future work.



**Figure 5:** Placement of the technological features of Ivy



**Figure 6:** Visualization of Ivy's growing mechanism

In addition to the direct connection used in Ivy, we also integrated different metaphors within the design. Paradoxically, metaphors provide an implied comparison [2], in other words an indirect connection. We ought this to be a complementary approach to qualitative interfaces, since both approaches aim to better the understanding of the intervention and enriches the ability to construct meaning from the feedback [2, 6]. Further work needs to be done to establish whether the design of Ivy actually enables this. We aim to examine how users construct meaning during our demonstration by using a reflective installation, allowing them to experience the artefact before expressing their thoughts on its criticality. The audience, adopting a third-person perspective, will also be invited to reflect and to write down provocations about current ways of working.

Whilst Ivy does not represent a commercial artefact, it provides a critical perspective towards sedentary behavior interventions. We aim to explore and spark discussion amongst designers and researchers in the field of Human-Computer Interaction to use qualitative interfaces as a promising approach to deepen the user's relationship with the targeted behavior and enrich the ability to construct meaning from the feedback.

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