

# Exploring ecological physicalizations -A user study in a hybrid work setting

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## 1 POSITION PAPER

Data physicalization is a huge and successful field of HCI research. It covers both the design and evaluation of device-oriented physicalizations and the study of physicalizations in their wider environment, their ecology [16]. This position paper is a user study that aims to find physicalizations occurring naturally in office work environments, what we in this paper call ‘ecological physicalizations’, and discuss how the user experiences these.

Physicalizations leverage the power of physical objects and spaces to support cognitive processes such as perception, spatial reasoning, and haptic exploration [8]. When designing physicalizations, the goal is to make data more accessible, intuitive, and understandable in fields such as architecture, product design, and urban planning, by creating a tangible representation of the data that can be easily observed, explored, and interacted with. Besides residing firmly in design explorations of physical data visualizations [15], physicalizations have been studied as physicalizations of Big Data in ethnographic contexts [2], of qualitative data [11] such as physicalizations of human dreams [13], physical sensemaking [9], and as physicalized power of institutions [5]. Notably, it has been studied in office work settings [6]. Physicalization has thus already a rich theoretical grounding.

In hybrid work settings, the ubiquitous-ness of technology and technological gadgets provide high-level flexibility, independence in location, and self-assessed productivity during the pandemic [1, 3, 14]. This flexibility and independence bring spatial hybridity, and people work anywhere they have an internet connection. In particular, knowledge workers appear to adopt hybrid working practices rather than working exclusively remotely or on-site. However, this brings various disadvantageous in the long term due to the unstructured characteristics of distance work and the risks for the work environments. Against this backdrop, exploring ecological physicalizations in their hybrid work settings appears crucial for understanding users and designing for their office vitality.

Hence this position paper aims to generate discussion about finding physicalizations in everyday ecologies. The assumption is that ecological physicalizations are already out there in everyday environments to study and learn from, but also that given the success of the physicalizations movement, it is worth considering what happens when they become common in everyday environments and how to find them with user ethnographies to support further design.

Our chosen method to explore ecological physicalizations is autoethnography or first-person experiment [7] to collect and analyze data from our own everyday hybrid work setting in a university. Briefly, the data was collected over a number of workdays and written up as a day with remote work and a day at work, reflecting the common way of shifting between working at home and doing the transport to work at the university department. The analysis was done by applying some of the suggested data types and settings proposed for office vitality in the call for papers for this workshop [15] and inspired by proposed key design dimension for ecological physicalizations [16]. Initial results are shown in Table 1 for a small subset of the auto-ethnographical data.

Table 1. Tentative categorization of ecological physicalizations for a PhD student in a hybrid work setting.

Data form	Embedded data representations	Data sculptures	Constructive visualizations	Casual information visualizations	Dynamic composite
Data type	Environmental data	Personal data	Social dynamic	Work related data/social dynamic	Work related data
Data subtype	Weather mood data	Personal energy, vitality	Competition/social support	productivity/social distraction	Work tasks
1 : at work site	It is a relatively sunny day.	I was wearing vibrant pink pants because it was a day to be energetic, and this sparked a small conversation with Sarah about colors and Tuesday energy.	Then, realizing that Arkun had finished getting coffee, I went to the coffee machine to get some	After a five-minute speaker and projector arrangement and ensuring that online attendees could hear and see the presenter in the room, the meeting started. By that time, I remember that we could not find the projector's remote control, and one of us had to stand up to arrange the volume and presentation.	I was startled by the notification from my computer. It was a reminder of the assignments related to the course I took.
2 : remote work site		Then, I came back to my room-office with my second cup of tea.	Then, I came back to my room-office with my second cup of tea. Especially if my roommates are not also working from home, I, my desk, and my window with Copenhagen view are ready to work as a team.	Even though I was wearing my headphones, I couldn't help watching people when it came time. When I realized this, I was changing my sitting position or ordering another coffee. But I still got distracted so I decided to leave early and go to the course.	Wednesdays are a suitable day to work remotely as there are usually no meetings or meetings.

The tentative categorizations of ecological physicalizations in a hybrid work setting may help widen the scope of what physicalizations can be and illustrates how to find them in everyday work domains. Physicalization seems promising as part of improving office vitality in hybrid work, as they become embedded in everyday artefacts [6]. However, while useful, the device-oriented design dimensions proposed based on previous physicalizations research [16] may need to be adapted to include the naturally occurring physicalizations in real-life domains such as hybrid work settings. An example is the “*it is a relatively sunny day*” quote that can tentatively be classified as a physicalizations of continuous data (degrees of sunny-ness), but at the same time calls for more discussion of what is meant by data and by physicalizations in the wider ecologies, environments, and domains.

At the workshop, we plan to present a fuller and richer taxonomy/paradigm [17] of ecological physicalizations in hybrid work at a university to enable a discussion about how to explore ecological physicalizations. We, the authors of this position paper, come with backgrounds in industrial design [18], design psychology [4], and user-oriented big data research [10], which we believe are important perspectives on physicalizations. For future research we consider doing a longitudinal autoethnography [12] and perhaps in groups, before entering the ideation, technical realization, and implementation of a physicalization system.

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