

Supporting Indexing Practices Through Spatio-Contextually Embedded Interactions/Systems

Eva Hornecker

Fak. Medien, HCI-Group, Bauhaus-Universität Weimar
Bauhausstr.11, D-99423 Weimar, Germany
Eva.hornecker@uni-weimar.de

ABSTRACT

In this position paper I suggest the notion of spatio-contextually embeddedness and human indexing practices. The latter, as illustrated by an example, can be supported by technology designs that achieve the former. A clearer understanding of how to achieve and design for well-integrated spatio-contextual embedding is needed.

INTRODUCTION: A SCENARIO

In one corner of a museum for natural history a screen is positioned low on the ground, where visitors can select a dinosaur skeleton by moving a lever next to the screen. The screen shows a picture of the exhibition hall people are in, depicting the real skeletons in direct view. As the lever is moved, the picture shifts left or right, and once the lever stays on one of the skeletons, it is selected. The skeleton on the screen transforms into a dinosaur, comes alive, the image of the hall replaced by a Jurassic landscape, and moves through a short animated sequence, to then transform back into the skeleton in the museum hall. This museum installation creates a direct and very compelling relation between the animated movies and the real exhibits. People constantly point back and forth and actively create connections:

Mother at screen to daughter: “look these animals - - Look, now this animal comes (points at a dinosaur turning alive on-screen) and it stands there (points out into the exhibition hall towards the skeleton), and this is how it lives in nature.”

Father, mother, and 3-year-old son watch a big dinosaur on-screen. As the animation finishes, the boy reaches up, pointing at the tallest skeleton in the hall and exclaims loudly: “The GIANT DINOSAUR!” A while later, they walk through the hall and pass by several skeletons. The father reaches out to his son: “Look, that’s the dinosaurs from the film” and points at the artefacts.

The data from this study [3] yields numerous examples of children and adults indexing between depictions on-screen and the skeletons. They ‘index’ via language (this, there, here) and by fingers pointing, and looking back and forth. Not only do parents utilize the possibilities that the content and spatial setup of the installation provide them with for educational dialogue. Children spontaneously do the same, pointing connections out to other children or their caregivers.

The installation is carefully embedded in the environment, making visitors look from the screen (set at an angle in the ground) out towards the skeletons in direct line of sight. The animations are thus contextualized in a meaningful spatial setup. But people have to discover this relation. The installation merely allows and supports this through careful positioning. The animation is not just another movie, but enhances visitor’s perception of the skeletons on exhibit.

INDEXING: SUGGESTING CONNECTIONS

The word ‘index’ derives from the latin for forefinger, informer, sign, and was mostly used as ‘index finger’ (the one used for pointing), coming to also mean ‘pointing’, and then to refer to the entity pointing to a fact (an index as a sign indicating something). A strong tradition within HCI for the notion of indexing is semiotics, where icon, index and symbol refer to different types of signs. Another influential strand of research are ethnographic and ethnomethodological studies, which focus on the ways people coordinate their actions [2], in particular through their bodily behaviours. Deixis, that is pointing gesture, is a part of this. Ethnographic studies are more relevant here, focusing on users’ indexing actions and investigating the semiotic resources of talk, bodies, and environment that participants in a situation draw upon [1].

A rich tradition in communication and gesture studies investigates the linguistic and cognitive function of gesture (including deictic gesture, here referred to as ‘indexing’), and increasingly defines gesture and language as one integrated system, where one can augment or replace the other. This is often expanded to also include the material environment and its social context. Hutchins and Palen [4] describe space, gesture and speech as being used to construct “complex multi-layered representations”, where the spatial organization of artefacts and the positioning of gesture to these artefacts provide important meaning. Pointing is a



Figure 1. From the children’s position at the screen (middle), one looks directly at the skeletons in the left image, the screen showing the same skeletons (right image)

prime example for this, as it relies on the visibility of the referent. Ethnographic studies have revealed the role of this kind of spatially contextualized bodily behavior, which includes the use of deictic gesture, in various contexts, such as centers of controls, design discussion, social interactions in museums, and even suggested that a better understanding of these situated practices can inform human-robot interaction. While communication studies and psycholinguistics tend to focus primarily on the communicative value of gesture, where indexical references use the environment to disambiguate an utterance, distributed cognition highlights the cognitive function of gesture [5,7]. Gesture often has a double function where, for example, pointing may guide one's own attention or externalize cognitive processes, while opportunistically being informative for others.

The understanding of 'indexing' laid out here has its base in a linguistic understanding of indexical expression (and deixis as non-verbal indexing). It goes a step further than the simple pointing to an external referent, beyond the 'this' and 'there', and focuses on how some indexing actions draw complex connections between the 'here' and 'there', between 'this' and 'that'. In lieu of a better phrase, the word 'indexical' is used to refer to the reference from here to there, highlighting a relation between the two.

In HCI we often find the notion that indexes are a property of the artefact (or representation), rather than the idea that people *actively* index between different things to make connections. This often reduces to the provision of indices by the system. For example, Augmented Reality tools like Layar directly overlay annotations and labels over a real view. What often is lost in this process is the users' active and purposeful discovery and creation of connections and references. Instead, we could leave the indexing to users, giving agency to them, supporting pro-active people [cf. 8].

SPATIO-CONTEXTUAL EMBEDDED INTERACTION AND SYSTEMS

The ideas suggested here are motivated by observations which indicate that technology designs which are spatially contextualized and physically embedded engender and support such indexing actions and can thereby increase our engagement with our surroundings, as in the introductory example [3]. This requires interaction techniques "that put us back in touch with our surroundings" [6]. In particular, we believe that tangible and mobile systems are well-suited for this, because they are physically embedded in real space and thus situated in social and physical contexts.

Here, *embedded interaction* is understood differently to the technical view of embedded computing, and refers to interaction with systems that are physically embedded, contextualized and integrated into a meaningful spatial setting. *Spatio-contextual* means the interface cannot be fully interpreted without reference to its setting. Interactions thus tend to index into the surroundings. The introductory story illustrated how a physical system that is carefully situated in a

context can enrich this context without taking attention away from it. The drawing of connections between system content and environment is engendered by how the system is integrated and embedded into the latter. This is because indexing is an embodied relationship with a situation or context.

DESIGNING TO SUPPORT INDEXING

From a design standpoint, the provision of indexes can be considered a quality of an interface. But from an ethnographic viewpoint, it is people who do the indexing, looking back and forth, making connections by pointing or verbally referring to objects, and their overt behaviour makes this activity visible to the observer. This is analogue to the two alternative understandings of 'awareness' within CSCW, which in ethnography is seen as an interactional accomplishment of human actors. This leads to the question of how technological arrangements may hinder or support this accomplishment. In a similar vein, our interest is in understanding what features of a technology engender and support the human activity (or behaviour) of indexing. To this end, we need to understand the design considerations to be taken into account when developing spatio-contextual embedded systems. What if the screen in the example scenario would not be embedded in the floor? What if it faced the other way? What if the skeletons used for the animations were not the same as the ones from the exhibition floor? These are just some of the aspects that could influence the degree of 'embeddedness' and how well indexing is engendered by it.

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