On the Other Hand: Embodied Metaphors for Interactions with Mnemonic Objects in Live Presentations

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ABSTRACT

We describe a presentation system based on the embodied metaphors of giving presentations: topics are *picked up*, one *goes through* a series of points, and *comes* to a conclusion. Technically, our system is based on body tracking and hand-worn RFID readers. Wearing these readers, users can activate topics in live presentations by picking up RFID-tagged mnemonic objects. Each topic can consist of multiple points, which are mapped to positions on stage. Users can activate a point (and its corresponding slide) by walking up to its position on stage. Various actions, triggered by constellations of hand-held objects and movements on stage, are supported by the system. We conducted a series of informal user feedback sessions. Its results indicate that our system has strengths and weaknesses, depending on presenter style and presentation context.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords

embodied metaphors; bimanuality; spatialization; mnemonic objects; presentations; improvisation

INTRODUCTION

When we talk about arguments and decisions in everyday language, we often talk about our body, too: '*On the one hand*, presentation software is a great tool – but *on the other hand*, it is crippling our ability to improvise.' We avoid standing in front of an audience *'empty-handed'*, and rather present a *'handful'* of good arguments that can then be *'weighed'* and are, hopefully, not easily *'thrown away'*. Furthermore, giving a presentation is often a matter of 'carefully *approaching* a topic', '*going through* different ideas', '*skipping* points' when necessary, and '*coming* to a conclusion'.
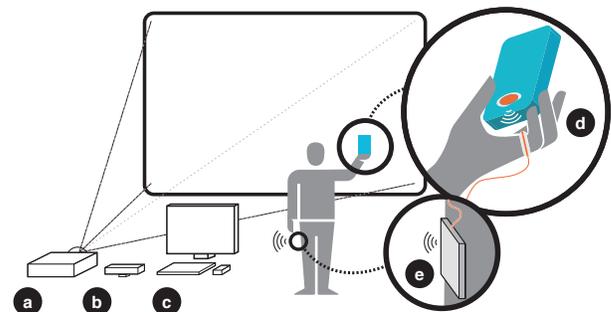
Figure 1. Prototype, consisting of a projector (a), a Microsoft Kinect sensor (b), a computer (c), and a pair of RFID-reading rings (d) that are connected to a body-worn Wi-Fi transmitter (e).

Many of the metaphors that are commonly used when speaking about presentations are what Lakoff and Johnson [29] call 'container metaphors' ('There is no *content in* that slide.', 'That idea *holds* great potential.') and are often coherent with Reddy's metaphorical framework of communication [38]. Lakoff and Johnson claim that we use such embodied metaphors not only in language, but that they fundamentally structure our thoughts and actions. This approach, which has been applied to HCI by Hurtienne and Israel [22], can also be seen as related to the pedagogical principles of Piaget, assuming that our physical body is our primary means for learning [37], and Merleau-Ponty's phenomenology, arguing that body and mind cannot exist without each other [34]. All of these theories are increasingly applied in HCI in general, and in 'embodied interaction' [12] in particular.

The project that we report in this paper focuses on embodied metaphors in the context of giving presentations. Giving a presentation is, for many people, a situation of mental and bodily stress [4]. Unfortunately, current presentation software does not appear to take advantage of any embodied metaphors, which might remedy some of the challenges of giving a presentation. It rather appears that the principles underlying current presentation software date back to the time of mechanical slide projectors: a fixed sequence of text and images, controlled with merely two buttons: 'previous' and 'next'.

| A | No Objects | B | One Object | C | Another Object | D | One Object (above head) | E | Two Objects | F | One Object (in both hands) | G | Two Objects (close together) | H | Two Objects (far apart) |

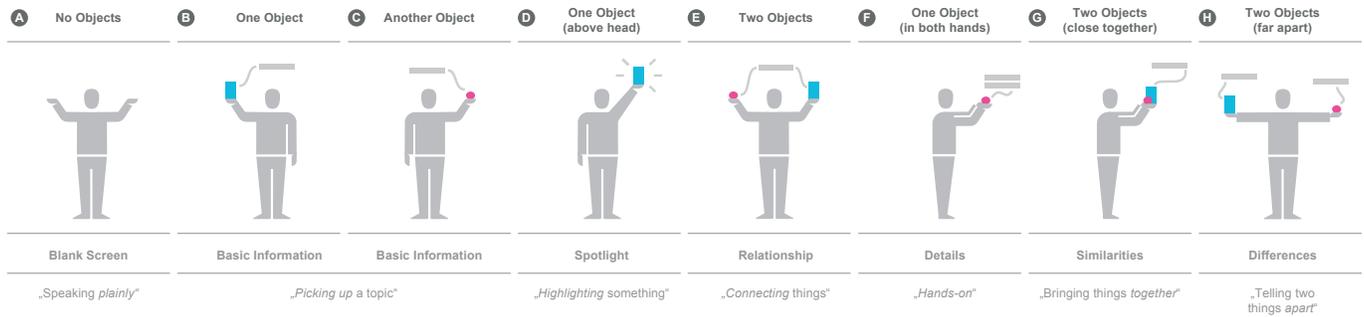| Blank Screen | Basic Information | Basic Information | Spotlight | Relationship | Details | Similarities | Differences |
| „Speaking *plainly*" | „*Picking up* a topic" | | „*Highlighting* something" | „*Connecting* things" | „*Hands-on*" | „Bringing things *together*" | „Telling two things *apart*" |

Figure 2. Objects held in hand, system responses and underlying embodied metaphors.

BACKGROUND
In this section, we provide a brief overview of related work, clarifying how our work integrates previous findings, in order to pursue previously unanswered questions.

Mnemonic Objects
The use of mnemonic objects that represent digital data is investigated in several HCI research projects. A related rhetorical technique is the 'mnemo technique'. It is based on associating thoughts with placeholder objects [49], in order to facilitate memorization. HCI applications of this principle include interfaces for communication [28, 5] and token-based programming languages [21]. Other applications focus on storytelling, often using objects to store multimedia elements of the story [33, 41, 2] – a principle that has also been shown to be beneficial for language development in toddlers with disabilities [19]. Manual interaction, which mnemonic objects often encourage, has also been found to support verbal memory [10], which might be beneficial for people presenting on stage.

Spatialized Information
In this area of HCI research, digital data is often tied to places in the real world, which users walk up to, point at, or reach out towards, in order to interact with the data. A rhetoric technique that appears related to this is the 'loci technique' [49]. It is based on the idea of associating ideas with objects and places on an imaginary path, and then mentally walking along this path, in order to recall the ideas. Tillmann applies a related technique, 'Story Embodiment', in professional speaker coaching [42]. HCI research projects in this area involve dynamically projected visual content on walls and furniture [7, 25], interactive floors [1, 26] and digitally enhanced desks [6, 47, 48]. The applications that are proposed for such systems range from individual, location-based task reminders [32] to position-based public opinion expression [45]. Technically, such systems often require precise and non-invasive tracking of a user's position. Besides depth camera-based systems, recent advancements in this area include systems based on pulsating LED room lighting [27] and sound waves [9].

Many of the embodied metaphors within the context of presentations are based on the concept of 'place' – thus, basing a presentation system on spatialized information might be a promising approach.

Bimanuality in HCI
As illustrated in the introductory paragraph, many of the embodied metaphors in the area of argumentation are based on the concept of bimanuality. Luckily, an active area of research in HCI is concerned with this topic. A great portion of it is based on Guiard's findings [18], implying that the actions of the preferred hand are framed by the non-preferred hand. In HCI, this principle is often used to split work between the two hands [13, 46]. Leveraging bimanuality has been argued to be beneficial in several ways and has also led to seminal new interfaces for 3D data exploration [20]. Furthermore, it has been argued to be beneficial for craft-like activities that intertwine digital and analog [43]. Bimanual activity has been argued to be helpful for reducing cognitive load [30] and for supporting creativity [8].

Because of this, bimanuality might be a good principle to be included in the design of a new 'embodiment-oriented' presentation system.

Live Presentation Systems
Several projects investigate live presentations from an HCI research perspective and propose new interaction paradigms for them.

These range from gesture-controlled systems for slide navigation [11, 3] and content manipulation [16] to systems for co-presenting with virtual agents [44]. Other approaches involve canvas-based systems [31, 40, 17]. These allow for organic movement across topics, and also provide a visual context for the current topic through animation. Relatedly, 'HyperSlides' creates slides with hyperlinks between related topics [14]. This appears to be beneficial, as visualizing the relationships between ideas and concepts has been argued to promote group creativity [23].

Other seminal works in the area of presentation systems are based on printed cards that show thumbnail versions of the slides that they represent. Using such a system, a slide can be activated by touching the card with a smart pen [39], holding it under a barcode reader [35], or via RFID-enabled buttons on the card itself [36].

Our project is much inspired by these pioneering works, and we wish to advance further along the path that they have shown.

Research Gap

We appreciate the advances in these areas – mnemonic objects, spatialized information and bimanuality are all topics that have the potential to make interacting with digital contents more human-friendly.

We do see great potential in their application to the context of live presentations. Creating a dynamic presentation by handling mnemonic, RFID-enabled objects in a room of spatialized digital information might be beneficial in terms of cognitive load, spontaneity and creativity. Unfortunately, and despite the rather object-, space-, and hand-centric embodied metaphors in this context, no project investigates this overlap area to date. Following a 'Research Through Design' approach [15], we developed a prototype to pursue the following research question:

How are embodied metaphors suitable as a basis for bimanual and spatial interactions with mnemonic objects in dynamically structured presentations?

PROTOTYPE

Our prototype (Fig. 1) consists of two hand-worn RFID readers (one for each of the user's hands), a body-worn Wi-Fi transmitter, a computer, a projector and a Microsoft Kinect sensor.

Technically, each ring consists of a rewound antenna from a 125 kHz, EM410x-compatible RFID reader. The reader itself is attached to an Intel Edison board, which runs a NodeJS script and wirelessly transmits any recognized tag's ID via the Spacebrew protocol to the computer. In an XML file on the computer, each object's ID is linked to the *topic* that it symbolizes. Each topic consists of an ordered list of *points*. Each point is linked to a text snippet, an image or a video file. The XML file can also store information about the semantic relationships of topic pairs (e. g. similarities, differences, as discussed below). The Kinect sensor is used to track the user's body on stage. Thus, content can be projected full-screen, but also directly adjacent to the user's hand holding an object.

The system allows various interactions (Fig. 2): users can activate a topic by picking up the corresponding object. Topics can be switched by switching objects. Holding an object over one's head activates a 'spotlight' projection on it. Holding one object with both hands reveals additional details about the topic. Holding two objects displays the relationship between the two topics that they represent: holding them close together reveals their similarities, holding them far apart displays their differences (in either text, image, or video).

These subjective distances are measured in relation to the user's body: 'far apart' means at least two shoulder widths apart, 'close together' means less than half a shoulder width away from each other.

When a topic contains different points, these are spread and mapped, from left to right, to places in front of the projection. Users can walk up to a place in order to activate the point (and its associated projection). Thus, users can *approach*, *walk through*, *leave behind*, *skip*, and – if necessary – *revisit* a topic's different points (Fig. 3).
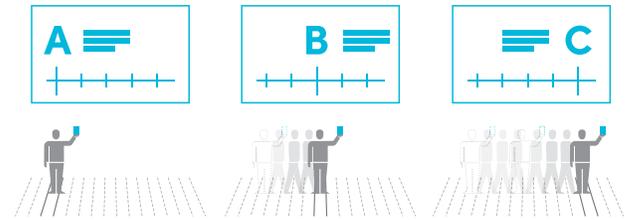

Figure 3. **Different points of a topic are mapped to locations on stage. Users can activate points by walking up to them.**

USER FEEDBACK

We conducted a series of informal user feedback sessions with 10 participants (3f, 7m, ∅27.6 yrs.). All participants took part in one of three sessions, in each of which the proposed system was compared to a traditional presentation software (Apple Keynote). At the beginning of each session, all participants were handed a questionnaire about their age, their gender, and their familiarity with presentations. The participants were not previously familiar with the proposed system. Their participation was voluntary, no reimbursement was made.

After filling out the questionnaire, all participants were given a printed hand-out. The hand-out outlined a short presentation about the parallel histories of food and information (i. e. from a scarce resource to an industrialized commodity), claiming that the mobile phone age was the 'fast-food age' of information consumption. An RFID-tagged plastic tomato and an RFID-tagged mobile phone were used to symbolize the two topics. Each topic had four different points, which were mapped to the space in front of the projection (ca. 2.5 m in width). In some sessions, sticky notes were placed on the floor to mark where each point was. After that, one group member presented in front of the others. Group 1 and 3 began with the proposed system, group 2 began with the traditional system. After the presentation, another member from the group presented the same presentation, using the other system. Each presentation lasted about 5 minutes. After that, users were free to try out the system as they wished, and discussed each system's strengths and weaknesses. They were encouraged to note down their thoughts on a feedback form, on which they also indicated whether they were commenting from a presenter's point of view, or from the audience's. Every user feedback session lasted about 45 minutes and was recorded on video.

Results

The proposed system was appreciated by most users for its 'dynamic' character, its 'interactivity' and its 'assistiveness'. Users pointed out that it could 'potentially be natural' and that the usage of objects, as proposed, was 'intuitive'. They embraced the ability to prepare for the talk by positioning the objects on the table, and to jump back and forth by picking up and holding them in different constellations. They appreciated that the system was non-linear for the presenter, but well-structured for the audience.

Yet, some users noted that the presenter would have to 'practice more' in advance to perform 'naturally'. Furthermore, they pointed out that the presenter would have to 'concentrate more'

and that the 'floating' projection could be a 'distraction from the presenter'. One user raised the question of how many objects would be required for a lengthy presentation of 80+ slides. Furthermore, it was noted that gesture control often leads to unnatural, 'system-controlled' behavior, which some users were afraid of. Lastly, users noted that projecting content adjacent to the hand looked nice, but only from a 'sweet spot' in the audience – sitting at the side distorted the effect.

One participant noted that such a system would make it 'easy to give non-linear presentations, i. e. to jump back and forward'. Users appreciated the 'easy', 'intuitive' and 'dynamic' character of the system, pointing out that they perceived it as 'a practical use for moving on stage', 'giving a sense of continuity as per "western" expectations (i. e. left to right)'. They also appreciated its 'hands-free' style of presenting, while, at the same time, being able to 'hold on' to something. One user found it to be 'more entertaining than a regular presentation', another noted that it 'feels like making progress'. Two users liked that the system 'forces the presenter to be dynamic'.

On the other hand, they also pointed out that the system was 'prone to unintentional jumps', 'lacking feedback' about 'where' exactly in the line of points one was. Many found the system to be 'limiting one's movement on stage', and one user also pointed out that the system is 'limited by stage space' itself. Some users noted that it 'requires the user to practice' in terms of getting used to the step distance between the individual points. Some users found it 'impractical for people who do not like to move on stage during presentations' and criticized the system for being 'inflexible in terms of the order of things from left to right'.

The traditional system, in comparison, was found to be 'unsuitable for the natural flow of speaking', 'static' and 'boring', yet also 'more clear', 'easier to set-up' and 'easy to record, reproduce and share'.

DISCUSSION

In general, users embraced the ability to use their hands to control the presentation using mnemonic objects. However, our study's findings also indicate that the proposed system might not suit every context. The simple rearrangement of objects makes it simple to reorganize one's presentation, which might be helpful for users who frequently present the same content in a different order. The underlying embodied metaphors were understood by the users, many of them highlighted the intuitive and natural character of the system.

It appears that most users intuitively understood how the system works, which may support the approach of basing interaction design on everyday-language metaphors. But at the same time, users found the system limiting and inflexible in some regards. Position-based systems like this one may indeed suffer from a 'Midas touch' problem [24] – movement in humans is ambiguous, and by no means a discrete form of input: some presenters tend to walk on stage as a means of stress relief.

While some light has been shed on the topic through our exploration, even more questions emerged. For example, it

is unclear how such a system compares to others in long presentations, and across different types of content – after all, our example presentation was tailored to the system, as it was much about differences and similarities of two things. Furthermore, it is not clear if the ability to spontaneously improvise during the presentations has a positive effect on the presentation – an issue that might strongly vary between different types of speakers. Lastly, no clear measuring unit for the quality of a presentation exists. Is it quality, is it authenticity? Is it how much it fits the original plan to present it, or is it how much it suits the audience?

CONCLUSION AND OUTLOOK

There are many different embodied metaphors observable in the context of ideas and presentations. Some, for example, conceptualize understanding as *seeing*, ideas as *light-sources* and discourse as a *light-medium* ('I *see*.', 'A *bright* idea!', 'That's *clear*.') [29]. Others conceptualize ideas as *cutting instruments* ('*Sharp* thinking!' '*Bluntly* speaking...'). In this project, we have focused only on *container metaphors* in the context of live presentations. Judging from the amount of new questions that have emerged, it is likely that our project merely scratched the topic's surface.

Presentations are an important part of many people's professional, academic and educational lifes. They are also one of our culture's primary means of spreading and exchanging ideas, and of motivating others to support what we do. Therefore, we hope that our project has shed light on some aspects of how presentation software could be designed, based on embodied metaphors, in order to help people to present more naturally, vividly, and in a way that suits their audience. We encourage further research in this area: it appears to be a worthwhile goal to help good ideas spread among people.

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