# Presenting Business Data: Challenges during Board Meetings in Multi-Display Environments

### Tom Horak

Interactive Media Lab Technische Universität Dresden Dresden, Germany horakt@acm.org

#### **Ulrike Kister**

Interactive Media Lab Technische Universität Dresden Dresden, Germany ukister@acm.org

#### **Raimund Dachselt**

Interactive Media Lab Technische Universität Dresden Dresden, Germany dachselt@acm.org

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author. Copyright is held by the owner/author(s).

ISS <sup>1</sup>16, November 06-09, 2016, Niagara Falls, ON, Canada ACM 978-1-4503-4248-3/16/11.

http://dx.doi.org/10.1145/2992154.2996774

## Abstract

In this work, we discuss important challenges arising when presenting business data in board meetings. After firstly considering the specific characteristic of board meetings, we have identified challenges concerning the following four topics emerging from the multi-display setup of (digital) boardrooms as well as the social situation in those board meetings: Control Presentations (Interaction), Content Presentation (Visualization), Discussion with Audience (Communication), and Remote Presence. Focusing on selected challenges, we propose first ideas how existing HCI research can help to tackle those challenges and thus help to improve efficiency of board meetings.

### Author Keywords

Presentation; Business Data; Multi-Display Environments

## ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

## Introduction

Board meetings are a very important component in managing large companies, regularly evaluating, e.g., the current progress, target compliance, or competitiveness of specific projects, departments, or the company as a whole. Additionally to supervising tasks, the board of directors







**Figure 1:** Different display setups in a boardroom ranging from a TV-sized display to a display wall.

also has to decide on managerial issues [11]. During the meetings, the *C-suite* (e.g., CEO, CFO) or representatives of individual departments report on current business data. Usually, this involves a presentation of numbers, measures taken, and existing challenges or possibilities.

Owing to the importance of the board meetings for companies, there is a special need to properly present data and being able to efficiently identify the best decisions. Although there is already research in HCI on, e.g., multi-display environments in general [1], handling visualization in ordinary meetings [10], or supporting the presenter [2], board meetings have unique characteristics and incorporate further HCI challenges that need to be considered. By identifying and analyzing these challenges, we plan to support the development of efficient systems that incorporate principles of natural interaction and user-centered interfaces. In the following, we will describe the challenges and categorize them into four major topics.

# **HCI** Challenges in Board Meetings

Before focusing on the specific challenges, we want to stress the unique circumstances and resulting social situation that characterize the board meeting scenario. Firstly, board meetings are regular, but non-frequent meetings that need to condense major activities and future plans of a company into a very strict agenda. Additionally, the presenter has to face the pressure to report in the best possible way as the consequences can be far-reaching: jobs, budget, powers and also his own position can rely on the presentation. This also means that the audience is very invested as well as critical and has itself experiences in managerial tasks [11].

Depending on the company, the board can differ in size mostly ranging between eight and 30 directors. Since

large companies have branches around the world, the board members may speak different languages and may take part by video-conference or telepresence. The boardrooms used often incorporate a long table that directors sit around (Figure 1 and Figure 2) and a display to present information or to show remote participants. These displays can be a projection, one or multiple TV-sized displays, or even a complete display wall. Furthermore, the table may be equipped with additional smaller displays for each member (Figure 3), thus forming a complex multi-display environment.



**Figure 2:** Image of a boardroom with a large display on one side (right),  $\bigcirc$  *reynermedia*<sup>1</sup>.

## Control Presentations (Interaction)

As a key feature for a successful report, the presenter has to be able to control the distribution of the content as well as to control the presentation in general—especially when using large, wall-sized displays or multiple displays. The presenter has to balance between making use of the

<sup>&</sup>lt;sup>1</sup>(CC BY 2.0) Empty Boardroom. https://flic.kr/p/hT9nnA







**Figure 3:** Additional displays for audience: large displays on the sides, built-in monitors or personal tablets.

available display space and reducing unnecessary walking to different display areas.

As a result, already the preparation of the presentation brings additional challenges as the space on the different displays has to be taken into account for content arrangement. This can be even more difficult when the presenter has no previous access or incomplete knowledge of the display setup. Hence, the presenter needs a well-equipped tool to define where each content item should be shown, possibly making content distribution flexible for the presentation. Furthermore, content is often provided by other colleagues and subordinates, extracting the data and preparing a story for the presentation (c.f. [8]) in groups to guarantee the best possible outcome where the presenter might not always be involved.

Depending on the software used (e.g., Powerpoint, Prezi), presentations can be linear or non-linear resulting in different ways of navigating through the presentation. There also exists proprietary software of companies for easily accessing business data (e.g., SAP Digital Boardroom) that can support both linear and non-linear presentation paths. Especially in non-linear presentations it can be challenging for the presenters to remember the current position as well as the next topics of their presentation. Thus, similar to presentations in other scenarios, the presenters may require a preview of the next content, their own presentation notes, the current time, or schedule of their talk.

Further, the presenter may use additional portable hardware (e.g., wireless presenter), fixed hardware (e.g., PC/laptop), or the capabilities of the display (e.g., touch) to control the presentation steps like loading subsequent content, highlighting specific aspects, or transferring parts to other displays. It's a challenge to support managing

these tasks during presentation with minimal effort. For instance, whereas touch enables a more explicit interaction (i.e., enhanced comprehensibility for presenter and audience), it may require more movements, can cause occlusions, or can even not supported by the display. Also, additional laptops cannot be used in some cases due to a complex technical setup. This can also involve technicians sitting in a side room and starting the presentation software, thus limiting controllability for the presenter.

## Content Presentation (Visualization)

A further challenge in boardroom presentations lies in the readability of data and content. Due to the number of people involved, the distance between presented data and audience member may be very large, so that individual data points cannot be properly identified on the larger display. Additional displays, either larger ones to the sides or individual displays for each participant (Figure 3), can help presenting the actual content. However, this further increases the number of attention switches required: focus switches between the presenter (i.e., facial expressions and words, gestures and pointing), content on the large display referenced by the presenter or otherwise visible (e.g., overview), the personal display (i.e., details), or the telepresence of remote collaborators (Figure 4).

While text is an essential part of presentations, it has been shown that visualizations improve attention, agreement, and recall of business strategies [5]. However, a challenging aspect to consider is the type and complexity of visualization used for presentation to allow accurate insights. Visualizations in board meetings have to be designed for domain experts, not data analysis experts. Explanations of visual mappings should not be required to understand the message of the visualization. An essential factor for this is using business communication



**Figure 4:** Participants need to switch focus, e.g., between the presenter, the content on the large display, remote participants, or their personal device/display.

standards (e.g., IBCS<sup>2</sup>), however, challenges regarding large display space and distances are not in their focus.

Furthermore, data of different aspects of a company are often interconnected and decisions have to be evaluated based on these connections, so that large display spaces are required to show individual aspects of these complex processes. The challenge here is to find appropriate smart visualization techniques and use coordinated views to present the data while also supporting interactions with these visualizations in the context of presentation, e.g., showing details or different time layers. Furthermore, dynamic and flexible visualizing that describe past events or even present predictions to indicate the consequences of certain decisions are an additional challenge.

Discussion with Audience (Communication) While listening to the presentation, the board members might interrupt to ask questions and discuss aspects of the presented data. It is a challenge to design flexible ways to allow each audience member to annotate content in this large presentation space in preparation of a question and to manage and organize their personal annotations. Furthermore, members require the ability to point to a specific data item visible to each board member when referring to specific data during discussion. Similarly, the presenter might want to highlight certain data points on the individual displays of each audience member when making a point.

As participants also ask for more detailed data [11], the presenter might need to adapt his presentation triggering either previously prepared back-up slides or manipulate visualizations to load additional information, e.g., a previous year or another sales area with which to compare

data. Providing this additional information live is essential as the board members are almost always required to make decisions in this very meeting and thus to avoid a deferral.

## Remote Presence

In many cases not all board members are able to attend in person but via video-conference or telepresence. In addition to general challenges of such systems [6], there are several boardroom-specific aspects: The placement of the remote participants' avatar or video may differ between the presentation and discussion part: For the latter one, it is beneficial to use a telepresence system providing an immersive experience, i.e., enhancing the impression the participant is sitting at the table [12]. However, this restricts the visibility of the previously presented content. During the presentation the content is central, thus the avatar can be placed less prominently or even hidden. In both cases, attention switches for the other board members are required. Of course, complexity increases as more remote participants collaborate.

Vice versa, it can also be challenging to determine what content is displayed to remote participants and how it can be controlled. Similar to co-located participants, remote participants can switch attention between presented content, the presenter, or other participants. Depending on their used setup (e.g., desktop, other boardroom), it may not be possible to display all things at the same time resulting in manual switches between views. These switches could be triggered by remote participants or the presenter (similar to personal devices of all participants).

## Tackling the Challenges

The presented challenges incorporate many aspects that can be addressed with knowledge from existing research in business communication, human-computer interaction as

<sup>&</sup>lt;sup>2</sup>http://www.ibcs-a.org



**Figure 5:** Showing hints and notes for the presenter on a smartphone.



**Figure 6:** Providing enhanced in-place hints and notes through AR glasses.

well as information visualization. Especially focusing on HCI, we want to indicate a few selected possibilities to tackle the challenges based on work about multi-display environments and cross-device interaction.

Additional notes, hints, and previews for the presenter Using research of interaction on large displays and multi-device environment as a basis (e.g., [1, 7]), we propose using an additional smartphone (or smartwatch) to guide the presenter in his presentation. As smartphones and even watches are wide-spread and the presenter will very likely own such a device, these can be used to allow showing hints and notes as well as triggering special functions like highlighting, moving content or loading next slides (Figure 5; c.f. [2]). To allow better use of both hands and freedom of gesturing during the presentation the device can also be attached to the presenter's wrist or arm [13]. Taking this further, augmented reality (AR) glasses can provide hints, the order of points to discuss, and next slide information in-place on the actual content (only visible to the presenter; Figure 6).

Recognition of content in focus and transfer to audience Especially in larger boards with enhanced distance between participants and the presenter, the challenge of controlling which part of the presentation is transferred to audience members' displays (both co-located or remote) is another interesting point to address. We suggest using additional sensors, e.g., a mobile's location in the presenter's pocket, Kinect data, or simply the current touch on the touch-enabled large display, to detect the presenter's current focus of the presentation. Based on this focus, the system could automatically decide what content needs to be transferred, e.g., the current data graph, multiple graphs, or the whole page (Figure 7). In this way, the need to prepare in advance which part of the content is transferred is reduced. This allows flexible presentation paths adapted to previous discussions.

#### Reducing awareness switches

As previously discussed, attention switches are an issue for audience members (Figure 4). By transferring the content in focus to the mobile device in front of the audience, we enhance the readability of the currently focused data but increase the need of attention switches at the same time (i.e., between presenter and content). To reduce attention switches again, we support the notion of integrating multiple views into one by merging the presenter and his motions into the presentation (Figure 7; similar to [9]). This may be of even greater importance for remote participants where integrating the presenter or even a present member in discussion into the content can help focus the conversation and reduce necessary management of views. However, focusing on the personal device instead of the presenter for a longer time could be felt as impolite for co-located participants.

#### Integrating the audience's mobile devices

To provide audience better insights, we suggest connecting the audience devices to the system and thereby allowing access to presentation content and data (Figure 8). As a result the audience can freely annotate (draw and write) and explore content on their devices (interaction similar to, e.g., [3]). Further, we propose allowing the audience to push annotations to the large display for question clarification and discussion (using known cross-device concepts, e.g., [4]). This might require management of user roles (e.g., presenter and audience) as well as system states (e.g., presentation or discussion) to restrict the audience's access, making sure the presenter stays in control and has the ability to focus the audience on the current presentation.



**Figure 7:** Transferring parts of the presentation onto the participants mobile device and embedding the presenter and his motions.



**Figure 8:** Providing access to presentation content on the participants mobile device with annotation support.

## Conclusion

We identified four topics of challenges arising in the specific scenario of presenting business data in board meetings. By considering these challenges, the development of presentation systems as well as the design of boardroom setups could be guided and thus enhance the experience for both presenter and audience as well as efficiency of board meetings in general. Incorporating existing research, we outlined different concepts how the scenario can be further supported in future with both additional hardware and unchanged setup. Of course, these are only a few selected possibilities how HCI research can help address the challenges, however, we are confident that these serve as a foundation for future discussion and research.

# References

- Boring, S., Baur, D., Butz, A., Gustafson, S., and Baudisch, P. Touch projector: mobile interaction through video. In *Proc. CHI '10*, ACM (2010), 2287–2296.
- [2] Bragdon, A., DeLine, R., Hinckley, K., and Morris, M. R. Code space: Touch + air gesture hybrid interactions for supporting developer meetings. In *Proc. ITS '11*, ACM (2011), 212–221.
- [3] Drucker, S. M., Fisher, D., Sadana, R., Herron, J., and others. TouchViz: a case study comparing two interfaces for data analytics on tablets. In *Proc. CHI* 2013, ACM (2013), 2301–2310.
- [4] Hamilton, P., and Wigdor, D. J. Conductor: enabling and understanding cross-device interaction. In *Proc. CHI 2014*, ACM (2014), 2773–2782.
- [5] Kernbach, S., Eppler, M. J., and Bresciani, S. The use of visualization in the communication of business

strategies an experimental evaluation. *International Journal of Business Communication 52*, 2 (2015), 164–187.

- [6] Larsen, S. Videoconferencing in business meetings: An affordance perspective. *International Journal of e-Collaboration* 11, 4 (10 2015), 64–79.
- [7] Ledo, D., Greenberg, S., Marquardt, N., and Boring, S. Proxemic-aware controls: Designing remote controls for ubiquitous computing ecologies. In *Proc. CHI* '15, ACM (2015), 187–198.
- [8] Lee, B., Riche, N. H., Isenberg, P., and Carpendale, S. More than telling a story: Transforming data into visually shared stories. *IEEE Computer Graphics and Applications 35*, 5 (Sept 2015), 84–90.
- [9] Matulic, F., Engeln, L., Träger, C., and Dachselt, R. Embodied interactions for novel immersive presentational experiences. In *Proc. CHI EA '16*, ACM (2016), 1713–1720.
- [10] Radloff, A., Tominski, C., Nocke, T., and Schumann, H. Supporting presentation and discussion of visualization results in smart meeting rooms. *The Visual Computer 31*, 9 (2015), 1271–1286.
- [11] Schwartz-Ziv, M., and Weisbach, M. S. What do boards really do? evidence from minutes of board meetings. *Journal of Financial Economics 108*, 2 (5 2013), 349–366.
- [12] Standaert, W., Muylle, S., and Basu, A. An empirical study of the effectiveness of telepresence as a business meeting mode. *Information Technology* and Management (4 2015), 1–17.
- [13] von Zadow, U., Büschel, W., Langner, R., and Dachselt, R. Sleed: Using a sleeve display to interact with touch-sensitive display walls. In *Proc. ITS '14*, ACM (2014), 129–138.