Co-Constructing Globally Collaborative Spaces: A Conceptual study of War Room Meetings as Spaces with placed-based activities

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Abstract. This paper presents insights from an ethnographic study investigating how globally distributed Danish and Indian engineers co-construct and reconfigure a shared socio-technical collaborative space for global interaction. The globally collaborative space was not persistent a priori but co-constructed and reconfigured through place-based activities forming the connections between people, artifacts, and activities. Global places are temporal in nature, thus only traces of the places can persist outside the place-based activities. We show how the engineers chose to transfer their globally distributed plan into a locally tangible and persistent artifact that was useful for handling the articulation work of engineering. This move produced new challenges related to the geographical distribution of the engineers because the locally tangible plan was not globally available.

Keywords: War room, group-to-group, engineers, space, place, globally collaborative spaces, global engineering.

1 Introduction

Collaboration across time and space is increasing entering the center of attention for Information Systems (IS) research. Over the last decade, important concepts such as common ground [1], shared context [2], and trust [3] have all been linked to collaborative practices between geographically dispersed participants. Although all of these concepts are essential to understanding the basic nature of globally collaborative practices, few studies reflect on how we can conceptualize a global space for collaboration and how this conceptualization is linked to the practical enactments of people collaborating.

This paper explores the creation and re-configuration of globally collaborative room-sized spaces as they appear in real-life collaborative practices between Indian and Danish engineers. The aim of this paper is to add to the existing research on the design of room-sized technologies [4] by exploring how we can conceptualize the notion of space and place in a global collaborative setting. We look at how large-scale group-to-group collaborative global spaces are re-configured to support global interaction, and how these global spaces emerge in the enactment of technologies and

human interaction. The engineers in our case enacted the global space through placed-based activities employing and reconfiguring a mixture of digital and physical artifacts. The artifacts was in particular related to the articulation of team processes making team methodologies and processes visible available [5] for others to monitor and thus act accordantly. Increased visibility is only a small step towards distributed collaboration; a much larger leap is how to adopt and reconfigure new methodologies for articulation of group processes [5]. Our empirical case is a unique opportunity to study empirically how the engineers engage in co-constructing and re-configuring a globally collaborative space. Insights from this study explain how the engineers configured and reconfigured both the technical and the social aspects of their collaboration while they enacted the collaborative space connecting the two geographical localities.

We have been studying how the engineers design and reconfigure their global meeting rooms and in this paper we investigate how we can conceptualize space and place in this type of setting. We focus on both the socio-technical structures and on the enactment of the available artifacts. Drawing from the debate about on spaces and places [e.g. 6], the argument in this paper is that the globally collaborative spaces are co-constructed and reconfigured through the connections between people, artifacts, and activities. Consequently, globally collaborative *spaces* are socio-technical co-constructions that become transformed through *place-based activities* during the collaborative practices between dispersed participants. However, place-based activities are temporal in nature; thus, only traces of the space can persist outside of the meeting activities.

The paper is structured as follows. First we revisit prior research on spaces and places. Then we introduce our method and the empirical case. The analysis has two sections, each providing an account for a different setup for the global collaborative space. Then we discuss the main findings, and finally offer our conclusions.

2 Spaces and Places

Investigating collaborative spaces as entities with certain affordances for collaborative practice is an essential part of Computer Supported Cooperative Work (CSCW) research, and design of collaborative technologies has often been articulated as design of common information spaces [7, 8], as collaborative virtual environments [9], as media space [10], or as wall-scale workplaces [4]. Common information spaces (CIS) or collaborative virtual environments (CVE) are two different approaches to making it possible for the distributed actors to perceive, access, and manipulate shared information either by providing shared databases or by making the participants represented within the virtual environment. Media space is somewhat different because it is more about creating a video/audio link for informal interaction [10]. One important feature of CIS and CVE is that the “virtual” aspect of these types of desktop technologies distorts the sense of the physical space – there is no clear notion of space in the virtual [11]. Media space technology creates some kind of spatiality because the “other” becomes visibly available [10], but it is not a “shared space”; it is, rather, a peek into other peoples’ spaces. The wall-scale workplaces approach takes the

"space" technologies to a new level by not focusing only on bringing the real to the virtual, or vice versa. Instead, this approach takes seriously both the physical and digital artifacts and interactions, and it designs a mixed-mode space where physical objects, such as post-it notes, are transformed into digital components that can be shared across geographical distance [4]. Common to all of these technology approaches is that they are open-ended by nature, meaning that they do not stipulate how the participants should apply them in their work. Therefore, users of such systems are required to engage in shared activities in order to arrive at a shared understanding and interpretation of the meaning within these technologies.

Our empirical case can be characterized as global group-to-group collaboration where multiple actors share a common field of work and are interdependent in their individual activities when they interact through various connections, primarily within and across geographical sites. A characteristic of such collaboration is that while the entire group at each site may participate in information exchange, a range of sub-groups (both across and within sites) also interacts in parallel [5]. In such collaboration, a new type of interaction problem occurs and articulation becomes a central activity. The concept of "space between" has been suggested as a way to identify the gaps in common understanding leading to miscommunication within group-to-group collaboration [5]. Space between can be used to identify when the perspectives of participants are aligned while figuring out the extent to which coordination and articulation can bridge the gaps. It is important to point out that even though the empirical case is group-to-group collaboration, our perspective and focus on space is quite different from the space between. Whereas Mark et al. [5] investigate the space between as the connections, interdependencies, and gaps leading to common meaning misconstruction that exist within group-to-group collaboration, we investigate the co-construction of globally collaborative spaces and the re-configuring of geographical localities as they transform over time within group-to-group collaboration.

There is an important distinction between space and place. While the shared *space* is the "scheme" for the collaborative engagement – the database or the virtual environment – it is not until people begin to use the shared space, when they enact the shared space, that the interpretation work is initiated. The meaning-making process of the shared objects and artifacts is initiated in *doing* the action, and this is where the space becomes the *place*.

Space and place are two-sides of the same coin, and the concepts of place and space have been intensely debated [12]. Describing the distinction between space and place is often done by quoting Harrison and Dourish's catchy phrase: "space is the opportunity; place is the (understood) reality" [6, p. 67]. The main point is that there is a distinct difference between the design of a space (simple physical or virtual location as in the CIS or the CVE) and the design of a place (conceptualized as a location designed for human functionality) [13]. A space comprises the available artifacts, which form certain opportunities for action. Place is highly related to the human activity, which goes on in the space. Places are characterized and explicated by the construction of meaning of place through three kinds of relationships: loci, people, and events [13]. Place can be understood as a semantic tangle connecting these three [13]. Loci is "the space-places that exist (or do not) prior to the commencement of the place creation" [13, p. 108], and the meaning of place is

dependent upon the people involved, the activities they do, the artifacts they encounter, and the loci. The main point here is that we cannot think about place without the activities going on in that place. A space emerges as a place through the activities people are involved in while enacting the space. If we change the people, this will transform the place – or, if we make the same people do different activities, this will transform the place. People's enactment of the socio-technical opportunities forms the place.

Related to the work in this article, this insight tells us that if we want to investigate how a globally collaborative place is constructed, we need to focus on how that space is used by particular participants when engaging in particular joint activities because this is the time were space becomes place. Put simply, we need to investigate how global spaces emerge through people's place-based activities. Also we must investigate how different people, different activities, and different artifacts transform the opportunity for collaboration at particular times.

But what about space then; how can we investigate globally collaborative spaces? Space is not just the opportunities, it is a socially constructed phenomenon [12]. The idea of spaces as socially constructed is interesting for the study of geographically distributed participants because space does not necessarily have to be linked to a particular physical location. In a study of the distributed work practices within in a wastewater plant, the authors argue that a continuum of places together constructs the space for collaboration [14]. Our focus is to understand the work practices of globally collaborative activities performed by engineers when designing spaces to create the opportunity for place-based global activities.

By studying how the globally collaborative space were constructed as connections between the geographical localities, we investigated both 1) how the collaborative space became socially constructed while 2) focusing on how the construction of space was further enacted when the geographically distributed participants became engaged in the activity of War Room meetings, thus enacting place-based activities.

3 Method

The method applied in this study was a empirical field study [15, 16]. The approach we took was to conduct observations and interviews from both the Danish and the Indian location. Moreover, we tried to become engaged with Danish engineers in their reflection about the design and re-configuration of the space by prompting on-going reflections of what was seen during informal lunches, etc. This approach allowed us to gain an understanding of the reflective nature of the practitioners when they were handling their collaborative planning practices while co-constructing the globally collaborative space for interaction.

We interviewed participants, War Room facilitators, engineers, and managers (in total, 19 people) in both Denmark and India. We observed the work practices involved in developing the War Room methodology and building the locations in both India and Denmark. Finally, we observed elleven War Room occasion each containing 4-5 meetings, two occasions from the Indian location and nine occasions from the Danish location.

Table 1. Data Sources.

Data sources	Numbers/hours	Month/year
Interviews	10/6 DK-4 IN	February 2010-June 2010
Group interviews	3/2 DK-1IN	February 2010-June 2010
Interviewees in total	19/11DK-7IN	
Observations of activities in DK (excluding War Room meetings)	4 hours	May 2010-June 2010
General observations in IN (excluding War Room meetings)	3 days in Feb/5 days in Nov	February, November 2010
Observation of War Room sessions IN	2 occasion of 4-5 meetings	February, November 2010
Observation of War Room session DK	9	June, Aug, Sep, Oct 2010

4 Empirical case

GlobalEngineering is a leading supplier of equipment and services to the global cement and minerals industries, and their main expertise is designing and building factories. GlobalEngineering employs more than 10,500 people world-wide and has a local presence in more than 40 countries. GlobalEngineering has three main locations in Denmark, India, and the United States. The engineers collaborate across geography, time, and culture when designing and building cement or minerals factories.

A project within GlobalEngineering is initiated when a client places an order for a cement factory to be designed, built, and erected in, for example, Africa or Asia. The clients are large global actors with several cement or minerals factories all over the world. GlobalEngineering then engineers the design while arranging for the factory to be erected in the location picked by the client within a particular time frame: normally 24 months.

4.1 War Room meetings

In the last two to three years, GlobalEngineering and other western engineering companies have been pushed from the market for building cement factories inside and outside of China because Chinese companies were able to design, build, and erect standardized factories cheaper and faster. GlobalEngineering is still the leading actor in the technology for cement factories as well as in designing, building, and erecting specialized factories, but they had to optimize their processes if they wanted to keep their lead.

In early spring 2009, GlobalEngineering began to develop new concepts for how they could manage the planning practices between their specialized engineers and, in particular, between their geographically distributed sites. One of the main ideas was

to implement so-called War Room meetings to support the collaborative planning practices between the approximately 300 engineers situated all over the world.

The main premise was to provide the individual engineer with an overview of the whole plan connected to the specialized individual tasks. In engineering a factory there are approximately 3500 individual tasks, all with dependencies and all requiring highly specialized engineering knowledge. Not knowing how the individual tasks influence the overall project, the engineers tend to put small tasks off for later, causing others to be delayed and creating "air pockets" within the plan. The War Room meetings were created to reduce these air pockets and to speed up the process. At the end of 2009, GlobalEngineering initiated three smaller projects (sub-processes of a whole factory) wherein the collaborative planning practices were handled as War Rooms; this change allowed them to do in only 16 weeks the same general engineering processes that would normally take 52 weeks. The War Room concept was a success, and in May 2010, GlobalEngineering decided to expand the concepts within the organization as well as started to think about how to design technologies to support the War Room meetings.

Fig 1: War Room meeting

5 War Room Meetings: Spaces and placed-based activities

GlobalEngineering have conducted War Room meetings in two distinct different types of physical setups. In the first socio-technical setup, they use their ordinary high-definition videoconferencing localities on both the Danish and the Indian site, and in the second setup, they reconfigured the Danish geographical locality to suit the War Room meeting in better ways, while leaving the setup in India the same. We will now investigate the two types of setup and reflect upon how the global spaces are constructed and enacted. We show how the construction of the spaces and places form the affordances for the socio-technical construction of the global collaboration and, in particular, how the spaces were co-constructed by place-based activities.

5.1 High-definition Video conferencing

The first socio-technical setup comprised two ordinary video conferencing rooms, one in Denmark and one in India. Here it is important to notice that GlobalEngineering have several ordinary videoconferencing facilities at their sites both in Denmark and in India. All employees can book these rooms, but for the War Room meetings the participants require the large physical posters, which cannot move easily. Thus, all War Room meetings were conducted in the same facilities at both sites. The rooms at both sites formed a normal size meeting room for approximately 12 people, with a large table surrounded by chairs in the middle of the room. On the walls of the geographical localities hung large brown papers (the War Room posters) for the different parts of the factory design.

5.1.1 Enacting artifacts in global activities

During the War Room meetings in this type of socio-technical setup, the participants stand along the walls in the room, because the large meeting table surrounded by chairs occupies the middle of the room. On the back wall the image of the other geographical location is projected.

Fig. 2. The artifact is not visible from a distance.

From the Indian geographical site, participants can see that the Danish facilitator is consulting the poster hanging on the wall located in Denmark. From the perspective of the Indian screen (see Fig. 2), the poster is placed on the wall to the right of the camera, and it is impossible to actually see what is on the poster. While the facilitator is working with the poster – moving yellow stickers around, crossing out tasks done while comparing it with the print-out plan located on the brown paper – he is speaking aloud, making it possible for the engineers in India to follow his individual work. From the Danish site the focus is on the local poster, however when looking at the screen projecting the remote location the Indian participants emerge into the collaborative space. The main role of the remote participants (not at the site where the poster is located) is in some situations to become aware of the overall status of the project, and therefore their role is to observe, while responsive when asked direct

questions. The facilitator speaks out aloud while going through the yellow stickers, plans, and dependencies. In this way, the facilitator makes the information audibly available for the Indian engineers to overhear, even though it is not visually available. The role of Indian engineers is then to relate this audio information to their individual activities and speak up in the case of a changed state of the common work.

The artifacts such as the brown paper and yellow stickers become part of the placed-based globally collaborative activities when these artifacts are included in the activities conducted during the War Room. While these artifacts are part of the local collaborative space in Denmark, they only become part of the globally collaborative space when enacted by the participants through place-based activities mediated by audio.

5.1.2 Including people in the global activities

During meetings in the high-definition video conferencing rooms including people into the global space is an essential activity. The Danish room is shorter and squared, and the camera is facing the meeting table in the middle. The Danish participants are standing behind the chairs of the table, thus they are out-of-sight for the camera. The Danish participants step in front of the blue wall into the camera sight when they asking or answering questions. The facilitator moves out of his way. This maneuver changes the global place of the meeting. Firstly, a new participant entered the space, becoming part of the global place, while another one left the global place, but is still present in the local Danish space. However, the facilitator did not totally leave the global place since he kept providing audio remarks such as “yes” and “ok,” making it audibly available to the Indian engineers that he was still “present.” The facilitator is still part of the global place through sound.

As for the construction of place-based activities in this type of meeting, it is clear that the “sum” of people present in the local space is not fully included in the global place – they are in the space, but only visibly available in at the Danish site. Moreover, the Danish participants are silent, thus their presence in the global place cannot even be mediated by audio. In large meetings with more than 20 participants, most participants are expected to be silent and participate by listing in and only speaking if they have an issue. In contrast, the Indian participants are all included in the global place, even though they are silent as well, because they are visually available. The video in the War Room meetings has an important role of bridging the local spaces and creating the global place. If we take seriously that place is constructed by the tangle of people, activities, and loci [13], then the global place is transformed by both the projection of peoples’ images as well as by the audio sounds they may produce. Thus, while the global space – the sum of the two local spaces – includes all people present (Danish and Indian), the collaborative global place only includes all people with “presences” through audio or video. This is not to say that video and audio are the only ways to mediate presence; clearly many technologies have been developed for exactly this purpose [17]. Instead, this insight tells us something about what is required for two geographically distributed spaces to be connected into one globally collaborative place – namely that we need to mediate the presence of all people available in the local spaces so that they become part of the global place.

5.3 Transforming Global Places and Spaces

GlobalEngineering wanted to reconfigure the localities of the War Room meetings while experimenting with the use of artefacts and digital technologies. They set up a new geographical locality at the Danish site, L10, where they had the opportunity to reconfigure and use a bottom-up approach when designing the space for the War Room meetings. They did not change the Indian locality.

The major reconfigurations to L10 were that there was no large meeting table, only three chairs placed by the wall. Due to the new locality, they also did no longer have the high-definition video conferencing equipment available. The room was much larger and six War Room posters hang on three of the walls. In the middle of the room, a desk table was located with a laptop, speakers, mobile video camera, and a projector. The connection to India was a combination of Skype and teleconferencing. The setup in L10 was experimental and re-configurable.

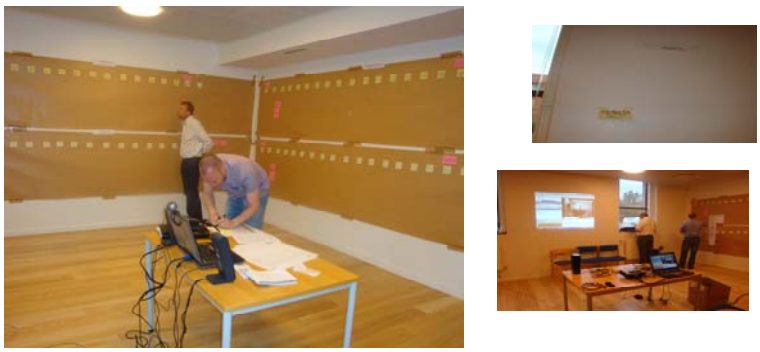

Fig. 3. The co-construction of the space L10 and the mirror wall.

We will refer to the design and re-configuration of the L10 location as a socio-technical construction of the global space for collaboration where the engineers configure and reconfigure artefacts within the local spaces co-constructing the global space. What we saw in L10 was that due to the larger room and lack of meeting table, the participants tended to spread around and was hardly ever captured by the web-camera, even though the web-camera was mobile. Participants would take the camera and point it to the poster, and in this way, the poster became more central, but in many cases, participants would forget about how they were captured and transmitted to the remote site. In these situations, the flexibility of the L10 actually made the place-based activities difficult especially at the remote site. The projection of the remote site in L10 was also transformed, since the Skype connection in many cases was captured by a laptop on the table in India and thus showed less of the room and from the perspective of the table, where the high-definition video-equipment was located so it captured more of the room.

The global space is not simply a social construction [12], but a socio-technical construction including the digital connection, the phone-line and network, the walls, and the projection of images. These are all socio-technical relations, and together they form the global space for collaboration. However, it is not until the connection

between L10 and the Indian site is up and running, that the people from both Denmark and India are present, and that the War Room meetings are in progress through various collaborative activities that the combination of L10 and the Indian location emerge as one globally collaborative place. This place is a transformation of the global space; however, it is temporal. As soon as the connection between India and Denmark is closed, the global place ceases to exist, and only traces in the form of the mirrored wall and the digital table of yellow stickers attempt to make the connection persistent. This was clear in the incident were the Danish participant tripped over the electrical wire, resulting in a total breakdown of all of the technical equipment. Here the meeting was interrupted – the global place was gone in a second, leaving only two separate local spaces, and only after the technical connection was re-established did the globally collaborative place emerge again.

6 Discussion

By bringing the collaborative plan for organizing the work of the 300 engineers "outside" the computer and visualizing this on the large War Room posters, the engineers, on the one hand, created more complexities for the global collaboration, and, on the other hand, also brought the "spatial aspects" back to the plan. The computerized plan changes the sense of spatial orientation of the plan by distorting a sense of physical space [11]. So, although it might seem strange to go backwards – from the digital globally shared plans to large paper posters with yellow stickers only accessible from particular geographical locations (especially since the participants are globally distributed) – this move actually brings back many of the inherent characteristics of the collaborative practices, such as space, time, bodily presence, and mutual awareness. Transferring the plan "outside" the computer transforms it into a tangible and persistent artefact useful for handling the articulation work involved in engineering. This move, however, produces new challenges related to the geographical distribution of the engineers because the plan "outside" is not globally available, thus the co-construction of the globally collaborative space as an opportunity for place-based activities becomes essential.

Looking at our empirical case, it was clear that the main argument for designing a special location for the War Room activities was specifically to bring out what was already shared within the computerized collaborative planning tool to the real world and to visualize this in the form of the large brown papers with yellow stickers. Earlier studies on the design of CVE technologies tend to apply the spatial metaphor as a process where the bodies of the participants become represented within the virtual environment in the form of avatars, thus the bodily experience is transformed from the "real" world to the "virtual" world [9]. We saw, in our empirical case, exactly the opposite: namely that what was in the "virtual" world was transformed into to the "real" world – the electronic plan was transformed into the War Room poster. To support the collaborative planning practices, the aim was to create an embodied experience between the participants of the tasks and their dependencies in relation to the larger coherent project.

So, the next question is how did the engineers then create the global space for the embodied experiences of the collaborative planning practices? If space is the opportunity and place is the understood reality [6], then let's start by looking at the construction of the space. Understanding space in the context of global interaction, it is clear that physical boundaries – as the demarcations of where the space begins and ends – are inappropriate concepts. Fitzpatrick et al. [11] suggest "centers" as a more appropriate concept, and thinking about the engineers, it is clear that you might be able to conceptualize parts of the collaborative practices as various centers of attention. So, one set of centers could be the different disciplinary departments (electric, pyro, mills, etc.), each with their team of geographically distributed members. In this perspective, the centers are distinctly different but with overlapping interest and dependencies, and we might conceptualize the War Room meetings as the activities where the center of attention changes from the individual disciplinary centers to interdependencies between the centers. Using the center as a concept, we see that the design of the L10 location is actually a process where the engineers are co-constructing a space for interaction between the various centers of attention and that this design is a co-construction of both the technical artefacts and the social methodologies and processes. Based on our observation, the argument is that the conceptualization of changing centers of attention could be the first "step" in the large leap of developing and applying methods for group-to-group interaction [5] and designing technologies supporting global interaction.

The design of the space has to take into account the global aspect of the interaction, and since the plan is outside the shared technology, the engineers have to find other ways of creating the space. Each of the disciplinary departments has a poster of their own, and we saw in the empirical case that the socio-technical construction of the global space included mirroring the absent posters on the white walls within L10. The engineers needed to create the global space as a mixture of the local and global spaces. However, it was only during the global collaborative practices that the globally collaborative space was established – when the digital connection between India and Denmark was initiated – and that the two geographical localities in mind merged into one globally collaborative space. It was only through the digital connections such as cameras, screens, and audio that the global space emerged.

The global space emerges through the enactment of *place-based activities*. When people begin to initiate activities within the geographical localities space, the global space arises. It is only in the enactment of the space that the shared meaning emerges through the interaction between people, activities, and artefacts – or with Harrison and Tatar's concepts, the place is created in the relations between people, event, and loci [13]. We see here that the space is co-constructed as two interdependent socio-technical entities in the cases where the work is organized as a collaborative effort between geographically dispersed participants. Space and place cannot be seen as two distinct features because they perform only in a co-constructed relationship [12]. Space and place are co-constructed in the actual collaborative practices during the processes where the participants interact and enact the artefacts they bring to the engagement, such as documents, posters, or yellow stickers. It was clear in the three examples of the socio-technical setup of the War Room meetings that re-organizing the space transformed the opportunities for understanding the socio-technical structures co-constructing the place. The spatiality emerged through the enactment of

the socio-technical setup of the War Room location (the L10 room) in the actual collaborative actions where the War Room became a place. In the empirical case, it was only during the actual War Room meetings that the space and place were transformed into a meaningful relation through the connections between the people, artefacts, and activities. Only when the participants turned on the video and audio links did the global space for collaborative opportunities arise. The global space did not exist prior to the digital connection, and with the digital connection no global place-based activities can emerges. The Danish and Indian engineers became connected, and the artefacts on both sites entered into one coherent globally collaborative place.

The construction and reconfiguring of the actual global space for the War Room meetings transformed based on the engineers' prior experiences and was, in this way, a social activity involving the construction of the "walls" or "boundaries" of the location (both physically and virtually). But it was only in the actual use of the global space that the geographical localities continuously transformed into one globally collaborative space where meaningful place-based events could occur. The centers of attention were connected.

7 Conclusion

This paper shows how geographically dispersed engineers try to create and co-construct technological opportunities (in a broad sense) to re-encounter and re-imagine the shared collaborative work space, which provides us with the unique opportunity to investigate the production of new spatiality and place-making activities. In this paper, it is argued that globally collaborative spaces are socio-technical co-constructions that become transformed into globally collaborative space during the collaborative practices between dispersed participants. However, global spaces are temporal in nature; thus, only traces of the space can persist outside the meeting activities. We conceptualize how place-based activities are crucial to create a global collaborative space. This crucial work of connecting people and artifacts we have labeled relation work elsewhere [18], and we believe that relation work and the conceptualization of global spaces and places provided in this paper together provides insights essential for new technologies supporting War Rooms meetings. For example, new innovative wall-scale technology-mediated workspaces might benefit to focus on global persistence in information still preserving the tangible nature of collaborative artifacts.

Acknowledgement

Thanks to post.doc Lars Rune Christensen and research assistant Carina Rohrbach for participating in the data collection. GIRI, the Global Interaction Research Initiative at the IT-University of Copenhagen (global-interaction.org) supported this research financially.

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