

Workplace Surfaces as Resource for Social Interactions

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Abstract

Space and spatial arrangements play an important role in our everyday social interactions. The way we use and manage our surrounding space is not coincidental, on the contrary, it reflects the way we think, plan and act. Within collaborative contexts, its ability to support social activities makes space an important component of human cognition in the post-cognitive era. As technology designers, we can learn a lot by rigorously understanding the role of space for the purpose of designing collaborative systems. In this paper, we describe an ethnographic study on the use of workplace surfaces in design studios. We introduce the idea of artful surfaces. Artful surfaces are full of informative, inspirational and creative artefacts that help designers accomplish their everyday design practices. The way these surfaces are created and used could provide information about how designers work. Using examples from our fieldwork, we show that artful surfaces have both functional and inspirational characteristics. We indentify four types of artful surfaces: personal, shared, project-specific and live surfaces. We believe that a greater insight into how these artful surfaces are created and used could lead to better design of novel display technologies to support designers' everyday work.

Keywords: Space, surface, design practice, ethnography.

1 INTRODUCTION

“Space is a resource that must be managed, much like time, memory, and energy. When we use space well we can often bring the time and memory demands of our tasks down to workable levels. We can increase the reliability of execution, and the number of jobs we can handle at once.”

- David Kirsh [9]

The importance of external resources in supporting our cognitive processes has been solicited by several studies in cognitive science research. Conceptual frameworks such as Activity Theory [10], Distributed Cognition [6], Situated Actions [20] and several studies in CSCW research [1, 5, 13, 14, 16, 17, 18,] have advocated the role of workplace artefacts (such as paper, notice boards, flight strips and calendars) in supporting and coordinating collaborative activities. Unlike the studies on artefacts, there is a very small amount of research [9, 19] in understanding the importance of space and spatial arrangements in work environments.

To some extent space can be seen as a technology that we use to support our actions. The use of space has become so implicit in our everyday lives that we do not realize how it helps in our thinking, planning and other behavior. Kirsh's [9] work has been very much focused on the way we intelligently utilize our space. His findings highlight the fact that intelligent use of space can lead to effective performance by humans by providing selective attention, longer memory span, facilitated perception and choice. Humans intelligently adopt environmental resources as means of bridging the gap that separates them from a desired solution. In the case of complex activity, people set interim sub-goals that progressively increase their opportunities of success.

This paper focuses on understanding the importance of workplace surfaces for supporting collaborative activities in design studios. Designers apply creative and innovative practices in their everyday work. A largely overlooked issue has been how the workplace surfaces in design studios play a role in supporting designers' creative work.

Their desks, office walls, clipboards and drawing boards are full of informative, inspirational and creative artefacts such as, handmade sketches, drawings, posters, post-it notes and so on. These artefacts have instrumental and productivity related functions and can be in the form of to-do lists, project-related information and other organizational details. At the same time, these surfaces also carry inspirational, provocative and other non-instrumental details such as posters and innovative design sketches. Workplace surfaces are not just the carriers of information but importantly they are sites of methodic design practices. Surfaces offer resources for social, organizational and individual activity that designers routinely encounter and use on an everyday basis.

Understanding the role of surfaces becomes especially relevant in the field of HCI, where the desktop metaphor used in the current GUIs is heavily influenced by workplace surfaces. Surfaces' social and organizational aspects, their informational structures and full range of purposes have hardly been studied within the HCI field (with few exceptions like [11, 12, 15 and 19]). Additionally, it has been frequently suggested that material artefacts that populate the workspace ecology need to be taken into account while understanding group work [6, 8 and 17]. In the case of design practices, different horizontal and vertical surfaces (as can be seen in Figure-1) become an important resource for understanding everyday design activities that take place in design studios and related organizations. We believe that important lessons can be learnt from current practices of using physical surfaces to design table-top and vertical display technologies.



Fig 1. A shared workspace full of artful surfaces.

Building on our previous work [23, 24, 25], in this paper we introduce the idea of artful surfaces – surfaces that designers create by externalizing their work-related activities, to be able to effectively support their everyday way of working. From a longitudinal fieldwork of two academic departments of industrial design, we develop a simple classification of artful surfaces: personal, shared, project-specific and live surfaces. Using examples from the field, we illustrate what these surfaces are like and what purpose they serve. Secondly, we illustrate the dual nature of these surfaces. On the one hand these surfaces help designers to organize their work and be accountable about it through allowing them, for example, to create to-do lists, to write time-tables, and to make charts for the division of work. On the other hand, these surfaces also have an inspirational role as they allow designers to reflect their social identity, and to collect inspirational, personal and creative sources of information. Hence, artefacts in general not only improve efficiency or have a purely functional role, but the presence and different manifestations of these surfaces bring quality and richness to designers' performance and help in making better sense of their everyday lives. We believe that for designers this inspirational role of artful surfaces is as important as the functional and productivity related role. The former is often neglected in the study of design practices.

In the rest of this paper, we first provide a brief background on the research about surfaces in HCI. Next we discuss our approach and methods used in ethnomethodologically informed fieldwork. We then discuss our four classes of artful surfaces, developed from the results of our fieldwork. We finally discuss the usefulness and

differences between horizontal and vertical surfaces and suggest some implication for developing table-top and large-sized vertical display technologies.

2 BACKGROUND

Different ethnographic studies have demonstrated the importance of vertical and horizontal surfaces in professional and domestic environments. However, there is a scarcity of specific efforts to understand the usefulness of these surfaces in the domain of design. In the following we will discuss some background research on surfaces, as we found in HCI and CSCW literature.

In the case of vertical surfaces, Perry and O'Hara [12] studied display-based activities in various office spaces and developed a taxonomy characterizing three valuable aspects of these displays: ready access to information, social orientation and coordination and planning. Within the domain of healthcare, it has been shown that vertical displays such as notice boards in the public environment of hospitals help medical doctors and nurses to coordinate their work [1]. The public availability supported by these vertical displays has shown to be useful also in other professional domains. A large corpus of research related to public availability and use of situated displays can be found in [11]. In the case of domestic environments, Swan and Taylor [21] have studied fridge surfaces and have shown that the re-configurability and portability of different informational artefacts on the fridge surface have strong implications for supporting and negotiating family relationships. The authors' ethnographic studies of photo display practices in homes have shown that the way people organize their vertical photo displays in homes also reflects the expressions they want to convey [22].

In the case of horizontal surfaces, a recent study in homes and offices was published by Salovaara and colleagues [15]. They show that understanding people's everyday methodic practices of using horizontal surfaces could provide important implications for developing table-top applications. They also suggest that some of the assumptions made in the current table-top technologies need to be reconsidered. Kidd's classical study [8] on knowledge workers shows that the spatial layout afforded by horizontal surfaces (in her case, populated with different material artefacts, for example, papers and files) such as office desks and office floors work as holding patterns and provide contextual cues about the overall progress of work. Sellen and Harper [17] shows that professionals prefer to organize papers by piling them on horizontal surfaces rather than filing them. This way of storing information makes specific papers visible, which in turn serves a reminding function. A review on the importance of papers in professionals' everyday work is provided in [17]. Hutchins's [6] work on distributed cognition also suggests that these kinds of artefacts serve as external memories that could help professionals to make better sense of their work in progress.

3 APPROACH AND METHODS

We have used an ethnomethodological approach [4] for understanding how industrial designers work, how they communicate with others, and what tools, methods and approaches they use for design. The reason for choosing ethnomethodology is to understand industrial designers' work in their everyday professional settings as they happen, without attaching any preconceived measures. The ethnomethodologically informed approach helps in understanding the 'instances' of observable practices and methods that designers apply in their everyday work which could help uncover mundane and everyday social facts.

We used naturalistic observations, contextual interviews and video recorded collaborative design sessions of designers and design students. Our fieldwork lasted approximately eight months. In the naturalistic observations, we studied the collaborative aspects of the design studios. Our goal here was to understand the natural circumstances of designers' collaboration, the tools and methods they use, and how the creative process of design is achieved. We had contextual interviews with 10 Master's students of industrial design and 5 designers / design researchers. We asked questions on individual ways of designing and on how designers understood creative ways of working. We asked how they brainstorm, what methods they use to come up with a design concept, how they convey ideas to each other, their preferred tools for designing, the perceived advantages of using such tools, and so on. We took opportunities to record design sessions of groups of student designers. In some cases, we were participant observers collaborating with design students and recording their design proceedings.

In the contextual interviews, we asked questions specifically focusing on their design processes and their use of material artefacts related to the design projects. For example, how do designers brain-storm in a team? What methods do they use for developing design concepts? How do they convey ideas? What are their preferred tools for

designing? What are the uses and advantages of different design representations? How do they test their design ideas?

4 ARTFUL SURFACES

Through a qualitative analysis of our fieldwork we discovered a specific pattern of design practice: *the use of surfaces*. Inspired by the work of Swan and Taylor [22], we categorized our analysis on surfaces as a set of functionalities, setup, placement, timeline and ways of using these surfaces. We discovered four types of artful surfaces: personal, shared, project-specific and live. Our analysis of different artful surfaces shows that there is something unique about each and every surface. The four classes of surfaces that we will discuss in this section are only a generalization of these surfaces. In the following section we will discuss these artful surfaces in detail.

4.1 PERSONAL SURFACES

Personal surfaces are created and utilized by individual designers. These surfaces can be in a vertical or horizontal form, or as a mix of both. These surfaces are incorporated into office desks, walls, private whiteboards, and other individually owned places. The artefacts that are associated with these surfaces vary in their materiality, multi-modality, size and temporality. Commonly seen artefacts are design sketches, ongoing project-related information, physical models and prototypes, as well as other inspirational and personal information. As we observed, the arrangement of these surfaces is diverse. Figure-2 shows an extreme example of a personal surface full of different material artefacts.

These artefacts have different sets of functionalities ranging from reminders, occasional communications with colleagues, time management and individual project management. These surfaces are generally used long-term. But the arrangement of different artefacts on personal surfaces changes in their lifetime. During the interviews, one of the designers commented, “the space allows me to organize my work and get reminded what I am doing daily. Also for the purpose of communicating with my peers I can very easily show what I am doing.” As can be seen in figure-2, these artefacts are also indicative of different phases in the design process: past ideas, the current state, future planning, and so on. One designer commented, “depending on the phase of the project, I arrange my surroundings. It’s important for me to have these artefacts around so that I can register where I am at in the project”. Hence, these design artefacts are also the markers for reminding.



Fig 2. Extreme use of artful surfaces at a designer’s private desk.

The construction of these kinds of artful surfaces is not only about organizing and accounting for different design projects, it is also about developing new ideas, inspiration and supporting creative thinking. One designer commented, “I normally try to visualize all the material and data that I collected from my user studies and try to find out patterns and explore design opportunities from this data. I then make my own sketches and models and keep all these in a way that can help me find out new ideas.”

In a comparable study [7] it has been shown that material artefacts could have experiential and performative roles and support collaborative creativity in a group of designers. Echoing this, in our work we also discovered some subjective purposes behind using these personal surfaces to express a designer’s social identity, personal history and experiences. Figure-3 represents an example of one such personal surface. A designer organized his workplace by sticking different images, sketches and posters on two walls of his office. One of the walls was more or less static (figure-3) and the other was dynamic – in a sense that its contents were changed over time. The static wall had artefacts ranging from inspirational sources to information about successful projects – representing a portfolio-type appearance summarizing the designer’s interests and achievements. This was an example of creating and displaying social identity. On the other hand, the dynamic wall had information about current projects and the arrangement of these items was a bit messy. In addition, he also kept documents about his plans within projects. Overall, the portability and flexibility of these material artefacts help designers to personalize their work environment.



Fig 3. A wall inside a designer’s office, representing inspirational as well as project specific artefacts.

Although we saw some examples of horizontal personal surfaces, designers often preferred and used vertical surfaces. The purpose of these personal surfaces was to have a quick look at different artefacts on these surfaces and to provide ease to “bystanders” while communicating on specific design issues.

4.2 SHARED SURFACES

One limitation of a large-sized design organization is the difficulty of having a single physical place for sharing between all the designers. In the two industrial design departments that we studied, we observed that many surfaces were specifically created and shared amongst a group of co-located design students. The main purpose of creating and using these kinds of surfaces was to share resources and information amongst relevant groups of people. Here, the surface itself was shared but not necessarily the informational and inspirational artefacts on it. However, there were some examples of jointly owned artefacts on these shared surfaces.



Fig 4. A shared wall, full of sketches, design ideas and other informational artefacts with an added layer of post-it notes and other annotations.

Normally, these shared surfaces were created and used over a long period of time. They were mainly in the vertical form with a few examples of horizontal ones. Most used shared surfaces were large notice boards, clipboards, and physical walls within the design studio. They carried both informational and inspirational design artefacts. Typical candidates were informative artefacts such as design sketches, scenarios, use-cases, design principles and guidelines. And inspirational artefacts such as posters, magazine cuttings and related material were also used. Importantly, artefacts like sketches have an inherent nature of sharability. For example, as shown by Baskinger [2], two-dimensional design sketches are useful not only to develop a design idea, they are used for envisioning, recording, and narrating ideas, sharing and reflecting both at an individual level as well as at social levels. As an example of shared surfaces, figure-4 shows a part of an office wall cluttered with different artefacts that was shared between 3 -4 design students.



Fig 5. An artful shared surface, developed by a group of students.

Since these surfaces are used by several people for different purposes, these surfaces require some formal organization. Figure-4 shows different labeling and patterning schemes in order to allow clear understanding of the

information. Also the figure shows colored post-it notes indicating categories of the artefacts. These shared surfaces can be used in a multilayered way and their portability helps in (re)arranging these artefacts.

A different example of shared surfaces can be seen in figure-5. In a corner of a cubical workplace, a group of design students have developed multilayered artful surfaces using wooden stands. The purpose of these surfaces is mainly educational as it includes visual guidelines and best practice schemes. Overall, we observed that the public visibility [14] and their availability in common physical spaces [3] allowed concerned design students to easily discuss and manipulate the contents incorporated in these shared surfaces.

4.3 PROJECT-SPECIFIC SURFACES

These types of surfaces are created by a team of designers when they work on a collaborative project. These surfaces are normally away from designers' personal workspaces. The organization, placement and interaction with these surfaces depend on the kind of project that designers are working on. The surfaces are developed using movable whiteboards, wooden walls, tables, and other similar placeholders. These surfaces hold artefacts that are relevant to a specific project. Informational artefacts related to project definition, project schedule, to-do list, division of work, design concepts and sketches and so on are normally seen on these surfaces. As the project progresses the contents of these artful surfaces emerge or change, but also diverge. Figure-6 shows an example of a project-specific surface made of soft wood (created for temporary purposes). It carries artefacts such as a detailed project schedule, initial sketches, related literature information and possible design concepts.



Fig 6. A project-specific surface.

In addition, a design team may decide to use other forms of horizontal as well as vertical surfaces to support their collaborative design activity within an ongoing project. Figure-7a shows a movable whiteboard, where a group of design students working on developing ‘an interactive toy for kids’ kept different concept sketches, time-schedules and scribbles about desired functionalities. This kind of artful surfaces can be dragged along to different meeting places, where designers, using pens, can add or change its details. Similarly, figure-7b is a whiteboard with written information about project schedule, deliverables, plans and current status of the project. We can see indications of changes by co-members of the team. Figure-7c is an example where a design team has used a table to keep their physical models – as a way for exploring different shapes, sizes and feel of an interactive toy. This kind of arrangement allows team members to constructively criticize as well as build on each other’s work throughout the duration of a project.



Fig 7. (a) A movable whiteboard full of different artefacts, (b) A detailed project schedule, and (c) A table full of physical models developed from different materials.

As we can see from all these examples, the function of project-specific surfaces is largely productivity-focused. Time-management, scheduling, work progress and division of workload were the most important functions of these artful surfaces. A normal time line of this kind of artful surface is the duration of the project (2 to 6 months) in the case of students we observed. During the project, these surfaces allow a team to organize, manage and reflect on their work in an effortless, visual manner. The informational artefacts that are attached to these surfaces are used both in synchronous and asynchronous manner. During a group meeting, for example, designers can easily refer to or demonstrate particular design phenomena by showing or pointing to specific artefacts. On the other hand, it allows individual members of a team to leave traces of their actions when not all members are present. In both cases, this type of artful surfaces serves as mediators of social coordination.

4.4 LIVE SURFACES

Live surfaces are the short-lived, temporary surfaces that designers develop and use during their real-time collaborative group processes such as brainstorming. These surfaces provide a platform for designers' creative thinking and innovation processes. These surfaces are very short-lived and last only until a particular brainstorming or other specific design session finishes. The differentiating aspect of live surfaces from other types of surfaces is that live surfaces are constantly built and changed by a group of designers in synchronous, co-located collaborative sessions. These surfaces could be either vertical or horizontal. As can be seen in figure-8, a live surface allows real-time collaboration between a co-located design team and involves the use of creative and inspirational artefacts.

Designers use, for example, large sheets of paper, post-it notes, physical models and prototypes and iteratively make changes in the contents and physical arrangement of these artefacts. Live surfaces effortlessly help in discussing two or three-dimensional design artefacts.



Fig 8. A live surface.

Figure-8 shows use of both horizontal and vertical surfaces. In this specific case, designers are trying to generate possible keywords individually on a horizontal plane (table) and after discussing these they create a new vertical surface with post-it notes to make a new categorization. A live surface helps design teams to find and allocate patterns within specific informational artefacts. Figure-9 shows a floor at a design studio working as a live surface to allow brainstorming amongst a team of designers. The spatial flexibility that is provided by these live surfaces helps designers' creative thinking. Because of its temporary nature, these surfaces could be created anywhere in a design studio, using almost any design-related material.



Fig 9. A floor as a live surface, supporting real-time brain-storming in a design team.

5 DISCUSSION & IMPLICATIONS

In this paper we have described a relatively mundane but inevitably important practice of using artful surfaces within the industrial design domain. We provided insights into the everyday ways in which design students externalize their design practices through the use of artful surfaces. Using examples from our ethnographic

fieldwork we provided a simple classification of artful surfaces that demonstrated their nature and purposes. Although, these examples focus on student designers working in two academic industrial design departments, we believe that the four types of artful surfaces would be as relevant in a professional design studio. In our analysis we considered the qualities of different surfaces and showed how these qualities help designers to incorporate their design-related artefacts into their surfaces in an artful and meaningful way. For example, a two-dimensional sketch can be easily stuck to a wall, notes and annotations can be easily written on a whiteboard or 3D sketches can be put on a table for comparison purposes. An emphasis is placed on the manner in which designers continually develop, arrange and integrate different artefacts to create these artful surfaces.

We also demonstrated that these artful surfaces have a dual nature. These artful surfaces can be seen as organizing systems as they help in communicating design ideas to others, reminders of certain work-related issues, managing projects (e.g. using to-dos, time-tables) and so on. On the other hand, these artful surfaces can also be seen as inspirational systems as they help in supporting a designer's social identity and work as a carrier of inspirational materials that constantly help designers' creative thinking. In other words, these surfaces, in a subtle way, help to (re)shape a designer's professional relationships with other members.

We want to point out some issues about the orientation and interaction with these different types of artful surfaces.

- Horizontal surfaces have generally a shorter life-time than vertical surfaces. Because of limitations of the physical space, horizontal surfaces are mainly used for real-time, instantaneous work. In contrast, vertical surfaces can be easily incorporated into readily available physical places like office walls. Even when new placeholders of vertical surfaces are created, they are more or less kept in the corner of a large cubical office or other non-obtrusive places.
- Horizontal surfaces are especially useful for synchronous working whereas (longer lasting) vertical surfaces are used both for asynchronous and synchronous work. Horizontal surfaces can easily hold three-dimensional objects like physical models (figure-7c), something vertical surfaces cannot easily allow. During a design meeting a table or a desk can easily help a group of designers to discuss, refer and point to these three-dimensional objects.
- Artful surfaces are created by designers keeping in mind different public and private environments. Amongst the four types of artful surfaces considered in this paper, personal and shared surfaces are used for long-term purposes at places that are within a close proximity of designers' own desks. This allows designers to keep inspirational and private items on these surfaces. On the other hand, project-specific and live (synchronously used) surfaces, because of their shorter life-time, mainly support team productivity and instrumental knowledge incorporated into them.
- The ways of interacting with vertical and horizontal surfaces differ based on the nature and purpose of these surfaces. Clearly, a relatively large group of people within a close physical proximity can easily discuss and point to certain artefacts on a vertical surface. Whereas with horizontal surfaces designers have to use other ways of interacting with these artefacts. As can be seen in figure-9, while working at a horizontal surface, designers have to pick-up a specific artefact and show it to colleagues in order to make a specific point during discussion. Hence, the orientation and interactions these surfaces afford play a role in how designers use these surfaces in their everyday work.
- This study shows that the kinds of material artefacts incorporated into different artful surfaces are common in most cases. We frequently observed the use of two-dimensional paper-based artefacts such as sketches – representing design ideas, use-cases and interaction mechanisms of products to be designed. Similarly, an organizational artefact like a project-schedule was seen frequently. Further research is needed to look into these specific artefacts and understand how they help in forming a particular artful surface.

Our work also points to some important design opportunities. The kind of ethnomethodological approach that we applied in our investigation allowed us to understand designers' everyday practices as they happen in the real-world. New technologies or systems to support industrial team design should allow to be *effortlessly integrated* into designers' everyday practice of using artful surfaces. The current use of surfaces shows that they are more or less placeholders, markers as reminders and carriers of organizational and inspirational objects that designers use in their everyday work. Hence, new technologies to be designed should, in a sense, provide a set of resources for designers to organize their own everyday arrangements and at the same time allow them to be creative and playful with these technologies. Technology should not attempt to institute organizing systems in themselves. For example, a new table-top display application could support real-time sketching and brainstorming in a small design team, whereas, a large-screen vertical display would be a better option when discussing issues with a large audience.

As was observed in our fieldwork, artful surfaces incorporate the use of different multimodal and heterogeneous artefacts. A digital table-top or large-screen vertical display should provide facilities to capture, integrate and arrange different artefacts on their surfaces, possibly including new types of artefacts such as video clips or sound tracks. This will only work if designers are able to use the display technologies to artfully combine different artefacts so that they can have their own *organizing system* to suit their individual or group needs.

It is important to understand the affordance of mundane artefacts like paper. As Sellen and Harper [17] show, paper has several advantages such as mobility, portability, sharability, amongst other things, that are not easily substituted by a new “digital paper” technology. A new display surface should be easily integrated with well established systems like surfaces with physical paper documents. We have to take into account that we build technologies that complement already existing systems, not replace them. Using new ubiquitous computing [26] ideas the use and manipulation of these mundane artefacts can be tracked using RFID tags. This can also be applied to other three-dimensional design artefacts that are frequently used by designers.

6 CONCLUSIONS

We have shown in this paper that a relevant and observable aspect of designers’ practice is the way they organize and personalize their working space, especially their surfaces. A designer’s working surfaces are important for supporting his/her everyday design work, his communication in a design team and with colleagues, and play an equally important role in designers’ performance and creativity. Designers keep informational and inspirational artefacts such as sketches, drawings, pictures, and models around at their artful surfaces in a way that constantly informs and inspires their design work. Designers’ work is visible from these surfaces even when they are not present. Looking closely into these surfaces allowed us to understand their functions, orientations, time-line and the interaction styles they afforded. Based on these categories we have identified four types of artful surfaces: personal, shared, project-specific and live surfaces. For designing new supporting display technologies lessons can be learnt from the current practice of creation and use of these everyday surfaces.

Acknowledgements. This work is supported by the European IST Programme Project FP6-0033812 (AMIDA). This paper only reflects the authors' views and funding agencies are not liable for any use that may be made of the information contained herein. We thank Kees Overbeeke, Caroline Hummels, Mark Baskinger, Mascha van der Voort and the master’s students of Industrial Design at Technical University of Eindhoven and University of Twente for participating in our study. Thanks also to Lynn Packwood for proof reading.

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