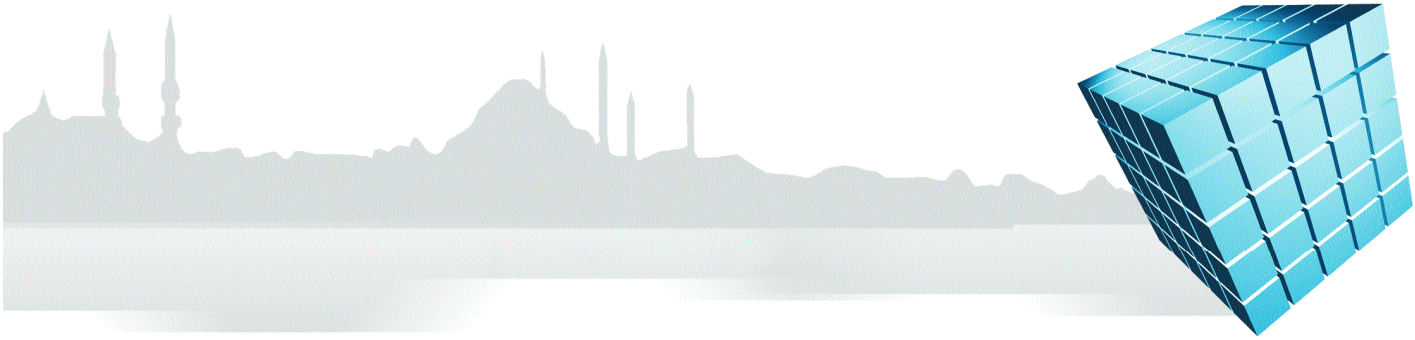

INTERACIVE PHYSICAL SPACE AND APPLICATIONS

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Introduction

In all parts of the world, every area of human life is affected by the revolution in the communication and information environment. Information and communication technologies have enormous potential to reshape and transform the ways in which people organize their lives, interact with each other and participate in the various spheres of society. The transformation is starting nowadays and the future will surely bring us new ad challenging discoveries. (5)

The architecture and urbanism is also shaping in a new context, as we live at the edge of the fourth machine age. The first machine age was characterized by the large and heroic machines like cars, airplanes and heavy industry and the second machine age made use of the mechanics of the first to invent small and pervasive mechanics like refrigerator and other household machines. The emergence of computer that is designed for specialized use in workplaces shaped the third machine age, while today, the computers become ordinary and gets in through every object. Computing can no longer be regarded as an isolated technological possibility; through networks and telecommunication it has become an integrated part of our everyday life. (1)

So, the buildings are also transforming in parallel with these technological developments. Increasingly telecommunication systems replace circulation systems and the solvent of digital information decomposes traditional building types. Architecture played an indispensable representational role by providing occupations, organizations and social groupings with the public faces. The internal organization of a building and the evident hierarchies of privacy and control-reflected the structure of the institution and physically diagrammed its pattern of activities.

Today, institutions generally are supported not only by buildings and furnishings, but also by telecommunication systems and computer software. And the digital, electronic, virtual side is increasingly taking over from the physical. In many contexts, storage of bits is displacing storage of physical artifacts such as books; so that the need for built space is reduced. Electronic linkage is substituting for physical accessibility and for convenient connection by the internal circulations of the buildings, so that access imperatives no longer play such powerful roles in clustering and organizing architectural spaces.

Nothing much changes building type by building type. The functions of a building can be clearly seen from the floor plan of a traditional building: particular places for the various activities are housed, together with a circulation system of doors and passageways that integrates these parts into a functioning whole. When the movement of bodies along circulation paths are replaced by telecommunication through bits and when tele presence substitutes for face-to-face contact among the participants in activities, the spatial linkages are loosened. (3)

Embedded technology and networking allow for the integration of physical objects with information infrastructure and augmentation of the physical environment with information and computing functions. When many physical objects obtain computational and networking functions and are integrated into a coherent mechanism of an information infrastructure, the physical world will become intensively interconnected and expands its possibility in developing new functionality and quality of human experience. (2)

The development of information technologies create a conceptual space composed of abstract and virtual information entities. So, the space that is formed by the relations between these entities that are

represented in some kind of information media is called media space. On the other hand, the space composed of physical entities that can be experienced through perception and physical interaction is called physical space. With embedded technology and networking, products can act as a bridge between two spaces and holds the characteristics both as a physical entity and media entity at the same time.

Introduction of the media space increases the potential for extending the modality of interaction with the multi-media technologies and abundant computing resources. In bridging physical and media space, the mapping between controlled variables and interface mechanisms becomes critical design issues because of the complexity and the possible indirect relations between the user and the objects to be controlled. (4)

Merging Physical Space and Media Space: Analysis of Two Research Projects

Architects still want to shape, arrange and connect spaces to satisfy human needs. But how can he get hold of human needs and design the architectural space embedded with IT?

Many research projects are developed in order to organize physical spaces in parallel with IT. One of the research topics in this area is related to the purpose of the building. What is meant with the "purpose of the building" is that; if it is a private home the focus in on the support or family life in the building, including access to relevant information as entertainment as well as support for using home as base for work. If it is an office building, the focus is on support for people's collaboration around documents and objects. (1) In this paper, we are going to examine the workspaces in offices.

Offices are work-specialized places where the information (numbers, words, and pictures) is collected, stored, transformed, and disseminated. So the parts of the organizations are mostly composed of desks equipped with information-handling devices (telephones, computers, fax machines, printers, file cabinets, inboxes and outboxes, and the like), meeting and conference rooms, copying centers and mailrooms, and reception and circulation spaces. From the economist's viewpoint, they are locations where value is added to information. (3)

People's activities at work often generate dynamic configurations of spaces, information and people –within the office, but also both digital and physical materials are part of such configurations. Activities for such work are diverse in styles, dynamic, spatially distributed and highly context dependent. Physical objects and relations between them therefore perform significant roles of composing contexts of an information intensive workplace.

Spatial computing environments respond to these challenges by making use of every technical possibility to support the social and spatial organization of work. The work environment can also be augmented through spatial computing components, initially for members of the design professions, with applicability to a wide range of work domains. (6)

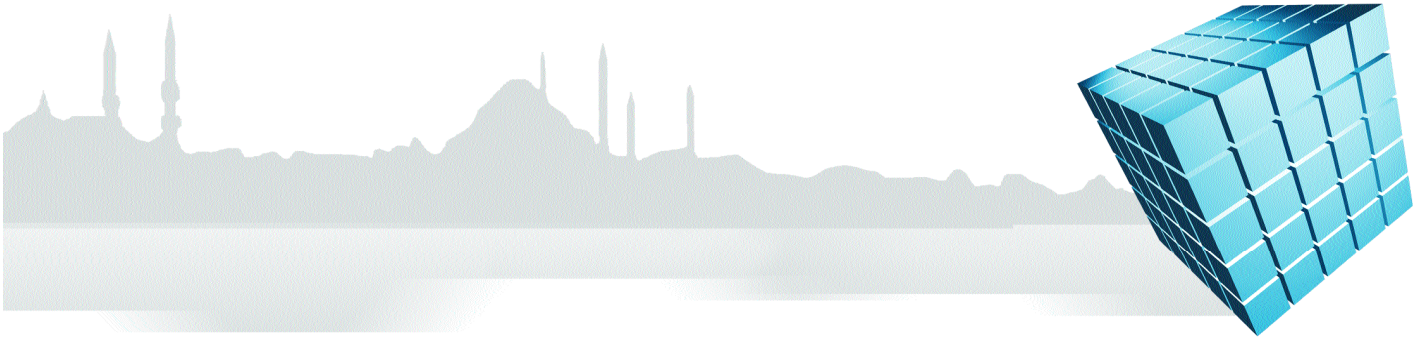
Following qualities are needed to for lively and effective interaction for knowledge-intensive work environment:

1. Redundancy of information: easy access to information sources and functions is critical for enhancing productivity so the redundancy of information and function allocation over space, time and presentation modes needs to be strategically planned.

2. Robustness of interaction sensitivity: The system must be designed robust enough to accept the variation of interactive actions by users and environmental conditions.

3. Flexibility of knowledge representation modes: Different modes of activities require different modes of knowledge representation

4. Appropriate use of active physical interface: Active interface that makes physical actions can be applied to extend the modality of interaction with objects and environment.



The human intentions and actions with objects, environments and media space are linked with physical interface. Combinations of physical interface and objects with media space produce a variety of interactive systems and interaction methods. The basic model involves the relation of the user, a physical object and physical interface, of which it varies with the different combinations of the added features of media, multiple media and environment. (4)

With in the frame of above, in this paper the research projects of a Swedish and Danish research groups, named “the FEEL project” and “Interactive Workspaces” respectively, will be taken into consideration to examine their work, which involves the design of the physical aspects of an interactive space and investigating the emphasis of non-intrusive behavior. The groups worked on building up computational environments where computers were replaced by many wirelessly connected parts, mixing small public and private artifacts dynamically. The groups focused on organizing spaces of workplaces to be used by small groups. Both projects are mostly concerned with the physical and hardware aspects of the interactive space. (1, 2)

The main scenario for both projects is that several project groups share a common interactive space for brainstorming and briefing sessions. The design and development requires integrated support for working with physical models and prototypes in combination with digital documents. Within their research, Swedish group named the physical objects and explained the recognition of objects, while Danish group developed room sized prototypes combined with the concept for how information and materials can be brought in and out of the room, and for shift between private and shared forms of information and materials. The prototypes all have interfaces that proved a link structure that supports users working with “live” documents and objects in a 3D environment where “workspaces” are used as a structuring mechanism. (1)

The common artifacts of the 2 projects which also make up the basis of the ideas are examined one by one, with their definite functions and roles in the space and the outcome.

Interactive walls: They will act as the center of focus for the shared information in the interactive space. Actors in the interactive space are able to instantly present information from their personal environments on the interactive wall and the wall will provide further facilities to manipulate the shared information. They will also function as a display for video and other streaming information. All interaction with the prototype applies and IR pen and a wireless keyboard. The room that has interactive walls serves as enhanced whiteboards. The interactive wall can be used as a 2D white-board and seamlessly move into a 3D mono interface allowing users to place documents and objects in the background, in clusters, on top of each other. That is to create more room for work while maintaining awareness of collaborative manipulation of other relevant documents and objects. (1, 2)

Public wall displays: Until an actor interacts with it, public wall displays are very calm, decorative and non intrusive. Actually these objects are not thought of as private/ mobile, but rather as public/ stationary devices acting as art objects. The display, based on which person stands in front may change and give info relevant with the person. Information can be displayed on them in non-intrusive manners as changes of content and purpose on these displays are considered as normal phenomena in the interactive space. (2)

Interactive meeting tables: In Swedish group’s project, the main function of the table will be seamless sharing of information. The spatial organization of the table effects whether they are to be seen as public or personal. It will provide both shared and personal areas where you can display and work with digital information. The table will provide ways to integrate personal equipment in the interactive space. Touch sensitivity of different areas is essential. Adding different kinds of sensors and actuator will also enhance the functionality of the table. In Denmark group’s project, a designer’s workbench is designed with a projection in the

tabletop showing the projected workspaces. The designer's workbench attempts to fill the gap between visualization systems and pure 2D digital desks in that it provides support for ordinary 2D documents and 3D models at the same integrated environment. (1, 2)

Public pads: There will be number of pads wirelessly connected to flat computers with touch sensitive screens available in the space. The pads can partly be seen as "electronic" paper. Another function of the pads is that they can be used for different kinds of interaction with applications running on the computer in the room. In contrast to laptops, screens that lay flat on the table might be perceived less intrusive than vertically positioned laptop screens. The use of public and shared artifacts might be perceived as less intrusive than private ones. (2)

Personal mobile equipment: Typically users bring their own personal equipment into the I-space. Such personal equipment could be mobile phones, handheld computers or laptops or commercially available kits. Actually they could be more useful if they could interact with the stationary equipment within the meeting room creating the potential for communication among services. (2) Through palmtops users can bring electronic link structures to and from the room, to be accessed on the palmtop or on the walls and boards elsewhere. Objects can be moved between walls, the table, and personal palmtop. (1)

The Outcome of Artifacts Placed In The Workspace:
For the Swedish group, the interactive wall had the intrusiveness aspect of not being able to accommodate many different streams of interaction in parallel. Rather than constant images, the wall must be able to accommodate many different streams. So if the default behavior includes parallel action and constant changes in the appearance of new information useful to individuals and subgroups in the interactive space, it can occur without the unnecessary intrusions on the rest of the group.

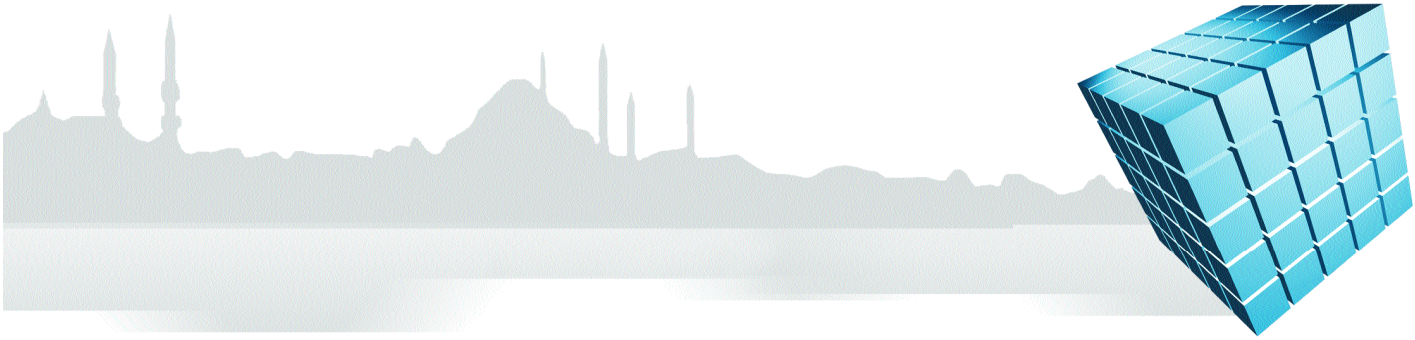
Another opinion comes for interactive meeting table; it was thought that many working tables are clogged with different personal equipment brought into the interactive space. This equipment and its behavior during interactions are today the major cause for interfering behaviors in a meeting room.

For personal mobile equipment, better integration of this kind of equipment is needed with the environment and improved designs will make the situation better, however the resulting defocusing of each participants attention from the central communicative process in the room will even be more negative. (2)

Within the research of Danish group, two of the prototypes in the laboratory for Interactive Workspaces (the "interactive wall" and the "designer's workbench") has been evaluated with performers, performing at a brainstorming session. The evaluation showed benefits such as: enabling the accumulation of knowledge, sharing of materials that can be directly referred in a discussion and altered if needed and an immanent possibility for rearranging materials to fit a collective view of the project at hand. The evaluation also showed a series of needs, especially regarding the interaction with the materials displayed. When wanting to rearrange the materials the users expressed a wish to do that by just grabbing he document by hand and moving it, while when they wanted to ad content to a document they'd want to use a pen or alike, patterns and actions known form manipulating physical documents. (1)

From an Architectural Point of View
If we examine the cases from an architectural point of view, the outcome from the Swedish group shows the functional deficiency of the artifacts, while the outcome from the Danish group shows the behavioral inadequacy of the designed objects. One reason for these physical objects to be intrusive in the space is that, although they are designed for the spaces, but they are hung on a wall or placed on the floor rather than fitting the spaces to satisfy the functions.

The core problem is, with the technological developments, not only the context of the physical artifacts changes but also the context within which



building is designed is changing. So the architectural program must be revised in parallel with the new technologies and context of life. As objects and their spatial organization form context for user activities, some needless items within the architectural building program must be moved, discarded or replaced and new items must be brought in to constantly modify to satisfy user need that change as the activities change.

What is more, the revision that must be done is not only in the frame of technical and functional elements for them to operate efficiently and effectively, but also with the behavioral elements that deal with the perception and psychological needs of the building users and how these interact with the facilities.

The above three main topics, to name as functional, technological and behavioral elements involve in the design business itself and IT is one of the main actors to shape the three fields so that a proper interactive space can be designed and be a satisfying bridge for users to get hold of the physical objects through media.

Conclusion

The key objective is to devise better means to bring people, materials and tools into productive relationship. Material and embodied practical achievement places “practice” at the heart of the approach. The emphasis lies upon the social and spatial organization of practice and the way in which the technologies merge into this organization.

When the objects of design can no longer be regarded as artifacts, the cultural and aesthetic properties of design are changed, which are comprised by activities mediated by networks and/or direct human manipulation and interacting with our context. Our perception of space will be challenged while having to include both physical spaces and media spaces. (1) So, for the design of these artifacts, functional and behavioral means become also very important as well as technological advances, because in such environments, space can no longer be comprehended by the notion of physically demarcation, but merely as an environment defined by social and cultural relations among the involved people and occurring activities.

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