Hybrid infrastructures for knowledge work

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Abstract
Factory architecture and its implications for workplace behaviour is a well-established theme in workplace research (Brunnström, 1990; Biggs, 1996). Workplace design for knowledge work, on the other hand side, has not inspired the same body of systematic research – due to some extent to the ephemeral character of knowledge work. The aim of this paper is to present an integrated perspective on how the office environment supports and shapes knowledge work, by conceptualising the office as a hybrid infrastructure for knowledge work.

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"Influencing behaviour is almost all of what management is about, and buildings

influence behaviour."

Seiler, HBR 1984

1. Introduction

In the last couple of decades, the discourse on office design has changed radically. There has been a large publishing activity beyond the specialist literature of architecture, building technology and facility management, and the very offices have changed from a somewhat dull and bureaucratic building style into what may seem as exercises in post-modern architecture (examples in Myerson and Ross, 1999).

The discourse on office design has entered the field of corporate strategy, through a new role for facility management, and through an emphasis on corporate aesthetics as a part of corporate image building – and therefore for the valuing of a company (Blakstad, 2001; Hatch and Schultz, 2000). The discourse on office design is also addressing themes from the field of organisation studies, through the assertion that office design is of great importance for the conduct of knowledge work – for creativity, co-operation and knowledge sharing. A highly profiled example is the advertising agency, Chiat/Day, first hailed as an example of "work-from-anywhere workplace for the knowledge workers of tomorrow", then denounced as a failed experiment of "egalitarian utopianism" (Berger, 1999; see also Dix, 1994).

The widening of the discourse has also implied the influx of a wide range of professions for office design, with implications for the languages being used for describing offices, their design, and their ways of functioning.

The goal of this paper is to contribute to the discourse on office design and its influence on knowledge work, through the development of a conceptual model of the role of office design for workplace behaviour.

2. Designing new ways of working

In the hey-days of the digital revolution, nomadic and office-less work was presented as the future of work. New ways of working, such as telework and other forms of "location-independent work", would indicate that office buildings have a negligible impact on knowledge work. For the "digital nomads" (Makimoto and Manners, 1997), the decisive material support would be ICT-tools, such as cell phones, laptops and PDAs.

Somewhat contrary to this ascribed "death of the office", a large number of companies have instead invested significant amounts of money into innovative office buildings, and aggressive facility management strategies, encompassing both collocation and distributed work solutions. Further, there is a consultancy business offering services as well as new concepts for aiding prospective clients in rearranging workplaces. By changing the physical layout of office buildings and at the same time introducing appropriate ICT-tools, it has been argued, innovation, creativity, and co-operation will be furthered, corporate culture will be strengthened, and real estate costs may be reduced (Duffy, 1997; Veldhoen and Piepers, 1995).

2.1 The case of Telenor

The interpretations and theory-building efforts in this paper have been decisively influenced through a close involvement with the move of the corporate headquarters of the major telecom operator and ICT provider in Norway, Telenor. The Telenor-case provides a rich and relevant example, due to the radical workplace solution chosen, the diversity of lessons learned, and the sheer volume of the relocation and recreation of workplaces. It is particularly interesting for the efforts of theory-development, since the relocation process was guided by (fragments of) a theory for workplace design.

In 2001, Telenor's activities in the Oslo-region started the physical relocation to a new corporate headquarters at Fornebu, just outside Oslo. In a 137.000 square meter building, Telenor had the ambition to collocate more than 7.000 Telenor-employees from more than 40 offices throughout the Oslo-area. The building was

designed to reduce Telenor's use of area by 40%, and to reduce occupancy costs by 20% compared to the 1997-figures. The total cost of the building project was some 370 million GBP (4.2 billion Norwegian kroner). The building was designed with "proper workplaces" for some 6000 people (Figure 1).

Figure 1a, b: Telenor Fornebu, overview, and perspective from East
Photo: Telenor Eiendom

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At the new corporate headquarters, Telenor aim has been to create the leading innovative workplace in Scandinavia (Telenor, 2001). The design philosophy has been to establish a workplace, supportive of collaboration and knowledge sharing. Within the new headquarters, exchange and cross-fertilisation of ideas are to be facilitated by an open floor plan, and a large number of casual meeting places. Hot-desking, laptop computers and other mobile devices enable work to go on wherever and whenever there is a need – both inside and outside the building. The corporate design philosophy has been to use ICT and workplace design to support new ways of working. Space use strategies have included the establishment of flexible, open-plan office solution, with fewer actual seats than the number of employees, meaning that a certain degree of hot-desking has to be deployed. Further, the collocation of different commercial units has been introduced as a facilitator for cross-departmental co-operation and knowledge sharing.

The design process has been supported by a conceptual model (Figure 2), describing how new ways of working are supported by workplace design and state - of - the - art information - and communicationtechnologies. Extensive piloting of workplace solutions, and a broad programme for employee participation in workplace design were other important instruments.

At Fornebu one has abolished the idea that the individual workplaces should be customised or

Figure 2: Conceptual model for the Telenor development project

New ways of working

Workplace design

Information and communication technologies

personalised, whereby the majority of status symbols have been put to an end. The indication of rank through the size of the office has been abolished, and even the CEO sits in an open-plan solution. Instead, a package or menu of workplaces has been established, that together provide the full range of facilities. This package includes generic workplaces, formal and informal meeting rooms, lounge areas, touch-down areas, coffee bars, etc, all supported by an extensive ICT-network, that is accessible at home, on travel, at customers' sites etc.

The Telenor-case exemplifies an ambitious organisation development approach, where the physical workplace design is deployed as a strategic instrument. It thereby also serves as a starting point for concept development as one step towards a more integrated theory development.

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3. The physical environment in / of organisations

In the discourse on workplace design, there is a multitude of conceptualisations of the new workplaces and new work practices. Examples of such concepts are flexible offices and flexible solutions, project rooms, guest offices, combi-offices, home offices, telework centres, office hotels, hot desking, time sharing and clean desk policy, caves and commons, non-territorial offices, cellular offices, cubicles, open plan offices, to name but a few. Practitioners, as well as theoreticians in a varied set of academic professions have developed a number of concepts and conceptual models for workplace design.

An influential approach has been developed by the British architectural firm DEGW (Duffy, 1997), asserting "affinities" between work patterns and use of space, and with work activities, and their autonomy and interaction as main concepts and variables (Figure 3).

Figure 3: Affinities between work patterns and use of space.
After Duffy (1997)
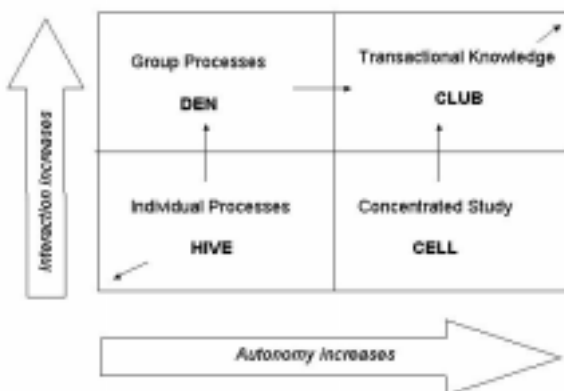
Although influential, it may bee argued that this approach does not present a detailed analysis of the "mechanical details of how specific work is socially organised in relation to place" (Brown and O'Hara, 2002). Some areas where this approach needs further development are the role of information and communication technologies for distributed and mobile work, and the role of transitions from work situation to work situation, including the physical movement within and among buildings.

A supplementary perspective is found in the Space syntax approach, with the programmatic formulation: "the ordering of space in buildings is really about the ordering of relations between people" (Hillier and Hanson, 1984; see also Hillier, 1996). The space syntax approach presents a rigorous method to the study of how buildings (as well as cities and other forms of material environments) structure movements and solidarity among members of social systems. The space syntax approach has been used for studies of office use and of buildings and power (Markus, 1993) among other research themes.

One particular strength of this approach is found in the study of collectives of people, and their interrelations: "The effects of spatial configurations are not on individuals, but on collections of individuals and how they interrelate through space" (Hillier, 1996), whereas the approach seems less appropriate for studies of how buildings accommodate and support individual and collaborative work activities, beyond the support for meetings – whether accidental or planned.
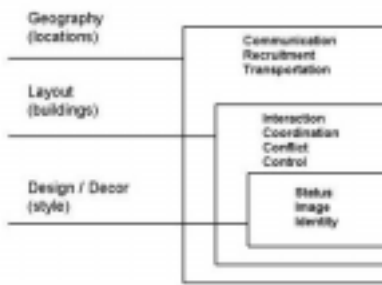
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A third instructive source for studies of how material structures affect organisational behaviour is found in organisation studies. This is, however, a fairly new theoretical orientation, since traditionally, the materiality of workplaces has received little attention. One researcher has commented on a mentalist bias in that "most of the research and analysis published in the arena of organizational theories and management studies describe the following, somewhat bizarre phenomenon: as soon as the human person crosses virtual or physical threshold of an organization, s/he is purged of corporeality, so only his or her mind remains" (Strati, 1999). This comment is appropriate for the majority of studies in organisation sciences, where organisations are described through concepts such as strategies, charts and structures, culture, norms and behaviour, power and status – with a few exceptions, such as references to the status symbolism of moving to a larger office, or the role of the office building as a figurehead for the organisation.

Recently, a growing number of studies have criticised the mentalist view of organisations, and have addressed the significance of the physical environment in and of organisations, and the corporeality of the organisation members, such as the study of aesthetics in organisations (Strati, 1999), and of the role of artefacts in organisations (Gagliardi, 1996). Mary Jo Hatch has formulated an elegant framework for the concept of physical structure and its links to other organisational issues (Hatch, 1997; Figure 4). She distinguishes between three main domain areas for the physical structure, and a few of the main lines of influence, with geography or location, affecting communication, recruitment and transportation; layout and buildings, affecting interaction, co-ordination, conflict and control, and design and décor, affecting status, image and identity.

Figure 4: The concept of physical structure in organisation science.
Source: Hatch (1997)

Geography (locations)
Layout (buildings)
Design / Decor (style)

Communication
Recruitment
Transportation

Interaction
Coordination
Conflict
Control

Status
Image
Identity

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According to Hatch, physical structures have some kind of influence on the formation of the individual worker, the group of workers and the organizational idea (1997). The purpose of Hatch's work is to describe and understand the physical structure of the organisation from two angels: modernist and symbolic perspectives. The modernist perspective focuses on the relationship between physical structure and interaction, and other forms of activity, in two perspectives. The symbolic perspective focuses on that physical structure "are a rich source of symbols and an important channel for cultural expression" (1997).

By geography Hatch refers not only to the locations of the organisation, but also the implications for internal and external communication, recruitment of people to the organisation and transportation. Layout "refers to the spatial arrangement of physical objects and human activities" (1997). Layout is the placement of objects, of walls, furniture and equipment, and it is also the internal layout of to what extent the workplace is an open space. The layout of the organisation will influence interaction, coordination, and conflicts and control in the organisation. Design and décor refer not only to the architecture of the building, the landscapes, walls and ceilings, but also to the "unplanned aspects of the appearance of buildings and other organizational facilities" (1997). According to Hatch, design and décor refer both to the exterior and the interior of the organisation.

For the purposes of the present paper, the framework developed by Hatch needs an elaboration in the direction of a fuller discussion of instrumental actions and of how artefacts help promote organizational goals – it is instructive to note that in her figure, interaction, coordination, conflict and control are included, whereas instrumental, goal-oriented workplace activities have not been included, as if physical structure was irrelevant for instrumental action. Further, the framework is challenged by the phenomena of distributed and mobile work – modes of work that contest the logical, clear-cut distinctions between location, layout, and design.

4. Towards a theory of hybrid infrastructures for work

In the previous sections, a number of building blocks have been outlined for the development of a model of the impact of workplace design on workplace behaviour. They include the central role of activities, collaboration and symbolisations for workplace analysis and design; the role of spatial configurations for understanding movements, transitions and sociability; the importance of ICTs, and the close interrelations between ICTs, and spatial configurations.

A first step towards a unifying theory is through the introduction of the concept of affordances.

4.1 Affordances

A key perspective for describing the impact of ICTs, is elaborated through the concept of technological affordances. Gaver (1991) describes affordances as a way of "focussing on the strengths and weaknesses of technologies with respect to the possibilities they offer the people that might use them". Physical objects have affordances that facilitate certain actions, impede others; whereas they can neither impose nor prohibit certain actions. The concept of affordances has been developed as a way of avoiding both technological determinism and the idea of technologies as tabula rasa, the idea that technologies can be used as neutral instruments. "An affordance of an object […] refers to attributes of both the object and the actor. This makes the concept a powerful one for thinking about technologies because it focuses on the interaction between technologies and the people who will use them" (Gaver, 1991).

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Criticism and modifications have been raised against the concept of affordances along several lines; Firstly, that the capabilities of technologies cannot be entirely distinguished from how we talk about them, since technologies – and actions – are embedded in interpretive frameworks. Secondly, that the concept of affordances does not recognise in sufficient detail that the (potential) users have quite different proficiencies or competences for deploying the affordances the technologies offer. In spite of these criticisms, the perspective remains fruitful as a way of acknowledging the capacities and limitations of technologies for supporting actions.

4.2 Hybrid workplaces

The perspective of affordances is not confined to ICTs, it could equally well be applied for the entire work environment, consisting of both the built environment and the available ICT tools, with activities and their material surroundings or substrate at the core of the conceptualisation. The concept of affordances may thereby also address how characteristics of space facilitate or hamper certain activities. The concept of affordances serves thereby as a unifying link between characteristics of technologies and characteristics of spaces, which, on an abstracted level, motivates the introduction of the term hybrid workplaces, as socio-spatio-technical ensembles.

4.3 Infrastructures for work

In the concept of affordances, a criticism of technological determinism is implied, where it is acknowledged that behaviour never may be totally "hard-wired" into the technology or into the spatial arrangement; not even in the assembly line factory was behaviour totally determined. There are, however, technologies designed purposefully to accommodate a variety of activities and applications, usually called infrastructure technologies.

Infrastructure technologies facilitate and support a multitude of activities, while still in a selective way, by encouraging some, de-motivating others, and that they require elements of a proper protocol to function. Further, infrastructures emerges with the following dimensions:

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- embeddedness, as it is "sunk" into other structures, social arrangements, and technologies
- transparency as it doesn't have to be re-invented each time
- taken-for-grantedness
- embodiment of standards
- built on an installed base
- becomes visible upon breakdown
  (Star and Ruhleder, 1996)

These characteristics are equally relevant and applicable for the physical environment for work, where certain spatial configurations or affordances for action facilitate particular activities, de-motivate others.

A final step is to consider the assemblage of technologies and spatial configurations as a hybrid infrastructure for work, by summing up the various elements discussed so far: the ability of the workplace to accommodate a varied set of activities, since the workplace expresses and embodies certain affordances for activities and collaboration. Further, this perspective manages to consider technologies and spatial elements on a symmetrical basis, not ascribing priority to either. Finally, this perspective opens a wide range of research and development activities, as further outlined in the next chapter.

The concept of hybrid infrastructures for work may be illustrated through a picture from Telenor's new headquarters (Figure 5). The lounge area - based on its spatial characteristics - seems to be primarily for recreational use or for informal meetings. Due to the wireless local area network installed, the ICT-infrastructure provides qualities beyond the very physical attributes. Instead, it is quite feasible to be on-line in the lounge area, and the area is frequently used for individual concentration work.

A final research challenge is to conceptualise distributed and hybrid environments, and the mechanisms whereby workplace behaviour, innovation and creativity are influenced by the distributed and hybrid office environments. The question "where does the telephone conversation take place" has no obvious answer (Bakke, 1996), neither is it obvious how the spatial character of distributed work group best should be conceptualised, except for the respective partners involved.

Figure 5: Lounge area for work and leisure.
Photo: Telenor Eiendom

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5. Implications for further research

The goal of this paper has been to initiate the development of a theory for workplace design, whereas a supplementary goal has been the attempt to develop an analytical framework for understanding workplace design and its influence on workplace behaviour, and to provide a common vocabulary for the various professions involved in the workplace discourses and workplace design.

The perspective of hybrid infrastructures for knowledge work will also be fruitful for the generation of research questions for the studies of workplaces. Important insights may here be drawn from analyses of urban infrastructures, such as roads, streets and meeting places, railways, electricity, sewers and water, where questions may be asked how infrastructure characteristics mould communications patterns and communication densities; zoning and activity-mixing; the evolvement of frameworks for appropriate behaviour; and the establishment of payment structures for infrastructure establishment, maintenance and use (Graham and Marvin, 2001). Further research themes include the maintenance of infrastructures, and of the interfaces between infrastructures and applications, and the economics of scale and scope of infrastructures.

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