

**MA-thesis in Education in Society, Science and  
Technology, ESST**

**Architecture as Bits and Bytes:  
Computer Mediated  
Communication in the Architecture  
Profession**

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## Synopsis

According to a report produced for the Department of Industry and Trade in the UK, the use of virtual reality techniques (VRT) has helped architects improve efficiency and communication in architecture. Along with the statement there are a limited amount of studies that have treated the recent convergence of computer- and communication technology specifically in relation to architecture practice. In that regard, this paper seeks to examine the use of computer mediated communication (CMC) in the architecture profession. The intention is to diversify the notion of how information- and communication technologies (ICT) are interpreted and deployed by architects.

The examination has adopted a theoretical approach which denies us to treat anything *technological*- separately from a *social context*. In three UK case studies of architecture practice attention has therefore been made towards organisational contexts as these are constituting the ability of CMC to reinforce inter-activity in the architectural design process. The relationships between architects, clients and other professions are exemplified and analysed to indicate how the role of CMC is changing due to different architectural- and organisational requirements.

Drawing upon the experience from the case studies, this paper suggests that *strategy*, *structure* and *design-philosophy* are organisational characteristics that influences the function of CMC in architecture practice. While these are contexts changing from company to company, an *image-enhancing role* of ICT is regarded important for *all* practices to consider in «information society».

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## Preface

This thesis is written in London /Oslo, and is part of the Masters of Arts degree under the Education in Society, Science and Technology (ESST) programme offered by The European Inter-University Association on Society, Science and Technology. A major objective of the course "Europe in an Information Society" offered by the ESST programme at East London University is to critically develop an understanding of current economic, social and cultural transformations relationship to information and communication technologies (ICT). In this regard, the notion of an "Information Society" is central topic of discussion. The paper wishes to contribute to the study of science, technology and society (STS) within the framework of the ESST programme.

The thesis has been made possible thanks to very interesting and rewarding meetings with IT-management at Edward Cullinan Architects and Skidmore, Owings and Merrill in London, and Boots Ltd. in Nottingham.

I want to thank my supervisor in London, Mr Graham Thomas, for his concern about my topic in general, for the contact with Cullinan and Boots, and for critically commenting on outline and drafts during the writing. I also wish to thank Sally Wyatt for supporting the initial research-idea, and all fellow students and tutors at the ESST-course in London for showing interest in my writing. The final responsibility for the thesis is mine alone.

University of Oslo, April 1999

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# 1 Introduction

The subject of this paper is the recent convergence of computer aided design (CAD) and computer mediated communication (CMC) in the architecture profession. CMC is normally regarded as computer-support of communication which otherwise is done by regular face-to-face meetings, telephone, mail, fax-machine or similar. It is either a substitution or (more regularly) a supplement of traditional communication. Information can run over applications like electronic mail, or at web-pages on Internet (Intranet/Extranet). In contrast to CMC, CAD was originally developed for *single users*, and is normally designed to give the architect computer-aids to draw his/hers ideas - without any communication features. The convergence of these technologies has emerged along with an *increased emphasis on inter-activity*, and is expected to reconstruct architecture practice, and possibly, the end product, architectural design.

Take for example the construction of the Jin Mao building in Shanghai: This 420 meter tall skyscraper was designed by architects in Chicago with associated architects at the site in China. The construction was erected supported by CAD communicated by CMC, with the Chicago architects visiting the site only once a month (Day, 1997, p.129). Finished last year, this modernist symbol of western economic supremacy was raised in Asia, though the architects still were working at the other side of the globe.

The example illustrates how architecture *may be* practiced today. What specifically will be treated in the following is the function of the technology involved in this process, the role of CMC for architecture practices: **Does CMC reinforce inter-activity between architects and other professionals in architectural practice?**

## Background

According to the European Union (EU), the introduction of ICTs, globalisation and international competition generates new forms of economic and social organization, a structure which is no longer subject to geographical constraints: «teleworking is emerging as a major social phenomenon.»<sup>1</sup> The EU has stated: “The move towards an "information society" is irreversible, and affects all aspects of society and interrelations between economic partners.”<sup>2</sup>

The term “Information Society” has originally been developed from Danial Bell’s «Post Industrial Society».<sup>3</sup> This society he characterised by a heightened significance of information processing -as opposed to the industrial era's major occupation of product-development.<sup>4</sup> To be able to gain the necessary competitiveness, research is supported by EU to stimulate and evaluate ICT development and use and it’s economic, cultural and ethical consequences.<sup>5</sup>

The information collected for this examination suggest that there has been done relatively few studies of CMC and the architecture profession. One reason for this is the short history of the technology involved. Networking of computers has not been commercially used in

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<sup>1</sup> The Commission’s “White Paper”, part B, II, Competitiveness, chapter 5, A, 5, 1

<sup>2</sup> The Commission’s “White Paper”, part B, II, Competitiveness, chapter 5, A, 5, 2

<sup>3</sup> Bell noticed that industrial societies now were moving towards a service-dominated society. The decreased need for labour in traditional industry and the growth of the service sector made him suggest that it would be more precise to talk about a post-industrial society.

<sup>4</sup> Frank Webster denies Bell's notion of both "post-industrial" and "information society". Even if he recognises the "information explosion" and the increased use of IT in society, he does not agree that this is qualitatively different from industrial society: *There is no novel, "post-industrial" society: the growth of service occupations and associated developments highlight the continuities of the present with the past.* (Webster, 1995, p.50)

<sup>5</sup> E. g. the research programmes ESPRIT and RACE.

architecture for more than a few years. Traditionally, the use of computers in architecture has been related to Computer Aided [Architectural] Design (CA[A]D).<sup>6</sup> In recent years a limited amount of literature<sup>7</sup> concerning architecture practice and CMC has appeared, and this will be extensively referred to in this paper.<sup>8</sup> The Department of Trade and Industry in UK has commissioned Spectrum Strategy Consultants to undertake a study of the progress of the information society. In the report published from this study there is a short description of how ICT and CMC is affecting the architecture profession *specifically*. I will quote a part of this report to further exemplify some common assumptions on the role of CMC for architecture:

“Illustrations of Impact of the Information Society on Business Processes”:

“The use of virtual reality techniques in architecture has helped architects to improve efficiency and communication with clients. Traditionally, a large portion of architectural time was spend showing the client the vision the architect had created for their building. This was mainly done by basic three-dimensional models and drawings -a time consuming and inflexible approach to planning. The introduction of interactive mapping and virtual reality software has made this process more rewarding for the client and more effective for the designers. Networking of this software enables disparate groups of professionals to communicate irrespective of their physical location especially during the construction phase of large projects.” (s.50)

From these assumptions I have developed my initial question into three categories that I want to examine specifically: Communication between architects and other *architects* 1), *clients* 2), and *collaborators/contractors* 3).

## Theory and methodology

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<sup>6</sup> The use of Computer Aided [Architectural] Design (CA[A]D) has been addressed in research for more than 30 years, e.g. by Negroponete, 1970 & 1975, Mitchell, 1977, Cross, 1977, Penz, 1992.

<sup>7</sup> Literature has been collected at The Royal Institute of British Architecture ( RIBA), which possesses a rich collection of architecture literature.

<sup>8</sup> Managerial literature: e. g. Day, 1997, McKenzie, 1992, Pressman, 1996. Coyne et. al., 1998, Maher and Saad, 1995, available on www.

To examine the subject, I have started with attending a theoretical discussion on the agency of change in technology generally. There exists a variety of different approaches to technology studies, but I have chosen to concentrate on «sociology of technology»-approaches. These are theories that suggest an «holistic» understanding of technology and society. From so-called social constructivist theory I have selected an approach suggested by Grint and Woolgar in *The Machine at Work* (1997) as a interesting point of departure. According to their proposal, there is an enduring presumption of “technological determinism” in most attempts that have been made to describe the relationship between technology and society. Determinism, either technological or social, is according to them, a false interpretation of technology/society. Technology and society are inseparable and indeterminate parts, and technological capacities can therefore not be described without including a social context.

A similar approach has been suggested and applied in a specific study of CMC in architecture done by Coyne, Sudweeks and Haynes (1998), and is therefore of major interest for this examination. Together, these approaches constitutes the theoretical framework for a qualitative study of the use and interpretation of CMC-technology in architecture practice. Drawing upon these theories, I have developed an hypothesis which I want to examine:

***The ability of CMC to reinforce inter-activity in architecture practice is dependent on the context in which it is applied***

The objective with this hypothesis is to qualify a role for the context where CMC is applied. This context may be constituted by requirements internally in an architectural

office, or externally, from incentives given by business relations or authorities. I have addressed my hypothesis in three case studies from architecture practice. Edward Cullinan Architects, Skidmore, Owings and Merrill (SOM), both in London, and in the architectural division of the retail-company *Boots*, in Nottingham. During interviews with IT-management I have searched for information on their strategies towards and experience with CMC in relation to their practice. Internally in communication between architects, and, externally, in relations to clients and contractors/collaborators. I will present and analyse the case studies in relation to the hypothesis I suggested above. My conclusion is that findings from architecture practice confirm that different practice is a variable that influences the capacities of CMC-technology. The findings also indicates an image-enhancing role of the technology that is dominant in the interpretation of technology in use. I will argue that such a role given the technology is constituted through the notion of ICT promoted e.g. by the European Union.

### **Structure**

In the next chapter, I will present general characteristics of architecture practice, and a specific description of three modes of communication in the profession. In chapter 3 I will present and discuss the theoretical framework adopted for the examination, and argue the incentives for my strategy and methodological choices. Chapter 4 will present case studies of the three UK architecture practices. In chapter 5, I will analyse the case studies in relation to the theoretical concepts adopted. Chapter 6 summarises my analyses and gives some additional remarks to the examination.

## **2 Characteristics of architecture practice**

## **Representation of architectural design**

Architecture and other design intensive industries are characterised by the importance of *the representation of an idea* as opposed to text or numbers. Even though designers do other things than making drawings, the representation of the image is of major concern for the architects' possibility to perform the profession. Traditionally architects have been communicating with drawings made on drawing boards in format A (118,8 x84,0 cm) or similar formats. With new possibilities provided by computerisation, the visualisation of design information has been downscaled on the computer-screen to something between size A3 and A4. This downscaling of the drawings met some reluctance in the early years of the computerisation because it meant a reduction of the visual perspective of the prospect (Cooley, 1981). Even if the plotters were capable of printing bigger formats, the introduction of PC's meant that the general working practice would change (in terms of downscaling of working-drawings), and some considered this change as having a generally negative impact architectural design. Today the "full-scale" drawing-boards are still kept in many practices because of the possibilities provided by traditional drawing techniques. Nevertheless, drawing on a computer gives the possibility to make drawings in any scale thinkable: A drawing of a building can be made in scale 1:1 and include any detail useful for engineers, all in the same drawing. This means that the engineers may expect more precision from the drawings, and possibly pay less attention to the sketches of the architects. Because it physically changes the representations of architectural ideas, the computerisation of drawing has potential impacts on the design process and the final design.

Even if the computer technology still is recognised as "immature" and developing (Maher & Saad, 1998, p.2), drawing software, scanners, plotters and other solutions makes it

possible to draw whatever images the architects traditionally have been able to. In addition the designer has been given a number of other possibilities which the traditional drawing-technique were not capable to provide. A main feature of CAD systems is the possibility of three-dimensional (3D) visualisation of constructions. Expectations towards 3D and virtual-reality technology have been high, but studies indicate that architecture practices have not taken up the technology as much as initially expected (RIBA, 1992, p.156). Technological possibilities do not always mean that the potential will be explored and used. As in other professions there are numerous qualities of the working process that imposes solutions to the practice, and the communication of design information between architects, consultants and clients is one of these factors.

### **Architecture practices communication**

Traditionally it has been a tendency to regard the architect as someone employing a role and position, between the aesthetic concern of an artist, and the needs of functionality demanded by the engineer. The "design genius" ideas have therefore to be communicated to the client, containing the original intention of the architect. An architect in a practice has to consider many external influences. Even if education in architecture traditionally has stressed the role of the architect as an explorer in design possibilities and - solutions, an architecture practice normally has to limit it's experimental potential. This is due to the requirements of the clients, the needs of the engineers, restrictions set by public law, etc. The nature of these relations are therefore crucial for the architects' traditinal work practice - and for the deployment of CMC. I will therefore give a specific description of requirements affecting arhitects communication in praticte.

### **Communication with other architects**

The most frequent form of architecture practice has traditionally been (and still is) a small company where a few architects are operating together as a team, or doing separate works, but sharing the same roof and administration.

Most projects architecture practices are involved in requires work of more than one single architect, and therefore some kind of internal co-operation and co-ordination of work. This may be due to a limited space of time for the drawings to be finished, or a need for utilisation of the special skills that the different architects may possess. Working in a design team means that designs will be done separately, either by different architects doing different parts of the drawings (e.g. one designing surface and another doing the elevation), or by doing different parts of the building. This means that the designers have to be able to understand and co-ordinate each other's drawings, and make the final suggestion publishable for the client and other collaborators.

The communication of design-information internally has previously been taken care of by a physical co-localisation of architects working together on a project. Architecture offices has traditionally been filled with architects that could communicate physically, face-to face during the design and construction period. In this sense, the architecture office has been the ultimate centre for communication of information and knowledge between architects.

Andy Pressman argue that the introduction of new ICT into architecture practice will ultimately lead to the development of "Virtual Design studios" (Pressman, p. 15). According to Pressman this kind of practice, as opposed to traditional practice, is not dependent on a physical location. According to a definition made by Maher and Saad: "A Virtual Design Studio comprises of a team of designers from various locations for which

communication is computer-mediated; essentially, the studio is distributed across space and time and information is represented electronically." (Maher and Saad,1998). The market will ultimately force architects to take up this kind of non-localised practice. (Pressman, p.17) Pressman builds his assumptions on two major factors that will bring the change to the profession.

First of all, there is a pressure in the marketplace that practices always have to take into account. In the architectural profession the high-and-low conjunctures in the building industry has always been a problem for the managers in regard to the planning of business. Traditionally managers have had to estimate fixed expenses (like office costs) and save money for the next recession. In a profession where the conjunctures are so influential, the ability to estimate the right profits in boom periods for support in recessions is of major importance for the continuance of the architecture office.

Secondly, and this is the changing factor, the recent advances in information technology is making it possible to organise the practice in a new way. In its most direct form, the new information technologies makes it possible to adjust the practice to the conjunctures in the market place in a more economic way by reducing the fixed overhead costs and turning

them into variable costs: e.g. the expenses on office-rental can be reduced because the architects don't need traditional work-space to do their work, and costs for transport and travelling for projects and meetings can be minimised because of use of computer mediated communication. In times of recession this will make the difference between the survivors and the losers in the business. Pressman is in the first place positioning himself

as a economical determinist, though secondly also technological determinist, as he assumes that the technology will be able to increase efficiency of practice. Though I will deny that there is a «*technological determinism*» (Chapter 3) in the relationship between CMC-technology and the development of architecture practice, I will suggest that Pressman's notion is interesting. In the discussion of the case studies (Chapter 5) I will return to Pressman's ideas and indicate representational requirements obstructing the development of VDS's. I will also suggest an «image-enhancing role» (Grint and Woolgar, 1997 p.129) of the technology that is constituted through forces of the market.

#### **Communication with clients**

Practicing architecture in a professional environment necessarily includes an important relationship with clients. Architects often participate in announced competitions on design, where they have been given information from the potential client on what kind of needs that exist regarding size, functionality, etc. The first step in the design process is therefore the communication of the requirements from the client to the designers.

The second step in the process is intended to *convince the client*: Drawings/models and consultancy are the most appropriate contributions in the competition of the commission. To land contracts is essential for the practice to stay alive, so the first drafts have to seduce the client without having spent too much resources if the client should turn their suggestion down.

When a contract is landed the client and architects will discuss alternatives within the contracted design-solution. Often changes have to be made before and during the construction period due to new information about user-groups, regulation-plans, economic

capacity, etc. Communication of these changes has traditionally been done by sending new drawing-solutions in respond to the changes needed, and explaining changes orally at project-meetings with the client.

Normally clients of architects have the possibility to influence the decisions towards the end of a design-process. The architecture practice responsible for a commission arranges meetings where the latest drawings are presented (for the client, and possibly other collaborators), This is an occasion for the client to make comments and suggestions to the drafts available. The case studies will expand this description of the relationship with an examianation of experience of computer meditated communication between architects and clients.

#### **Communication with contractors/collaborators**

The architects' design also goes to other participants in the design-process: Public authorities has to be informed continually about changes that may be of their concern, and finally, the design has to be approved. Landscape-architects and interior-designers are also interested in receiving good prospects of the site, and may wish changes to be done to accommodate their needs.

The biggest group of participants in the building-process is engineers. Structural-engineering of building-materials and intra-structural engineering, like electronic and pipeline engineering is heavily dependent on the quality of the work done by the architects. Communication of design-information to all kinds of engineers involved in the construction-process is therefore a vital task, and sometimes place for controversies on responsibility: The degree of specification provided by the architects is essential to the

engineers capability to be effective, because un-precise drawings increases the need of controlling and measuring done by the engineers.

Sharing design-information with engineers and authorities involves the possibility for inter-active communication in the design process. It is therefore essential to the architects set of work-practices, as well as the final design of the construction. Architects have traditionally been using different perspective-drawings or selected "cuts" of layers in their design, and changes has been made by correcting these on a drawing-board. A change made on one slice of the construction may also affect other parts of the construction and has therefore be co-ordinated with other drawings. (A relatively big change may require between 100 and 200 different drawings). A problem sometimes rises when a change is known by the architects but not by the engineers. The information does not reach the engineers fast enough because the changes on the working-drawings has to be done manually.

Interestingly, as one of the case studies later in this paper shows, "automatisation" (by CAD and CMC) of this process has brought an "opposite" problem: Now changes are being made on all drawings automatically during the process, but "no-one" knows who has done the changes and why.

### **3 Theory and methodology**

In this chapter I will introduce a theoretical approach suggested by Grint and Woolgar (1997) as a possible way to describe and understand a role for technology in society. While their attention is at technology in organisations in general, I suggest a term adopted by

Coyne et. al. (1998) for describing the role of CMC in architecture specifically. The approaches are presented and discussed in order to become an analytical tool for the methodology adopted for my study.

### **The debate on technological determinism**

Like Grint and Woolgar (1997) and Marx and Smith (1994) I find that a discussion of technological determinism is a necessary starting point for a study of the potential role for technological capacities on society. Technological determinism in different forms appears in many descriptions of technology, but is not an approach that is supported by many theorists directly. Nevertheless it is a way of understanding technology that receives criticism as it unintentionally appears in impact studies of technology. As Marx and Smith point out: "These before-and-after narratives gives credence to the idea of "technology" as an independent entity, a virtually autonomous agent of change."(Marx and Smith, 1997, p.xi). In most cases other descriptions than technological determinism offer more precision to theories of societal/technological change, and I will therefore seek to use the explanation carefully.<sup>9</sup>

Technological determinism is a term that is often used by theorist to describe an understanding they are opposed to, and I believe the explanation of the term can best be understood in light of this practice. I have not been able to find theorists using the term to describe their own ideas, all descriptions so far has been made by the opponents to this notion.

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<sup>9</sup> Bimber, in Marx and Smith, p.79-100

An attempt to diversify traditional impact studies of technology has been done by a group of theories that roughly can be identified as “sociology of technology” scholars. A common feature of their theories is that they are searching to avoid technological determinism. Examples of theories are social construction of technology (SCOT) scholars (MacKenzie and Wajcman, 1985, and Bijker et al, 1993) and so-called actor-network theories (ANT) (for example, Latour, 1987, Bijker and Law,1992). These are both theories trying to explain the capacities of technology by pointing to different aspects of construction and negotiation of the technological development. While these two directions are both emphasising the social shaping of technology, there are some differences in their method for study of technology: SCOT- theorists tend to stress the developing and confirming stages of the “stabilisation” of technology, as the relevant target of study (Bijker 1995). After a stabilisation there is a “closure”; social and political negotiation ceases to influence the development and the technology reaches it’s form. As a comparison, the actor-network- theory argue that networks (of human and non-human actors) are reconstituting technology constantly. As a methodological approach, the theory also rejects the distinction between the social and the natural/technical.

The theories are suggesting divergent routes towards anti-determinism, and I do not wish to discuss these further in details. Instead I will focus on their common *idea* of anti-determinism and examine this notion through specific case studies of CMC and architecture.

While “determinism” is a term that may require relatively little explanation, “technological” and “technology” are very much disputed expressions that is central to many discussions of technological capabilities and capacities. Still, “determinism” points

towards at least two different aspects: First, that there is a necessary chain of causation, and second, that the agent of this causation can be external of the human will.<sup>10</sup>

Despite the many definitions suggested on technology, I will only introduce one variation here. I choose this variation since it can help explain the interpretation I have searched to deploy in this specific paper. In the examination of the role of technology (CMC) for architecture, I will try to deploy Grint and Woolgar's suggestions of how technology can be defined. Grint and Woolgar have pointed out that the common idea of avoiding determinism not it is able to disintegrate "the enduring presumption" that there is, in the end, an essence to the machine, a capacity to technology (Grint and Woolgar, 1997, p.37). Thought, Grint and Woolgar are sharing the idea of avoiding technological determinism, they do not agree that this has been done in this tradition so far. As an alternative to SCOT and ANT, they are claiming a need for a more radical falsification of determinism. Their suggestion is that any technical, social or political constructions assumed to be found in the technology really are external (Grint and Woolgar, 1997, p.98-101). Technology does not exist without a "context", whether this is political, sociological or other. (This emphasises the importance of knowing what context technology appears in, and to understand the limitation of generalisations possible to draw from one level of interpretation.)

While a similar explanation also would be accepted by SCOT- and ANT theorists, Grint and Woolgar maintain criticism of essentialism and technicism (Grint and Woolgar, p.31) they suspect these theories are hiding. To avoid the possibility of hiding a "God within" the technology they suggest an approach known from literature studies (reader-response technique). Their ("post-essentialist") route towards an understanding of technology gives

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<sup>10</sup> The New Shorter Oxford English Dictionary (1993).

the advice to compare technology with texts and ask whether there are inherent characteristics or meanings in the artefact, or if these are effects that appear only in the meeting with an interpreter. By doing this move from constructivism they want to emphasise the importance language plays in the theories developed to describe the technology -society relation.

So far, they argue, social-constructivists and other theorists have failed to escape different forms of “textual-determinism” in their attempts to escape technological determinism. Their own theory is only suggested as a vague first step towards an anti-essentialist understanding of technology. In the end of their theoretical argumentation, they suggest that anti-essentialism is a necessary move towards truth as the basis for political action (Grint and Woolgar, p.164-168). I will not discuss their argumentation for the relation between technology, truth and power, any further, but use their theory as a possible approach to studies of technology. Specifically I will trust their explanation of how capacities really is constituted outside the technology - always affected by interpretation. Technology is always set in a context, and this context is flexible and crucial for the effect of the technology.

The theoretical concepts adopted from philosophical “post-modern” approaches may easily be ignored in studies of practice. Even if there is a theoretical acceptance of relativism this may be hard to pursue in evaluation of technology in practice. Our deterministic presumptions are reborn and supported through linguistics and rhetorics in most descriptions of technology, whether these come from technicians, organisational managers or the researcher self. We are surrounded by descriptions of technological capacities that

suggest impact as a result from the emergence of a new technology.<sup>11</sup> As a consequence, technological determinism receives major support through promotion of technological products from a variety of interests. Hence, consumers of technology may also support the notion of technological determinism in their hunt for competitiveness:

“The image-enhancing role of technology appears to be especially important where the technology in question is at the leading edge of innovation, and the more information technology people use, the more they appear to think they will be regarded as competent and innovative.”(Grint and Woolgar, 1997, p.129)

While this notion only is briefly touched upon in “The Machine at Work”, I will pursue this notion further and discuss it in relation to the findings from the case studies.

### **“Disclosure”**

In relation to the argumentation I related to technological capacities generally, I want to introduce and discuss a concept suggested to explain the relationship CMC/architecture *specifically*. While different forms of technological determinism seem to dominate managerial literature on ICT and architecture, the approach taken from Coyne, Sudweeks and Haynes (1998), searches to take the theoretical implications of anti-determinism into account, and is therefore of special interest for this paper. A report on the use of CMC among architects made by Coyne et. al, has suggested “disclosure” as a useful concept to explain the role of technology for practice. This is a term adopted from Heidegger’s terminology to explain “the process whereby something is both revealed, but also changed

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<sup>11</sup> The most obvious example is commercials for technology. (It is crucial for manufacturers and distributors to emphasise the importance of choosing *their* exact product and not e.g. the importance of doing

through that process” (Coyne et. al., 1998, p.15). According to Coyne et. al. "disclosure" of practice is a useful term because it seeks to explain changes, although staying indeterminate. In this regard they suggest that the distinction social/technological is a uninteresting dichotomy. The concept does not require that technological or social causes are identified, because what really is interesting is to see *what is disclosed?*, and who or what is the agency of change is a matter of interpretation. In this regard the term is applied similarly to the suggestion from Grint and Woolgar.

Coyne et. al. does several illustrations of how they understand the term, and why they find that it suits for describing the role of technology. First of all, they believe that technology brings to light certain qualities of practice already existent before the introduction of the technology. They underline the function of technology as a tool, an extension of pre-existing gadgets like an arm, an eye, a voice. In this sense, the capacity of the technology is not of any qualitative difference from the pre-existing aims and means of an organism or an organisation, the technology only *reveals* those qualities already existing. This suggests that technology is neutral, not able to change anything by own agency (either this is restricted to purely technical explanations or if social, political or other aspects inhibiting technology is included).

Coyne et. al.’s suggestion is that technology also may disclose in a way that changes practice due to changed emphasise. Their comparison with the introduction of CAD may fit to illustrate this point:

To say that CAD discloses firms as custodians of databases suggests that firms always had data in the form of drawings, and the new technology made that function more obvious. But we could

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strategically right choices on terms of organisational structure).

equally say that the concept of drawings as data, as we currently understand the term, did not really exist before the invention of the computer. (Coyne et. al, 1998, p17)

Similarly, it is argued; "...CMC discloses the firm as an entrepreneurial enterprise, a handler of texts, a collaborator, and a player in the global arena." (Coyne et. al., 1998, p.18).

The approach taken by Coyne et. al. apparently searches to escape any form of essentialism, either this is seen as technological or social. It does not consider the source of capacity to be the most interesting subject of study, but rather see the study of CMC and architecture not dependent on a detection of this. In this sense it is an attempt of pragmatism, trying to escape the discussion of different terms describing the relationship between technology and society.

While I find their report and approach useful to understand the role of CMC, I want to suggest that Coyne et. al.'s approach is lacking this dimension of the description. Since this is their intention I do not say this as a criticism, though as a reminder for the further research.

Like Grint and Woolgar suggested in their critique of anti-essentials approaches, it can be argued that Coyne et. al. here search to ride two horses that are running in different directions. In the first instance they argue that CMC reveals qualities in terms of strategy, already existent in practice. On the other hand, they argue that "...CMC amplifies, re-defines, re-orientes, brings to light, or generally "discloses" certain aspects of (that) practice." (Coyne et al., p.1).

I will argue (in accordance with Grint and Woolgars theory) that the capacities of CMC are fundamentally dependent on a practice, a context. Because there always are contexts (whether one define these as external or internal to the technology), it is possible to see effects of the introduction of technology. Since contexts change, it is impossible to see general, determining effects. Still, I suggest that different practice/contexts may have similarities that make it possible for similar changes to happen in the architecture profession. While this is not determinism, I suggest that CMC is not “neutral”: Reinforcing inter-activity is far from a neutral capacity. Like other social/political actions may influence architecture practice, CMC is part of a social/political context that is affecting CMC, most notably, the «information society».

### **Methodology**

The methodological choices made for this examination is closely related to the subject, Architecture practice. While it is possible to examine the architecture profession collecting information from samples, statistics etc., the objective of this examination can best be reached through practice-studies. I have therefore studied cases of architecture offices. This is not really a methodological choice, rather an object of study (Stake, p. 236), or a research strategy (Hartley, p.209). “...the key feature of the case study approach is not method or data but the emphasis on understanding processes as they occur in their context.” (Hartley, p.227). I am examining context, as this always appears in relation to the changes that I am studying.

The methodological choices made for this study is also related to the *theoretical* framework I trust for a understanding of technology and society: As I believe that the

capacities of technology (and other artefacts) are constituted through interpretation, my intention is to qualify a role for *interpretations* of the technology. In the introduction I illustrated how CMC and ICT has been interpreted in sources of literature concerning architecture practice specifically. There, increased inter-activity was suggested to be a consequence of the introduction of CMC into practice. In accordance with the theoretical framework for this paper, this is one of several possible interpretations and capacities of the technology. I have chosen to do case studies to identify the relationship between capacities and context and how this is interpreted by practitioners.

The information on practice in this study is gathered from findings done in case studies conducted in architecture practice in Edward Cullinan Architects and Skidmore, Owings, and Merrill (SOM), Both in London, and in the architectural-design division of Boots, Nottingham. The studies are interesting as *single cases* -not aiming at a general conclusion but useful in refining the theory I have presented in the previous section of this chapter. In accordance with the theoretical framework adopted for this study, my objective is not to describe “reality”, but rather to illustrate *realities*, as constituted through different contexts, that can extend our understanding of CMC and architecture practice.

The examination will focus on the three major categorisations of inter-action in architecture practice. The categories of study are developed from characteristic notions of CMC related effects on architecture practice found in literature. I have illustrated examples of these notions e. g. from the report from Spectrum Strategy Consultants and from Andy

Pressman. As I have also suggested (Chapter 2), these categories also are representative for the professional contacts architects traditionally has been most dependent upon:<sup>12</sup>

-communication with other *architects*

-communication with *collaborators/consultants*

-communication with *clients*

(A further description of the methods used in the case studies is described in chapter 4.)

I believe the method for this paper should be related to what in social science often is labelled *qualitative studies*. Although this is not a homogenous method (Van Maanen, in Cassell and Symon, p.3), I will search to describe some general characteristics of qualitative studies, and suggest some consequences this had for the examination in this paper:

-Qualitative studies are interested in change, aiming to answer the questions; how? and why?, as opposed to quantitative studies which generally is more concerned with frequency. In this paper I have not intended to measure to which extent change has occurred, but reveal agency of a suggested change in architecture practice.

-As a result of the underlying epistemology (from theoretical tradition), qualitative methods allow some flexibility in the research process. During the study new insights may appear and change the focus of attention. This e. g. implies that a definite hypothesis does not have to be kept throughout a study. Instead new hypothesis should be created during the process (Hartley, p.211). In this paper I have used a *quantitative* statement (that CMC has increased emphasis inter-activity) and searched to share light on the *quality* of this change.

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<sup>12</sup> A relation of communication that has been left out is architects -authorities. While this relation probably is

During the discussion of the case studie I will move focus from differences towards similarities of context.

A main objective of the ESST master is to converge different scientific approaches to possibly benefit our knowledge about technology, science and society. I have brought my experience from studies of comparative literature and history of ideas into this study. This has undoubtedly affected my approach also to the subject here. The interpretation of the researcher is, like the interpretation of technology by society, constituting for the subject. This may be regarded as a problem with partly structured qualitative studies. I will argue that this is an appropriate way to approach the subject, even if my interpretation and presentation is highly subjective. I do not consider subjectivity as more problematic here than in any other interpretation. Rather I will argue that this kind of qualitative and case-specific study is the best way to escape misleading determinism and support a necessary and more rewarding "holism" in the understanding of technology.<sup>13</sup>

Collecting information from three different practices has made the presentation and discussion of the case studies a big challenge. I have included a large number of examples of practice/context in the chapter on the case studies, though I have not been able to give them the treatment I ideally find satisfactory. On the one hand, illustration from several cases has been useful to verify my hypothesis, on the other hand, the plurality of information has made it difficult to decide which examples to go with the discussion in chapter 5. Redoing the project in another setting, I would prefer to concentrate on one

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subject of communication during most architecture processes, I this is not treated here separately.

<sup>13</sup> -Technology and "context" is inseparable. While information technology often is regarded as *cause* and information society a *consequence*, the examination here is therefore going to treat the two as *indeterminate* parts. The paper does not search to quantify the role of architecture practice in "information society", quite the opposite, I wish to qualify a role for "information society" in architecture.

single practice and treat this in a deeper analysis. In addition, I have experienced a “paradox” due to the strategy made for methodology: While I have argued for the value of the single cases opposed to generalisations, I have in the end of my discussion suggested a general conclusion on the role of CMC. This may illustrate how difficult it is not to search for generalisations, and at the same time defend relativism suggested in theory. I will emphasize that only a brief part of the role of CMC for architecture practice has been explored and explained by this paper. My hope is, though, that the approach and the variety of examples applied in the thesis may be useful as an introductory point for someone, either interested in technology, architecture, or both.

What should be emphasised is the distance between the researcher and the object of study. Though I have spent more than a year gathering information and studying interpretations of CMC and architecture, my knowledge of architecture practice is not of “first hand” and not fully developed. Architecture practitioners and other researchers may find interpretations in my paper not in accordance with their own experience. I admit that a deeper level of study could have made my observations more interesting. Unfortunately time is one of several aspects that has limited my possibility to extend the knowledge of architecture practice. Still, I will suggest that a distance between the researcher and the object of study may be rewarding. As an interpreter distant to the conventions of architecture practice my analyses and suggestions may be different from interpretations from practitioners and other researchers, and thereby diversify the notion of CMC in architecture. If so, my examination contributes to the study of this subject and the objective of multi-disciplinarity in the ESST-program is possibly satisfied.

## **4 Case studies from architecture practice**

### **Introduction to the case studies**

#### **Objective**

Introductory I stated that this paper was going to use case studies to share light on and refine theory on the relationship between technology and society. My intention was to find a path to do the kind of indeterminate technology studies that has been suggested by the constructivists as an alternative to traditional «impact studies». I also stated that case

studies are interesting as *single cases* not aiming at making general conclusions, but as representatives for a possible “nature” of the technology. The intention was to show a *variety* of different practices and strategies, rather than finding a *representative* selection of a rather diversified profession. The case studies have been selected to exemplify three different environments of practice that architects are operating in: One is genuinely concerned with design, another is coupling designing, engineering and management of construction, and a third is an architectural department within a big retail-company. I also wanted to use practices that actually had an experience with CMC. The case studies are, as a consequence of this, from relatively big practices.<sup>14</sup>

The case studies were conducted in May and June 1998 during my stay in London. The relative restricted amount of time available for my study suggested that methods for case study had to be limited in number. Before the interviews took place, the practices were introduced to a list of questions that I developed. Here are examples of three main groups of questions:

- Who are the users of ICT in the design-process, and what is the technology used for?
- What are the implications of ICT for the design-process and for the organisation of your business /How does CMC and ICT affect relations to architects, clients and contractors/collaborators?

My lack of inside experience and knowledge from architecture practice also suggested that I had to search for the exact questions to raise during the study. The questions were intended to help the forthcoming communication between interviewees from professional practice and an external academic (me). During the meetings I experienced that many of

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<sup>14</sup> According to a report produced by RIBA (1992), take up of ICT has in general been much more

the topics suggested in the questionnaire were responded upon as we were discussing singular questions from the list. As a consequence, interviews have been “unstructured”(questionnaire only used as a loose guide), but quotations are searched made due to the initial research questions. All the interviews were taped and this has helped me secure the right quotation of the respondents.

### **Structure of presentation**

The structure of the presentation of the case studies will be the same for all three examples. I will first give a short presentation of the practice’s history and area of business, and then move to a description of central elements of the company’s *strategy* towards the use of CMC. From there on, I will try to specify the main *experiences* due to the three categories that I have chosen to highlight; Internal communication with other architects, and external communication with clients and consultants/collaborators. At the end of each presentation I will emphasise the interviewees interpretation and expectations of the consequences for the design-process in this regard.

## **Edward Cullinan Architects**

*Edward Cullinan Architects is a medium-sized architecture practice located in central London. It has some 20 employees, most of them being architects. The practice was formed in the 60's as a co-operative, and today it is registered as a Limited Company. Still, all members are taking part in the development of the company's policy through plenum meetings held once every second month.*

### **Strategy**

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developed in large practices than in average or small practices.

The company has 16 workstations and a similar number of traditional drawing-boards in their office, leaving for the architects to choose proper tools. The workstations are shared, which means that staff may work with whichever of the machines they find useful. The machines consist of 10 Mac's for CAD-drawing, and 6 are applied in project-management, as databases, and word processing. Information about previous and ongoing projects is made available for all employees thanks to a file-server on the Internet.

For Cullinan the number of employees is considered important. From being 36 employees at the height of the boom at the end of the 80's the company has been down to 11. Now they want to stabilise around 26-28. During the last big building-boom the practice had to split up on two different floors. Their experience from this period was that working on separate floors with a larger number of people decreased their ability to communicate effectively. By restricting the number of employees at the current site they want to keep all the people at the same floor, and thereby maintaining what they believe is an important feature in the design-process: *Easy communication*. Today therefore traditional drawing-boards and workstations are situated in the same room.

**Internal communication:**

Normally a design team needed for an incoming commission is put together quite arbitrarily: Because people are occupied with ongoing projects, members of a team for a new commission is made up of the people whom are finishing their current project and therefore can be the first to attend a new design-group. This often means that new constellations of architects can work together, and that no one is dedicated to the same colleagues for a very long time.

These arbitrary constellations of architects in of design-teams are considered favourable because it promotes knowledge-sharing between people with different experiences. Here. IT-skills versus more traditional skills is a typical example. Younger architects are normally choosing to work on CAD-machines, while the more experienced architects often chose to stick with traditional techniques. Training in CAD-drawing is time-consuming and not forced on the employees:

*"We don't have the time for learning."*

As a consequence of this the office rather emphasise the need for developing what they feel they currently do best. In other words, the parallel use of traditional and new techniques is not considered a problem, but rather a resource for the projects. When a group of architects are approaching a new job they want to consider:

*"what would be good to do on a machine?"*

On two recent and similar projects the practice explored two different sets of working; at one site they decided to use computers exclusively for the drawing part, on the other they did the drawings of elevations and sections by hand, and the plans by machine. Their experience was that job number two was progressing faster than the first one. Still, it is believed that the need for computing is changing from project to project. As long as two different modes of practice are used, design-teams are sometimes using the electronic network for CMC of CAD-drawings, though, the advantage of being on one floor is a support for both CMC and traditional co-operation.

#### **External communication**

##### **With clients**

Originally computers were introduced to the practice in an attempt to win jobs: In order to get clients they wanted “desktop”-facilities for publishing of brochures, or prosperts:

*- "We see the role of desktop-publishing as vital in the office" [...] "We don't like the idea of standard brochures."*

Even if the practice is capable of sending drawings on-line to the clients they mostly prefer to do this by brochures. A number of reasons were given for this policy. Most clients did not have the necessary CAD-software to get any use out of an on-line CAD-transaction. Another reason was the doubted usability of CMC of architectural drawings. At one occasion the company was asked to send their new CAD-drawings to their client every week during the project period. There was no real inter-active communication taking place, and when announcing that drawings would be sent on-line only when requested, the client stopped asking for it. From there on communication was maintained by phone and meetings.

The experience from on-line-correspondence with clients has made the company stick to brochures developed on their workstations. In addition they believe that there are qualities to traditional drawings that not can be represented in CAD: Even if CAD-drawings (2D and 3D) sent on-line opens the possibility for inter-action in the design-process with the client, this does not happen because the drawings are not sufficiently "inter-active". According to the IT-manager traditional drawings communicate better with the client:

*- "If you do hard-drawings on the top there is a lot more imagining left - more skills."*

It was also argued that a CAD-drawing can contain *to* much information:

*-“the client doesn't need all these details.”*

**With consultants/collaborators**

A benefit from electronic exchange of design-information has been experienced in the relation with service- and structural-engineers: The engineers can receive the structural-drawings from the architects, make them appear on their own computers, and then do the calculations and other work required. The exchange of information externally is therefore considered as improved by the introduction of CMC to the office. However, the practice has experienced many obstacles to this kind of information sharing, mainly related to problems of different formats and lack of compatibility. In fact, they have closed down the ISDN-line they used to rent because they felt that the expenses of having it did not pay off: According to the manager it sometimes took hours to set it up, and hence caused economic losses:

*-«To kickstart a project this is find, but when they (the engineers) send it back with some changes -because you are using different software it takes you a couple of hours to set it up and send it to them. It chrashes the machine several times.»*

In general, the practice does not want to spend to much time solving problems in relation to ICT and CMC. Rather than working hours to be able to transfer a drawing electronically, they try other solutions:

*-“We try it once. If it doesn't work it doesn't work.”*

The solution they mostly prefer today is to "burn" information on drawings on their own CD's, and send these by ordinary mail to their collaborators. (*-“Drawings are to big for*

*floppy[disc]'s these days.*") Even if using mail can cause a few days delay, it is not considered a major problem.

There is however another concern in relation to electronic information-sharing between the practice and professionals that causes unagreement, and in the end, obstructs compatibility and cooperation:

*"There is almost a written belief from the consultants that they will be sent information on desk for them to read. Service and construction consultants assume that they will be sent information, that they normally receive as drawings, on computer, so they can take the information and not have to draw the building.[...] And there is nothing written in any agreement between you. In terms of capital investment this is a huge saving to them."*

#### **Expectations in Edward Cullinan**

The architects in the company were increasingly using computers for drawings, calculations, desk-top-publishing, word-processing (much work that previously was left for secretaries were now done by the architects themselves), and information-sharing. Even if it was denied that the company had any particular "policy" towards ICT, the practice of "trial and error" was apparent. Their experience was clearly that; *"Computers doesn't always work"* but that they often are useful tools for the architect. To solve the problem of compatibility was considered as essential for the future development of CMC, but it was not expected to happen yet.<sup>15</sup>

The practice still believe in the importance of sharing the same office-space to maintain important communication in the design-teams. Despite the experienced compatibility-problems and lack of economic benefit from the information exchange with external collaborators, and clients not being ready for electronically mediated design, the practice still see the importance of being competent on IT. Even if the practice does not want to push a “high-tech”-image, and not necessarily use their computer-facilities in all commissions, it still seems to be important for the managers to offer a “state of the art” solution for their collaborators. And since consultants prefer to be sent information this way, information technologies can not be neglected.

Despite the recognised consequences on architecture communication, the IT-manager was reluctant to credit any *direct* influence on the development of architectural design from new information and communication technologies. Even if there is a increased recognition of the importance of communication with the client and the contractors in doing a architecture project, the manager here did *not* find that information and communication technology is influencing architectural design.

The manager went as far as definitively denying "influence":

*- "In our office [...] the design-philosophy is not inhibited by technology - ever."*

Still, it was argued that some changes had been made possible by the technology:

*- "You do things that you wouldn't have done if you had hand-drawn it" and* -

*- "We now have a built up library of specifications that we can use."*

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<sup>15</sup> Also, the monopoly situation for one software-developer was regarded as bad for prices as well as the

-“We tend to work with larger buildings now”.

## **Boots**

*The second practice considered in this study is not primarily an architecture company, but it is an architecture practice within the Nottingham based retails-company Boots. The company has ca. 1300 outlets for it's products throughout Britain. The stores range in size from less than 50 to several thousand square-meters, and Boots is very often performing the design/drawing part of the construction project themselves. The stores often have to be (re)built to fit the requirements of Boots, and it is the commission of the architecture-department to re-design the stores.*

In this practice, people from three different departments were interviewed: CAD-drawing, Design-Standards, and Information Support.

### **Strategy**

For the design of the stores the firm has employed ca. 50 people managing or working on CAD-design, all working at one floor in one of several sites of the organisation. At another floor some more than twenty people are working on "design-standards" used for the models in the CAD-design. These are standard sets of components/modules used as a basis for the modelling of seven different standards of stores. In addition there is a separate Information Support (IS) -group developing and maintaining the IT for the CAD-work. Today the major part of the architectural design-work in the company is done on CAD-machines. Only a few drawing boards are kept in the office, among a large number of workstations, printers and plotters. Each of the architects has their own workstation. The traditional drawing-facilities are not used under normal circumstances.

### **"Design standards"**

The architects are now using "design-standards" in their work, which have been developed and reassessed during the last eight years. The idea is to have a *library of bits/modules*, which is used in the seven models of standard-stores drawn by the CAD-department. Even if they have decided to have seven standard sizes on their stores, this does not mean that they all are going to be the same. It is the size of the stores that restrict the possibilities of interior-solutions, and the models are used as guidelines for what should be in a store, e.g. space for desks and rest room for the employees. The "bits" can for example be electronic components, furniture etc. When changes are done regularly four times a year due to seasonal changes, standards are making it easier for the company to equip all their stores at the same time.

### **Internal communication**

At the time of the interviews, the company had had their CAD-information sent on the same network as other text-information for two months. This meant that the architecture-departments' drawings from now on were potentially available on-line also for other interested people within this big organisation. The drawings could for example be used to visualise a new store and let people from other parts of the organisation come up with suggestions to them. It was suggested that "business people" within the unit also wanted to have access to the CAD-data.

The convergence of word-processing and CAD is part of the company's strategy towards increasing information sharing in the organisation, by making all information available in a shared network. Data storage-space is purchased from an Internet provider, and the program Lotus Notes is used for communication between the offices. Originally CAD and other parts of computer processing were run on two separate networks, but now they are on the same network making it easier to do overlaps of information between the departments, e.g. bringing a CAD-drawing into a text-file, and vice versa.

### **External communication**

At Boots they did not have any external client to take into account. Having a more stabile "client" internally in the company, their drawings could, after the convergence of the CAD-machines and the rest of the network in the organisation, less problematically be communicated to management and other divisions in the company. Still, the architects emphasised the importance of actually having a shared understanding of the design-representations *before* communicating CAD-design. In the same way as traditional

drawings may need explanation for someone outside architecture-practice, the computer-mediated drawings also needed explanation. Textual explanations were therefore added to some of the drawings to ease the communication.

**Communication with contractors/collaborators**

During the last years the amount of work (measured by revenue) has more than doubled within the department. Despite this, the number of people working within the department has dropped by two-thirds. This is due to a larger utilisation of external contractors. ISDN-lines have been applied successfully for two years and are considered very useful for the company:

*- "There is a very high level of data-exchange between us and them, and that's why we are really trying to get to the ISDN-side".*

But, even if the company now has rented ISDN-lines and is capable of converting information from other systems, "hard copy's" are still used frequently. They generally use hard copies sent in from outside:

*- "Now the company wants to get the outside people to do it the way we want to do it -to make our life easier."*

Because of the size and importance of the company they are able to force their contractors to use compatible IT solutions. Response from contractors is expected to be in the same format as drawings were initially sent in. Sometimes «*they preferred to say*»:

*- "This is what we decided, if you want to work for us you do it like this."*

One reason for pushing contractors into sending information on-line is the time saving made. According to a interviewee at the Design Standards department, it takes days to get a hard copy through the mail, while on-line information arrives within five minutes. In addition communication of the design-representations are more difficult with hard copyies:

*"...also people's interpretations of what's on the drawings is then more difficult, because if you got the hard-copy going through the post then you have to ring them up or write them a letter to find out what they actually mean about some area which you are not quite certain of the representation of, whereas electronically we can look at the screen, they can look at the screen, and talk through it over phone."*

#### **Expectations in Boots**

There were basically two ways for the people developing design standards to enable information sharing:

- To design standards and give these to the contractors:

*"Because we know that we will use them [the particular drawings], we generate those on the standards -and then people go into those, open that particular one and actually input the data directly into that."*

The "standardisation" is here used to help contractors like engineers, so that they do not have to redraft the buildings to figure the data required for their job.

- Another possibility is to make the suppliers of materials do the job. Boots encourage them to do the drawings and specifications electronically, and then download this into the CAD-system before completing the drawing of the stores.

Interestingly, implementing new ICT is also done to achieve other things than improving efficiency: At one occasion the management decided to do a “high-tech” visualisation of a project, that according to an IS-manager was done to demonstrate that they were able to do the same things as some of their most advanced competitors:

-«Once we decided to do a complete visualisation. Really we did that purely because one of our competitors were doing something. So we decided we had to be in the same area.»

For the architecture division in Boots, there seem to be a recognised need to substitute the various forms of communication used in the multi-divisional organisation with a more compatible CMC. Different departments in the company have developed different communication-strategies as the technology has been adjusted to fit purposes for different areas of work. The convergence of telecommunication and computer-technology has now made it feasible to reduce different forms of storing and communicating of information into a more unified culture based on Intranet. There was a strategy in the company to reduce the number of media devices from seven to four.

The company is “traditional” in the sense that one of its competitive advantages is its potential for large-scale and standardisation business, and the use of CAD and CMC seem to support this kind of organisation business-strategy. This does not deny the possibilities

for CAD and CMC to be important “tools” for companies that want to be small, agile and product-innovative. The example from Boots immediately illustrates that the “nature” of CMC at the moment not only supports practices that want to be small, flexible and globalised.

### **Skidmore, Owings, and Merrill -"SOM"**

*The multinational and multi-professional company Skidmore, Owings & Merrill, (SOM) represent a third kind of architecture practice. The company is doing both designing and engineering of buildings, and has become especially competent on large and difficult structures. Today the company is well established, and has been responsible for the design of many of the tallest buildings in the world.*

*The company was established during the building-boom in Chicago in the 30's and has since then opened offices in some big cities in America, Asia and Europe. The London office was established in the late 80's in relation to the building of Canary Wharf in the Docklands. SOM were responsible for the master plan of the project. At the peak of the project (the largest ever in Britain) the London office employed close to 300 people. After this major project was finished the office decreased in size, but they are now again*

*working on several medium-sized projects in London, employing approximately 75 people at the moment.*

*SOM is one of the larger practices in Britain. In addition the office is part of a trans-national organisation of offices, all working as parts of the SOM company. Today the London office is a "satellite" also doing projects in other parts of Europe, where temporary offices are set up for the construction periods.*

*In addition to the commissions undertaken in their respective cities/countries, the six offices world-wide are supporting each other with special competence. This can for example mean that the people at the London office are responsible for delivering drawings for a project, whereas people from the Chicago office give support on the drawings for the structural-engineering.*<sup>16</sup>

#### **Strategy towards internal communication**

Supporting knowledge-sharing naturally becomes an important issue in an organisation like SOM. Also, *capacity-sharing* is a competitive advantage for a company that may be facilitated by computer mediated communication. Since conjunctures may differ from continent to continent, the company may exploit its possibility to use skilled and experienced architects from other offices to support local activities in times of building-booms. This happened when Canary Wharf was constructed and the London office was set up.

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<sup>16</sup> Alan Day (1997) is using a case-study conducted in SOM's London and Chicago offices in 1994 in his analyse of architectural practices' use of IT. Where it is found useful, information is selected and cited from his study, as well as from the company's web-site on the Internet.

To maintain communication between the different offices, the company has developed a progressive strategy towards information sharing, and is now using new information technologies in all parts of the organisation to support this. Initially, the company stored large quantities of data in each of the offices. Communication between the offices was maintained by phones, fax-machines and mail only. But two and a half years ago SOM decided to open their own electronic information system. Two networks, one internal (for the London office) which is supposed to ease communication within the office, and one "Wide-Area Network" (WAN) for the global organisation. In addition, all employees have the possibility to access information from Internet and use email-facilities on workstations.

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Sharing of and working on drawings mediated by computers on the network means that changes have to be communicated to all users during the project-period. If an architect or a group of designers, working on one part of the building is making changes to the construction, this has first to be done on a separate file. The different changes can then be collected and co-ordinated by the use of reference-files that are used as the basis for the drawing. (Day, 1997, p.129)

Even if the wide-area network was established two and a half years ago, people have not started using it actively before the last twelve months:

*"Architects are a bit slow to take up IT." [...] "Implementation is more difficult on low-level than on high-level, because people [at low-level] like to do what they have always been doing".*

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<sup>17</sup> The office sometimes rent facilities for video-conferencing. For educational purposes this is regarded as useful, e.g. to assist someone in troubleshooting on a workstation. Still these facilities are seen as both to

The reluctance was understood as a consequence of problems finding measurable and convincing information proving the actual benefits of new work-practices:

*- "We are trying to find a way to quantify the rewards of IT".*

Another obstacle for information to flow easily between the offices was the difference in culture: The company has had several of the offices geographically spread for some time and each of them has developed different cultures of work in their office. Also within the four offices in USA there were big differences in work-practice and culture. The London office has been synchronised with its "mother" organisation, the Chicago office, since the beginning in the 80's. Hence, the two offices work well together.

One of the major benefits of the wide-area network is the database developed and maintained in Chicago. The Chicago office also operates the CAD-system over the network. Information about all projects is stored and made available for all offices in the organisation: *- "We are beginning to understand how powerful it (the database) can be - not to loose historical information."*

The database includes information about the organisation during projects, e.g. which people and contractors that are used. This information can be used to find the right people for new projects. A benefit of the network compared to communication by telephone or mail, is the possibility to identify and get in direct contact with persons that are able to give the information required;

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expensive (even for a big office) and not satisfactorily developed. The manager of IT sees a possibility for

*- "It does actually increase the ability to communicate with the people you need to talk to."*

Working at each side of the Atlantic ocean, the London- and the Chicago-offices have to deal with different working-hours due to the different time zones. This means that telephone-contact has been restricted to 1-2 hours per day. With the new network, people do not have to agree about the exact time for communication. The e-mail message from London will be received when the Chicago staff arrives in the morning. For an organisation communicating from two different parts of the world this had eased co-operation.

The network is also useful when projects are taking place outside the area of the six offices. Because so much information is available on the network, temporary offices can be established without too much difficulty:

*- "Nowadays it is very easy to set up a office whether it is one or ten architects - all are connected to the SOM network".*

#### **External communication**

SOM is using a CAD-software from IBM, that the company actually developed themselves in the 70's. This software responds very well to all SOM *internal* needs. A problem is however appearing when the drawings are to go to external consultants that are not using the same software. Thus, while design co-operation works fine within the organisation, the

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this to become more used within 3-4 years, "*when technology has matured*".

relation to external "third-parts" is not facilitated by the proprietary SOM-software which is not wide spread in the market.

As a response to this problem the software will be "faced-out" and substituted by another system. Even if the alternative software is considered less developed in terms of drawing-features, it is still preferable due to compatibility. Meanwhile, the solution has been to customise the system that is most widespread among collaborators.

Another problem related to using a non-market standard system, is hiring people with the knowledge of this system. In times when new employees are needed it is hard to find people outside the company with the relevant CAD-experience. For the information systems manager this was an important concern:

*- "The key for doing business is to have easy access to skilled people".*

#### **Expectations in SOM**

The transnational and multi-professionalised company SOM is possibly an example of a practice where CMC is used as a tool for increased knowledge-sharing and agility. The organisation of six offices world-wide seems to fit the requirements of CMC used internally for information and communication of knowledge that exists within the company, though are geographically spread. The company has also developed a Web-site on the Internet for presentation of their business, which indicates that they also want to exploit the possibility for Internet-based business. Their web-site present some of the big projects they have been responsible for previously, as well as those projects under development in different parts of the world at any given time.

When asked about any possible consequences of the use of CMC, some possible trends were emphasised:

- increased speed of design-processes is made possible by new technology. For example, a project manager can fly to a project meeting and by the time of his arrival the drawings for the meeting have been transferred, with all the latest specifications updated.
- Because communication is becoming easier, more people can be included in the design-process from distant places, to contribute with special skills. This will also encourage the development of special expertise.
- Better communication systems world-wide will make it easier to do projects overseas.

*"We are doing projects now where we were not able to do it before".*

Working close with the project team (physically) is emphasised as a never changing prerequisite for success. Hence, video-conferencing is not regarded as a replacement of project-meetings with the client:

*- "I don't think anybody seeing it replacing face-to-face contact".*

Clients still expect these physical meetings. There are still good reasons for people to meet during design-work:

*- "People are more mobile now anyway".*

## **Conclusion**

In this chapter I have presented three case studies from three architecture practices. The companies examined have exemplified some very different types of business-environment for architects. Cullinan is producing design-solutions which are their one and only commodity, SOM are doing both design, engineering and masterplanning, whereas the Boots-architects are using their expertise to support the construction and reconstruction of stores in their own company.

During the next chapter the findings from the three case studies will be discussed in relation to the theoretical concepts from the introduction of this paper.

## **5 Discussion: expectations, strategies, and effects**

### **Introduction**

Introductory, I stated that the convergence of computing (CAD) and telecommunication (CMC) had emerged together with an increased emphasise towards inter-activity in architecture practice. This presumption was based on findings from literature that have suggested this as a consequence of the development and deployment of new ICT's (e.g.Coyne et. al.,1998,and Mitchell, in Tan et. al., 1995). The literature points towards consequences for the communicative relationship between architects, clients, and collaborators/contractors. I wanted to find information on the *quality* of change. From the approach towards technology suggested by Grint and Woolgar, and the specific theory applied by Coyne et. al., I developed a hypothesis that I wanted to examine: *The ability of*

*CMC to reinforce inter-activity in architecture practice is dependent on the context in which it is applied.* To investigate this argument I conducted case studies in three architectural practices, which I have presented main findings from in the previous chapter. I will now analyse the findings from the case studies in regard to this hypothesis.

In the first part of this chapter I have selected illustrations from case studies to exemplify how assumptions of technological determinism regarding CMC's role for inter-activity can be dismissed. Showing how architects' practice of CMC is affected by flexible contexts, the examples are able to confirm how external influences are constituting for the effects of technology implementation. In the second part I will present the analyses made due to the concept «disclosure» and suggest «an image-enhancing role of technology».

## **Increased inter-activity?**

### **CMC between architects**

In the first category of communication, I examined communicative relations between architects internally within single- or multiple distributed offices. My intention was to find out how the practices used and experienced CMC technology in their office(s). I wanted to examine the notion of Virtual Design Studios suggested e. g. by Andy Pressman. The experience made from SOM verifies that Virtual Design Studios have a position in today's architecture market. The organisation of SOM was indeed distributed world-wide, with different offices co-operating on projects developing all over the world. According to the IT-manager in London, their new Wide-Area-Network made it possible for them to communicate irrespective of the time-difference between Europe and USA, since

communication through computers did not require that the architects were present at the same time in the offices. The network also made it possible for them to set up temporary offices anywhere, not dependent on special physical requirements for office-space. Instead of bringing a lot of information to the site, the architects now could download this information from the common network, or ask directly the relevant person at any given office.

In terms of competitiveness, the organisation exemplifies how distributed architecture offices world-wide actually are capable of exploiting the potential Pressman has suggested. For example, while there has been a relative recession in the construction and architecture - business in USA and many parts of Europe, this has not meant that the offices has been unemployed in accordance with this. The relative building-boom in Asia has requested the services of experienced practices like SOM, and kept offices in USA and Europe supporting their Asia office.

Still, this observation does not necessarily bear witness of increased competitiveness due to CMC and inter-activity. Like Pressman, Coyne et. al. stress that a development of “globalsation” is evident in architecture practice today. While Coyne et. al. suggest an increased internationalisation of the architecture market, even for small practices, it is emphasised that this change has been evident for some time, also *before* the introduction of CMC technologies.

The traditional organisation of the construction industry, where temporary coalitions of firms come together to work on a project and then disband, exemplifies that architecture practice already is a profession characterised by great flexibility. Markets were

increasingly becoming bigger also before the emergence of CMC, when other information technologies were taking care of communication world-wide. According to a practitioner in the survey of Coyne et. al. "the fax machine was the most significant technology in that regard" (Coyne et al, 1998, p.14). The suggestion from Coyne et. al. is that: "It seems that CMC enables firms of any size to participate in this restructuring rather than wait to be swept along by it's tide." (Coyne, 1998, p.15).

It should be noticed that SOM also previous to the introduction of CMC was an organisation working globally. At the time when the London office was set up, the WAN was not established yet, but the company was still dependent on telecommunication like telephones and fax-machines. There is therefore no reason to emphasise the presence of CMC for the establishing of the London office. Instead, the fact that SOM wanted to establish in London due to the market there, should be noticed.

While Pressman argues that the development of IT will cause the architecture practices to re-organise (Pressman, p.15), Coyne et. al. emphasises that CMC is a tool in the restructuring of practice caused by the market (Coyne et. al. p.15-19). The difference between the two illustrates how consequences of technology are explained either by internal technical capacities or by referring to the external factors like the market.

The example from SOM illustrated how a practice not necessarily is reshaped by deploying a technological solution: SOM were not forced to reconstruct their organisation due to the technology. Instead the company had chosen a international arena for their services at an earlier moment, and the deployment of their WAN is a step in the development of their organisation structure. It is therefore misguiding to see CMC as the direct source for their

organisational behaviour in this regard. While CMC certainly seem to be supporting their strategy of globalisation, it is important not to regard this specific technology as determinative for their behaviour. It can of course be useful to see the development of the company in relation to the development of ICT during their whole history, and then argue that such a company would not have been existent if the technological development had not been sufficiently supporting inter-activity. This is an argument I will not deny, rather this can be seen as illustrative of the indeterminate relationship between technological development and organisational change.

On the other hand, most practices are still small organisations fighting to survive the ups and downs in the building market, locally, or at a national level. The example from Edward Cullinan illustrates an organisation that, though it has had the technology of CMC and CAD, seem to prefer some of the possibilities offered by traditional communication facilities. In this practice it was expressed as important for the architects to be able to meet physically during the design-process, and the relocation into one floor (after being separated on two for a while) was done to please this requirement.

While competitiveness arguably always has been of major interest for the architects, *compatibility* seems at first sight to be an issue related to purely technological requirements. In terms of compatibility a restructuring of practice seem to be dependent on many external factors to the technological solutions offered. While those producers promoting their communication solution emphasises the impact of their product on organisation, inter-activity and compatibility, the examples from practice here indicates that some other conditions has to be present for the effect to appear.

The example from SOM is illustrative: When architects are going to co-operate overseas, it is crucial that there is a common culture between the architects established before CMC takes place. This culture was established with the Chicago office when the London office was set up, and has, according to the London manager, been decisive for the co-operation between those two offices. Also, according to Pressman (1996): "At its core, the virtual office is held together by both the common sense of purpose and the mutual trust and competence of its members."

The importance of the social dimension was also illustrated by the strategic move made by Edward Cullinan Architects. Not being satisfied with working on two floors after a building boom they decided to reduce staff to be able to fit on one single floor. According to the IT-manager here this was done to be able to communicate better, despite intranet possibilities.

In Boots the architects also stressed the importance of actually being able to communicate face to face. Though they used text to accompany graphics this was not enough if the architects had different experience in illustrative language. Again the common culture seemed to be crucial for good communication.

What these examples illustrate is the importance of understanding representations in a distributed environment. While "technical" compatibility can be solved by agreeing on compatible standards for graphics, the understanding of these standards are reliant on social agreement in the profession. These conditions are examples on external influences that seem to be affecting the technology, and indicating that the technology not is

determining. They also illustrate that compatibility not is a matter of technological solutions, but just as much a result of social factors. At the moment neither technical standards nor «global» agreements on representation is established, and it is therefore problematic to expect architects to localise unaffected by these requirements.

### **CMC in relation to clients**

In the last section I gave examples on how different practices applied CMC-technology in different ways in accordance with their organisation and work practice. I also pointed to non-technical factors that affected the technology's ability to "work", in terms of common culture and shared understanding of representations. While these were examples of how CMC was affected due to different requirements of internal communication, I will now suggest some examples of requirements of external communication affecting the introduction of CMC into practice.

According to the Spectrum Strategy Consultants report quoted from in the introduction, a major benefit from information technologies is the flexibility and efficiency networking of software enabled. The experience of this kind of communication in the case studies is generally in opposition to this claim. Neither from Cullinan nor from SOM I was given confirmation of increased efficiency, flexibility, or inter-activity. To the contrary, I have found that CMC with clients so far had not been very successful.

In Edward Cullinan Architects the argumentation for the failure of CMC in regard to clients was of two types. First of all, most clients did not have the necessary software or hardware to be able to download big graphical data transferred by electronic networks. This is of course a banal explanation of how inter-activity in regard to clients were not supported by CMC, though it was obviously of great importance for the practice.

Secondly, according to the IT-manager, those clients who were able to download this kind of information electronically did not understand the drawings. The representations used in CAD-format were not sufficiently "inter-active", the clients did not understand the information, and could therefore not respond to it in a rewarding manner. The practice did not offer CMC of drawings to their clients anymore, but trusted brochures as a better solution for the communication.

In SOM the client requirements were seen as unsolvable by CMC. The physical models used to show the clients their ideas were seen as superior to the any 2D or 3D virtual models. The clients were also expecting that discussion and contracting would be done in physical meetings.

While Boots did not have an external client, the two other cases illustrates some of the problems that practices may experience with CMC. They exemplify what kind of obstructions and restrictions that affect the possibility for CMC to become successful in this relationship. Also, they are examples of how expectations of inter-activity not is describing for all practices. The description of "efficiency" and "reward" made e.g. in the Spectrum report seem to be in contrast to the explanations given by the IT-managers in these examples. At least it does not seem to be capacities to CMC that leads to a higher

level of inter-activity as a consequence of improved communication. Rather, it looks like the designers of the technology is not sufficiently taking care of the requirements that have been established through the practice of contracting/constructing meetings in the past.

This exemplifies why professional requirements from architectural practice has to be taken into account when CMC/ICT solutions are designed. When both architects and clients agree on a traditional way of communicating through the design process, the technological solutions offered as an alternative can be turned down.

In terms of technological determinism the examples are interesting as they illustrate how practices are experiencing and noticing problems of CMC that normally is not reflected upon in case-studies used by ICT-vendors and the architecture companies themselves.

### **CMC in relation to contractors/collaborators**

Architects are extensively depending on collaborators and contractors that are able and willing to do their part of the construction process from idea to completed building. Requirements from engineers have always been a factor that architecture practices has had to take into account.

The smallest of the practices examined had made an interesting experience in this regard: According to the IT-manager in Edward Cullinan the computer mediated communication of CAD drawings had affected the relationship between engineers and architects due to a changed role of the drawing. Traditionally there had been a relatively sharp distinction between the design-work of the architects, and the engineering-work of the engineers. By making the drawings available on an electronic network, architectural-drawings have

suddenly a different use for the engineers. While the architects' drawing previously had to be re-drawn to fit engineering requirements, they can now be imported directly with a much higher level of accuracy and detail. Engineers and other consultants in the construction period may benefit heavily from CAD-drawings developed by the architects, especially if the drawings have been made in accordance with knowledge of physical restrictions of building-materials, from specifications made by manufacturers of steel, piping etc. This may be of great benefit for the engineers who can spend less time developing their own working drawings.

Benefits from the use of CMC do however make the interchange of documents a target for disagreements about ownership. From the architect's point of view, this means that their drawings now have become valuable, but also vulnerable to the "outside" world.

As the example from Cullinan illustrates, it is difficult to assess the "benefit-for-who?" equation related to electronic drawings. Since architects actually have to put a lot of effort into making their drawings electronically available for the engineers, they expect to get something in return. At the moment Edward Cullinan Architects did not see that value coming, and are therefore hesitating to implement and use CMC fully.

It can of course be argued that the architects will increase their possibilities to win new tenders, because they can offer this kind of information service. Arguably, the problem of measuring the value of electronic drawings can be solved. The effect of not having to redraw a building should somehow be rewarding both for the architect and the engineers, and in the end for the client who should be able to get a better result for the same price.

Still, it seems like the uncertainty of the actual value of the drawings makes it harder to exploit the potential for better collaboration between the two different professions.

It therefore seems to be a question of business that restrict the possibilities for inter-activity. While the success of CMC in relation to clients can be adjusted and increased by acquiring new "purely technological" solutions, the relationship to contractors/collaborators possibly requires a reorganisation of practice to be successful. CMC require technological compatibility like in the other relationships, and this may influence the way that practices choose their partners. IT-management in Boots explicitly said that technological ICT-compatibility was a requirement the company made when they wanted a contract done. In this sense the diversity of partners that traditionally has characterised the construction business is regulated by requirements made on technological requirements by Boots.

It can be argued that contractors/collaborators possibility to participate in tenders for Boots is restricted by these technological requirements. The size of a company like Boots makes it an important actor for contractors/collaborators to consider, and the technological requirements are a result of Boots strategy and position in the market. This example does not suggest that there is a *technological* determinism. The technological requirements are merely constitutive for a *strategy* of selecting collaborators/contractors.

### **Disclosure? An image-enhancing role of CMC for architecture practice**

So far I have discussed the notion of increased inter-activity with respect to the three categories of communication; with architects internally, and with clients, contractors/collaborators externally. I have used examples from case studies to illustrate how inter-activity is dependent on requirements from different professions, in terms of expectations of how architecture is best represented and communicated. The ability of CMC to support or improve communication that traditionally has been maintained by other media may be restricted by requirements of communication of architectural-design; The cases shows that inter-activity not necessarily is improved by the introduction of CMC, the technology currently available is not considered "sufficiently inter-active".

According to Coyne et. al. " CMC discloses the fragility of current modes of practice." (Coyne et. al, 1998, p.18). The suggestion from Grint and Woolgar was that there nothing, not even a potential, within the technology for capacities. This interpretation also finds

support in my study of architecture practice. The findings from the Edward Cullinan Architects, Boots Ltd., and Skidmore, Owings and Merrill, support this view. In accordance with the findings from the case studies I have argued that there is no reason to see inter-activity as determined by “technological” capacities in CMC. The always changing context of practice denies the possibility for technology to determine one single direction of development. The examples have indicated that different practices has different requirements and strategies, and that these are affecting the capacities of the technology to a considerable extent in terms of inter-activity.

What the findings suggest is that contexts, in terms of organisational- structure, strategy, design philosophy of the practices, is a considerable factor affecting technological capacities.

For example, I believe that Boots’ *strategy* were influencing the inter-activity provided by CMC-technology in their organisation. The already existing use of “design-standards” had originally been developed to make production of components and relocation of these more effective. The standards already introduced before the deployment of CMC makes communication of representations less difficult to maintain in a CMC environment. As a consequence, the company also see CMC as a more useful technology and strategy than e. g. Edward Cullinan Architects, whose *design philosophy* was to do “customised” solutions. Also, a pre-existing “global” *structure* of SOM is an important pre-requisite affecting the company’s success with CMC technology.

Coyne et. al also suggested that the introduction of CMC may change architecture practice, in terms of amplifying, re-defining and re-orienting aspects of practice. “Disclosure” was suggested as a term that could describe this change although staying indeterminate. In the

presentation of this concept in chapter 3 I argued that this is a interpretation of technology that can be defended if it is regarded as context-sensitive .

As the case studies also illustrates, context is flexible. Though I have suggested that there may be characteristics of this that is shared in several architecture practices. I presented some general characteristics and requirements in terms of communication, that I assumed could be found in a majority architecture practices. These assumptions is supported by the information from Coyne et. al., and Pressman. They have suggested that communication with architects, client, collaborators/contractors, has been important in relation to architectural business also before the introduction of CMC. In this sense, inter- and intra company collaboration is not *qualitatively* changed due to the convergence of single-user CAD and multi-user CMC.

The diversity of the case studies makes it difficult to verify *a* specific role for computer mediated communication in architectural practice. This was neither the intention in this study which examines *context* of CMC practice in the profession. Still, the findings suggests that ICT may constitute or «disclose» architects as practitioners, (re)defining their needs due to incentives given in a ever-changing market: If theoretical support and evidence from practice currently gives rather diversifying credence to this notion of technological capacities, why does our expectations towards technological impacts still stay so high? Investing and implementing IT is expensive, even though the price of e.g. a CAD workstation has decreased dramatically since the 70's (a single CAD machine might cost a practice 75.000 £). The costs of maintenance, up-grading and line-rental does make up a substantial part of the architecture practice' budget. So does the time spent troubleshooting and customising solutions. Still, it can be argued that even if it is problematic to

relate "effects" to technology *per se*, there is a important feature of the technology that not should be ignored: The «*image-enhancing role*» of information and communication technology Especially in «high-tech» industries (Grint and Woolgar, 1997, p. 129), technology can be useful in promotion of a company. The importance of spending money on CMC is not necessarily related to the effects expected in terms of increased inter-activity, but as a mean to promote the company with a «high-tech» image, suggesting that this is a practice with modern design-philosophy. For example, it is important for some practices to show that they have "developed an interest in IT" because this indicates an innovative and progressive strategy. So if the technological solutions not necessarily are making the services cheaper or better, the "image" of the company may be an important step towards landing a good contract.

Architects currently expect technology to become better, more adjusted to specific needs of the architecture design process, and therefore want to be ready to take advantage of the promised development. CMC is seen as very important for architects to consider, as there is now way that architecture is going to exist in the future without it. Whether it is an organisation that uses CMC for promotion only, for internal communication requirements or on demand from external professionals in the design process, it seems like architecture practices want to be competent on digitised communication. CMC is regarded as “determining” for the professions development, not because practitioners do not have the capability to, or interest in, diversifying the notion of development of technology and architecture practice, but because they seem to recognise CMC and ICT as an influential factor in terms of *competitiveness* in the further development of their profession.

## 6 Conclusion

### Summary of findings

In this examination, expectations towards increased inter- and intra company collaboration in architectural practice were a starting point for a study. The Spectrum Strategy Consultants reported that virtual reality techniques had helped architects to increase efficiency and communication in relation to clients. Also, networking of software had enabled disparate groups of professionals to communicate.

My intention was to critically examine this notion in respect to constructivist theory of technology. According to the theory of Grint and Woolgar technological determinism is an assumption that occupies many descriptions of the relationship between technology and society. To escape determinist assumptions they suggest a radical move from essentialist thinking towards a «post-essentialism» (Grint and Woolgar, 95-115). Like recent theories from comparative literature studies has suggested, there is no meaning *within* a text. Rather meaning is constituted through the readers *interpretation*. Likewise, there is no capacity within technology separated from society, the context is influencing the role of technology.

In accordance with their suggested approach, I wanted to examine how and what contexts are constituting for the role of computer mediated communication in architecture practice. I suggested: *The ability of CMC to reinforce inter-activity in architecture practice is dependent on the context in which it is applied.* To examine this hypothesis I conducted case studies in three architectural practices. In summary, the hypothesis found support in the case studies. The main finding was that architects had different experiences of inter-activity due to different *aspects of organisational contexts*. The practices experience and interpretation of CMC were that inter-activity is a question of technological compatibility. Thus, there was also a recognition of organisational differences able to support or obstruct inter-activity. The organisational contexts were:

#### **Structure**

CMC was regarded most useful for internal communication in the geographically distributed organisation of SOM. Already having offices on four continents, the practice experienced CMC as improvement in terms of communication between their offices. For them the ability to communicate effectively, despite the time-difference between continents, were increased by CMC.

#### **Strategy**

The large practice *Boots* saw CMC as most interesting in their relation with collaborators and contractors. The IT-management in the office experienced that they could make decisions on and direct requirements of compatibility in their relation to contractors/collaborators. Their pre-existing use of design-standards in CAD was also compatible with CMC and able to increase efficiency of communication within the organisation.

#### **Design philosophy**

The medium-sized Edward Cullinan Architects saw CMC as problematic for communication between architects, clients and collaborators/contractors. According to their experience, CMC did not support a one-floor practice. Clients did neither use nor need CMC of design, and economic efficiency were obstructed by increased requirements from engineers.

Although the cases are largely showing diverging use of CMC and hence support my initial hypothesis, the findings suggests that *an image-enhancing role* of CMC is an important feature of the technology within all practices studied. Whether the current technology is experienced as useful or not for representing and communicating architectural design, the incentives to take up computer mediated communication can be found in the marketplace.

#### **Additional remarks**

This thesis has been written in an exploratory spirit, without the intention of making definite conclusions towards strategy or policy. As stated in the methodology, I do not have the necessary knowledge or experience of the subject to come up with concrete recommendations for practice. Also, the conclusions I have made may be of little interest for the profession, as they do not support a specific strategy of action. A hope is though, that the theory and the approach chosen, together with the findings in the case studies, can stimulate further multi-disciplinary examination of architecture . In the end, I will therefore briefly suggest some topics that can be developed further from this paper:

Giving incentives to take up ICT, EU policy documents are supporting an image-enhancing role of technology. This may illustrate how the notions of «information society», where new ICT's are increasing inter-activity and competitiveness, also is reflected in architecture practices. Though, policy decisions are fundamentally dependent

on continuously undertaken research- and development efforts to identify requirements and consequences. This suggests that incentives given by the architectural profession can and *should* be reflected in R&D and policy making. Regarding this, more studies of architectural practice and CMC is required for development of user-friendly inter-faces (in terms of representational requirements) which is not sufficiently inter-active at the moment.

In the Forth Framework Programme of EU, support of R&D on the development of information and communication technologies has been a priority, and emphasis has been made to take into account user- and market needs to generate competitiveness in European industries. In this respect, public policy towards increased standardisation and adoption of ICT in Europe (and elsewhere) will be important for the whole construction and engineering industry. According to the examination of architectural practice made here, *Compatibility* still is as a major challenge that R&D programmes should face. What this thesis may suggest is that research and development of ICT should further focus at *standards* used in architectural representations, as they appear to be stimulating certain practice and organisational structure, though not being capable to support customised architectural design.

Within the scope of the thesis it has not been possible to examine the consequences for architectural design facilitated by this change in practice. Still, the mentioned example from the construction of the Jin Mao skyscraper in Shanghai illustrated that the organisation of architecture practice also may influence architectural design, in terms of changing the design-process and possibly the character and localisation of projects. While the examination here has illustrated how organisational context is constituting for CMC-

capacities, analyses of CMC and its role as a (re)defiant of architectural-practice and *design* seems like an interesting further development of this study.

## Bibliography

- Bell, Daniel (1974). *The Coming of Post Industrial Society*, Heinemann, London
- Bijker, W. E.(1995). *Of Bicycles, Bakelites, and Bulbs. Toward a Theory of Sociotechnical Change*. MIT Press
- Bijker W. E and Hughes, T. J. and Pinch, T.J. (1994).*The Social Construction of Technological Systems: New Directions in the Sociology of History and Technology*. Cambridge, MA, MIT
- Bijker, W. E. And Law, J. (eds.) (1992). *Shaping Technology/Building Society*. MIT Press, Cambridge Massachusetts
- Bimber, Bruce: *Three Faces of Technological Determinism*. In: Marx, Leo and Smith, Merritt R. (eds.) (1994). *Does Technology Drive History? The Dilemma of technological Determinism*. The MIT Press, Cambridge, Massachusetts, and London, England.
- Cassell, C. and Symon, G (1994): *Qualitative Methods in Organizational Research*. Sage Publications
- Cooley, Mike (1981). *Architect or Bee?* Langley Technical Services, Slough
- Coyne, R, Sudweeks, F, and Haynes, H.(1998). *CMC in Design Firms, (III)*. <http://www.caad.ed.ac.uk/~richard/ComPrac/PART3.html>
- Cross, Nigel (1977). *The Automated Architect*, Pion Limited, London
- Day, Alan (1997). *Digital Building*, Oxford, Loxton
- Grint, Keith and Woolgar, Steve (1997). *The Machine at Work. Technology Work and Organization*. Polity Press, Cambridge
- Hartley, J. F. In Cassell, C. and Symon, G (1994): *Qualitative Methods in Organizational Research*. Sage Publications

Hughes, Randall and Shapiro. *CSCW: Discipline or Paradigm? A Sociological Perspective*. Lancaster CSCW Research Centre

Latour, Bruno (1987). *Science in action*. Milton Keynes, Open University Press

Lyon, David (1988). *The Information Society*, Polity Press Blackwell, Oxford

MacCullough, Mitchell & Purcell (1990). *The Electronic Design Studio*. MIT-Press, Cambridge, MA

MacKenzie, Donald and Wajcman, Judy (eds.) (1995). *The Social Shaping of Technology*. Open University Press

Maher, M. L. ,and Saad, M. (1995). *The Experience of Virtual Design Studios at the University of Sydney*. the Key Centre for Design Computing, University of Sydney ([http://www.arch.usyd.edu.au/kcdc/design\\_studio/papers/anzasca95.html](http://www.arch.usyd.edu.au/kcdc/design_studio/papers/anzasca95.html))

Mansell, R. and Silverstone, R. (eds.) (1996) *Communication by Design, The politics of the Information and Communication Technologies*, Oxford, OUP

Marx, Leo and Smith, Merritt R. (eds.) (1994). *Does Technology Drive History? The Dilemma of technological Determinism*. The MIT Press, Cambridge, Massachusetts, and London, England.

McKenzie, Ronald A. & Schoumacher, Bruce H.(1992). *Successful Business Plans for Architects*. McGraw-Hill inc.

Mitchell, William (1977). *Computer Aided Architectural Design*, Petrocelli/Charter, New York

Negroponte, Nicholas (1970). *The Architecture Machine*. MIT-Press

Negroponte, Nicholas (1975) *Soft Architecture Machines*. MIT-Press

Penz, Francois (1992). *Computers in Architecture*. Longman Publications.

Pressman, Andy (1996). *Professional Practice -A Compendium for Business Management Strategies in Architecture*. John Wiley & sons

R.I.B.A (1992). *Strategic Study of the Profession*, Royal Institute of British Architecture, London

Spectrum Strategy Consultants for the Department of Trade and Industry. (1996). *Development of the Information Society -An International Analysis*. Crown, Norwich

Stake, Robert. A, *In Handbook of Qualitative Research*, (1994). Sage Publications

Tan, Milton & Teh, Robert (eds.) (1995). *The global Design Studio* MIT-Press

The Commissions «White Paper». <http://www.ispo.cec.be/infosoc/backg/whitpaper/top.html>

The New Shorter Oxford English Dictionary (1993).

Walsh, Roy, Bruce & Potter (1992). *Winning by Design; Technology, Product Design and International Competitiveness*, Blackwell Publishers, Oxford and Massachusetts

Webster, Frank (1995 ). *Theories of the InformAtion Society*, Routledge, London & New York