The Future of Information Systems - Using Social Systems to Create Protocols for the Virtual Environment.
(Systems Analysis through Social Analysis.)

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Information is the medium for communication, power-play, politics, and the building block for knowledge systems. It is associated with social interaction, and can be mediated by technology use.

This paper argues that the key to understanding the impact of future technologies lies in the interaction between the social and technical environment. It suggests that future technologies such as Virtual Reality make necessary a move away from traditional methods of systems analysis and design. The interactive nature of such technology requires a validation in the social environment.

The paper proposes the creation of protocols (a set of universally applicable standards) for the Virtual Environment. It suggests that Information Systems are split into three Protocols: Physical, Learning, and Cultural Protocols. Finally it illustrates that their influence over each other can be understood by applying Structuration Theory.

Introduction

"Because of its potential to change us as humans, as communities, as democracies, we need to try to understand the nature of CMC, cyberspace, and virtual communities in every important context - politically, economically, socially, cognitively". (Rheingold, 1995)

The World Wide Web, the Internet, and technologies such as Virtual Reality[+] , represent the future of Information Technology (IT); their interactive nature, make possible social contact across the boundaries of space and time. Daily, we hear of more new terms springing from this technology: 'Virtual Communities', 'Cyber Punks', and 'Surfing the Net'. New terminologies for a new society.

Virtual technologies are reminiscent of philosopher Baudrillard's "Simulacrum", a universal reality where the border between artefact and reality has vanished. As such these technologies require a new approach to understanding and building the systems needed to support, what is essentially, a new social phenomenon.

Current analysis and design methods, based on specified logical and sequential processing, lack the flexibility and dynamics for understanding this technology. This paper builds on social theory as a basis for developing a new systems and design methodology for such technologies. It argues that the key to achieving this lies in an understanding of the relevance of information in both the social, and the technical, system.

Background: The business of virtual reality

Tenbruck (Tenbruck, 1989) suggests that today's society is constantly in the process of "producing a new and partial reality" that forces people to keep up with the flow of cultural production. These new realities are the result of media manipulation and aggressive marketing of information that encourage people towards a consumer society. Virtual systems are being hailed as the new tool in the evolution of the

modern business organisation and its associated information systems.

This increased interest in new technology has resulted from a paradigm shift over the last two decades that has emphasised the use and manipulation of technology within the commercial environment. Sociologist Bruno Latour (Latour, 1995) suggests that "It is no longer clear if a computer system is a limited form of organisation, or if an organisation is an expanded form of computer system".

Another stimulus for the creation of 'The Virtual Organisation' is the increasing recognition that, for certain types of work, the Fordist principles of mass production have resulted in a decrease in employee satisfaction and efficiency - a phenomenon described by Peter Drucker as far back as 1951 (Drucker, 1951).

Drucker stipulates that industrialisation destroys the prestige of individuals in traditional work. It has long been argued that new forms of communications technologies have the potential to reverse this trend. For example, Iyenger (Iyenger, 1972) states that technology is "causing an implosion forcing people back together in tribal unity".

McHale (McHale, 1972) provides another perspective on how technology has affected the social environment. He states "(besides the enlargement of the physical world now available to our experience, these media (newspapers, television, and radio), virtually extend our physical images of the world for our daily appraisal. They provide psychical mobility for the greater mass of our citizens. Through these devices we can telescope time, move through history, and span the world in a great variety of unprecedented ways". McLuhan's vision of the "Global Village" (McLuhan, 1989) is now, for some, a reality thanks to the information highways of the Internet.

Information: The gate between two worlds

Information interaction between the social and the technological world can be represented by the image of a mirror. We shall call this the Socio-Technical mirror. Information interchange in both environments share many identical traits. One may be considered to be a mirror image of the other, although there are subtle differences that exist in these opposing systems.

At the most basic level, both environments use various tools to represent information (such as language, symbols, pictures, icons, etc). These are tools that reflect or model real life events and environments.

Information exchange in both worlds results in synergy, where the whole is more than the sum of the parts. In the social system this is achieved through group interaction and the use of shared knowledge. In the technical system, this occurs when data is aggregated and transformed to new data that is then networked and exchanged.

Technical systems have never been able to mirror the social world accurately or completely. The technical system is simply a repository and converter of data that is only given form and meaning through the user. It is people who create knowledge systems (Walsh, 1995) and information from that data. Technical environments lack the framework, based upon a socially derived consensus, required to give the data the form and meaning that it has in the social world.

Virtual information environments (such as E-mail, and the Internet) may represent a departure from this. They have shown themselves to be capable of evolving beyond their original technical specification. ARPANET, the ancestor of the Internet was never conceived as a medium for virtual communities, and yet, today the Internet has grown into an environment that support MUDS and MOOS[*].

Traditional systems analysis and design methods were never designed to support the 'soft' issues of information that relate to the social environment, such as power, meaning and control.

How can we address these issues? The answer is with information itself. Information is neither objective (as traditionally extolled in Systems Design) nor completely subjective. Information is instead inter-subjective: common meaning can be extracted through shared action and culture (Mingers, 1995) as happens with virtual communities.

Socially formed information systems (knowledge), and IT systems such as Virtual Information Systems, share the commonality of information. Socially based knowledge systems are created by social interaction, but can often be influenced by the technology that mediates this process. Conversely, Virtual Information Systems, such as virtual communities, are created in artificial environments but are influenced by the social norms that mediate social interaction.

Using social systems to create protocols for the virtual environment

Traditional systems analysis and design methods such as SSADM, IE, Yourdon and other Structured Methods, take into consideration some of the social or 'soft' issues involved in new systems development. However, they more than often fail to adequately make the connection between the technical and social aspects of information, its role and its subsequent use. These methods follow techniques that eliminate or distance soft aspects of information, in a bid to delayer 'fuzzy' issues for clear and systematic analysis. Gibbons et al (Gibbons, 1994) provide an appropriate summary.
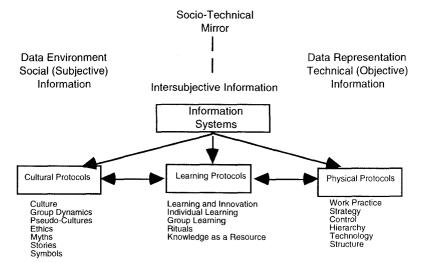
"Systems models imply greater stability in the relationship between actors than is justified given what we know of distributed knowledge production. More helpful descriptions could be worked out by trying to develop models that incorporate the evolution of patterns of interconnections; the ability to establish, on a recurrent basis, new modes of exchange _"

This section provides, in outline, a methodology that moves away from traditional systems analysis and design methods. As with 'soft systems' methods there is a shift in emphasis towards social context to achieve systems optimisation. This methodology reflects a structure that places equal weighting on social and technical structure. It recognises the inter-subjective nature of information as the dominant form of information exchange in the organisation and the environment at large.

Previously, this paper identified that information systems can be categorised with both social and technical systems. It has suggested that the new forum for this convergence is fast becoming the Virtual Information System. Therefore, it follows, that a medium is required to facilitate the transition of information systems between the technical and social worlds. The authors suggest that this may take the form of Protocols based on social theories. Protocols, are used in the sense of 'fixed rules of accepted behaviour used by agents'.

It is proposed that Information Systems are split into three Protocols: Physical Protocols, Learning Protocols, and Cultural Protocols. We believe that classic approaches, do not go far enough in taking into consideration the various social and psychological factors that make up the decision making process of individuals. Understanding these factors will make for a better 'fit' or interface between systems design and human interface.

The diagram below illustrates some of the factors that may be included under these headings. The list is by no means complete.

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                          Socio-Technical
                              Mirror
                                |
  Data Environment             |            Data Representation
  Social (Subjective)          |            Technical (Objective)
     Information     Intersubjective Information    Information

                       ┌─────────────────┐
                       │  Information     │
                       │  Systems         │
                       └─────────────────┘

┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│ Cultural Protocols│◄─►│ Learning Protocols│◄─►│ Physical Protocols│
└──────────────────┘   └──────────────────┘   └──────────────────┘

  Culture              Learning and Innovation    Work Practice
  Group Dynamics       Individual Learning        Strategy
  Pseudo-Cultures      Group Learning             Control
  Ethics               Rituals                    Hierarchy
  Myths                Knowledge as a Resource     Technology
  Stories                                         Structure
  Symbols
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A Mirror Representation of Information Systems in the Social and Technical Environment

These protocols are clearly inter-related both on a micro and macro level. Their influence on each other can be understood by applying Structuration Theory (Giddens, 1984), (Orlikowski, 1992).

There are several reasons for using Structuration theory. Firstly it enables the flexible interaction of social theories with other theoretical approaches. It builds on the relationship between human interaction, social action and social structure, and illustrates the relationships and cause/effects that these factors have on one another.

In this sense, Structuration Theory has proved to be a useful medium for understanding Socio-technical systems. It has been applied to Information systems interpretation by a number of authors (De Sanctis and Poole, 1994), (Orlikowski, 1992), (Walsham, 1990), (Barley, 1986), (Boland, 1985).

Orlikowski's treatment of Structuration Theory in particular takes into account the fluid and dynamic nature of VIS. Orlikowski states "rather than positing design and use of disconnected moments or stages in a technology's life-cycle, the structurational model of technology posits artefacts as potentially modifiable throughout their existence. In attempting to understand technology as continually socially and physically constructed, it is useful to discriminate analytically between human action that affects technology and that which is affected by technology" (Orlikowski, 1992).

Conclusions

Virtual environments have a greater potential to narrow the divide that currently exists between Individual and machine. It is a technology that is offering a new reality. It represents the coming together of two opposing worlds: that of the technical and the social.

Virtual Technologies will, in the same way as the personal computer, play out their future social position in the organisation. As company structures change and adapt in a quest for perfection, profit and globalisation it may prove that this technology is the key to achieving these aims. Virtual systems however are in their infancy and as such

require a framework for application and use. This can only be achieved through appreciating the nature of information and the interaction between the social and the technical world.

It involves recognising information is more than an interface for conveying meaning: that it has significances attributed by the users of the information and that these come about through shared action and culture.

The use of a set of universally applicable standards, or protocols that are formed from critical aspects of the social and technical worlds may be the answer to achieving greater integration between the systems. Unlike traditional systems analysis and design methodologies, these protocols will achieve more understanding of the cause and effect of human interaction, action and social structure in relation to technologically mediated information systems. We suggest that using Orlikowski's structuration model (Orlikowski, 1992) may be one way of achieving this.

We believe that such a methodology will make possible the creation of an analytical framework that is compatible with both the technological and societal domains. One that will bridge the gap between these two worlds and help create a culture that can be constantly reconfigured through continual interaction with information.

References

(Barley, 1986) Barley S R, "Technology as an occasion for Structuring, Evidence for Observations of CT Scanners and the Social Order of Radiology Departments", Administrative Science Quarterly, Volume 31, p78- 108, March 1986

(Boland, 1985) Boland R J, "Accounting and the Reproduction of Culture: Budgets and the process of Structuration", Working Paper No 1168, College of Commerce and Business Administration, University of Illinois, Urbana, 1985

(De Sanctis and Poole, 1994) De Sanctis G, and Scott Poole M, "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory", Organisation Science 5(2), p121-147, May 1994

(Drucker, 1951) Drucker P, "The New Society, The Anatomy of Industrial Order", Heinemann, 1951

(Gibbons, 1994) Gibbons M et Al, "The New Production of Knowledge - The Dynamics of Science and Research in Contempory Societies", Sage Publications, 1994

(Giddens, 1984) Giddens A, "The Constitution of Society: Outline of the Theory of Structure",University of California Press Berkley, California, 1984

(Iyenger, 1972) Iyenger M S, "Can we Transform a post industrial society?" from The Futurists, edited by Toffler A, Random House 1972

(Latour, 1995) Latour B, "Social Theory and the Study of Computerised Work Sites", p302, from Orlikowski et Al (Eds.), Information Technology and Changes in Organisational Work, Chapman and Hall, 1995

(McHale, 1972) McHale J, "The Plastic Parthenon", p52, from The Futurists, edited by Toffler A, Random House 1972

(McLuhan, 1989) McLuhan M and Powers B R, "The Global Village, Transformations in World Life and Media in the 21st Century", Oxford University Press, 1989

(Mingers, 1995) Mingers J C, "Information and Meaning: Foundations for an Inter-subjective Account", Information Systems, (5), p285-306, June 1995

(Orlikowski, 1992) Orlikowski W, The Duality of Technology, "Rethinking the concept of Technology in Organisations", Organisation Science 3(3), p398- 427, 1992

(Rheingold, 1995) Rheingold H, "The Virtual Community", Minerva, 1995, p15.

(Tenbruck, 1989) Tenbruck F, "The Cultural Foundations of Society", p29, in Social Structure and Culture, De Gruyter, 1989

(Walsh, 1995) Walsh J P, "Managerial and Organisational Cognition: Notes from a trip down Memory Lane", p281, Organization Science Vol 16, No 3, May/June 1995

(Walsham, 1990) Walsham G, Han CK, "Structuration Theory and Information Systems Research", 10th Internal Conference on Information Systems, p53- 59, 1990

+ Virtual Reality Systems, including Virtual Information Systems (VIS) such as E-mail, increase interaction. They are a medium that allows more flexibility and makes possible representation of real life systems. For example, E-mail is an enhanced conversational medium that approximates the informality of everyday speech. Theoretically Virtual environments have the potential to enable people to interact within virtual worlds, outside the confines of time, space and social conformity.

* MUDs - Multi-User Dungeons, and MOOs - Multi User Object Orientated - textually created virtual worlds that simulate social communities.