From Social Machine to Social Commodity:
Redefining the concept of social machine as a precursor to creating new web development approaches

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ABSTRACT

This poster critically examines the concept of a social machine and redefines it in environmental terms as a social commodity designed as an intervention in the web ecosystem. Its effectiveness will depend on the predictions and understanding of the social and technical environment it is placed it. Study of the concept of the social machine clears the way for gaining an understanding of the social construct which is critical for web development. The nature of the social construct in web development in web science is discussed using analogies from environmental science and some areas in need of research are suggested.

Categories and Subject Descriptors
D.2.10 [**Design**]: Methodologies

General Terms
Management, ,Design,

Keywords
Web Science, Web Development, Social Machines

1. INTRODUCTION

Hendler et al (2008) outline a new approach to web development. In doing so they define several new concepts which need to be understood by developers and for which methods and tools are needed in order to implement them. Three concepts need further research. The concept of a social machine, the focus of this poster, suggests an amalgam of technical artifacts, culture and organization working together to drive a social system. The second is a social construct, defined as part of the development process; and the third is the transition from a web system developed in the micro to its global use in the macro.

Our first set of questions centre around the social construct. What is the social construct? What does it represent? What does it contain? How do we build a model of the social construct? How do we represent it? How does it fit into the web design process? How does it influence the physical outputs of web development?

Early web development according to Hendler et al (2008) involves the development of a system in the micro. The application is tested on a limited group of people and design changes are made as a result of testing basically in the manner of any well-bounded system. However, Hendler et al contrast micro development with the macro effects of the release of an application onto the web. Here 'something happens' and the limited micro application usage spreads in the macro, becoming 'viral', spreading its use across the web.

In a macro application emergent effects occur. This may involve unpredictable social and ethical effects, unexpected usage and unpredicted influences on society and economics. This leap into the dark from a controlled micro application, tested on a small group of users and having predictable behaviour, to an uncontrolled viral application, producing emergent effects, leads to a strategy of 'hoping for the best'. Such an approach is clearly inadequate.

The interaction between the micro system and the macro web results in a social machine. A web system is developed in the micro with an intended macro effect. But there is currently little way of knowing whether that macro effect will be achieved. Our second set of questions, in understanding web development as part of web science, centres round the transition from micro to macro. What is the nature of the gap between micro and macro? Can emergent effects in anyway be predicted and designed for? How do we understand the nature of application adoption across the web? Are we at the mercy of a fickle public like book publishers or movie distributors with no more than a hunch of what will work and what will be the difference between millions of sales and no sales? Or is there something more predictable?

Hendler et al (2008) are clear that a number of disciplines need to be brought to bear on this problem as part of web science. But which disciplines and how?

A social machine is the combination of technology, rules, policies and organisational structures which drive or manage a social system. Hendler et al (2008) state that, "*Given that the success or failure of Web technologies often seems to rely on these social features, the ability to engineer successful applications requires a better understanding of the features and functions of the social aspects of the system*". They ask how we would create social machines. However, they are not clear on the nature of a social

machine and how it drives a social system. Do social machines exist? What are the constituents of a social machine and how are they bound together?

If we are to develop new approaches to web development that resonate with the structure and function of the web, we must understand the nature of social machines, and the nature of the social construct.

This poster develops understanding of the social machine, the social construct and the gap between micro and macro as a prerequisite to further research which will enable the design of new web development approaches; a clear goal of web science.

Given that so much is invested into web applications, a 'hope for the best ' strategy is inappropriate. Research into social machines and the social constructs behind them will lay foundations for developing new approaches to web development.

2. THEORETICAL APPROACHES TO SOCIAL MACHINES

In order to identify the characteristics of a social machine, we must examine the possible theoretical models that it could be based on. Four approaches are examined below.

Technological Determinism. Suggests that the implementation or installation of ICT will directly cause social change. An implementation of a system will change people's behaviour. Technological determinism defines clear boundaries between the technical and the social. The technical drives the social. Hence implementations of web systems will directly change social behaviour. This is clearly not the case in web-based systems since acceptance of a web application, and its structure and configuration are affected by how people used it. However, technological determinism may be implied in the concept of a social machine.

Social informatics. The view of social informatics is that the social and the technical influence each other. The social will equally affect the technology. There was a clear identification that the social context mattered. The work of Kling established the importance not only of studying the social context in organisations but of considering ICT as a commodity, bought by the public. However, such a view considers there to be strong divisions between the technology and the social. One possible approach is to view the development of the social and the technical as a process of co-evolution, where each has an effect on the other.

Actor-Network. The application of actor-network theory in information systems, and hence it applicability to web science, raise the technology to the same status as the social. The ICT itself can be considered as an actor, with its own interests and influencing people. Both the technology and the people are parts of actor-networks which give meaning to the technology through the way in which the interests of the various actors and the technology are aligned by the translation of the goals of actors into the goals of the network. Actor-network theory underlines the importance of the interaction between the technology and the people but still retains their separation.

Sociomateriality challenges the social / technical division and suggests that the society and the technology are entangled. The social and the material are constitutively entangled in everyday life. (Orlikowski, 2009). Yoo (2010) suggests a framework that

has not just artefacts, but space, actors and time. The social and the technical are viewed as a seamless tapestry.

I do not think that any of these approaches are adequate for developing a web science understanding of how web-based applications flourish or fail on the web and hence for overcoming our fatalistic 'hoping for the best' A technical artifact may not determine behaviour of social systems. Social informatics is valuable in pointing to the importance of social context and technology as a commodity. While actor network theory provides some good ideas for understanding the how acceptance of technology spreads within a social network, I am not convinced that raising the status of the technology to equality with the human actors gives a true picture of the role of technology. The entanglement of the social and the technical offered by socio materiality is an important sensitising concept, but despite this entanglement, analysis requires some separation between the social and the technical n order to design the web application.

3. CRITIQUE OF THE CONCEPT OF THE SOCIAL MACHINE

So what are we to make of the social machine as suggested by Hendler et al (2008)? It combines artifacts and institutions to produce a social technical machine which then drives a social system on the web. The ideas of machine and engineering suggest the management and control of social systems by design, and by reproducible, technically definable mechanisms. But to what extent is this true?

The metaphor of a machine carries with it ideas of managerial control where through rewards and penalties control of a group of people – usually employees can be regulated. It carries with it also the idea of regularity and repeatability. In pursuing the idea of a social machine we are suggesting that interactions among the people and the technology are predictable and controllable. The idea of a social machine further suggests that:

- The social system can be controlled and engineered
- There are scientifically testable solutions to understanding the behaviour of the social system.
- The design of a social machine will manage the behaviour of the social system
- Complexity can be managed and bounded such that all social effects are anticipated.
- Cause and effect clearly delineated and mathematically explained.
- Control of all variables is possible such that the social system does not encompass uncertainty.

None of these points are wholly true.

- Strategies of resistance, effects of initial conditions, and complex behavior will disrupt efforts to control.
- There will be multiple worldviews in a social system which will increase complexity.
- The complexity of the social system will lead to unpredictability and models which are inevitably incomplete.

4. FROM SOCIAL MACHINE TO SOCIAL COMMODITY

I would suggest that the idea of a social machine is flawed. Web development is more analogous to environmental engineering than machine engineering. The web as an environment contains uncertainties. Aspects of the environment may be unpredictable, and managerial control is limited by the complexity. Complex interactions of worldview and culture occur. Social alliances amongst individuals and groups are formed and dissolved dependent on agreed meaning. A vast range of purposeful activity takes place. The development of a web system is more akin to an intervention in an environment rather than the imposition of behavioural control in an organisation through the implementation of ICT.

Web developers' focus is still on designing an artifact. That artifact encodes the rule, norms, process models, policies and organisational worldviews of the institution in for which it is developed. The web developers then seek to influence the behaviour of individuals and social systems through the artifact and people's use of it.

Web development is really a social intervention which seeks to alter the digital environment by providing a new digital substrate on which a social system can grow, Hence a web-based ICT system is more like a nest-box, a dam, a redesigned pond, a hedge which is put in place to influence the ecosystem. As the intervention takes, it alters the nature of the ecosystem, and is itself altered. The intervention may be planned, with expected outcomes. But those outcomes are not guaranteed or engineerable. The outcome may be affected by shortcomings in our knowledge of the ecosystem which lead to unpredicted outcomes. It may be affected by the complexity of interactions in the ecosystem which results in emergent behavior. Outcomes are difficult to predict in an ecosystem. For example, an intervention to feed raptors so that the grouse population increases is based on predictions resulting from knowledge, but may not necessarily succeed.

Hence social machine is rather the social commodity, a technically designed intervention in the web ecosystem which changes and is changed by the web environment.

5. CHARACTERISING THE SOCIAL CONSTRUCT

If the outcome of a web development is a social commodity which becomes entangled in a social system, influencing the web ecosystem, then this leads us to consider what the social construct is. The web application is an artifact which encodes the rules, norms, culture, organization structures and business processes of the developers and their organization. It is an expression of their worldview, and an interpretation of their understanding of a social system on the web its current state and future prospects.

If an intervention, such as feeding raptors, it carried out in a biological ecosystem, it will be based on:

- Research in to the behavior of species in the ecosystem
- Previous experience and test runs of the intervention

- Simulations of the intervention
- Predictions about aspects of the environment such as weather.
- Understanding of available human and natural resources

An equivalent environmental understanding is required in web development. The design of a web intervention will need to consider the 'environmental science' of the ecosystem within which the web application is expected to thrive. The environment is social, ethical, organizational, and dependent on the rich human behavior occurring within overlapping social systems. The intervention will be based on:

- The motivations, practices and purposes (telos) of individuals in the social system.
- The affiliations mediated through norms, values and rituals.
- The ethical atmosphere of the social system.
- The meanings attributed to ideas, phenomena, activities (effectively the ontology of the social system).
- The loyalties and responsibilities accepted as part of normal behavior in the social system and derived from the history of the social system.
- The expected outcome of engaging with the web application and the value or importance attached to those outcomes, in particular the nature of the internal and external goods derived from participation in the social system and the web applications that mediate it.
- The virtues and characteristics of people participating in the social system which are particularly valued.

The social construct is not a business proposition but a science-based interpretation of the web environment in which the web application will thrive. It is to a certain extent a predictive tool. But it will also underpin the development process, providing a simulation test bed and a basis for a vision of the purpose of the web application. The social construct will also provide a tool towards the sensitizing of the web developers to the social and ethical issues surrounding the web application.

Additionally, the development of a social construct will be a key step in enabling web developers to bridge the gap between the micro and the macro. The micro can be developed using current system development methods, and testing and contact with a defined group of users. The macro requires a different approach.

The micro / macro gap is a source of ICT failure in implementation. What seems simple and straightforward in the development laboratory becomes unpredictable and complex in the web ecosystem. Failures of large scale ICT occur because many non-technical issues have not been considered. Particularly issues of acceptance of the system either socially or ethically have not been considered. Often developers do not consider the wider remit concerning the interaction of the web application with society and the nature of the entanglement of social systems with the ICT artifact that occurs once the application is implemented on the web as an intervention in the web ecosystem.

The success of the web application in the competitive environment of the web depends on the validity of the model represented by the social construct.

6. RESEARCHING THE SOCIAL CONSTRUCT

A research programme is needed in web science to understand the social construct. The following outlines some areas to be covered.

Scoping the Social Construct. A definition must be developed of the scope and content of the social construct. What aspects are considered? What areas are investigated? What concepts are developed.

Investigating the Social Construct. Guidelines must be developed concerning where evidence to support the social construct should be drawn from. An evidence-based social construct is essential, although the limitations both in completeness of evidence and in the limits to which the evidence supports predictability must be noted.

Supporting the semantics of the social construct. Since part of the social construct will be an analysis of the meanings attributed to web-based systems by a social community, definitions of ontologies may be needed to support the social construct.

Representing the social construct. The social construct must be represented in a model which combines both diagrammatic techniques and text. Systems-based diagrams such as causal maps and rich pictures may be of value.

Tool support for the social construct. There will be a need to support the development of the social construct through tools which enable the social construct to be expressed.

Ethical reflection in the social construct. Both the development and use of the social construct will require reflective practices by the developers in which the social system is considered empathically. Approaches to this need to be developed and the reasons why developers often failure to engage with the wider implications of systems development need to be understood.

Defining the process for developing the social construct. The steps by which the social construct is constructed will need to be researched, so that a usable process can be designed.

Implementation of the social construct. Incorporation of the social construct into the web application development will need research concerning how the social construct should influence the web development. In other words, how aspects of the social construct are expressed in the data and processing of the web application.

These areas will all require research to define the output and processes. And such research will probably require the application of a design science approach in order to define the social construct artifacts – tools, processes, and structures.

7. CONCLUSIONS

This poster concludes that the idea of a social machine is an inappropriate metaphor for considering a web application working in a social system. Web application development is more like environmental engineering than manufacturing engineering. A web application represents an intervention in the web environment with the aim of eliciting change in a social system. That change is based on the interpretation of the web environment by the developers affected by the goals, purpose, culture and values of the organization or community within which they work.

Hence web developers provide a social commodity which may influence a social system but will have a limited capacity to manage a social system because of the level of complexity and uncertainty involved.

Understanding that the social machine does not really exist and that we are working with a social commodity leads to an increased necessity to develop a social construct as a key driver in the web development process and a bridge between the micro and the macro.

The poster explores the analogy with biological environmental interventions to discuss the content and process of developing a web development social construct and suggests areas for research.

Finally, one way of understanding the web development social construct is to develop retrospective social constructs for existing large scale ICT web applications, in the light of knowledge of the success and failure of those applications in the macro. Such reverse development of social constructs will highlight the aspects of the social construct which, if they were understood and reflected on by developers at the time of software development, may have resulted in a more successful implementation.

One such web application is the UK NHS Choose and Book system, and research is underway to retrospectively develop a social construct for this application.

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