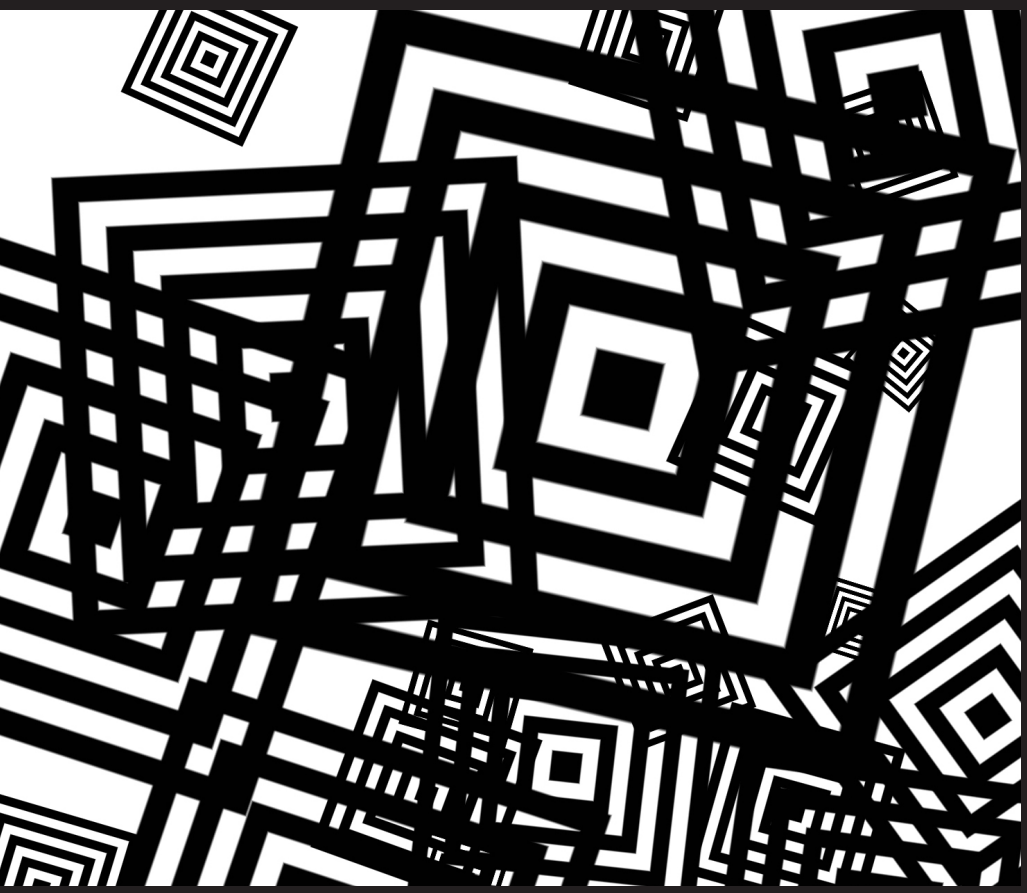
LSE Department of Management

ISSN 2042-5686 (Online)

iSCHANNEL

The Information Systems Student Journal



Volume 9
Issue 2
February 2015

ISSN 2042-5686 (Online)

iS CHANNEL

Volume 9
Issue 2 (The Quadrangular Issue)

February 2015

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ABOUT THE CONFERENCE

Quadrangular Conference on Technology, Organizations and Society 2014

Knowledge Practices in the Contemporary World - 25/26 September 2014

The Quadrangular Conference on Technology, Organizations and Society is organised jointly by the University of Cambridge, Lancaster University, University College Dublin and the London School of Economics and Political Science. The Quadrangular Conference 2014 was hosted by the Information Systems and Innovation Faculty Group at the London School of Economics and Political Science on 25th and 26th September 2014.

The event provides an exceptional opportunity for PhD students, post-doctoral candidates, and faculty to get in-depth feedback by colleagues from outside their own institution. The conference draws together a number of distinguished scholars to help novice academics at different stages of their research projects to conduct successful research and develop contributions for the disciplines of information systems and organization studies.

The theme of the Quadrangular Conference 2014 was "Knowledge Practices in the Contemporary World". We focused, as a main topic, on how organizations absorb, elaborate, and at the same time generate knowledge, in response to the opportunities and challenges of an increasingly interconnected global context. In this domain, intercultural perspectives on organizational dynamics are particularly relevant to discussion, as well as reflections on how the very concepts of knowledge generation and learning processes evolve as a result of the new globalising landscape.

The contributions for the Quadrangular Conference 2014 included the following main topics:

- Intercultural perspectives on management, information systems and organizations
- Theoretical innovation on learning and knowledge generation
- New technologies as enabling/constraining organizational practices
- Social dimensions of the development and use of ICTs in organisations
- Developing countries vs. the opportunities/ challenges of globalization
- Public management vs. the new globalizing landscape
- Sociological approaches to globalization and its consequences
- Material practices, discourses and knowledge in organizational settings

Organising Committees

The Quadrangular Conference on Technology, Organizations and Society 2014 was made possible through the combined efforts and participation of the following organising committees at the four universities:

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EDITORIAL

The Quadrangular Conference between Tradition and Innovation

It was a huge honour and pleasure for us, PhD students and junior research staff at the LSE Department of Management, to host the 7th edition of the Quadrangular Conference on Technology, Organizations and Society on 25th-26th September 2014. This edition has constituted, on the one hand, the continuation of a well-established tradition, which sees the Quadrangular Conference being hosted in turn by its four founding institutions – Lancaster University, University College Dublin, University of Cambridge, and LSE. In continuity with the past editions, the Conference has constituted a forum for research-in-progress which has provided, for the selected candidates, the opportunity to present their work in an informal environment, having the opportunity to receive very extended feedback from a wide group of fellow students and faculty. Research-in-progress is indeed the focus that marks the identity of the Quadrangular, making it a forum to share ongoing research problems as well as potential frameworks, ideas and preliminary findings.

Along with continuities, this year's Quadrangular has seen two major innovations, on which we are looking to build as the upcoming editions of the forum are organized. Firstly the Conference has seen, this year for the first time, the organization of a Post-Doc and Faculty Track, which has hosted five presentations by research fellows and young faculty – all sharing insights from their ongoing work. The organization of this track has enriched the Conference, broadening its focus from PhD students to one inclusive of a broader range of academic positions, now involved as speakers and contributors rather than just as a source of feedback. Secondly, while the organizational role has been covered by the four founding universities, participation has seen students and staff from more institutions including the University of Warwick, University of East Anglia, and Brunel University in the United Kingdom – plus international guests from Copenhagen Business School and Hanken School of Economics. This has contributed to an extremely interactive symposium, and we are looking forward to seeing a similarly heterogeneous participation in the next editions.

A third innovation, and somehow an experiment for us at iSCHANNEL, is constituted by the current Special Issue, which groups four papers from the research-in-progress contributions that the Conference has seen over its two days. A theme as that of Knowledge Practices in the Contemporary World, which has informed the symposium, lends itself to a plethora of interpretations, of which the variety in the themes of the contributions presented here is indeed representative. But the theme is, at the same time, focused enough to reflect a field like that of information systems and organizations, revealing its common denominator in a focus on how knowledge is generated, absorbed and utilized, without losing sight of the opportunities and challenges presented by an increasingly interconnected global context. It is the presence of common denominators in research foci, methods and epistemologies that defines us as a community, highly benefiting from its internal variety.

The first paper in this Special Issue, "Towards Interaction Machines", focuses on Antti Lyyra's PhD research. The paper constitutes an epistemological narration of the phenomenon of task transitions from humans to machines, observing the consequences on this phenomenon on the parallel domains of automated and autonomous artefacts. In the paper, the core differences between these two domains are brought forward, and paramount implications to the design of autonomous machines and artefacts are discussed. Antti's work provides an exceptional example of progress achieved in a first-year PhD work, moving fast from the stage of sense-making to those of analysis and independent theorization.

In "Rational, Interpretivist, and Practical Approaches to Organizational Memory", Dmitrijs Kravcenko provides a structured reflection on the domain of organizational memory, and the polymorphous nature

that characterizes it. As he reviews different theoretical approaches to the subject, he presents an overview of the mnemonic phenomenon that aims to integrate them in a holistic approach, thereby providing a composite view of this complex domain. The author's contribution goes beyond a powerful synopsis, and is substantiated in a proposed distinction between short- and long-term manifestations of practice memory, as well as in the role of organizational memory in consolidating organizational knowledge practices. Dmitrijs' work, while still constituting research-in-progress, already presents clear signs of a sophisticated theoretical contribution, central to the field of knowledge practices carried out at the organizational level.

In "Mobile Banking as Enabling and Constraining Financial Inclusion in Pakistan: A Theoretical Perspective", Atika Kemal presents a theoretical framework for exploring the role of mobile technologies in reaching the unbanked. Inscribed in the domain of ICTs for Development (ICT4D), Atika's work relies on Orlikowski's duality of technology to make sense of the social construction of mobile banking networks: she then applies her theoretical framework to Pakistan, a country in which the adoption of mobile banking is increasing rapidly. By doing so, the author makes a conceptual contribution to a field whose pragmatic orientation is helpfully corroborated by theory, and by frameworks which have the structure and properties of technology at their core. Furthermore, by adopting an IS framework to conduct ICT4D research, Atika fosters the cross-fertilization between two domains of knowledge that benefit greatly from mutual learning, and whose interaction generates positive implications for the integration of technology in development practice.

Finally, a paper by myself and my esteemed co-author Amit Prakash provides a commentary on our ongoing work towards a theory of ICTs in poverty reduction. As social safety nets around the world are increasingly pervaded with computerization, we attempt at making sense of the intertwining between technology and the political agendas that inform it in an anti-poverty setting. To do so, we have recently initiated fieldwork in the state of Karnataka, southern India, where the main national food security programme (the Public Distribution System – PDS) has been computerized, reshaping the interactions between users and providers in a key social safety system. Our commentary provides an early examination of the links between the artefact and a set of policy assumptions, embodied in its construction and reflected on the ways it mediates between the programme and its beneficiaries.

The current Special Issue – named so after the Conference that we have been honoured to host – also constituted a "special" one for this Editor-In-Chief, as I am now bound to leave my position after two wonderful, extremely enriching years at iSCHANNEL. As I thank, from the bottom of my heart, all those that made it possible for us to continuously publish truly excellent research, I am proud to leave the Journal to the new Editor-In-Chief, Gizdem Akdur, whose relentless commitment has been irreplaceable for the whole Editorial Board. It is with happiness, and with the passion that has always animated our great team work, that I leave the Journal to her expert guidance. Things done out of love always turn out to be great, and to leave unforgettable signs in their makers.

Silvia Masiero

Editor-in-Chief

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Towards Interaction Machines

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KEYWORDS

Automation
Autonomy
Autonomous Artefacts
Robots and Autonomous Systems
Interactive Computation

ABSTRACT

Machines are an integral part of modern societies; they extend and expand the ability of the humankind to manipulate their environment by transcending the natural limitations intrinsic to humans. Advances in computationally enabled sensing, learning, action and control mechanisms and related techniques allow a wider variety of tasks and activities to be automated and passed from humans to machines. This paper aims to outline characteristics of this phenomenon by examining the foundations of machinery, automation and computation and consequently comparing the characteristics of automated and autonomous artefacts. As a result, the difference between the concepts is brought forward and implications to the design of autonomous machines and artefacts are discussed.

Introduction

Machines are ubiquitous in modern societies; individuals and organisations alike rely heavily on them in their daily routines. Given the wide spectrum of tasks, machines performing them also appear in various forms and operate on different functional foundations and principles.

Notwithstanding the differing appearances, they have some features that are common. To a certain extent most of them could be considered as extensions of human capabilities as well as embodiments of human knowledge that is built into machines to fulfil human needs and purposes. They are also artificial constructs that do not exist in the world without human involvement. In the context of automation, this involvement can be considered as a process of transforming life processes to mechanised operations that are automatically operated. These phenomena of mechanisation and automation have brought humankind to the machine age where a great deal of both material and immaterial outputs are produced by machines.

Modern machines, despite the great level of automation, require people to supervise and operate them because they are not very capable of adapting to the changes emerging from their environment. In order to loosen the coupling between machines and their operators, there are demands to equip machines and computer alike with capabilities to operate autonomously. The sustained efforts to build such artefacts have proved this to be challenging, although at the same time somewhat rewarding. This paper is set to compare and contrast the paradigms related to automation and autonomy with an aim to provide clarity on some foundational differences.

To begin the exploration, the second chapter outlines a brief history of machinery from early tools to the machine age along with some limitations of that machinery. After that, the third chapter discusses the concepts of agency, automation and autonomy. The fourth chapter reflects automation and autonomy against the backdrop of closed and open systems, after which computing techniques that enable autonomous behaviour in open systems are presented. The underlying characteristics of autonomous techniques are contrasted to that of Turing Model. Finally, the results are discussed in chapter five before concluding remarks.

Modern Machines

According to archaeologists, our ancestors started using simple stone tools in the Stone Age around

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3.5 million years ago (McPherron et al. 2010). Later, although the exact timing is not known, early primitive machines were contrived, a prime example being the one for making fire that consists of a fast spinning stick driven by bowstring (Paz et al. 2010). The foundations of modern machines were set around the 3rd century BC in Greece where Archimedes discovered the principle of mechanical advantage in the lever while studying levers, pulleys and screws (Wikipedia). Various machines and mechanical principles have become widely applied since their invention (see Nof, 2009).

The utilisation of machinery started at greater scale during the Industrial Revolution in the mid 18th century. At first, manufacturing facilities housed mechanically controlled machinery and production lines that were powered by steam engines (Paz et al. 2010). At the beginning of 20th century, the electrification of factories decoupled machines from the engines that powered them. With electricity also emerged electromechanical devices that enabled more sophisticated automation by providing means to operate and control machines and production lines automatically (Nof 2009).

In the first half of the 19th century, the first versions of mechanical machines capable of performing numerical calculations were introduced (see Grier 2005). Later, roughly a hundred years later, the first versions of digital reprogrammable computers started to emerge (Bissell 2009). Unlike their mechanical predecessors, these computers were able to process various types of information as long as it was presented in a correct format and reprogrammability made them pliable to various tasks*.

Computers were superior in performing calculations and processed information significantly faster than their human counterparts and quickly started forming structures that could be called information systems. Those systems record, manipulate and display information and transfer it over distances (Kallinikos 2001), making various types of data and information widely available and accessible for people or other systems. These systems could be considered as neural networks of modern societies (Arthur 2011).

Aforementioned technological inventions have helped transcending some physical and mental limitations intrinsic to humans. If tools used in the Stone Age served as a medium to extend the reach of human intelligence beyond the physical limits (Lovejoy 1981), the industrial revolution and its aftermath compares with growing the muscle of humankind (Weizenbaum 1984). In similar fashion, the modern computer technology could be reflected as an extension of cognitive and communicative capabilities.

According to W. Brian Arthur (Arthur 2007) technologies can be defined as a means to fulfil human purpose regardless of what the purpose is or how clearly it is defined:

> *As a means to fulfil a purpose, a technology may be a method or process or device: a particular speech recognition algorithm, say, or a filtration process in chemical engineering, or a type of diesel engine.*

The purposes that need fulfilling are human constructs, and while the human needs may be abundant, the technologies and techniques available to satisfy them typically are not.

This paper concentrates on the gap between the needs and enabling technologies in the field of automation. The great majority of aforementioned machines and computers introduced trail predefined procedures; should something unexpected happen, they quickly render themselves unable to operate. Therefore, while recognising that some of them may run reasonable long on their own, they ultimately need to be subjected to human supervision or be operated by humans.

By loosening the coupling between the machines and their operators, running a machine would not be contingent upon the availability of human operators or supervisors to the extent as it is now. Thereby, in order to reduce human involvement, techniques that would allow machines with a greater degree of autonomy are under development. This artificial simulation of human cognitive abilities, if embodied in machines, would extend the reach of human intelligence

A great majority of research on automation and autonomy have been carried out under the labels of electrical engineering, computer science, robotics and artificial intelligence (Siciliano & Khatib 2008; Brooks 1986; Winfield 2012). While approaches and problem areas vary, they rely on digitally enabled interaction in order to provide as a means to machines and computers with autonomous capabilities.

To conclude, humans have a long history of pushing boundaries; they build various types of

* Given the reprogrammable nature of the digital computer, it is capable of performing various information processing tasks, as long as the one requiring attention can be formalised (programmed) by specifying inputs (data) and desired outputs through a suitable sequence of instructions for data manipulation (algorithm) using the digital binary (0/1) numbers understandable by a computer (bits). Digitisation results as loose coupling between the type of information and its processor upon the assumption that all digitised information adopts the same form (bits). While digitised data format is flexible, the Turing model as computing paradigm is less so as it assumes the computer as a single processor that takes a input and performs calculations defined in a given algorithm until all steps have been completed. (Tilson et al. 2010; Kallinikos et al. 2013; Yoo et al. 2010; Weizenbaum 1984)

artificial machines as well as manipulate the natural environment they occupy. While great benefits have been received through mechanisation and automation, there is a will to provide machines with autonomy to relax the coupling between machines and their human operators. To further discuss this theme, in the following chapter, we examine the characteristics of automation and autonomy.

Automation and autonomy

Given that the creation of autonomous artefacts is grounded in robotics and artificial intelligence, we start this chapter by looking into the definition of a robot and the nature of agency. After that the origins and meaning of the terms autonomy and automation are discussed.

Autonomous artefacts

There are many ways to define and classify robots depending on their structure (see Siciliano & Khatib 2008) or areas of application (Haidegger et al. 2013). However, the definition provided by the Institute of Electrical and Electronic Engineer's (IEEE) Ontologies for Robotics and Automation (ORA) working group is presented as it emphasises the core aspects of robotics at a more abstract level (Prestes et al. 2013):

> *For our general purposes, robots are agentive devices in a broad sense, purposed to act in the physical world in order to accomplish one or more tasks. In some cases, the actions of a robot might be subordinated to actions of other agents, such as software agents (bots) or humans. A robot is composed of suitable mechanical and electronic parts. Robots might form social groups, where they interact to achieve a common goal. A robot (or a group of robots) can form robotic systems together with special environments geared to facilitate their work.*

While the definition provided is holistic and well rounded, it is worth noting that Prestes et al. (2013) consider robots as agentive devices with varying degree of autonomy that act in the physical world leaving out of the definition immaterial artefacts that operate only in the cyberspace. Although autonomous immaterial artefacts do not act in the physical world as such, they may still have concrete effects on the real world. To provide an example, trading robots may be used to monitor selected stocks and commodities in exchanges and to place sell and buy orders in the hope of gaining profits. Although trading robots, in other words, software programs running on digital computers connected to electronic market places (Lockwood et al. 2012), operate only in the cyberspace, the acts they perform have very concrete monetary consequences in the real life when the trades are cleared.

Thereby, in this paper, no borderline is drawn between the artefacts based on their manifestations or how they interact with the real world. Instead, the aim is to keep focus on the agentive and autonomous nature when explaining principles related to the phenomenon, hence we refer to them interchangeably as autonomous artefacts or autonomous machines.

Agency

The concept of agency is often present when robots and other autonomous artefacts are discussed. To avoid confusion, it is important to note that the term agent has different connotations depending on the context. In films an agent can be a spy working for a state, in business it can be a salesman contracted to act on the behalf of a company, and in philosophical discussion agent can be considered as a conscious, reflexive, intentional and rational agent symbolising an independent human soul (Rammert 2008).

However, when speaking of machines, agentive behaviour should be in principle considered in the light of representing someone else because machines as such do not have any inherent reflexivity or intentionality in them; should desires, beliefs and goals be embodied in machines, they would have been designed and implemented by humans, although some reservations must be left for the techniques and systems that are built on the idea of evolution, transformation, learning or emerging behaviour (Hayles 2005).

John Searle (1995), when presenting his argument regarding institutional and non-institutional agentive functions that are assigned to various artefacts, described the agentive function as follows:

> *…use to which we [conscious agents] intentionally put these objects. (p. 20)*

As an example Searle provided a stone that can be assigned with a function of paperweight. This definition reflects the human origins of the agency that is assigned to artefacts, and while it may leave the definition of the nature of agency debatable in terms of autonomy and how it may be perceived, it does provide the language and flexibility to discuss the evolving nature of agency in the context of post-modern machines. As an example, if a general-purpose machine has a capability and can be instructed to perform different tasks and therefore assigned to many different uses, the agentive function may change over time.

In this paper, the pragmatic and functional notion of agentive functions as presented by Searle is embraced and further exploration continue with the terms automation and autonomy.

Automation

The terms and automation and autonomy are quite often conflated because a great degree of automation may lead to an appearance of autonomy. However, this notion is somewhat misleading and therefore the difference between autonomy and automation is discussed here.

According to Richard D. Patton and Peter C. Patton automation is a combination of two words, automatic and operation (R. D. Patton & P. C. Patton 2009). The Oxford English Dictionary defines automatic as *"working by itself with little or no direct human control"*. The word has it roots in the Greek word *autómatos*, which means *"acting of itself"*, self-dictating and self-moving. The Springer Handbook of Automation automatic describes it as follows (Nof 2009):

> *A key mechanism of automatic control is feedback, which is the regulation of a process according to its own output, so that the output meets the conditions of a predetermined, set objective. (p. 23)*

From automatic we return back to combination of the words automatic and operation, to the definition of automation that Patton & Patton (2009) present in their chapter in the Handbook of Automation:

> *Automation is fundamentally about taking some processes that itself was created by a life process and making it more mechanical… it can be executed without any volitional or further expenditure of life process energy. (p. 305)*

By automation through mechanisation Patton & Patton mean the ability to perform linear and step-wise algorithmically defined processes with clear inputs and clear outputs.

This is similar to the definition, which Herbert A. Simon (1996) has provided on artificialness: Simon made a distinction between the natural sciences and the science of artificial, noting that natural science aims to find patterns hidden in apparent chaos whereas engineers and other designers of artificial systems aim to create new functional compositions out of patterns discovered in nature (pp. 1-10). Therefore, even if mechanistic automation may rely on phenomena that can be found in nature, it is not natural; it is not inevitable in the world and would not exist without human involvement.

With the notion that automation refers to artificial automatic operations that are self-dictating mechanised forms of real life, we move on to autonomy.

Autonomy

To start, in the Oxford English Dictionary the term *autonomy* is defined as "*the right or condition of self-government*", and it has its roots in the Greek word *autónomos* that has the meaning of "*having its own laws*". According to Froese et al. (Froese et al. 2007; Froese & Ziemke 2009) autonomy could be further defined in terms of external behaviour and internal autonomy, something they refer to as behavioural and constitutive autonomies. The former is generally required for having stable and flexible communication with environment whereas the latter is related to self-production, mutation and evolution as well as natural intentionality.

If we examine some of the most complex machines that humans have built such as digital interaction systems that control self-driving cars (Thrun et al. 2006), deep down we find nothing but formalised linear step-wise instructions (algorithms) and data that are represented by strings of binary numbers in order for necessary calculations to be performed. These rules that govern the self-dictating are realised and inscribed in machines by their designers. Thereby, it appears that such machines are automatic instead of autonomous in the sense that they do not posses the right or condition of self-government in the sense as a free person does, namely constitutive autonomy.

Joseph Weizenbaum (1984) describes a distinction between automatic and autonomous behaviour as follows:

> *Most automatic machines have to be set to their task and subsequently steered and or regulated by sensors or human drivers. An autonomous machine is one that, once started, runs itself on the basis of internalized model of some aspects of the real world. (p. 24)*

With *automatic machines have to be set to their task* Wiezenbaum presumably means that their behaviour including inputs and outputs must be formalised - this is what Patton & Patton refer to as mechanisation of a life process. When referring to autonomous machines, Weizenbaum indicates that they run themselves based on the some aspects of the real world.

The early attempts to build artefacts with autonomous behaviour were founded on the idea of predefined aspects of the real world and mechanised, computational models of the decision-making, rationalistic reasoning and cognition. This approach, currently known as GOFAI, Good Old Fashioned Artificial Intelligence (Haugeland 1985), assumes that objects existing in systems are presented in the form of meaningful symbolic knowledge presentations and logical step-by-step deductions used in problem solving were grounded on these knowledge

representations.

These early attempts were heavily criticised due to their narrow view to real-life problem solving, human behaviour and decision-making. These shortcomings were debated by prominent philosophers, computer scientists, roboticists and anthropologists (H. Dreyfus & S. E. Dreyfus 1986; Winograd 2006; Suchman 1987; Brooks 1986; Winograd & Flores 1986).

However, through failed attempts to create autonomous behaviour it started to become increasingly evident that there are a multitude of modalities that guide human behaviour in different situations. As an example, Lucy Suchman (1987) argues that actions are always situated:

> *…insofar as actions are always situated in particular social and physical circumstances, the situation is crucial to action's implementation. (p. 178)*

Moreover, psychologist Daniel Kahneman (2011) argues the human brain consists of two systems, fast (1) and slow (2): the system 1 being fast, automatic, reactive and subconscious whereas the system 2 is slow, logical, calculating and conscious. In addition to human behaviour, other natural forms of interaction and communication have provided inspiration for technologists creating autonomous artefacts.

Thereby, it became evident that the early attempts to build autonomous artefacts did not recognise the multitude of modalities inherent to human communication or the role of context in action. In this light it seems that Weizenbaum's notion on the some aspects of the real world do not only refer to the aspects that can be captured, formalised and embodied into a machine, but also to the aspects that cannot be subjected to such mechanisation.

Open systems and interaction machines

In order to reflect the influence of surrounding environment, we continue with Patton & Patton (2009). They write that mechanical means non-context sensitive and discreet and also highlight that machine theory is the opposite of general systems theory. By *general systems* they mean open systems or in other words, systems that can locally overcome entropy and are self-organizing. Moreover, open nonlinear context-sensitive systems are fundamentally different from the computational algorithms inscribed into machines in the sense that everything else in the systems affects the behaviour, not only the previous step in an algorithm (p. 306).

Because it is not possible to model open systems, an artefact, in order to function as a part of self-organising open system, should be capable of orienting itself in such a system; it should be granted with capabilities to negotiate with and adapt to the surroundings it is located in and is a part of. In other words, artefacts should be modelled as complex adaptive systems similarly as the environment they operate in, such as road system and traffic, may be. John H. Holland (1992) describes such systems as follows:

> *Complex adaptive systems are evolving structures; these systems change and reorganize their component parts to adapt themselves to the problems posed by their surroundings.*

Embracing "*the right or condition of self-government*" as the general definition of autonomy and reflecting the notion of behavioural autonomy provide by Froese et al. (2007), in the context of artificial autonomous artefacts, autonomy could be considered as a behavioural model of an autonomous artefact that provides it with a local and situated capacity to act in an open and dynamic environment when it is performing an agentive function.

Because objects in open systems are in constant communication with their environment, several techniques have developed to simulate natural phenomena that allow interaction with and within open systems: examples include computing techniques such as neural networks for machine learning and speech, image and text recognition (Haykin 1994), embodied sense-react heuristics for direct interaction based behaviour modelling (Brooks 1986) as well as technologies and techniques for sensing, localisation and mapping, planning and actuation (see Siciliano & Khatib 2008) and communication (Mezei et al. 2010; Arumugam et al. 2010).

Some advanced compositions of these techniques have been brought together in form of autonomous vehicles (Thrun et al. 2006) and bipedal robots (Bekey 2005). While their behavioural autonomy is limited, they have been able to operate in loosely constrained systems somewhat successfully. These systems are built on foundations that are radically different compared to the Turing hypothesis that serves as a foundational concept for computation and states that any process that can be naturally called an effective procedure [algorithm] is be realised by a Turing machine (Vitanyi 2012).

The thesis defines a closed system where inputs, processing logic and outputs are clearly defined in symbolic format while simultaneously preventing undesired external impacts from entering the system. An ordinary personal computer, in its basic form provides a good analogy: a user instructs a machine, using a mouse and keyboard and validates the outcomes that are displayed on the screen. To outline the closed and artificial nature of this approach, Gordana Dodig-Crnkovic (2011) states:

> *The Turing Machine essentially presupposes a human as a part of a system—the human is the one who poses the questions, provides material resources and interprets the answers.*

To further illustrate the shifting paradigm of computational processes, Dodig-Crnkovic (2011) describes them as outlined below:

> *Computational processes are nowadays distributed, reactive, agent-based and concurrent. The main criterion of success of the computation is not its termination, but its response to the outside world, its speed, generality and flexibility; adaptability, and tolerance to noise, error, faults, and damage.*

However, the techniques to interact with surroundings are fundamentally, at their lowest level, automatically operated mechanisms that utilise a variety of feedback loops for controlling and steering the processes of adapting to the environment while pursuing for goals. These techniques could be referred to as sensing, thinking, acting and reacting. While the individual atomistic features and mechanisms can be composed and modelled as algorithms, together they may form an interaction machine that operate in a non-algorithmic manner. In Peter Wagner's (1997) words:

> *Interactiveness provides a natural and precise definition of the notion of open and closed systems. Open systems can be modeled by interaction machines, while closed systems are modeled by algorithms.*

Also, here we must note that such interaction machines may resemble Russian dolls by their nature and be compositions of different artefacts with varying degree of autonomy consequently forming open artificial systems. This is what Prestes et al. (2013) refer to when they argue that a robot can be a composition of robotic devices, a robot group a composition of robots and consequently a robot system may consist of robot groups.

In this kind of open systems the overall functionality may emerge in a generative manner from the interaction of components - as Robin Milner (2006) puts it:

> *[I]n interactive systems everything can happen as soon as the interactions which trigger it have occurred.*

However, if interfaces between components of the system, are highly constrained, non-algorithmic systems may become algorithmic (Wegner 1997). The capabilities of components as well as their interconnections together define the capabilities and constraints of a given machine, in other words, its level of autonomy in a given context (Parasuraman et al. 2000). Reflecting the potential range of capabilities and assuming that only a subset of all interactional capabilities will be in use at any given one time, others remaining dormant, I refer to the whole set of possible interactions within a single artefact as *interactive affordances*, denoting the potential characteristics of *interactional performances*.

Although realisations of computing applications are evolving towards interaction machines, the Turing model is not perishing. Instead, it plays a central role as an atomic unit of interactive systems (Dodig-Crnkovic 2011), as it does in today's practical implementation of interactive systems such as self-driving cars or telecommunication networks. To better understand systems at the level of interactions, the focus of sense-making is expanding from single Turing machines and algorithms to computational processes, from computational prescriptions imposed on a computer to behavioural descriptions in terms of on-going interactions (see Goldin et al. 2006). According to Robin Milner (2006) computing has grown into *Informatics* that he calls as the science of interactive systems.

Discussion

In the previous chapters a brief history of machinery was described, before moving on to the emerging trend of granting machines with behavioural autonomy in open systems and discussing on how autonomy is different from automation along with the role of interactive computation. This chapter summarises the main ideas.

The examination of autonomous artefacts started from robotics. While Prestes et al. (2013) described robots as devices, it was suggested that immaterial autonomous artefacts operating in the cyberspace should also be taken into consideration when examining the emerging computing paradigm, given that the interactive nature of computation applies equally in both cyber and physical worlds. In robotics, physical features such as frames, sensors and actuators act as an interface to the real world (Dodig-Crnkovic 2011) whereas in the cyberspace that sensing and actuation are realised through electronic messaging interfaces. Therefore both material and immaterial realisations were referred interchangeably as *autonomous artefacts* or *autonomous machines*, indicating their human-made nature and autonomous behaviour.

After outlining briefly different meanings of agency, it was decided to follow John Searle's definition due to its pragmatic definition, suggesting that agency is manifested in the form of *agentive function* that is considered to be uses that we conscious agents intentionally put these objects. Here it is important

to note that in the context of reprogrammable autonomous artefacts, the agentive function, the act, the goal to pursue may change over time.

In terms of automation, it was concluded that it refers to automatic operation and is a mechanised form of a life process, designed to work in closed systems without sensitivity to the context outside systems' boundaries. Furthermore, when autonomy was explored, it was considered that behaviourally autonomous machines, operating in open systems, are to proceed in a more non-deterministic manner by choosing an appropriate course of action from the spectrum of possible choices. In order for a machine to succeed in doing so, the machine should possess an ability to react to the changes emerging from the environment (open system) and to negotiate a solution that is in harmony with the local context and agentive function. These interactional capabilities could be referred as *interactional affordances* because these capabilities define the capacity to act, although may remain dormant as well. However, this autonomous behaviour is modelled through a series of interacting automated mechanisms that are designed and embodied into autonomous artefacts by the designers of artificial systems. Thereby, the point where autonomy ends and automation begins remains sometimes debatable.

Persistent efforts have been made to equip machines with autonomous capacities. The early attempts of creating artificial intelligence were not very successful given that system designers created knowledge representations and rational logics for solving selected problems problem. They were more suitable for cognitive reasoning within closed systems; in open systems problems they rendered themselves unintelligible because the knowledge embodied in them was not necessarily relevant *in situ* as its meaning and purpose was not grounded in the reality emerging from the environment.

After the failed attempts and realising that there is a multitude of modalities associated to human behavioural and interactional models in situated contexts, several computing technologies and techniques have been developed to provide a solution for particular communicational problem. As none of them is able to solve all communicational and interactional challenges at once, several technologies and techniques need to be combined in order to develop a desired behavioural model. This transforms the focus from a computable algorithm to behavioural models as compositions of interaction processes, which could be considered as a paradigm shift. Moreover, compositions of interacting artefacts can consequently form systems where overall behaviour may emerge from the interaction of artefacts. In these cases, the nature of perceived agency may vary depending on the point of view the observer has. A person building a machine may have a clear understanding of the inner workings and embodied logic, whereas, someone not familiar with the system could be tempted to speak *as if* the autonomous artefact had desires and beliefs because he or she is required to explicate the behaviour by interpreting the actions taken by an *interaction machine*.

This change in the quality of computational processes from transaction to interaction processing and behavioural modelling at a system level provides engineers and computer scientist alike with challenging problems to tackle. The challenges revolve around how to transform and model continuous, analogue and open-ended world into machines as on-going series of discrete interactive computations. This requires new approaches and techniques such as multi agent systems and agent based modelling together with a solid theoretical foundation comparable to the Turing model that has served as a theoretical cornerstone of algorithmic computation (Wegner 1998; Goldin et al. 2006; Dodig-Crnkovic 2011).

Concluding remarks

Recent advances in computational techniques and approaches have made it possible to build autonomous artefacts that are able to perform tasks and activities in open environments, denoting the shift from algorithmic computation to interactive computational processes. Should these techniques be adopted at the speeds encountered with personal computers, the Internet and smart phones, it is quite possible that autonomous artefacts in various configurations will constitute a significant part of our digital infrastructures in the near future. For this reason, it would be important to expand information system research towards the fields of interactive computation and autonomous artefacts and study various technological, organisational and sociological implications they may arrive in the wake of the interaction machines.

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Rational, Interpretivist, and Practical Approaches to Organizational Memory

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KEYWORDS

Organizational Memory

Practice Theory

ABSTRACT

To study organizations means to study their memories. At different points in time, organizational memory has been considered in the literature as a time-capsule, a social system that attributes meaning, and a teleological aspect of a practice. Building on these theories this essay will attempt to present a holistic overview of the mnemonic phenomenon. A proposed distinction between short- and long-term manifestations of practice memory and the role of organizational memory in solidifying regimes of practices within an organization is discussed. Possible questions for further research are put forward.

Introduction

Organizational memory is a feature that contextualizes and communicates an organization both internally and externally. It is difficult, if not impossible, to understand an organization without looking at where it came from and how it got to where it is. Furthermore, memory is a key epistemic feature – Tsoukas and Vladimirou (2001), for example, place prior experience and history as primary aspects in the generation of knowledge.

The prevalent way of thinking about memory stresses the importance of preservation juxtaposing this against the fear of loss. Good memory is pre-emptive to the loss of information and knowledge, and poor memory is inadequate at preservation of those. A rational course of action in those cases is to minimize or eliminate those aspects of memory that cause defects to the preservation process - achieving this goal would allow for next to ideal background to knowledge codification, dissemination, and absorption. However, this is not the only way of looking at organizational memory. In this essay I will journey through academic literature on organizational memory and attempt to infuse this thinking with the epistemology of practice to allow for the role of power and contestation. To assist in navigating the considerable body of work on organizational and collective memory I have grouped the theories that I will consider into two broad categories. These categories attempt to group theories together based on their common ontological and epistemological orientations towards the rationality of organizational memory, i.e. the collective orientation to the efficient accomplishment of functional collective goals (Scott, 1987). Ontological assumptions concern such areas as nature and mechanics of memory and epistemological assumptions concern how memory is defined and operationalized.

Following this review I will argue that there has been a misrepresentation of the role and relationship of the collective memory as it relates to organization. I propose an alternative way of thinking about practice memory as an essentially recursive, continuing accomplishment of practice memory at an organizational level and within the greater field of practice as a whole. I will demonstrate how thinking of practice memory in such a way aligns the field of organizational memory with the epistemology of practice.

Rational approaches to collective memory

Key assumption on the rational approach to organizational memory is that there is a purposeful function to it. This function is normally to do with storage and retrieval of information and knowledge. By storing knowledge through time and enabling a way of retrieving it, organizational memory should allow organizational members to gain deeper and broader understanding of organizational history and past actions in order to learn and avoid repeating

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certain organizationally undesirable courses of action. There is a noteworthy paradox generated by the rational approach to organizational memory which provides a snapshot of this entire theoretical platform - organizational knowledge is cumulative and persists indefinitely through time (Argote, 2013). Despite individual persons moving within and outside of the organization, technologies and structures changing, organizations fail to not remember and persist in learning for the length of the existence of the organization, and possibly longer (Burt, 2002).

From a rational perspective, the way organizational memory works is by recording information useful to organizational goals, maintaining it through time and space, and releasing it to those members of the organization who can make use of it. There are variations across different theoretical approaches, but the fundamental ontology assumes that individuals are willing contributors and distributors of organizational memory, and that those individual inputs into the memory of the organization are equally valid. The entire concept of memory is only meaningful when defined against the idea of 'knowledge' as well as some rudimentary aims and/or objectives of knowledge, such as 'learning' and 'forgetting'. In the case of organizational memory, the rational approach implicitly proposes that individuals are able to take these concepts into account when engaging in collective action, recognize how their (inter)action will align with these concepts, and regulate their behaviour accordingly.

In this section I will identify and group a variety of approaches to organizational and collective memory that may, otherwise, be perceived as incompatible. While I concede to the internal heterogeneity of these schools of thought, I believe that it is useful to group them in this way so as to highlight fundamentally similar assumptions about the role of the organization that they make, rather than dwell upon the different approaches to memory that they take (see Rowlinson et al., 2010 for a good review).

Transactive memory systems and the repository model

The concept of a transactive memory system is based around the idea that individuals serve as external mnemonic aids to each other (Wegner, 1987). When applied to organizations, this suggests that individuals are capable of benefitting from each other's individual knowledge and expertise if they develop a shared understanding of 'who knows what' in the organization. A transactive memory system is built on the assumption that there is internal and external memory. Routinely individuals memorize into their 'internal' memories (i.e. brains), and 'external' memories (i.e. diaries, notes, documents, etc.). When memorizing into 'external' memory, individuals 'internally' make a note of the type of knowledge and its location, but do not memorize the knowledge itself.

As individuals make notes of where the knowledge is, or who has the knowledge, they enact 'meta-memories' (i.e. memories about the memories of others). Wegner (1995) distinguished between two types of meta-memories – one, where individuals collect information about what each person in the organization knows (i.e. areas of expertise); and another, where individuals collect information about the locations of the knowledge and ways of reaching them (i.e. how, and where to look in the database). Remembering is achieved when knowledge that is encoded and stored in various locations across the organization is identified and retrieved by means of transactions (verbal, material, political, etc.) between individuals, based on their meta-memories. Individuals do so by '*verbalizing details about the context in which the knowledge was obtained, posing questions, or verbalizing associations with the question*' (Hollingshead, 1998: 661). As, in order for individuals to enact 'meta-memory' a knowledge of 'who knows what' is required, the transactive memory systems perspective potentially allows to account for inequality amongst actors. Indeed, Bunderson and Reagans (2011) have indirectly touched upon the subject, but even their work concludes, in key with the rational paradigm, that transactive memories can be functionally managed by altering the behaviour of powerful actors.

Directly following the transactive memory system view is the idea of organizational memory as a knowledge repository. Otherwise known as the repository model, this view considers organizational memory as a '*set of repositories of information and knowledge that the organization has acquired and retains*' (Huber, Davenport & King, 1998: 3), or simply '*stored knowledge*' (Moorman & Miner, 1998; de Holan & Phillips, 2004).

A detailed literature review by Walsh and Ungson (1991), conducted with this concept of memory in mind, is widely acknowledged to have established organizational memory as a sub-field of its own (Olivera, 2000). They defined organizational memory as '*stored information from an organization's history that can be brought to bear on present decision*' (Walsh and Ungson, 1991: 61) with the fundamental proposition that organizational memory should be understood in terms of its function and location. Where 'function' is the benefit of 'good' memory in preserving information that may aid organizational decision making and 'location' is the whereabouts of such information within the organization.

Walsh and Ungson (1991) were not naïve in their understanding of organizations – they did not

think of them as machines that can be reduced to their constituent parts. Walsh and Ungson (1991) though of organizations as interpretative systems held together by common language. From this epistemological stance they concluded, based on the existing literature at the time, that certain types of knowledge tend to 'gravitate' towards certain places in the organizational order. These places became known as the five 'storage bins': individuals, culture, transformations, structures, and ecology; as well as external archives. If the five storage bins could be effectively identified by management, they could be tapped into to improve '*the organizational outcomes and performance*' (Walsh & Ungson, 1991: 62) as and when required.

The repository model has been subject to some fierce criticisms over the years. These are normally addressed at the mechanics of remembering, the nature of repositories, and the functionalist nature of such organizational. To summarize, what most of the critiques argue towards is that a better understanding of the role of the social is required if we are to have a serious discussion on the nature of organizational memory. In part, because thinking of memory as a container for knowledge sterilizes it into a neutral, objective entity.
It is worth noting that theories that fall under the label of repository model, however arbitrary, tend to postulate that good memory is pre-emptive to the loss of information and knowledge, and poor memory is inadequate at preservation of those. While this makes sense from a rational or functionalist perspective, if followed through to their underlying assumptions, these views of organizational memory seem to result in a paradox - if memory is a process of reducing the loss of information and knowledge from within an organization or even an individual, then upon the attainment of perfect information and knowledge preservation and zero loss (however unlikely), organizational memory will have succeeded in serving its purpose. However, if such memory is defined and understood against memory loss, then the removal of the potential for memory loss made possible by the attainment of total and infallible memory will also result in the removal of memory as such. For if memory is defined against memory loss, then the absence of memory loss removes the very purpose that memory is supposed to serve - if there is no possibility of memory loss, there can be no meaning to memory for it will do nothing.

While the above is clearly more at home in the domain of philosophy than organizational theory, it does expose the questionable nature of assumptions underlying the codification movement and the repository model that is part of it.

Social memory studies

Critique of the repository model called for a more socially inclusive theorization of organizational memory. This call was addressed by what is now referred to as social memory studies. Seen through this lens, organizational memory as a retention bin disappears to give way to organizational memory as continuously (co-)constructed and reconstructed by individuals interacting with each other and their socio-material environment (Corbett, 2000). Social memory is understood in social time and can be described as '*the representation of the past in a whole set of ideas, knowledge, cultural practices, rituals and monuments through which people express their attitudes to the past and which construct their relation to the past*' (Misztal, 2003: 6).

Social memory studies school of thought can be further sub-divided into two categories: one, more closely related to the repository model, that views memory as socially negotiated but still located in people's heads; while the other, more sociologically oriented, that views memory as patterns of symbols objectified by a particular society at a particular period in time. These are respectively referred to as *'collected memory'* and '*collective memory*' (Olick, 1999: 336). The collected memory perspective is operating within non-rational approach and so will be discussed later. The collected memory perspective is more epistemologically receptive to the idea of inequality of memory, but not much of current theory makes use of this capability.

Collective memory is discourse in general and language in particular. No memory is feasible outside the collective, in this school of thought, and the collective nature of memory is made most apparent '*by the degree to which it takes place in and through language, narrative, and dialogue*' (Olick, 1999: 343). Groups create definitions, as well as divisions, by which they consequently establish meanings of events; and then share, legitimize, and translate those meanings amongst interacting groups and individuals. This externalizes symbols and their relationships away from the individual and into the social. As one of the most fundamental aspects of using language is the ability of individuals to use it in an appropriate social context, the use of a particular language by an individual also signals distinct social context to the outside world. Individuals do not understand each other because language has a representational relationship to reality, but because of co-contracted and co-negotiated structures of communication (Wittgenstein, 1953).

The same principle applies to collective and organizational memory. Collective memory view considers organizational memory inseparable from '*the frameworks used by people living in society*

to determine their recollection' (Halbwachs, 1992: 43), and as co-constructed through interactions in particular social contexts. While the social contexts of memory are distinct, they are also equal in their representational value and any implicit power discrepancy is considered in passive terms. What this means is that when one memory replaces another, the change is confined to history and not elaborated upon nor brought forward into the present - the process behind change is left in the shadows (Assmann, 1998 for example). Language and collective memory do not exist in some external state, like in the repository model, but are re-established at every interaction (Berger & Luckmann, 1967). As individuals remember and memorize in groups and organizations they simultaneously constitute those groups and organizations in the process of remembering and memorizing. Language as a concept of memory is essentially a Plato's cave.

Organizational memory as language may seem to exist as a system with its own external logical reality, lingering around objects in particular, but it is only so because groups construct it as such using narrative patterns to create and maintain persistent institutional arrangements (Elias, 1991; Luhmann, 1996; Olick, 1999). This is an outsider's illusion - social memory is not something that can be managed or designed for organizational purposes; it is an 'organic' product of epistemological development of a group of people. Here, the term 'epistemological' denotes the rationale for the grounding of a particular knowledge in a particular social fabric (Knorr-Cetina, 1991). In other words, social memory is a form of retrospective logic (i.e. the meaning of a series of past decisions that bear on the current social situation) of a particular group of people brought together by their vocation or avocation. What is traditionally understood as forgetting (i.e. failure to internalize knowledge (Kransdorff, 1998)) is the main function of social memory because it enables the system to continue to exist and '*to be sensitive to new irritations'* by preventing unfiltered influx of new information and knowledge (Luhmann, 1997: 579). For a group to forget, for example, would actually mean to become overly receptive to new information up to the point where the group would cease to exist in a recognizable form.

Summary

Transactive memory systems and the repository model of organizational memory are vastly different from the social memory studies perspective. But the three share similarity on an ontological level, where the rational approach prevails. The analysis at the centre of these theories focuses on establishing the logical ways in which acquisitions, storage, and retrieval of knowledge from memory. The rational approach has helped to break a great deal of ground in some aspects of memory studies, but it has also restricted the way scholars perceive other aspects. Namely, there is either a denial of the heterogeneity of memories on an organizational level, or a distinct inhibition of considering interaction of memories of different groups as confrontational and/or domineering.

Organizational memory, interpretation and power inequality

If the rational view of organizational memory assumes logical coherence to actions of groups and individuals as well as, indeed, memory, the theories in the perspective I will discuss here reject these premises and attempt to understand how the pervasive nature of human hierarchy and power inequality interacts with organizational memory. Within this group I have included one sub-group of social memory studies, the 'collected memory', as well as the more recent development in the field - practice memory.

Morgeson and Hofmann (1999) suggest that collected memory is enacted by interacting individuals who, through the process of probing their personal (biological) memories and organizational information systems, recall and make sense of past events. Similarly to the repository model, function is an important criterion, but location no longer matters and is replaced by structure. If function, for example, is the recollection of past events, then structure would determine how individuals interact so as to socially remember. Relationship between memory and organizational outcomes is presented as socially and politically mediated, reflecting interests and agendas of powerful parties and implying that organizational memory is embedded within a particular social context.

Work of Nissley and Casey (2002) on corporate museums as sites of memory is illustrative of collected memory approach. Corporate museums are seen as results of a historical mix and match by corporate management. This suggests that memory can be broadly politicized for use as a strategic asset and that it is also a '*dynamic, socially constructed phenomenon or* […] *a process*' (Nissley & Casey, 2002: 37). One fundamental property of the process present in the construction of corporate museums that Nissley and Casey (2002) describe is the subversion of one version of memory by another in a public forum. Museums are instruments for learning about the past, and frequently museums are the primary sources of experiential learning about the past - a space where individuals can experience materiality of the past and contextualize it into the social. This process also functions in reverse when individuals re-conceptualize the social based on the materiality of

the past that they experience in the museums.
The idea that certain groups can, and do, manipulate the selection of historical materiality available for learning as well as supply only partial information to assist in contextualization is very significant to understanding the inequality of memory. At the very least this voids the implicit assumption within the rational approach that all memories are equally valid. In the case of corporate museums only certain memories are valid and only those that are seen as valid are the ones that are perpetuated. Assmann (1998) refers to this phenomenon as 'mnemohistory' - a history where events are not arranged in a chronological order, but in order of social significance. The work of Nissley and Casey (2002) essentially transplants the idea of mnemohistory from a macro-level of societies to the micro-level of organizations and their constituent groups. And while the account of 'collected' memory paints a broad picture of how organizational and collective memory can be politicized, it does not offer a detailed account of this process.

Practice memory

Practice-based view has been experiencing a re-emergence in the recent years, with an increasing amount of authors exploring what it has to offer (Nicolini, 2013). Applied to organizational memory, the practice-based view simultaneously evolves sociological underpinnings characteristic of social memory studies, and provides a viable alternative to the pragmatic aspirations of organizational memory studies. It does so by considering individual cognition as emergent and embedded in social practices.

In short, practice theory argues that in order for anything to exist in the society, there has to be an element of production and reproduction behind it. Practices are self-perpetuating through the process of 'doing' – something that in itself is a product of dispositions acquired under the epistemological orientation of the practice (Bourdieu, 1977, 1990). In terms of studying organizational memory, epistemology of practice allows to shift the unit of analysis from the individual or the collective as a source of meaning, identity, and organization, to the practice itself (Chia & Holt, 2008). In doing so, the practice theory provides an alternative to the collective-individual dichotomy as well as to theories of rational action. It is practices and their combinations that produce and reproduce the politically uneven structure of society as they serve the interests of some groups of people and get contested by others (Bourdieu, 1977; Nicolini, 2013). In effect, to practitioners, practices are akin to applied epistemologies – by performing practices, practitioners simultaneously determine the validity of their own knowledge as well as perpetuate and reproduce it for fellow practitioners, who repeat the process duly.

Organizational memory as practice

Schatzki (2006) views organizational memory as persistence of structures of practices from the past into the present by the way of rules, understandings, and teleological orderings. He anchors these ideas in the work of Assmann (2005), who, similarly to Halbwachs (1992), argued that memory is primarily a mechanism to instill certain ways of interpreting the world into the identity of individuals. Assmann (2005) distinguished between memory as collective and memory as cultural, where collective memory is localized and cultural memory is embedded in language as a whole. These would be operationalized via 'mnemohistory' – an active process of assigning meaning to selected events from the past (Assmann, 1998: 14). Mnemohistory is what enables an otherwise sterile chronology of events to become a social memory.

Schatzki (2006) adapted the idea of collective memory as manifestations of practices from the past, and cultural memory as a translation mechanism that uses language to place practices from the past into the socio-material context (such as rules) of the present. In many ways, what Schatzki (2006) proposes is a comprehensive adaptation of Luhmann's (1996, 1997) theory of systems of communication to the epistemology of practice, where memory is a filter rather than a sponge.

From what Schatzki (2006) suggests practice memory can be seen as a vector of a practice, spanning from decisions made in the past into the future situations made possible by these decisions. After all, teleology is embedded in the very nature of practice (Schatzki, 1997). This does not mean, however, that practices are objective. Teleology simply implies that there is a direction (into a potential future) to practices, but this direction is constantly contested. The very consideration of potential futures is contingent on the experiences and decisions made in the past – once a decision has been made, it will inevitably close some doors in favour of others by rendering certain versions of the practice unavailable. Practice memory is a *telos* of a practice that encapsulates the past, present, and future dimensions of the practice as of this moment (this will be further discussed later). Practices persist because practitioners 'do' them, and practitioners 'do' practices because they provide structure to comprehend everyday life, the past and the future, as well as the surrounding objects.

While a detailed discussion of teleology of practice is beyond the scope of this essay, it is worth noting that by grouping a complex combination of spatial, material, and temporal activities into a *telos* of something is a form of organizational memory in itself. Teleological thinking has its roots in the Aristotelian philosophy of knowledge in general,

and in the notion of final causality in particular. Final cause is the purpose for the sake of which something exists. Contemporary science is by and large less sympathetic to such metaphysical reasoning about the world, so to understand teleology would normally mean to impose a *telos* on an arbitrary pattern of events that exhibit some form of regularity. In other words, teleology of practice, or the 'why' in 'why are we here doing this organization/project/product' is very much a subject to interpretation and manipulation by practitioners as well as the reason behind why the memory of practice is not homogenous – teleology is a post-hoc description, not an essence of any kind.

Practice memory is maintained by actions, shared thoughts, abilities and readinesses of its members. Memory persists only because there are practitioners, and also because it is not spread evenly amongst them. The idea of uneven distribution is central to the inequality of memory. The presence of practitioners is an obvious pre-requisite, as practice requires individuals to labour behind it. For many purposes, these individuals do not even have to be alive and/or present within the practice at the moment – the mere social sustenance of their identity by living practitioners may often be enough to perpetuate practice memory. As for the imperfect distribution of practice memory, it allows practitioners to debate, discuss, politically engage, and otherwise remember their practice. It is inscribed in their identities, language, rules, and surrounding objects, all of which reinforce and are reinforced through practice. In remembering, practitioners are enacting the practice and perpetuating it (Lave & Wenger, 1991; Gherardi & Nicolini, 2002).

One way of understanding something as abstract as practice memory is by looking at what routines do. Routines offer a medium of communication between practitioners (Giddens, 1983; Pentland & Feldman, 2005). They have ostensive and performative aspects, the relationship between which is a source of change and evolution of routines. Routines can simultaneously signal and camouflage the practices they belong to to/from the outside world. Consider a locksmith and a thief working together to unlock a door – while the routines they perform are probably similar, the locksmith may find it surprising to see the burglar remove the contents of the property the door to which they've just opened. That these two hypothetical individuals would find themselves in such situation suggests that actions are interpreted through practice memory – a prior understanding of a situation (Wittgenstein, 1953). However, unless there is a reason for consideration (such as conflict), as illustrated by the act of theft, practitioners may not even recognize the different practice origins of the superficially similar routines that they enact (Giddens, 1983). Unlike actions and routines, practices reserve the right to ontological properties (Schatzki, 1997).

It must then follow that the relationship between practices and routines suggests at least two levels of memory that can be thought of as 'short-term' and 'long-term'. Practice memory in a form discussed by Schatzki (2006) is a form of meta-memory – a 'long-term' memory of the epistemological nature that determines meanings of activities of practitioners. Practice memory is closely related to where the practice takes place, the site of the practice as described by Schatzki (2005), or *habitus* as theorized by Bourdieu (1977). It is something that resembles the concept of 'collective memory' in the way presented by Halbwachs (1992) and Assmann (2005), as well as the way in which practices continuously extend and renew themselves by replicating the conditions that define them (Giddens, 1978).

Importantly, practitioners perpetuate the memory of practices through actions and routines within organizational contexts, not on a scale of practice as a whole. As discussed above, this is because different practices are brought together within the frameworks of the organizations. It is there that practitioners are mobilized by other practitioners to engage in their respective practices and interact with one another. This interaction, depending on the resilience of memory (Luhmann, 1996, 1997), dilutes practices. As practices performed within the organizations are 'diluted' by other practices, they may become at odds with the 'long-term' practice memory, which can also be thought of as a 'dominant memory'.

The dominant memory may then become challenged by the 'diluted' practice and, depending on the outcome of this challenge, the practice as a whole may either change or remain. In the event the practice does change, the 'diluted' practice becomes the new 'dominant' memory and establishes the epistemological regime in own image. If the practice remains unchanged, the 'diluted' memory most likely falls back in line with the epistemological regime of the dominant practice after some time. Practices performed on organizational levels can thus be considered as 'short-term' memory that may, or may not, translate into the 'long-term' memory following an internal power struggle.

Summary

Epistemology of practice presents an appreciatively more inclusive picture of inequalities between memories. Practice memory can be summarized by the following five characteristics:

- Practice memory is fundamentally subjective and relativistic owing to the fact that it is unevenly distributed between practitioners. This means that different groups and individuals would have varying perspective on the practice in question when they attempt to remember it.

- Practice memory is inherently political as different groups benefit from remembering and/or memorizing the practice at the expense of others.

- Practice memory is consistently challenged from 'below' (at the level of 'short-term memory') and from the 'flanks' (at the level of other practices).

In many ways there is little distinction between a practice and its memory and it can be reductively argued that practice memory is simply a practice that has transpired a moment ago. There is some truth to such a statement, but practice memory achieves a far more important task than just providing a term to describe past practice. Practice memory defines practice as it is a record of numerous political battles within the practice that made it as it is now (teleology). Practices are hugely complex in their own right but, as discussed above, they never exist in isolation. Not only do practices encapsulate internal political struggles to define them, but also from other practices. In effect, practice memory is a 'hall of fame' of very specific objects and decisions that succeeded in subverting their challengers and managed to persist on a large enough scale to dominate within the framework of the entire practice and to define it (Bourdieu, 1977; Engestrom, 1987; Miettinen & Virkkunen, 2005).

Rethinking the place of the organization in practice memory

Considering collective memory at the level of practices allows for significant insight into the peculiarity of the spatial-temporal arrangements of organizational life, but it also demeans the importance of individual organizations and the role they play. As discussed above, organizations irritate practices to confront and acknowledge one another by bringing them together for the purposes of work. But this part of the argument accounts for the multitude of memories within a frame of any single organization.

As with anything in the epistemology of practice, organizations and practices exist in a recursive relationship. Organizations can simultaneously be equated to the practices that they house and as unrelated temporal arenas for practices to interact on. In other words practices both can and cannot comfortably exist outside of any one organization. Even though practices fundamentally precede any kind of 'doing' that may happen within and between organizations, they cannot persist without the aforementioned 'doing' regularly taking place. Analytically this presents an almost dichotomy between practices as performed on an organizational level and practices as maintained on a practice level. But as this relationship is recursive, the events at the organizational level have every chance of influencing the overall direction of the practice because, after all, practices are argued to be teleological in their entirety.

Following the discussion above, practice memory is closely related to the spaces where practices occur. Even though such spaces do not have to be within organizations, they probably most often are. This does not exclusively mean buildings or meeting rooms, but organization in the broadest sense – as an ongoing holding together of different practices in some recognizable inter-related arrangement. Seen from this perspective the role of organization is far less proactive in the mnemonic matters than presupposed by other theorizations.

Thinking of organizational memory in this way results in several implications relevant to those people who develop products and make decisions based on their understanding of it. Firstly, a literature review of organizational memory should have demonstrated a strong case for it being far from a rational process. A great deal of models used in product development and learning initiatives by contemporary organizations assume a naively linear, almost causal, relationship between learning, memorizing and remembering. Organizational memory is far more inclusive and unstable than such approaches suggest. Secondly, organizational memory does not end, or even begin, with the organization in question – there are nexuses of practices and spatio-material arrangements that stem above and beyond the limits of an organization, however large it may be. In the design of knowledge management systems and information communication technologies that go on sale to organizations, this insight has important connotations – not including parts of the practice outside the organization means drawing artificial lines of separation within larger practices. Finally, with organizational memory as a time-capsule like entity gradually descending into the annals of organizational history, it is worth reconsidering the way we operationalize our thinking about organizations – how uniform, monolith and/or stable are they? how can we integrate broader practices into organizational space, especially using ICT's? what is the role of materiality and objects in organizational memory?

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Mobile Banking as Enabling and Constraining Financial Inclusion in Pakistan

A Theoretical Perspective

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KEYWORDS

Mobile Banking
Enabling and Constraining
G2P
Financial Inclusion
Socio-Economic Impact
Women
Duality of Technology
Pakistan

ABSTRACT

This paper provides a theoretical framework for exploring the role of new technologies for 'banking' the poor via mobile banking (m-banking) for financial inclusion in developing countries. It extends the literature beyond previous studies that examined m-banking through a technological or economic lens from the provider's perspective, or from a collective national or regional level focussing on the individual user's perspective. Thus the aim of the paper is to bridge the theoretical and methodological gap by justifying the application of Orlikowski's Duality of Technology, as a socio-technical lens to evaluate how the social construction of m-banking enables and constrains poor women to access government-to-person (G2P) payments, or digital social cash in Pakistan- a country that has been previously under researched. By shifting the level of analysis to the organisational level, the structuration framework helps us investigate the social and economic impact of m-banking in the restructuring of poor households for financial inclusion in Pakistan, and the effect of external and internal institutional forces in the redesign of emerging new technologies and financial practices. Furthermore, the paper debates why the socio-materiality of technology fails to provide a conceptual framework for this research. To conclude the paper highlights how the Duality of Technology contributes to new knowledge through a socio-technical perspective that underpins the philosophical orientation of the research to study the complex relationship between m-banking, households structures and social actors that provide an interpretive frame within the case study of the Benazir Income Support Programme in Pakistan.

Introduction

The exponential growth of mobile technologies in the developing world has revolutionised the way people do banking (Ivatury and Pickens, 2006) as there are more people with mobile phones than with bank accounts (Porteous, 2006). In the meantime, the majority of the population in developing economies is unbanked and live in informal or cash economies relying on services that are associated with high transaction costs (Kimenyi and Ndung'u, 2009). This contrast creates an inequitable economic world where the poor are financially excluded that impacts on the individuals' social standing ad well-being (Donner, 2007; Donner and Tellez, 2008).

M-banking, in developing countries, is facilitated by branchless banking regulations enabling banks to extend the outreach of financial services to marginalised populations using mobile channels penetrating remote underserved regions. Mobile phone users, through their 'virtual accounts' or m-wallets, are connected to banks through 'banking agents' who act on behalf of banks converting 'virtual' cash into physical cash and vice versa (Mas and Kumar, 2008; Ivatury and Mas, 2008; Donner and Tellez, 2008; Ivatury and Pickens, 2006). Banking agents, also known as retailers, or merchants, include local post offices or airtime resellers located in pharmacies, petrol stations and bakeries in rural communities. Thus, banking agents are more accessible to local communities where there is an absence of traditional bank branches, either due to infrastructural deficits, or high costs associated with the 'outreach' of offering financial services to the poor (Mas, 2009).

Focusing on developing nations several models of mobile banking have been critically studied in Africa; especially in Kenya (M-PESA), Tanzania

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(M-PESA) and South Africa (WIZZIT), and in Asia such as Philippines (SmartMoney and G-Cash), India (Eko) and Bangladesh (bKash and Dutch Bangla Mobile) (Omwansa, 2009; Hughes and Lonie, 2007; Morawczynski, 2008, 2009, 2011; Comninos et al., 2008; Camner and Sjoblom, 2009; Mas, 2009; Ndiwalana and Popov, 2008; Alampay and Bala, 2010; Chen, 2012; Mishra and Bisht, 2013). Whilst research on M-PESA in Kenya and Tanzania reveals that mobile operator-led models are dominant due to low levels of banking penetration and poor state of fixed communication infrastructures (Ivatury and Mas, 2008; Mas and Ng'weno, 2010), however, in South Africa partnership-led (MTN money) or third party-led models (WIZZIT) are more distinguished in the current literature. Moreover, the literature celebrates Kenya's M-PESA, as the most successful model, owing to its cost effectiveness and safety as compared to Tanzania's M-PESA model (Kimenyi and Ndung'u, 2009; Mas and Morawczynski, 2009; Omwansa, 2009; Hayes and Westrup, 2012). Nevertheless, in Latin America, bank-led models relying on magstripe/cash cards and point-of-sale (POS) terminals are more commonly deployed as the enabling infrastructure for branchless banking (Mas, 2009; Ivatury and Mas, 2008).

Furthermore from Asia, such as Philippines, the mobile operator-led model, G-Cash, due to its flexibility is more popular than its competitor, SmartMoney that is partnership-led (Ndiwalana and Popov, 2008). In contrast, we see that bank-led models dominate the South Asian landscape, especially in Pakistan, India and Bangladesh that are known to be more conservative models with fewer access points and limited inter-operability as they typically follow a top-down design approach from policymakers (Mishra and Bisht, 2013).

Also studies from practitioners provide valuable insight into the usage of current m-banking practices. In Kenya and Tanzania, domestic person-to-person (P2P) payments are common, in contrast to Philippines where the majority of m-transfers comprise of international m-remittances (Heyer and Mas, 2009; Mas and Radcliffe, 2010; Alampay and Bala, 2010). However, in Latin America, particularly in Brazil, and in South Asia such as Pakistan and Bangladesh, over the counter person-to-person (P2P) or person-to-business (P2B) transfers are exclusive amongst users. There is also a significant increase in the outflow of government-to-person payments (G2P) that has been significantly undocumented (Mas, 2009; Chen, 2013; Bold, 2011) in South America and Pakistan.

So while we see that the terms m-money, m-finance and m-banking are used interchangeably within the current literature to include practices that bring financial services to the unbanked using mobile phone comprising of person-to-person (P2P) payments, person-to-business (P2B) payments, government-to-person (G2P) payments, m-credit/insurance and m-savings (e.g. Duncombe and Boateng, 2009; Donner and Tellez, 2008; Donner, 2007; Ndiwalana and Popov, 2008), in this paper m-banking specifically refers to G2P payments within social cash transfer programmes.

Therefore, critically reviewing the m-banking literature from developing countries, the majority of research pertains to person-to-person (P2P) payments, while research lags on the role of m-banking within the Government sector for disbursing welfare payments, or G2P payments to poor people. As the research is currently in progress, the objectives of this paper is to provide a theoretical lens to guide our study on m-banking for leveraging G2P payments for financial inclusion within the context of a social cash programme in Pakistan- a country with 74% mobile penetration rate with established mobile banking programmes, but has so far been largely under researched in the current literature.

In what follows in the paper, section 2 highlights the gaps in the theoretical literature to justify the choice of the framework for this study. Section 3 reflects upon the philosophical orientation of the study that underpins the Duality of Technology, while section 4 outlines the limitations of other structuration frameworks from previous studies. In section 5 we outline the Duality of Technology that proposes the research questions, and later in section 6 how the framework is related to the objectives of the study to drive our methodology for future work as this is a research-in-progress paper. Section 7 provides a critical insight on the framework proceeded by conclusions and contribution to new knowledge in section 8.

Theoretical Gaps in Mobile Banking Literature in Developing Countries

Technological Deterministic Perspective

New technologies for knowledge practices, or Information Systems (IS) innovation and transfer from developed to developing economies is primarily perceived to be technologically deterministic, as the focus on local needs of individuals and communities is discounted by international development agencies and donors (Avgerou, 2010; Kyem, 2012). Hence, majority of m-banking literature within the technological deterministic perspective is framed around policy reports and documents for regulatory institutions, governments or funding bodies acting as an 'enabling environment' at the macro-level (Porteous, 2006; Lyman, Pickens and Porteous, 2008). Also, the technological-deterministic perspective captures the upstream perception of m-banking

providers (mobile operators, banks and MFIs) and intermediaries (retailers/banking agents) within the m-banking ecosystem (Mas and Ng'weno, 2010; Mas and Morawczynski, 2009; Jenkins, 2008), so technological innovation may not logically 'fit' with users expectations (Avgerou, 2001) and may lead to 'disruptive' transformation (Avgerou, 2010). As the technological and institutional trends are set elsewhere, business models may overlook the developing country's local context (Thompson, 2008; Avgerou, 2010). In contrast, we debate that M-PESA's success in Kenya, despite foreign agenda, allows it to 'catch up' with the developed world so is 'progressively' transformative (Avgerou, 2010) despite criticism that the model fails to link users to a wider range of banks that limits access to a variety of financial services for a more segmented tariff and sub-agent model (Mas and N'gweno, 2010).

Technology Acceptance Model (TAM)

Although many scholars focus on m-banking adoption by users to assess economic transactions in their social context, however, they fail to highlight the challenges that impedes adoption and usage (Porteous, 2007; Donner, 2007; Donner and Tellez, 2008; Tobbin, 2012). Hence, we find that current research is heavily biased towards m-banking adoption, reflected through technological-deterministic models, like Technology Acceptance Model (TAM), primarily relating to a set of behavioural constructs that dominates m-banking adoption studies (Venkatesh and Davis, 2000; Tobbin, 2012; Mbogo, 2010; Ngugi, Pelowski and Ogembo, 2010). Additionally, criticised for being a static model and drawing upon computer science literature, TAM denies the ontological belief that technology constantly evolves through user's interaction. Hence, it perceives technology to be 'exterior' to the user, thereby, ignoring the 'social side' or 'context' (Avgerou, 2001) that is explicated through social construction of technology (SCOT) design and use (Bijker and Law, 1992; MacKenzie and Wajcman, 1999; Pinch and Bijker, 1987).

Rogers' Diffusion of Innovations Theory

Rogers' 'Diffusion of Innovations Theory' (Rogers, 1962, 2004) as applied within IS literature reflects upon the S-shaped pattern of IS innovations although scholars have identified two variants within the pattern. Whilst the more optimistic 'normalisation' pattern illustrates that social profile of communities broaden over time (Norris, 2001), the second variant offers a more pessimistic 'stratification' thesis predicting that more radical innovations diffuse more slowly in society but was later challenged by business process reengineering innovation models (Rogers, 1995).

Moreover, diffusion of innovations theory within m-banking literature is criticised for being influenced from positivist literature whilst underlining the importance of creating awareness, as a critical first step, to drive adoption and usage of m-banking innovation (Sivapragasm, Aguero, and de Silva, 2011). Also by discounting time as an independent variable within the life cycle, critics evoke that the approach has a 'pro-innovation' bias, based on the assumption that all innovations are 'good' and hence, uniformly adopted by 'early adopters' or 'innovators' being 'agents of change' belonging to higher socio-economic groups (Rogers, 2004; Cruz and Laukkanen, 2010). Also the theory neglects the effect of the 'task technology fit' failing to address 'whom' and 'why' the late majority or 'laggards' are sceptical about adopting new technologies over an on-going application of habitual technology (Zhou, Lu and Wang, 2010). Therefore the theory fails to establish any link with capabilities development that may encourage m-banking adoption and does not distinguish between varied adoption factors between genders.

Socio-Technical Perspective

However, a socio-technical perspective on m-banking perceives the ICT artefact to be 'socially embedded' based upon the 'situated' approach considering IS innovation to be constructed and enacted by social actors. This perspective coincides with the view that m-banking innovation is locally constructed and diffused within communities following a bottom-up approach to include marginal communities in the mainstream (Casal, 2007; Walsham and Sahay, 2006; Avgerou, 2010). However, according Donner and Tellez (2008), m-banking adoption and use is causal to impact and therefore, m-banking practices need to be holistically evaluated by researchers. Hence, contextual and institutional factors influence the design of m-banking innovation, and consequently, adoption and usage to determine impact on individuals and structures.

Other studies through various social-technical lens examine the intersections of financial and socio-economic networks identifying key questions of trust that emerge and how m-banking usage and behaviour patterns alter socio-economic relationships between low-income individuals and households across the developing world (Donner, 2007; Medhi, Ratan and Toyama, 2009; Kareer-Rueedi and Trueb, 2011; Tobbin, 2012; Morawczynski and Miscione, 2008). Whilst Adaptive Structuration Theory (Orlikowski, 1992, 2000; Orlikowski and Baroudi, 1991; Oudshoorn and Pinch, 2008) evaluates how m-banking 'amplifies' social structures rather than 'transforming' them to trigger myriad 'effects' (Donner and Tellez, 2008; Donner, 2007), in contrast, studies from Kenya reveal that urban-rural transfers 'transform' financial practices used for the cultivation of livelihood

strategies (Morawcyznski, 2011; Morawcyznski and Pickens, 2009).

Additionally through a socio-economic perspective, studies by Jack and Suri (2011) and Morawczynski (2009, 2011) focus on users illustrating rising household incomes, risks, saving and usage patterns of m-banking across households in Kenya. However, authors debate that the economic 'effects', linked to the social 'effects', are not distinctly visible, uniform and homogenous across all communities, but are rather influenced by gender and geographic location (Plyler, Haas and Nagarajan, 2010). Although the Capabilities Approach (Sen, 1999) has been applied in the mobile technologies literature, it is absent from any m-banking studies.

Nevertheless, from a methodological standpoint, women users have been largely marginalised in the literature. Furthermore, geographically while m-banking literature is pervasive from other developing countries, there is scant interpretive research from Pakistan analysing how m-banking is used by poor women for receiving G2P payments from the Government. Hence, drawing from the theoretical and methodological gaps in the literature, the paper seeks to investigate how m-banking 'enables and constrains' women users for receiving digital social cash and its impact on households for altering the socio-economic dynamics of structures for financial inclusion. By offering a new epistemological lens, 'Orlikowski's Duality of Technology' (Orlikowski, 1992) that has not been applied in previous studies, the paper seeks to extend the literature by analysing the relationship between m-banking, social actors and institutions. The next section highlights how the philosophical orientation is reflected within structuration theory to influence the choice of invoking the framework to guide the methodology for the study.

Influence of Research Philosophy on Theoretical Framework

The epistemological stance of the study reflects the philosophical belief regarding the nature of m-banking and its emerging role in shaping social processes and structures. As within the 'interpretivist' paradigm, truth and knowledge as social products, are incapable of being understood independent of social actors (Orlikowski and Baroudi, 1991; Walsham, 1993, 1995), we subscribe to the ontological belief of 'social constructionism'. Hence, by signifying that social actors, through their participation in social processes, construct and reconstruct reality and knowledge, and endow it with subjective meanings, beliefs and intentions (Orlikowski and Baroudi, 1991), researchers concede that the 'world is not conceived of as a fixed constitution of objects but rather as an "emergent" social process - an extension of human consciousness and subjective experience' (Burrell and Morgan, 1979, p.253).

On the contrary positivist IS research, illustrated through the 'technological imperative model', posits a 'hardware' view of technology that is an external, exogenous force with causal unidirectional and deterministic impacts on institutional properties or structures (Davis, 1989; Carter, 1984). Other authors conceive technology as 'social technologies' as reflected in the 'strategic choice model' (Orlikowski, 1992, 2010; Markus, 1983; Davis and Taylor, 1986; Zuboff, 1988) despite criticism that it relies heavily on the capability of human agents, and discounts the influence of institutional forces in the environment, and the subsequent unintended consequences of organisational change (Orlikowski, 1992, 2010).

Hence, the discourse related to the ontological nature of m-banking, and its role within institutions is paramount to shape the theoretical framework for this research. Thus, the structuration model adopted in this study directs an interpretive and social constructionist view to examine m-banking in Pakistan. By reconceptualising the scope and use of technology (m-banking) and its relationship with social agents (women/designers) and institutions (households), structuration research provides deep insight to investigate how m-banking impacts on individuals and transforms social processes and structures at the household (institutional) level.

Thus, 'Duality of Technology' (Orlikowski, 1992, 2000; Orlikowski and Robey, 1991) negates the 'objective' view of technology, but rather subscribes to 'social constructionism' highlighting the flexible nature of technology enacted by designers and improvised by social actors, or users through interpretations, social interests and disciplinary conflicts. Hence, by re-characterising social technology as 'technology-in-practice', Orlikowski (2000) argues that technology structures are emergent rather than embodied, thereby, reflecting upon the 'interpretive flexible' nature of its design and use. The next section highlights the limitations of other structuration theories in previous studies to further justify why the Duality of Technology is the most appropriate framework for the study.

Limitations of Other Structuration Theories in IS Literature

While Giddens structuration theory (1979, 1984, 1993) does not explicitly address the issue of technology, and is limited to the analysis of the relationship between social actors and the institutional properties of organisations, other scholars draw upon the fundamental concepts from his structural paradigm to study technological innovation. This has given rise to a number of structurational models of technology

in the past decade, providing myriad insights into the role and impact of technology on organisations (Barley, 1986, 1990; Poole and DeSanctis, 1989, 1990; Orlikowski and Robey, 1991; Walsham and Han, 1991; Orlikowski, 1992; Walsham, 1993, DeSanctis and Poole, 1994).

Although structuration theory has been deployed by some scholars to study technology-induced organisational change (Barley, 1986, 1990), there has been little attempt to reconceptualise the notion of technology, leading to anticipated or unanticipated structuring that alters its physical form and use across time and context. Despite technology being defined as a social object, that is socially constructed, authors contend that 'technical-driven' social change is rooted in technology's material constraints, and transformed into social forces for it to significantly affect social organisation (Barley, 1990). Some authors have also critically reviewed structuration models of technology exploring concepts, such as practical and discursive consciousness, routinisation and unanticipated consequences resulting from technological innovation through an interpretive frame (Walsham, 1993; Walsham and Han, 1991).

Nonetheless, other authors have extended the structuration literature through adaptive structuration theory (AST) (DeSanctis and Poole, 1994; Poole and DeSanctis, 1990) that addresses the mutual influence of technology and social processes while departing from Giddens idea of structuration. Hence we note that AST's view of 'structure within technology', its identification of other independent 'sources of structure', and the concept of 'dialectical control' between the 'group and technology' contradict Giddens' principles. As these ideas are further elaborated through underspecified concepts, such as 'spirit' and 'appropriation', for which no substantive theoretical justification is offered to produce a contingency model of technology 'impacts', AST is incompatible with the central tenets of structuration theory (Jones, 1999). Thus, we observe that AST proposes an agenda for research that is heavily oriented towards deterministic functional research, clashing with the interpretivist stance in this study.
Other studies show that scholars have attempted to link structuration concepts with newer theories such as actor network theory (ANT) (Walsham and Sahay, 1999; Lea et al., 1995). While the 'black boxing of technology' and treating the content and context independently has been severely criticised (Lea et al., 1995), Walsham and Sahay (1999) have applied structuration as a meta-theory and have used ANT as a 'more detailed methodological and analytical device'. The next section outlines how the framework can address the gaps in the literature and embed the research questions to further propel the research.

Theoretical Framework for Mobile Banking

Orlikowski (1992) extends the concepts in Giddens structuration theory (1979, 1984) to allow a deeper dialectical understanding of the interaction between technology and social agents in organisations. Consequently, by offering a 'soft determinism' through her practice lens, Orlikowski (2000) examines how technology is shaped and improvised by user's ongoing practices to enact structures whilst structurally enabling and constraining users. So in consequence with IS literature structure, as defined by Giddens, cannot be inscribed or embedded in technology, else it would exist separate from the practices of social actors and independent of their knowledgeable action. This effect would eventually turn 'duality'- a central feature of Giddens and Orlikowski's position into 'dualism' (Jones and Karsten, 2008).

The Duality of Technology

By linking Orlikowski's structuration theory (1992) to the context of the study, the model comprises of human agents (programme designers, users, m-banking service providers), technology-in-practice (m-banking) and institutions (households) related to structural properties; customs, tradition, socio-economic properties, income, household size, communication patterns and division of labour. Other external factors, such as regulatory controls, economic, political and socio-cultural forces are paramount to influence the shift from cash payments to digital G2P payments, and the redesign of technological tools to access social grants within the Government Social Cash Programme in Pakistan (see figure in section 9).

Technology is a product of human action (process a)

The first influence draws upon the ontological stance of social constructionism that technology is socially constructed by designers, and being 'socially embedded', it captures the social beliefs of its creator. However, it is improvised and enacted by social actors through its engagement and continuous use; only being relevant and useful when users attach different meanings to it. Hence, technology is created and sustained by human action through on going use, maintenance and adaptation (Orlikowski, 1992, 2000). Although social constructionism reflects on how shared interpretations, social interests and disciplinary conflicts shape the production of technology that becomes 'stabilised' through cultural meanings and social interactions amongst various social groups, the 'stability' is later criticised owing to the fact that it is 'interpretively flexible', as it is constantly shaped and improvised by users through practice (Orlikowski, 2000).

Subsequently, the notion of 'interpretive flexibility' defines that in the design mode, m-banking designers build certain interpretive schemes, facilities and norms in the technology that are a function of the institutional and social context implicated in its development and use to meet managerial goals (Pinch and Bijker, 1984, 1987; Bijker, 1987; Bijker and Law, 1992; Mackenzie and Wajcman, 1999; Orlikowski, 1992). Whilst in the use mode, women users appropriate m-banking physically, socially and culturally by assigning shared meanings to it with the capacity to change technology through their interaction (Orlikowski, 1992, 2000). Hence, technological innovation is not independent of women users, but is rather emergent when enacted from users repeated and situated interaction with m-banking (Orlikowski, 2000).

Technology is the medium of human action (process b)

Orlikowski (1992) further postulates that as technology is enacted through human agency, it cannot 'determine' but only 'condition' human practices. While this influence resembles that posited by earlier scholars of the *impacts of technology* on the *use of technology*, however, within the structuration model of technology we argue that while 'conditioning' social practices, technology may 'enable' and 'constrain' or do both. Thus, the *duality* of technology assumes that while being a product of human action, technology has a 'dual effect' on users, unless users 'choose to act otherwise'. However, the dual influence has not been typically recognised in that attempt to determine the 'positive' or 'negative' effects of technology (Orlikowski, 1992). Thus, technology-in-practice serves essentially as a 'behavioural and interpretive template' for user's situated use of technology (Orlikowski, 2000).

Linking this to our context, m-banking may have certain implications for women users, and hence little discretion over which meanings and elements influence their interaction with it. As the constraints may be institutional, or inherent within the technological artefact, m-banking may become challenging for women who may fail to use it, modify their engagement with it, or subsequently use other alternative financial practices.

Based on the above processes (a and b), the framework within the context of the study, helps us to investigate how the design of m-banking, constructed by designers, 'enables' and 'constrains' poor women to receive social welfare or G2P payments via their mobile phones. The designer's objectives in designing mobile phones in the social welfare programme may or may not achieve user's expectations that may give rise to emergent technologies.

Institutional impact of technology on structures (process c)

Extending the model further, Orlikowski (1992, 2000) draws a relationship between technology and institutions linked to user's recurrent engagement with technology that constitutes and reconstitutes emergent structures of using technology-in-practice. Hence, the structuration model defines the manner in which m-banking practices become reified and institutionalised in social structures, or households, either by reinforcing practices or transforming them (Orlikowski, 1992).

So while an innovation may be adopted or improvised because of its acquired legitimacy, irrespective of whether or not it produces its promised technical value, technology is an 'enacted environment' in which its construction and use is conditioned by an organisation's structure of significance, domination, and legitimation (Orlikowski, 1992, 2000; Powell, 1987). Hence, the appropriation and use of m-banking implies the *'institutional consequences of interaction with technology'* that are not often reflected by women users, who are generally unaware of their role in either reaffirming (more typically) or disrupting (less frequently) the institutional status quo (Orlikowski, 1992).

Nonetheless, whilst organisational rules and norms mediate human action they are subsequently reaffirmed or challenged by human actors through interpretive schemes. So when technology is not used as intended it may undermine and sometimes transform the embedded rules and resources, and the institutional context of technology's designers. As a result, m-banking may be developed in 'unanticipated' ways and 'normalised' through a 'negotiation process' between various social actors. Therefore, the institutionalisation of technology in structures may impact institutional properties resulting in emergent structures and financial practices (Avgerou, 2000, 2002).

This particular relationship explores how G2P payments impact on changing the socio-economic dynamics of households. By shifting the level of analysis to households, we can further investigate whether G2P payments are financially inclusive by linking poor women to the banking sector via their virtual mobile phone accounts, thereby, providing greater access to a wider range of financial services, such as savings, micro-credit and insurance for micro-entrepreneurial development.

Institutional impact of technology on agents (process d)

The combination of internal and external institutional forces influences the design of technology used in

the social construction of m-banking. Thus, human actors are subject to the institutional properties of their setting drawing upon resources, stocks of knowledge, structures of significance, domination and legitimation of the organisation, and 'normalised' standards for improvising technological practices (Orlikowski, 1992). Also, in their recurrent social practices designers and users draw upon institutional resources; experiences, norms, power relations and meanings to inform their ongoing practices that recursively instantiates the rules and resources that structures their social action (Orlikowski, 2000). However, we note that these influences are often unarticulated in Orlikowski's framework and referred to as the '*institutional conditions of interaction with technology*' (Orlikowski, 1992).

This final influence in structuration theory has been ontologically linked with the emerging nature of technology-in-practice. As it assumes that m-banking is embedded in the social context, designers and women users have the potential to adapt and innovate technologies that are more compatible with the forces from the environment. This allows us to critically assess the political, economic and regulatory forces that influence the design and re-design of alternative payment technologies in the context of the study. The next sections shows how the research questions are incorporated within the Duality of Technology framework.

Research Questions

So we see that the theoretical framework offers a set of propositions for deriving the research questions that guides the data sample and collection methods through a qualitative approach and interpretive methodology. We have constructed the following research questions to undertake future research work:

RQ1. How does m-banking 'enable' and 'constrain' poor women for accessing G2P payments and how are these effects linked to the construction and design of m-banking? (Process a and b)

RQ2. How does m-banking affect the institutional properties of households, such as socio-economic development for financial inclusion of poor households? (Process c)

RQ3. To what extent is m-banking sustainable under the economic, political, cultural and regulatory forces in Pakistan? (Process d)

The next section links the framework and research questions within the context of the G2P sector in Pakistan.

Research Setting and Future Work

Pakistan boasts of a high mobile phone penetration of 74 percent* while 88 percent† of the population is unbanked, including 63 percent‡ in rural areas. As the majority of population is financially marginalised, the gap between the rich and poor widens. While currently five established m-banking models provide a range of mobile financial services in Pakistan; *Easypaisa, UBL-Omni, Mobicash, Timepey and U-fone*, we see that mobile transfers, such as P2P or P2B transfers are common practices among the unbanked low income male population (CGAP, 2011, 2012). In addition, mobile banking for G2P transfers can provide further opportunity to 'bank' the poor to reduce the financial divide. Hence, branchless banking initiatives have enabled the Government Sector in Pakistan to digitise a large share of government flows to people moving the country towards a digital financially inclusive system. Consequently, the initial efforts to distribute social cash transfers digitally have been expanded to include a wider variety of government-to-person (G2P) flows. More generally, whilst social cash transfers constitute about 11 percent ($1.1 billion) of total annual government payments ($9.3 billion), salaries comprise of 68 percent ($6.3 billion) and pensions make up 21 percent ($1.9 billion) of social transfers in Pakistan. Thus, the success of digital G2P payments builds upon the progress made by the branchless banking sector, and with appropriate experimentation, digital G2P payments have the potential to become a vehicle for extending financial inclusion and improving the welfare of the poor people (CGAP, 2013).

Although the prospect of 'banking' the 'unbanked', via m-banking, for delivering G2P payments seems promising, however, there is no documented research that provides evidence for this proposition. Therefore, the objectives of this paper is to explore the role of m-banking for distributing G2P payments in the Government sector and how its design affects the usage of m-banking by poor women and its effect on organisational structures. The duality of technology framework proposes a set of research questions as previously illustrated in section 5.2.

Our focal case study is the Benazir Income Support Programme (BISP) in Pakistan, an initiative by the former Pakistan People's Party Government in 2008 and running successfully through the current Government. BISP provides unconditional cash assistance (around $11.4 per month) to approximately

* www.pta.gov.pk/

† Yaseen Anwar, Governor of the State Bank of Pakistan at the 6th International Conference on 'Mobile Banking in Pakistan', Karachi, 14 March 2013

‡ www.data.worldbank.org/indicator/

5.3 million§ low-income families, constituting around 18% of the entire population across all four provinces (Sindh, Punjab, Baluchistan, Khyber Pakhtoonkhwa) and other regions, such as Federally Administered Tribal Areas (FATA), Azad Jammu and Kashmir (AJK), Gilgit Baltistan (GB) and Islamabad Capital Territory. Initially women received cash payments through parliamentarians and money orders through the Pakistan Post. In 2010, mobile phones were designed into the programme in five locations; Layyah, Larkana, Battagram, Islamabad and Rawalpindi as pilot projects. Poor women were notified of their payments, via a text message, on their mobile phone but physically received money from the banking agent after showing the text message containing PIN (personal identification number) and identity card for verification (BISP, 2014).

Our methodology, an interpretive case study (Yin, 2009), purposively sampled poor women residing in the semi-urban/rural clusters around the twin cities of Rawalpindi and Islamabad, Pakistan. Primary data was collected through qualitative methods; semi-structured interviews, observations and focus groups from women using m-banking for receiving G2P payments, Additional interviews were conducted from other social actors; BISP staff, bankers and mobile operator and banking agent staff in order to analyse and interpret the data through multiple perspectives in the light of the structuration framework. This allows triangulation of results to construct validity, transferability, trustworthiness and reliability in the research findings. Additionally, we also drew on secondary data from BISP company reports, official publications and formal/ informal media sources.

Critical Discussion

Firstly, Duality of Technology (1992) has been criticised for offering an overly socialised view of technology (Leonardi, 2013) and fails to provide a cross organisational examination across various institutions as technology may be designed in one, but used in another organisation by different users. Hence, the framework is limited for structural analysis across multiple forms of institutions that emerge. Further, by acknowledging that all elements within the framework interact recursively, and may be in opposition to undermine each other's effects, structuration is seen as a dialectical process that is also inherently contradictory (Orlikowski, 1992).

Secondly, we note that the structuration model of technology overlooks the incompatibilities between cultural systems and formal functional aspects of power relations that are symbolic in organisations (Markus, 1983; Powell and DiMaggio, 1991; Meyer and Rowan, 1991; Zucker, 1991; Avgerou and McGrath, 2007; Foucault, 1980, 1982). This relationship is important to explore as technology can change cognitive systems through the reflexive behaviour of social actors' that may further affect the use of technological practices in institutions.

Thirdly, scholars have presented another perspective on technology, namely, 'entanglement in practice', or 'socio-material' view that entails a commitment to a relational ontology through fusion of the 'social' and 'material' as socio-technical hybrid networks undermining 'dualism' (Scott and Orlikowski, 2014; Orlikowski and Scott, 2008; Orlikowski, 2007, 2010; Mingers and Willcocks, 2014; Leonardi, Nardi and Kallinikos, 2012). Such an ontology privileges neither humans nor technologies (Latour, 2005; Schatzki, 2002) as the social and material are 'ontologically inseparable' sharing a simple dualistic view of agency framed around 'agential realism' at the philosophical level (Introna, 2007; Barad, 2003). However, other scholars are critical of this assumption as it creates complications while mapping the philosophical discussion onto empirical phenomena, so they contend that critical realism and agential realism should be treated separately within various contexts (Leonardi, 2013; Mutch, 2013).

Therefore we argue that the socio-material perspective of technology lies outside the scope of this paper as the notion of 'stability' in socio-material networks fails to acknowledge that hybrid networks may have the tendency to collapse in future. Further, capacities for action within this view are studied as relational, distributed and enacted through particular instantiations of the synthetic world, as in the case of real time virtual community networks (Scott and Orlikowski, 2014; Orlikowski, 2010). However, this concept is irrelevant for the study as actual physical engagement between the material and the social is pervasive through users' interaction with mobile phones. Nonetheless, we believe that Orlikowski's framework is apposite in our study because we are not restricting our analysis to m-banking practices, but also studying the 'enabling and constraining' factors affecting the usage of m-banking on individuals and organisations for socio-economic change.

Conclusion and Contribution to Knowledge

This study, to our knowledge, is the first of its type from Pakistan that aims to investigate the intertwining themes between mobile banking, financial inclusion and socio-economic development of poor women. As the framework adopts a context-specific approach to examine m-banking through a structuration lens, it will bridge the theoretical gap by offering new insights into the relationship between social actors interacting with social technologies, and how the enabling and constraining effects of m-banking

§ Brief on Benazir Income Support Programme (BISP)- A Social Safety Net: BISP, Government of Pakistan

impacts upon financial and social inclusion across households in Pakistan. Furthermore, the study will seek to determine whether G2P payments is a 'constructed reality' for financial inclusion that triggers micro-entrepreneurial activities for steering economically deprived communities towards 'progressive' transformation (Avgerou, 2010). Or whether it offers a false 'utopia' or 'optimism' for the academic IS community who deem that m-banking will be a paradigm shift towards more financially inclusive technologies for re-structuring households and communities for poverty elimination in Pakistan.

Theoretical Framework: The Duality of Technology

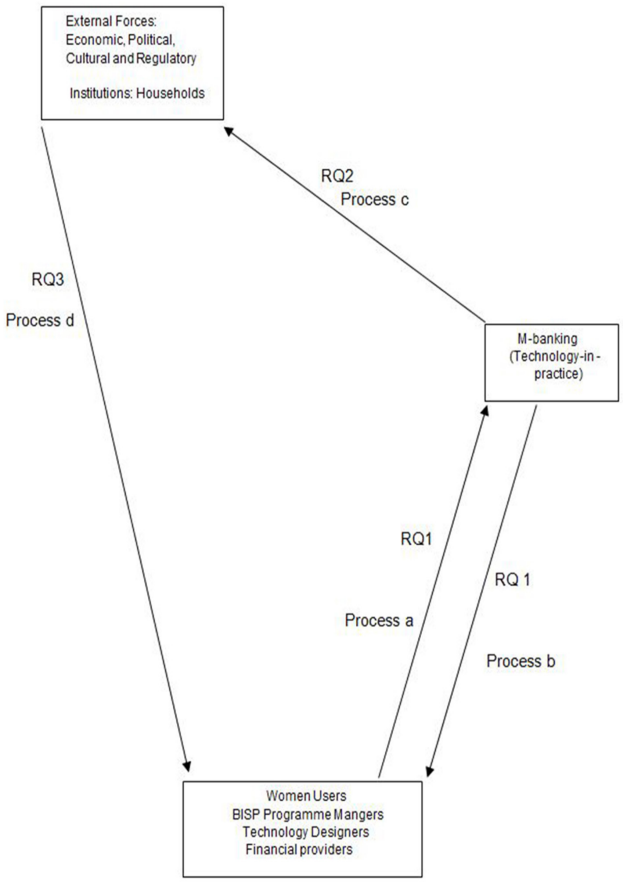

Figure 1. Adapted from: Orlikowski (1992).

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Towards a Theory of ICTs for Poverty Reduction

Researching Computerization of the Indian Public Distribution System

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KEYWORDS

E-Governance
Food Security
Poverty Reduction
Anti-Poverty Programmes
India
Karnataka

ABSTRACT

The study of e-governance for poverty reduction has become a central theme in the area of ICTs for development (ICT4D). Yet, the intertwining between technology design and the political agendas behind it still needs to be theorized more explicitly, from both an analytical and a normative perspective. To this end, we study the dynamics underlying computerization of the Public Distribution System (the largest food security programme in India) in the state of Karnataka, and the ways in which ICTs mediate access of beneficiaries to the scheme. Preliminary findings suggest that technology, rather than simply pursuing more effective programme delivery, is designed to advance specific political agendas, which embody clear assumptions on the roots of food insecurity, and on the ideal ways in which these should be tackled. This commentary, based on research in progress, outlines our preliminary considerations towards a theory of technology for poverty reduction.

Introduction

As powerfully synthesized by Heeks (2014), the study of e-governance for poverty reduction has become a top priority in the ICT for Development (ICT4D) research agenda. Among the factors behind this is the fact that social safety nets, utilized to develop anti-poverty systems all over the world, are increasingly being pervaded by digital technologies in all their phases, a phenomenon referred to as end-to-end computerization. The increasing digitalization of anti-poverty schemes gives rise to a set of questions: primarily, what are the causes behind it, and how are they related to the context of development? And crucially, how can any beneficial effects of ICTs be leveraged beyond isolated cases? In sum, the field of ICTs for poverty reduction is in dire need for dedicated theorization.

So far, discourse on anti-poverty ICTs has been crafted in a predominantly results-oriented fashion, leading to a focus on *what* may lead to success in digitalizing social safety nets. Predominance of this thread, while helpful from the point of view of policy prescription, may lead to a limited vision of the problem: sheer identification of success factors, aimed at cross-contextual replication of outcomes, transcends the localized processes of interaction between technology and the actors around it. In the case of developing countries, where the provision of locally relevant content and adaptation of tools to recipients are paramount, a sheer results-oriented view may miss this part of the picture, leading to weak grounds for analytic generalization.

Our research is predicated on a socially embedded view of technology (Avgerou 2008), articulated through political context and observation of the *meaning* of development embodied in e-governance (Prakash and De 2007). Observing technology through this view, we aim at building theory on the intertwining between ICT systems for poverty reduction and the policy agendas behind them. To do so, we have embarked on a study of the Indian Public Distribution System (PDS), the biggest Indian food security programme, as mediated by technology in the state of Karnataka: we aim to arrive, through ethnographic insights, at formulation of analytical theory on these processes.

Social Safety Nets and the Politics of Technology Design

The idea that "artefacts have politics", articulated in seminal work by Winner (1980), is inscribed in the

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theoretical understanding that inspired our research. The view that technology constitutes the physical embodiment of political visions and goals acquires specific meaning with respect to e-governance, with technology being framed as a potential "carrier" of the policy objectives of governing actors (Cordella and Iannacci 2010). However, the vision of technology subsumed here goes beyond a deterministic tool view, which reduces the meaning of the artefact to that of a sheer means to given purposes. The idea from which we start is instead that of an *ensemble* view: the unit of analysis is not technology *per se*, but the ensemble resulting from its enmeshment in the social, political and institutional context of use (Orlikowski and Iacono 2001).

The ensemble view is at the root of our vision of technology, which ascribes to Avgerou's (2008) concept of social embeddedness: technology is *embedded* in its context of action, and emerges from it while, in turn, influencing its evolution. Having being largely accepted in the information systems domain, the idea of technology as socially embedded has gained substantial grounds in ICT4D: developing nations, it is sustained, conceive new technologies according to local needs, and lead implementation according to locally determined sets of priorities.

As we apply a socially embedded vision to ICTs for poverty reduction, two notions become particularly relevant. First, when it comes to e-governance, the *political* context of action (specifically, locally determined objectives of policymaking) needs to be explicitly considered. Second, technology may be used to advance a specific vision or *meaning* of development, enacted by policymakers through the construction of dedicated programmes. Identification of that meaning, as it surfaces in the design of anti-poverty technology, becomes therefore relevant to theory-building.

This leads us to the question inspiring our project: specifically, what is the nature of the relation between anti-poverty technologies and the policy agendas behind them? And, how does that relation come alive in practice, as appraised by programme recipients? Our study of food security in southern India aims at making sense of these relations. To do so, we are leading ongoing fieldwork on the state of Karnataka, one of those in which digitalization of food security is most advanced.

Karnataka: The Computerization of Food Security

As per the IFPRI (2914) Global Hunger Index report, hunger and malnutrition persist at extremely alarming rates in India today. The PDS is the main food security programme in the nation, based on rationed distribution of basic-need items – primarily rice, wheat, sugar and kerosene – to below-poverty-line (BPL) households through a network of ration shops. To leverage the anti-poverty potential of ICTs, the National E-Governance Plan mandates computerization of PDS for all states.

The IT system for the PDS, developed by the National Informatics Centre (NIC) Karnataka, consists of a back-end infrastructure, in which details of all ration card holders are registered into a database (available at http://ahara.kar.nic.in), and a front-end one, constituted by biometric weighing-cum-point of sales machines installed in the ration shops. While the Ahara database covers the whole state, the machines – designed by a private firm, Essae Teraoka – are part of a pilot project of end-to-end computerization, which partially covers 6 of the state's 29 districts. The government's plan is that of scaling up the pilot to all districts, in order to reach full automatization of the transactions conducted in the ration shops.

The newly-implemented machines directly affect people's access to the PDS, by structuring the transactions through which they buy the subsidized goods. In Karnataka, all BPL households are entitled to a certain quota of PDS goods: as they require their rations, they are identified through their ration card number (a ration card is a document of entitlement) and their thumb impression. As the ration dealer weighs commodities, the machine's speakers announce (in the local language) the type and quantity of goods being sold: when the transaction is completed, a bill is printed automatically. The IT system for the PDS acts, therefore, as a composite technology, in which a back-end infrastructure is completed by the front-end machines through which people's access is structured.

Emerging Linkages: Technology vs. Anti-Poverty Agendas

As it emerges from preliminary fieldwork results, the purpose of mediating PDS transactions through biometric machines is twofold. The main issue, programme staff reveals, is that of non-entitled users accessing the system: before the creation of the Ahara database, "temporary ration cards" had been released to many, without proper verification of entitlements. To curb misappropriation of PDS supplies, the machine has made sales conditional to secure identification, as only verified PDS beneficiaries can access the subsidized goods. At the same time, the machine is designed to prevent misbehaviour from ration dealers: speakers and bills "force" them (at least on paper) to sell exact PDS entitlements, at their correct price. This is particularly relevant in a state where diversion of PDS goods to the private market has constituted, historically, a major impediment to the programme's good functioning (Khera 2011).

Both problems – misappropriation by users and

ration dealers – are corroborated by statistics on PDS diversion (Government of India 2010), whose pervasiveness has motivated computerization of the PDS across states. And still, at the core of our ongoing investigation is the embodiment of assumptions on patterns of corruption in the PDS, and on the measures to be taken against them: in this respect we are observing two threads of connection, apparently linking the computerized PDS with a specific policy agenda.

The first assumption emerging here is that inclusion errors (assigning PDS benefits to non-entitled citizens) are to be prioritized over exclusion errors (i.e. excluding needful beneficiaries). The machine's design focuses indeed on preventing non-entitled users from accessing the programme: this does not apply to citizens who, while genuinely entitled to the PDS, are factually unable to access it. Even in a relatively well-functioning PDS like that of Karnataka, exclusion is still widespread this is largely due to narrow targeting of the system, arrived at as a consequence of structural adjustment policies in the 1990s (Swaminathan 2008). To poor households excluded by BPL criteria one needs to add, after computerization, citizens whose details are "not recognized" by the machine, which may result in rations being denied. In fact, though implementation is generally smooth, we met users whose rations had been denied for months after installation of biometric machines: this is due to failure of recognition, mismatching fingerprints, and failure of the ration shop to pay for connectivity.

A second assumption can be envisaged in the fact that machines, as they are constructed, control transactions at the ration shop level: but do not, *per se*, monitor the previous stages of the PDS supply chain. A software programme (Financial and Stock Accounting System – FIST) has been designed for usage in wholesale points, from which ration dealers lift their foodgrains: its utilisation is however in its early stages, and not yet scaled up at the state level. The decision of focusing on ration shops reflects the assumption that diversion of goods, from the PDS to the market, occurs primarily at this stage: be it through customers misappropriating goods, or through ration dealers reselling them through illegal networks, the ration shop is seen as the unit at the core of the problem. Evidence is being collected on whether this is the case in Karnataka, where diversion of PDS commodities is articulated on several levels, and often results in theft of foodgrains *before* they even reach the ration shops.

Our research questions required close observation of how technology is enacted in practice, with specific reference to anti-poverty programmes. This led us to approach them through a method - an in-depth, interpretive case study - which is particularly suited to process-related questions, regarding ongoing dynamics unfolding on the field. Our aim, in doing so, is close to Gregor's (2006) notion of analytical theory-building: our purpose is that of generating theory with an inherently *descriptive* nature, on phenomena on which existing knowledge in theory/practice is limited. This descriptive purpose, as we proceed in our investigation, will be coupled with a *normative* one building on it, in order to draw lessons for states computerizing their social safety nets.

The Way Forward

The idea that is taking shape here is that technology, when applied to poverty reduction programmes, may reshape them on the basis of policy agendas with specific assumptions and priorities. This puts into question the idea that technology, when applied to social safety nets, acts as a mere catalyst of process effectiveness: ICT seems instead to create whole new routes to accountability, based on localized identification of the roots of programme's malfunctioning. At the same time, recipients' perception of IT seems to depend on how their access to core entitlements is affected: a focus on entitlements should then inform the dialectics of technology design and implementation.

As anti-poverty programmes worldwide are increasingly being imbued with technology, discourse on computerization as a means to better performance is steadily gaining hegemony in this respect. It is in this context, potentially prone to a partial return of the old determinisms in ICT4D, that disentangling the relations between technology and context acquires new relevance, as applied to the multiple politics that characterize the anti-poverty domain. This is why we believe that a theory of ICTs for poverty reduction needs to have political context at its core, and be inspired by identification of the *meaning* of development that is imbued in each programme's construction. It is by these principles that our ongoing work, and its way forward in Karnataka's food security system, are inspired.

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THE INFORMATION SYSTEMS STUDENT JOURNAL

VOLUME 9 ISSUE 2

- THE QUADRANGULAR ISSUE -

FEBRUARY 2015

Sponsored by

Department of Management
London School of Economics and Political Science

Published by Department of Management
at the London School of Economics and Political Science.