

7-1-2013

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## **Theorisation in Critical Realist IS Research and its Implications on Structure and Agency Interplay: A Morphogenetic Approach**

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### **Abstract**

*The paper develops a conceptual framework to advance the understanding on theorising the socio-materiality of Information technology (IT) especially with regards to a complex inverse information infrastructure (II) that depicts emergent usage behaviour. Drawing on Archer's morphogenetic approach, derived from the critical realism (CR) philosophy, we discuss the relevance of understanding theory/theorisation from a critical realist perspective and its implications on structure and agency interplay. We also highlight the contributions of realists' theorisation to IS research and the need to identify the mechanisms that give rise to emergent IT usage as a future research endeavour. We then propose the morphogenetic model of emergent IT usage behaviour which questions the assumption of the duality of structure and agency, instead of conceptualising them separately. We illustrate this approach with a discussion of a specific example of web personalised systems for online banking services, as an example of a complex inverse II.*

*Keywords: artefactual structures, critical realism, theory and theorisation, agency and structure*

## **1 Introduction**

Recent years have seen the rise of complex inverse information infrastructures (IIs) such as web personalised systems for online banking services (WPSOBS) in the form of personal financial management (PFM) websites, and social media websites (e.g., Facebook, Twitter). These technological innovations are facilitating the emergent interactions of large numbers of heterogeneous users across space and time. WPSOBS in particular is a complex, tailorable and inverse information infrastructure (II) designed to assist customers to adapt technology features to match their unique preferences and individualised banking activities. IIs are defined by Hanseth and Lyytinen (2010) as shared, open, heterogeneous and evolving socio-technical systems with IT capabilities. WPSOBS is deployed by banks or third party financial service providers in collaboration with the banks that hold the physical deposits. It links users' online banking accounts implicitly, where it aggregates individual customer's accounts from different banks or from the same bank in the case of a customer that holds multiple accounts into a unique user model. From this user model a combination of gamification and behavioural science techniques represented as personalised autonomous agents (PAAs) is used to gain a holistic picture of the financial situation of users and improve their ability to self-manage via adaptive interactions. The novelty of this II is its emergent usage behaviour that emanates from the adaptive interactions not governed by top-down organisational fiat. Rather it requires users' self-organised exploration, new discoveries, and bottom-up adjustments of the IT features based on their capabilities (Nan, 2011). Vree (2003) coined such an II as complex inverse II.

Apart from the intrinsic artefactual structures inscribed by both designers and users via social processes, WPSOBS is also interwoven with external structures of social, economic, legal, informational and technological contexts to constitute a network-in-use for everyday life banking activities of users, none of whom have complete knowledge of the entire network, and all of whom are conditioned by the socio-economic environment and personal experiences, as they commit to usage (Egyedi & Van den Berg, 2012; Merali, 2006). The network structure of such IIs is non-linear, open, co-evolving, and saddled with heterogeneous individuals outside organisational settings, who share a common virtual territory to achieve individualised needs in the principles of what has been referred to as "collective wisdom of the crowds" (Majchrzak, Cherbakov, & Ives, 2009, p. 103). Emergent IT usage accounts for artefactual structures that are "treated as a program of action that coordinates a network of social roles" (Holmström & Robey, 2005, p. 169), wherein customers co-create, share their financial knowledge, make decisions and discuss their consumption experiences. By doing so, the link between design and usage is cemented by socio-economic and organisational structures inscribed during the IT design phase to condition agential interactions with the technology. Thus, users inject their interpretive flexibility to (re)adjust and (re)interpret the designers' efforts leading to emergent usage behaviour as well as the transformation of the technology to fit their usage behaviour, not anticipated by the designers (Sein et al., 2011).

Paradoxically, while becoming pervasive in everyday banking life, WPSOBS and its underlying mechanisms' effect have remained underexplored due to insufficient theorisation of the interplay between the structures and the social agency being the main constituents of the IT artefact (Mutch, 2010). We argue that contemporary understanding of what theory is and the theorisation process, as mobilised in IS research is insufficient for addressing this phenomenon. The lack of understanding of what theory/theorisation process actually is and the unacknowledged stratified ontological influence on theorisation process have made previous attempts in this same or similar technological innovation ignore the materiality of IT in favour of social agency (Leonardi & Barley, 2010). Therefore, a more balanced view on how socio-material entities influence human agencies and their emergent usage of such IT artefacts is bound to bring interesting insights. To do this, we turn to critical realism (CR) presuppositions to explicate the concept of theory and the theorisation process. Besides, we draw from Archer's (1995) morphogenetic lens to theorise the interplay between IT structures and their conditioning effects on agency that give rise to emergent IT usage. Therefore, the questions that will focus this conceptual paper are: (1) what is a theory and what does the theorisation process entail when adopting critical realist ontology in IS research? (2) What are the implications of such a

theorisation process in structure and agency interplay, and (3) how does morphogenetic theory provide a lens for theorising the interactions of artefactual structures and human agency that give rise to emergent IT usage?

The rest of this paper is organised as follows: Section 2 consists of a brief outline of CR. Section 3 discusses what a theory is and theorisation in critical realist IS research. It also brings in the implications of realist theorisation in structure and agency interplay. Section 4 presents Archer's (1995) morphogenetic theory and based on it develops a morphogenetic model of emergent IT usage to explain artefactual structure and agency interactions. Besides, the section discusses how the morphogenetic model for emergent IT usage was appropriated in the case of WPSOBS. Section 5 presents the contribution of the paper and areas of future research and section 6 concludes the paper.

## **2 Brief Outline of Critical Realism**

There are a variety of realism philosophies, but we focus on the “Bhaskarian” version termed critical realism (CR) (Archer, 1995; Bhaskar, 1979, 1986, 2008b; Mingers, 2010). There are also three waves of Bhaskarian CR – original CR, the dialectical CR and the quasi-religious philosophy of meta-reality termed Transcendental Dialectical CR (TDCR) (Bhaskar et al., 2010). We follow the tenets of the original CR, being the first wave. The first wave of CR according to Bhaskar et al. (2010) is the revindication of ontology (study of being) as separate from and irreducible to epistemology (study of knowledge) and aims to liberate science from the flat ontology of the Humean theory of causal laws that underpin the doctrines of almost all orthodox philosophy of science. Based on this, Bhaskar et al. (2010, p. 1) maintain that the first wave has been able to refocus science by situating the argument as:

- “the necessity to disambiguate ontology and epistemology, based on a critique of what [Bhaskar] called the epistemic fallacy (or the analysis or reduction of being to knowledge of being);
- the necessity, accordingly, to think of science in terms of two dimensions - the intransitive dimension of the being of objects of scientific investigation and the transitive dimension of socially produced knowledge of them; and
- the compatibility of ontological realism, epistemological relativism and judgmental rationality – the ‘holy trinity’ of CR” (Bhaskar et al., 2010, p. 1).

Bhaskar's (1979, 1986, 2008a) original CR (first wave) posits that a world outside and independent of our knowledge exists (i.e. reality) and this reality possesses a stratified and differentiated ontology in three domains - (1) the *real*, which is the domain of structures and mechanisms, events, and experiences with causal powers or tendencies that might effect changes. Structures could be physical, social or conceptual with observable effects, even independent of knowledge, (2) the *actual*, where generative mechanisms seen as events reside. Such generative mechanisms result from the interplay or contingent relations among structures in the real domain leading to the occurrence or absence of particular events, and which may or may not be observable, and (3) the *empirical* as the domain where particular events that occur in the actual become observable events (Mingers, 2004, 2006, 2010). Events in the actual world cannot be perceived without leaving empirical traces, and it is the empirical traces we perceive, not the actual events. Our perception is also fallible because our senses are not always completely reliable (Bhaskar et al., 2010; Mingers, 2010). Bhaskar (2008a) classifies generative mechanisms as the *alethic truths* —the underlying processes that give rise to actual events that might be observable in the empirical domain. Such generative mechanisms are what scientists should identify in a phenomenon of interest. We will now discuss the implication of these assumptions of CR on theory and the theorisation process in critical realist IS research.

## **3 Theory and Theorisation in Critical Realist IS Research**

There are implicit elements of meta-theoretical assumptions that strongly influence the way we define theory/ theorisation processes (Pare et al., 2008). Consequently, the term “theory” differs from research paradigm to paradigm. Many IS researchers who use the word theory in their work do not acknowledge this fact and as such, offer little in definitions or discussion of the nature of theory or

types of knowledge that can be expected from different research paradigms (e.g., Gregor, 2006; Weber, 2012). To empiricists, theory generally means a law-like statement that explains a certain phenomenon. These law-like statements have been extensively used in IS (Gregor, 2006; Weber, 2012). Gregor (2006, p.611) identifies five types of theory in IS, namely “(1) theory for analysing (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting, and (5) theory for design and action”. The definitions provided for these types are predicated on Hume’s (1966) constant conjecture of events, where causality is regarded as a matter of empirical regularities. Similarly, they resonate with Weber’s (1949; 1978) view of causal explanation that stems from reconstructing a context of meaning for the purpose of understanding people’s motives or intentions of behaving the way they do.

The widely accepted specification of causality by Hume (1966), being an empirical theorist characterises the deductive-nomological-explanatory model, which is also the Popperian (Popper, 1980) notion of scientific research where falsification of hypothesis is critical for knowledge of reality. Thus, the acknowledgment of theorisation as being scientific depends on how propositions are tested with efforts made to refute them. The deductive-nomological notion of theories in social-technical systems / social science stems from the transference of agential actions in a closed system to the actions of agents in the open or quasi-closed systems which IS as a social technical system is constituted (i.e. open systems) (Kling & Scacchi, 1982; Lamb & Kling, 2003). Such a transference is in error (Fleetwood, 2001), for closed systems being the same as where outside factors are neutralised (Collier, 1994), and in which all disturbances anticipated are held at bay (Lawson, 1997) are unobtainable in social science (Bhaskar, 1986). As such, transformative action is impossible in a closed system (Bhaskar, 1986). By virtue of the assumption of a closed system, Gregor’s (2006) Type 4 theory (theory for explanation and prediction) holds since there is symmetry of explanation and prediction to achieve successionist causality (Mingers, 2006; Sayer, 1992). Succession causality mostly comments that “the independent variables explains ‘X’ per cent of the variance in the dependent variables. The term explanation here is strictly technical and does not provide an answer to a “*Why?*” research question and therefore lacks explanatory power. Fleetwood and Hesketh (2008) maintain that the very essence of a theory/theorisation is explanation for “[t]o lack a theory means to lack explanation” (Fleetwood & Hesketh, 2008, p. 129). Actually, successionist causality merely explains observations through experience that one event regularly follows another—a constant conjunction - or its correlation (Mingers, 2006, 2010; Rotheim, 1999). Even though this has been the driver of the dominating variance theorisation in IS research (Mingers, 2004; Pare et al., 2008), it denies the existence of entities or structures that are not physical and observable (e.g., ideas and social structures). This reduces science to the domain of empirically observable events (Mingers, 2006). We argue that this is an impoverished theorisation approach in explaining the real objects or phenomena in IS research.

Turning to interpretivism, Weber’s (1976; 1978) repudiation of the Hume’s (1966) empiricist concept of causality and introducing causality that thrives in contextual interpretive analysis is partially accepted, yet is not the goal of theorisation in CR. CR’s goal for theorisation is in ontic causal analysis. Both analysis (i.e. interpretive and ontic causal) are interdependent and do not oppose each other since interpretation and understanding of the meanings are significant to causal explanations of social actions (Ekström, 1992; Outhwaite, 1987; Sayer, 1992). However, we have to understand that Weberian interpretive ideology that drives most interpretive IS researches (e.g., Klein & Myers, 1999; Walsham & Sahay, 1999) has its scientific-historical root in nominalism influenced by neo-Kantianism of transcendental idealism. Transcendental idealism centres on moving beyond what is experienced with a ‘severely deformed metaphysics’ notion to capture empirically founded scepticism that continues the neglect of ontology in what Bhaskar terms the *epistemic fallacy* (Bhaskar et al., 2010). Subsequently, the interpretive “*Why?*” research question is different from the critical realists “*Why?*” research question. The interpretive “*Why?*” research question by using a hermeneutical oriented approach, seeks for contextualisation, understanding and meanings geared towards explaining why people act as they do (Walsham, 2006). As a result, theory and concept formation (i.e. abstraction) is by “idealisation and by artificial construction being the heuristic aid in uncovering concrete empirical meanings and causal relations” (Ekström, 1992, pp. 118-119). Such a Weberian

notion of theorisation propagates the *linguistic fallacy* where ‘being’ is reduced to our discourse only, and also the *epistemic fallacy* that suggests that ‘being’ can be reduced or analysed in terms of our knowledge only (Bhaskar, 2008b). The social world is greater than people’s interpretation of it, since it includes structural and institutional aspects that influence behaviour. Most times the structural and institutional aspects exist independent of our thinking (Pawson & Tilley, 1977).

Theorisation within CR ideology stems from transcendental realism (Bhaskar, 1986), and is influenced by dialectical Marxism where laws are seen as tendencies that are transfactual in nature (i.e. separated from the factual outcomes the tendencies produce) (Danermark et al., 2002; Ekström, 1992; Fleetwood, 2001). Bhaskar’s (1986) transcendental realism focuses on *depth realism* in social reality with *transitive* (i.e. the known) and *intransitive dimensions*, and is against the *epistemic fallacy* and *anthropocentric bias* (i.e. the world is what men can experience) (Bhaskar, 2008b; Danermark et al., 2002). The intransitive dimension reveals the existence of an external and independent reality that is separate to our perceptions and understanding (Collier, 1994; Danermark et al., 2002). Based on this, science therefore has two dimensions or objects: an *intransitive* and a *transitive* dimension / object and there is no direct relation between science and the intransitive object because of the ever present ontological gap (Bhaskar et al., 2010; Danermark et al., 2002). Therefore, scientific results are always consisting of a set of theories selected among a number of competing theories using judgemental rationality to explain this independent intransitive object or reality (Smith, 2006). These theories – not the reality-constitute the ‘raw material’ that science uses to mediate or poke into this reality in a practical sense and by so doing transform the theories into a deeper knowledge of the reality (Collier, 1994; Danermark et al., 2002). “Theories thus are the *transitive* objects of science [and by being located in the social practice of science]; they constitute the dimension that indirectly connects science with reality” (Danermark et al., 2002, p. 23). The knowledge of this reality is fallible, progressive, with usefulness that varies among contexts and is obtained from answering the transcendental question: “what properties do societies and people possess that might make them possible objects for knowledge” (Bhaskar, 1978, p. 13). By attempting to answer this question, scientific theorisation assumes the critical role of investigating how scientific knowledge is actually generated (i.e. science in practice) and the search for the properties of reality that are prerequisite to enable this practice to serve any purpose, rather than addressing only the *justifiability* of knowledge claims (Danermark et al., 2002). Therefore, the critical realist “*Why?*” research question, by using abduction to re-contextualise with the aid of conceptual frameworks and retroduction logic, goes behind what is re-contextualised to uncover real existing structures and mechanisms, *which if they existed* could causally generate the phenomena under investigation (Dobson et al., 2007; Mingers, 2006). Providing explanations of the phenomena, couched in terms of the real structures and mechanisms discovered through retroductive scientific enquiry to have likely caused the phenomena, is the process of explanatory theory development in CR (Mingers, 2006; Strong & Volkoff, 2010). Thus, a theory now becomes:

*a fallibilistic explanation about the intransitive causal mechanisms that give rise to the observable real world events or phenomena under specified conditions which might not necessarily be used for intervention and action at that time; such causal mechanisms are expressed in the form of conceptual entities or constructs referential to existing reality that have deep or transfactual causal efficacy and such constructs may or may not have interrelationships*

In summary, a CR approach to theorisation and theory is not adequately addressed in IS research in general as illustrated by Gregor’s (2006) typology of theories in IS. Gregor’s (2006) type 1, 3, and 4 theories, despite their merits, have little relevance to a critical realist, due to the critical realist belief in transcendental realism. Types 2 and 5, on the other hand are useful as starting points. The definite focus on causal explanation in Gregor’s Type 2 theory (theory for explanation) positions it as valuable to CR, provided it depicts generative causal powers, with elucidation of the processes that generate the objects, events and actions we seek to explain. With regards to Gregor’s Type 5 theory (i.e. theory for design and action), Gregor and Jones (2007) argue that sound design theory in IS research involves the exhuming of deep prescriptive rules and its explanation for resolving real world problems. Hence, Gregor’s (2006) type 5 theory also resonates with the critical realist perspective of identifying underlying causal mechanisms.

### 3.1 Implication of CR Theorisation in Structure and Agency Interplay

The implication of realist-inspired explanatory theory outlined above evidently promulgates the ontological distinctiveness of structures and agency as well as their interdependences. Such structures of IT have *sui generis* properties and powers, which amongst their properties include *anteriority*, *relatively enduring nature and emergence*, while their powers are *enablement and constraint*, but not deterministic (Fleetwood, 2005; Reed, 2005). Similarly agency, defined in this context as something that has the tendency to produce an effect or change, be it non-human such as PAAs (Komiak & Benbasat, 2006) or people (Giddens, 1984; Rose & Jones, 2005) also possesses *sui generis* properties and powers. Amongst the *sui generis* properties of agency are emotionality, cognition, intentionality, reflexivity and self-consciousness (Archer 1995). The prime power of agency is the capability to reproduce or transform the structures encountered by not only depending on their individual reflexivity or meanings enacted, but by also depending on people's collectiveness sufficient to attain the threshold of political or social visibility for change to erupt (e.g., the impact of social media, a variant of complex inverse IIs on Arab Spring) (Archer, 1995; Carter & New, 2004). The *sui generis* properties and powers of structure and agency presuppose that structure and agency are irreducible to each other. This undermines the mutually constitutive '*structuration*' view of their interplay proposed by Giddens (1984) and negates the notion of seeing people as "cultural dopes or discursive effects" (Archer, 1995, p.100). By holding the autonomy of structure and agency, IS researchers can theoretically and analytically explain structure-agency dynamic interactions over time and place, or their long-term institutional consequences, as well as their necessary /contingent relations that prompt explicable emergent outcomes (Reed, 2005). By this, CR aspires to provide an overarching explanatory framework that focuses on structural shaping of the agency in the course of their emergent interactions with the technology (Mutch, 2010). "Thus any form of substantive social theorising, research and analysis drawing on [CR] will need to combine abstract conceptualisation, creative model building and detailed historical interpretation within a philosophical framework that is sensitive to the structure/agency dilemma and its critical implications for social explanation [that embraces ontological depth]" (Reed, 2005, p. 1637).

## 4 Towards a Morphogenetic View of Structure-Agency Interplay

The realist theorisation contribution also underpins Archer's (1995) morphogenetic approach (MA), which is crafted on the concept of analytical *dualism*, to prevent the conflation of structure and agency, as in Giddens' *duality* of structure and agency (Jones & Karsten, 2008; Mutch, 2010). The centrality of the CR theorisation approach and analytic dualism in the MA is apparent in its two founding principles: (1) that "structure necessarily predates the action(s) leading to its reproduction or transformation and (2) that structural elaboration necessarily postdates those actions that have transformed it or give rise to it" (Archer, 1995, p. 156). By recognising the historical pre-existence of structure at this point might be tempting to suggest that volitional capacity of agency is undermined. However, that is not the case because of the *sui generis* properties and powers of the agency; therefore, structures can only influence but not determine agential actions (Archer, 1995, 2003). With analytic dualism, structure and agency are separated, thus enabling the investigation of the relational and sequential interplay between structure and agency over time, as opposed to "sinking one into the other" (Archer, 1982; Danermark et al., 2002). Such an analytic dualism concept also recognises the stratified, open, and nomic (undetermined) nature of causation in social reality. The two founding principles underpin a three-part explanatory cycle – i.e. 'structural/cultural conditioning, social / cultural interaction and structural/cultural elaboration' (Archer, 1995, p. 16, 1998, p. 376) as well as primary and corporate forms of agency leading to analytical history of emergence (Archer, 1995, 1998, 2003), as shown in Figure 1.

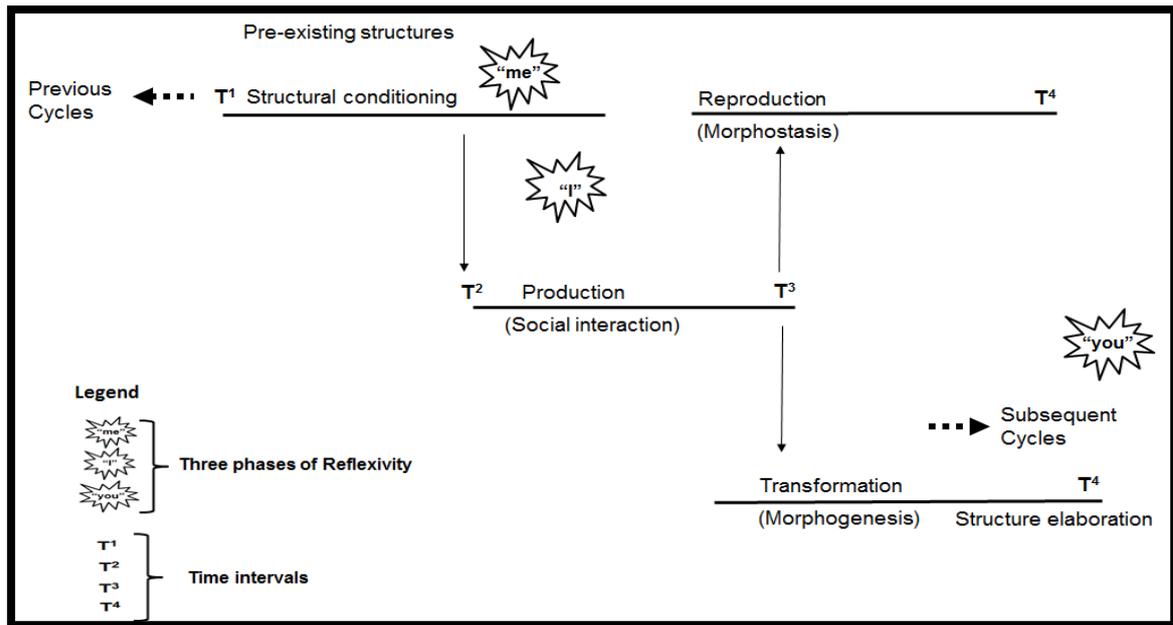


Figure 1: Superimposition of Archer's (1998) Morphogenetic model and Archer's (2003) internal conversation framework

The structural / cultural conditioning at time T<sup>1</sup> depicts that social structure sets out the enablement or constraints in which the actions of social agents play out. However, at this point, internal conversations on "me" based on the emerging results of previous deliberations and the input of previous interactions all works to condition the action at T<sup>1</sup>. This first mode of internal conversation is what Archer (1995) calls communicative reflexivity wherein actors rely mainly on other actors' shared input or social norms to boost confidence in the reflexivity process before committing to the influence of structures in respect to the context (Archer, 2003; De Vaujany, 2008). The second phase is between T<sup>2</sup>-T<sup>3</sup> where the social interaction occurs. During this phase the agents actually and freely engage with the social structures as influenced by the structural conditioning. This phase depicts the "I" to reflect the lonely and autonomous kind of reflexivity that agents engage in. This drives the performativity aim - although dependent on the individual interpretive schema- that specifically depicts the nature of the interactions for transformation of the social structures (Archer, 2003). The last phase is the structural elaboration phase at time T<sup>4</sup>, where the modification of the previous structural properties that have encountered human activity to yield either reproduction of the structure (i.e. morphostasis) or transformation (i.e. morphogenesis) (Archer, 1995). The change may be intended or unintended by actors, but it will produce a social context with emergent properties as outcomes. The structure being modified is ready for the next cycle that will return to structural conditioning at T<sup>1</sup>. In this last phase (i.e. the "you" phase) at time T<sup>4</sup>, agents / actors exhibit meta-reflexivity in their internal conversation (Archer, 2003; De Vaujany, 2008). The individuals in this mode of meta-reflexivity seek for self-knowledge and indulge in self-critique for the sake of self-improvement and self-realisation (De Vaujany, 2008). The links connecting Phase 1 (T<sup>1</sup>) and Phase 2 (T<sup>2</sup>) consist of the distribution of "vested interests" and operate by presenting agents with different "situational logics" for attaining their interests (Archer, 1995, p. 296). Also, the links between Phases 2 and 3 which lead to social elaboration work through the relational emergent properties of "exchange and power" (Archer, 1995, p. 296), since whether transformation or reproduction takes place depends on available resources (Archer, 1995; Markus & Silver, 2008).

#### 4.1 A Morphogenetic Model of Emergent IT Use

The MA can become part of the theoretical foci and central explanatory vehicle for investigating the emergent use of complex inverse information infrastructures (IIs), such as WPSOBS as shown in Figure 2.

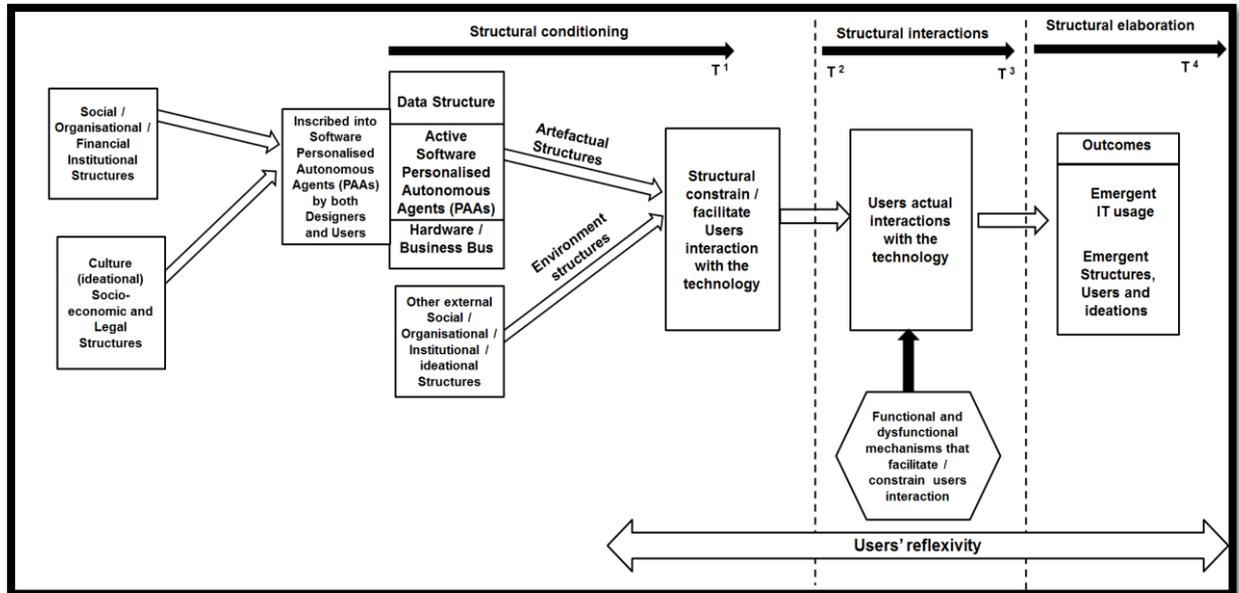


Figure 2: The morphogenetic model of emergent IT use

A brief explanation of the model follows. Legislative artefacts that embody the financial market and banking operations are inscribed in PAAs as the technical objects or artefactual structures. The socio-economic / cultural belief systems are also part of the inscribed IT artefacts, coupled with the organisational structures (i.e. the designers of the technology). These intrinsic structures have *sui generis* properties and powers that enable or constrain the emergent use of the technology at the structural elaboration phase of the model (Mutch, 2010). Besides, being a complex inverse II that adaptively co-evolves with a large installed base, social, legal, political, economic, cultural and institutional structures constitute the external social structures. Both the intrinsic and extrinsic structures of the website constitute the social-technical objects that largely influence the emergent way users interact with the technology. Based on this, there is “a type of relationship between PAAs and a specified user (or user group) to identify what the user may be able to do with the [PAAs of the website], given the user’s capabilities and goals” (Markus & Silver, 2008, p. 622). The PAAs allocate their functional affordances, defined “as the possibilities for goal-oriented action afforded to specified users or group of users by technical objects” based on users’ capability and needs (Markus & Silver, 2008, p. 622). The PAAs are linked to a unique user model of every individual that has access to the technology. The user model stores individuals / customers web logs and monthly transactions from their respective accounts with various banks that hold the physical deposits anonymously. Users now utilize the content of their individual user model to adapt and customize their preferences and interests. As experiences are gathered and utility increases the website implicitly allots more functional affordances to individual users. The technology has a service oriented architecture (SOA) that enables easy plugin into other complementary websites. Such complementary websites include insurance companies, medical aid, mortgage financing and car dealers, to extend the services of such technology (Bygstad, 2010; Hanseth & Lyytinen, 2010). By reason of the large installed base, the network is characterized by network externalities, in which the benefits of joining a network increase with the size of the network and the availability of complementary services. The relationship between the size of the installed base and the availability of complementary services is self-reinforcing (Bygstad, 2010), as a larger installed base also tends to be more attractive to suppliers of complementary services and increases users’ service value.

The IT structures do not exist in a historical vacuum, but are influenced by the legacy of processes that precede them. Bygstad and Munkvold (2011) argue that IIs do not emerge from scratch, but are the outcome of processes that reinforce the technical, social and business characteristics emerging from the layering of technical choices over time. Another domain in which history matters is in the gradual increase in the installed base that shapes the diffusion of the technology, and somehow constrains the growth of other technologies and users. As Star and Bowker (2002) have argued, an infrastructure itself “does not grow [ex nihilo]; it wrestles with the inertia of the installed base and inherits strengths and limitations from that base... failing to account for these [enablements and] constraints may be fatal or distorting to new development processes” (p. 152). The pre-existing Internet structures also are the base for the PAAs to function and adapt to individualised preferences and interests to deliver better content. By interacting with the technology as it pulls and aggregates different customer accounts anonymously from different banks, customers are able to understand the different bank charges and possibly compare prices, as well as make financial decisions. As user- system interaction exists over time in ( $T^2$ - $T^3$ ), there is the need to identify the reinforcing functional and dysfunctional mechanisms that facilitate /constrain such interactions to produce relatively enduring emergent usage behaviours in the structural elaboration phase. At the same time, users adopt various forms of reflexive mechanisms as technological sense making processes to evaluate both the previous, present and post interactions.

Despite the usefulness of morphogenetic model for emergent IT usage it does not provide explanation whereby the emergent macro pattern feeds back and influences the actions of micro agents to achieve a self-reinforcing positive feedback cycle (Benbya & Mckelvey, 2006). By this, we can understand how the actions of individuals (i.e. micro agents) give rise to distinct complex macro behavior and how the macro behaviors influence the behaviors of individuals. Also, the model neither proposes any explicit mechanisms that drive emergence nor does it capture the non-linearity of social activities. The explanatory power of this model extends beyond WPSOBS to social media (i.e. Facebook, Twitter, etc.) or Wikipedia IT artefacts that exhibit complex inverse IIs characteristics.

## **5 Contributions and Future Research**

The major contributions of this paper are: (1) IS researchers will be able to identify an adequate theorisation process upon which to base empirical research on complex inverse information infrastructures (IIs) as well as (re)establish IS research on a general philosophical base. (2) with adequate understanding of what a realist theory is, IS researchers will be able to identify potential theories that might fruitfully underpin empirical research on this phenomenon instead of theories selected in previous studies (e.g., *structuration theory*) that suffer from axiological inconsistencies and lack of explanatory power (Fleetwood & Hesketh, 2008; Orlikowski, 2005). (3) It provides adequate theorisation of empirical phenomenon that suggests the existence and simultaneity of micro-macro levels of analysis to explain change over time in terms of interactions between social agency (micro) and macro-structural influences (Jones & Karsten, 2008; Nan, 2011). This is one of the ignored aspects of *structuration theory* (ST), for Jones and Karsten (2008) see that ST could not provide the “linkage of individual micro-level action and macro-level institutional processes” (p. 150). This paper points to the possibility of applying the MA toward closing this research gap. Lastly, the study provides a substantive theory /model that can explain the socio-materiality of IT and its emergent usage behaviour, which several IS researchers have noted to be a pervasive problem in IS research (e.g., Kautz & Blegind, 2012; Mutch, 2010; Orlikowski, 2005). For further research, efforts should be made to enhance the model to provide explanation into how macro emergent structures feedback to micro structures (i.e. the individual agency). Also, case study research is needed to identify the functional and dysfunctional mechanisms and structures that shape users’ interactions since the model does not explicitly state any mechanisms.

## **6 Discussion and Conclusion**

We began this paper by highlighting the deficiencies of IS in theorising the simultaneity of socio-materiality of IT especially in complex inverse IIs that depict emergent usage behaviour. These deficiencies exist despite the considerable empirical evidence with such technology usage in society.

We argue that a lack of understanding of what theory / theorisation should be in a CR perspective largely accounts for this deficiency. We discussed the implications of CR theorisation in structure-agency (i.e. macro-micro) interplay, where we saw its criticality in understanding that structure and agency are both emergent strata of social reality with *sui generis* properties and powers. Therefore, the ways IT structures influence people and how the actions of people maintain or change the IT structures they initially confronted can be explicated. We believe that to the extent that IS literature continues to overlook the ways in which artefactual structures are treated as a program of action that coordinates a network of social roles to influence user behaviour, our understanding of societal influence on technology will remain limited. IT has transcended beyond organisations to society, with power shifting to users who adapt technology to fit their needs irrespective of whether the designers or the adopting organisations are aware of it. We have proposed a morphogenetic model of emergent IT usage in analysing the interplay of the distinctive sets of causal powers of artefactual, ideational, institutional structures and the people using the IIs in the context of WPSOBS. The model has enabled us to adopt a more holistic, socio-technical and evolutionary approach, putting the research in combined social and technical complexity at the centre of empirical scrutiny. Beyond its contributions, it has also helped us in positing further research for identification of structures and mechanisms that will demand empirical enquiry using a case study. It would be difficult to clearly tell the story of activities and influences of structures on users' interactions with the technology and their emergent usage behaviour without reference to both the people using the technology and the relevant social, organisational, cultural, and institutional structures involved.

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