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Blending Complexity and Activity Frameworks for a Broader and Deeper Understanding of IS

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Completed Research Paper

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Abstract

A new age of significance and opportunity for Information Systems (IS) is upon us driven by current developments in the use of digital artifacts. In this paper we endeavor to make sense of contemporary IS, as well as possible future directions of IS, by bringing together the notions of complexity and activity within two theoretical frameworks, namely the Cynefin framework and contemporary uses of Activity Theory. We describe activity as a holistic unit of analysis within the Complicated and Complex Domains of the Cynefin framework. This will enable us to make sense of tool-mediated IS activities in those Domains. Our proposed research philosophy blends these frameworks to support new thinking about IS that impacts on our choices of research methods, the way we apply them and the way we modify them as the world we study evolves into an uncertain future context.

Keywords: Activity Theory, Cynefin, Complexity, IS theory

Introduction

Over the years there have been many published articles that provide philosophical commentary on the nature of the field of Information Systems (IS). These vary from those that draw heavily on the literature of the Philosophical discipline itself (e.g. Hirshheim 1992; Aarons 2004), and others that are philosophical in the popular sense of the word (e.g. Adam & Fitzgerald 2000; Banville & Landry 1989; Hirschheim & Klein 1989, 2003; Klein & Hirschheim 2008; Van Gigch & Pipino 1986; Mumford et al 1985; Nissen et al 1991; Sidorova 2008). This paper belongs to the latter group which presents ways of thinking about IS, in the language of IS, and also draws on concepts in the many other fields of study, from which IS researchers have appropriated theories and methods. In writing this paper, we are encouraged by the words that describe this (IS Philosophy) track that such reflective pieces "guide our collective understanding of what information systems can be and what role information technology can play in building the future of the humanity at the individual, collective, societal and global levels of inquiry". Our proposed research philosophy brings together frameworks of complexity and activity to support new thinking about IS that will "guide the scientific inquiry process". Our philosophical framework impacts on our choices of research methods, the way we apply them and the way we modify them as the world we study evolves into an uncertain future context.

In this paper we endeavor to make sense of contemporary IS, as well as possible future directions of IS, by bringing together the notions of *complexity* and *activity* in the context of the two theoretical frameworks, namely the Complicated and Complex Domains of the Cynefin sense-making framework (Snowden 1999, 2002, Kurtz & Snowden 2003) and contemporary uses of Activity Theory, from Vygotsky (1978), Leontiev (1981), Kaptelinin (1996, 2005), Engeström (1987, 1999, 2000, 2005, 2007), Kuutti (1991, 1995), Hasan (1998, 2001, 2005), Bødker (1990) and others. We claim that a new age of significance and opportunity for IS is upon us driven by ongoing developments in the use of digital artifacts. Terms such as 'social media', 'globalised markets', 'knowledge era', 'democratization of information' and 'distributed communities' point to the need to examine IS research and practice in ways appropriate to the context and, in particular, to the complexity of the emerging socio-technical systems that new digital technologies afford and continually changing environments demand. The Internet provides the most startling example of an information system that has had, and is continuing to have, a profound influence on the world. Eric Schmidt, Google's CEO, highlights the challenge the Internet presents for contemporary IS when he describes it as "the first thing that humanity has built that humanity doesn't understand, the largest experiment in anarchy that we have ever had."[1] To provide evidence for our argument and to illustrate our claims we will use well-known examples of online applications as people try to make sense of the Web as it evolves from 'Web1.0' to 'Web 2.0'.

Changes in the way we see IS

While there are many descriptions of IS, a relatively uncontentious statement is that IS is a field of academic endeavor that informs, and is informed by, practice involving information systems artifacts in organizations (Hasan & Kazlauskas 2009). As a discipline "at the intersection of knowledge of the properties of physical objects (machines) and knowledge of human behavior" (Gregor 2006), it is distinguished from other management fields in the social sciences by its concerns for the use of "artifacts in human-machine systems" (Gregor 2006) and from more technical fields, such as Computer Science and Information Technology, by its concern for the human elements in organizational and social systems (Hasan et al 2007). Twenty to thirty years ago the IS artifact was primarily located in organizations and definitions of the IS discipline from that time explicitly reflected this. However this has changed and no doubt will continue to do so. There is concern for not only the artifact and for associated human behavior, but for the emergent phenomena arising from their interaction (Lee 1999). Whilst many IS artifacts in large organizations have become ossified or commoditized (for example some legacy or enterprise resource planning (ERP) systems), many other exciting developments, which demonstrate emerging phenomena for the IS discipline, are emerging in the global virtual social and knowledge space (for example the social application of Web 2.0).

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[1] Widely quoted see e.g. http://news.cnet.com/Net-founders-face-Java-future/2100-1001_3-278526.html

IS research draws its significance from the uniqueness of computer-based information and communication tools and their place in shaping recent human, social and organizational history. Changes resulting from developments in information and communications technologies (ICT) including the growth of the Internet, have contributed to increasing complexity in organizations to a point where hierarchical structures, suited as they are to established knowledge and procedures, no longer provide a platform for effective and efficient management and operations (Miller & Stuart 2005). As observed by De Vulpian (2005), "we are in the process of moving from a pyramidal, hierarchical society to a single-story society where heterarchical relationships dominate". De Vulpian also notes that these societal changes are both the result of new digital technological capability and the cause of new needs for mobile communication and networking across previous social, cultural, and geographic boundaries. These needs have in turn spawned new networked communication tools and ICT systems.

The lack of success of traditional hierarchical management initiatives is revealing the need to take an approach influenced by notions from complexity theory, where a new network-centric paradigm is emerging (Warne et al 2005). As a full representation of complexity theory is beyond the scope of the paper, the paper draws on the Cynefin framework's perspective (Kurtz and Snowden, 2003; Snowden, 1999) on complexity. Supported and enabled by ICT and the Internet, progressive organizations are tending to refocus on supporting self-directed teams in community-style networks (Crawford et al 2009). This style of organization requires different structures, processes and systems from those currently used in most organizations and demands a cultural shift that has tremendous implications for IS.

As we explain in the paper, the Cynefin sense-making framework distinguishes between the Domains of 'Order', where situations may be *complicated* but problems can be solved with *complicated* but *ordered* solutions and the Domains of 'Unorder', where problems are too complex for any amount of forward planning to guarantee only the desired outcomes. Particularly in situations of *unordered* complexity we find that tool-mediated activity, as understood by the Cultural-Historical Activity Theory, is a suitable, holistic unit of analysis. The significance of this is central to our understanding of the current challenges in IS and to its future directions.

There has been a tendency in IS to seek *ordered* answers to research questions, *ordered* solutions to research problems and to use ordered frameworks in the conduct of this research. Telling examples of this are the continued use of variations of the Technology Acceptance Model (TAM) introduced by Davis (1989), the DeLone and McLean (1992) model, the call to emphasize the IT artifact (Orlikowski 1992), the persistence of the Data, Information, Knowledge Wisdom (DIKW) hierarchy, structured systems development methodologies, the popularity of the Unified Modeling Language (UML), fourth generation languages, case tools, wizards, etc. We do not deny that this research has contributed to the forward progress of the IS field, and will continue to so. However, in this paper we make the case that emerging technologies present volatile contexts where digital technologies now mediate increasingly complex activities that instigate a need for an alternate philosophy for IS researchers, a philosophy that will enable and encourage them to take a broader, less *ordered* view as newer technologies become more pervasive and ubiquitous and novel dynamic contexts emerge. With the social orientation of many of these technologies it becomes even more important to consider the context of an activity's overall purpose in addition to the human, social and cultural aspect of the activity. This contrasts with the limited *ordered* nature of previous 'scientific' research which, in Activity Theory language, focuses on goal-oriented *actions* rather than the whole purposeful *activity*.

Before developing our philosophy, we introduce those elements of Activity Theory and the Cynefin framework that will enable us to make sense of IS activities, and in particular, of those that are both complex and emergent. We first set out the Cynefin sense-making framework followed by those concepts of Activity Theory needed to describe how *complicated* and *complex activities* unfold in the Cynefin framework.

Complexity and the Cynefin framework

Cynefin is a general framework that is useful for making sense of the broad spectrum of situations and problems that face the field of IS, particularly complex ones that have been largely neglected by IS researchers. As shown in Figure 1, the Cynefin framework has five domains reflecting the different relationships between cause and effect and different ways of working in the various domains. Each domain has a different mode of community behavior and each implies the need for a different form of management and a different leadership style with the adoption of different tools, practices and conceptual understanding. Four of the Cynefin domains set the possible contexts for collective decision making, an approach which has been used in knowledge management as well as in other

applications including conflict resolution.

Figure 1: The Cynefin framework drawn from Kurtz and Snowden (2003).
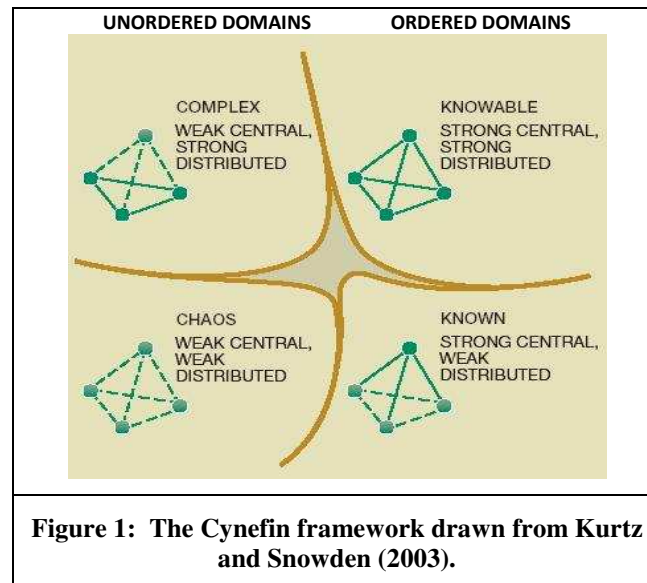
The four outer domains moving anticlockwise from the bottom right are:

The Known or Simple Domain, in which evidence has established the relationship between cause and effect and this relationship widely and publicly accepted. The approach suited to this context is to *Sense - Categorize - Respond* (SCR). This suits a centralized bureaucratic way of working using vertical command and control with weak horizontal links in organizations. Solutions to problems in this domain often involve the generation of best practice, standard routines, rules and regulations.

The Knowable or Complicated Domain, in which the relationship between cause and effect requires analysis or some other form of investigation and/or the application of expert knowledge. The approach here is to *Sense - Analyze - Respond* (SAR). This Domain is the realm of scientific research and assumes that, although not apparent, all knowledge is knowable. Matrix organizational structures reside in this domain with strong relationships both vertically and horizontally. Problems in this and the Complex Domains are of particular interest for this paper.

The Complex Domain, in which the relationship between cause and effect can only be perceived in retrospect, not in advance. The approach is to *Probe - Sense - Respond* (PSR) and then allow *emergent* practice, that is, the appearance of increasingly coherent and structured phenomena resulting from small stimuli and probes that resonate with people (Snowden & Boone 2007). Aspects of Complexity Theory developed in biology are relevant to this Domain as is Activity Theory's notion of expansive learning (Engeström, 1987). Networked organizational structures are usually here and the notion of expansive learning.

The Chaotic Domain, in which there is no relationship between cause and effect at systems level. The approach is to *Act - Sense - Respond* (ASR) to discover *novel* practice. Aspects of Chaos Theory developed in mathematical disciplines are relevant to this domain. The connections between individuals and organizations working in this domain are weak. . Here there is no discernable structure or obvious solutions.

The two right hand Domains (Known/Simple and Knowable/Complicated) in Figure 1 are *ordered* whereas those on the left (Complex and Chaos) are sensibly viewed as *unordered*. As *ordered* or *simple* problems become more *complicated* we can either endeavor retain order by simplifying and decomposing into small problems that can be tackled more easily or we can move to the left side of the Cynefin framework, and take a holistic view where the *complexity* and *chaos* is retained. Wicked problems that defy obvious solutions or have conflicting objectives, require responses in the *unordered* Domains and need to be acknowledged and treated as such.

Disorder, the central Domain, is the destructive state of not knowing what type of causality exists and thus not knowing which way of working is best. The harmfulness of contexts in the Domain of Disorder indicates that this

Domain should be kept as small as possible. Decision makers should achieve consensus about the nature of, and the most appropriate response to, a problematic context.

Clockwise and anti-clockwise movements between the four outer knowledge Domains occurs naturally. There is a natural drift in a clockwise direction over time: from the *unordered* Chaotic Domain, to the Complex Domain where the patterns of cause and effect are identified retrospectively, to the Complicated Domain where the patterns of cause and effect are tested for reproducibility, to the ordered Simple Domain where the stabilized knowledge of cause and effect are harnessed as known solutions as part of everyday ritual. In everyday terms this happens as people live together, share mutual concerns and experience, then as ideas emerge, "convenience leads to stabilization and ordering of the ideas; tradition solidifies the ideas into ritual" (Kurtz & Snowden 2003, p. 479). Simultaneously counter-clockwise movement occurs as the forces of the future counter those of the past at times disrupting what seemed to be settling into a predictable, manageable space. Counter-clockwise forces include obsolescence and forgetfulness, the arrival of new challenges, and the curiosity and energy of new generations or outsiders who break the rules, question the current order of things or the validity of established patterns, radically shifting the power and perspective. Just as there is benefit in the taming of chaos through the natural clockwise movement between the Domains, there is benefit when counter-clockwise movement leads to new knowledge, new perspectives and better, though different, ways of knowing and working.

In proposing the Cynefin model Snowden (2002) makes a point of strongly resisting the existence of a single or idealized model and raises an awareness and understanding of the porous borders between different Domains and the acquisition of tools and techniques to enable border transitions when needed. People, be they workers, managers or researchers, are usually most comfortable in one of the Cynefin knowledge Domains and interpret problems through their own lens in that Domain. They often try to force their interpretation on decisions to address the problem leading to inappropriate solutions. This may perhaps have led to the predominance of the use of perspectives best suited to the *ordered* Domains by IS researchers. In particular, problems in the complex domains require a holistic dynamic approach that allows emergence of the understanding of the relationship between cause and effect. Many (*simple*) IS research frameworks are best suited to research carried out in the *ordered* Domains. The richness of Activity Theory concepts make it one of the few suited to both *ordered* and *unordered* Domains as its concepts are appropriate for contexts in which the relationship between cause and effect is either known or yet to become known.

Activity Theory

With its roots in the work of German philosophers Kant, Fichte and Hegel, the immediate origins of Activity Theory are found in Russia during the 1920s by the work of Vygotsky, Luria and Leontiev (Kuuti, 1995). Based on the idea that human activity is mediated by cultural signs: words and tools, *activity* in the Activity Theory sense is an imperfect translation of the Russian word 'deyatelnost' which carries the connotation "doing in order to transform something" (Kuuti, 1995, p. 23). *Activity* in this sense is purposeful, not simply busy-ness. Kuuti and Molin-Juustila (1998) describe Activity Theory as "a philosophical and cross-disciplinary framework for studying different forms of human practice as historically developing cultural systems" (p. 75). Kaptelinin points out that "Activity theory is not a monolithic approach. Instead, it can be described as a variety of approaches sharing basic principles but differing in how these principles are implemented" (2005, p. 8). We present here the basic principles as we find applicable to IS research, recognizing that there are other approaches that are just as valid as ours and that there are many concepts pertinent to the Cultural-Historical tradition of Activity Theory that are beyond the scope of this paper.

Basic Concepts

Vygotsky (1978) defined purposeful *activity* as a tool-mediated, dialectic relationship between *subject* and *object*, i.e. a person using *tools* as they work at something with a focus on achieving some purpose. The *object's* purpose drives the *activity* and can be physical (e.g. building a website and/or psychological (e.g. supporting an online meeting space). The *subject* can have one or several motives for undertaking an *activity* and these can be intrinsic (e.g. a will to succeed) or extrinsic (e.g. an imposed reward such as pay) which may or may not become the *activity's* achieved *outcomes*. The central relationship of an *activity* is dialectic in the sense that it is a dynamic Hegelian synthesis of two opposing perspectives (i.e. a thesis and its antithesis) giving validity to both subjective and objective interpretations of what is happening (Meloche & Hasan 2008). . In this dialectic relationship the
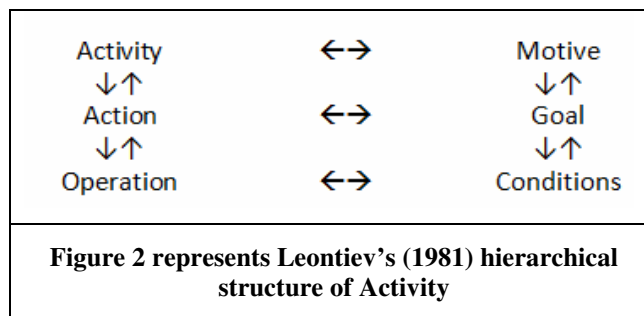
'always active' *subject* learns and grows while the *object* is interpreted and reinterpreted by the *subject* in the ongoing conduct of the *activity*.

According to Vygotsky (1978) the fact that human *activity* is mediated by *tools* distinguishes us from animals and machines. This is a two-way concept of mediation where the capability and availability of *tools* mediates what is able to be done and *tools*, in turn, evolve to hold the historical knowledge of how the community behaves and is organized (Crawford & Hasan 2006). . This is particularly powerful when the *tools* are computer-based as the evolution of these *tools* occurs at an unprecedented rate (Kaptelinin 1996). Three kinds of *tools* mediate human *activity*:

- Primary: artifacts, instruments, machines, computers, mobile phones, etc.
- Secondary: language, signs, ideas, models, etc.
- Tertiary: cultural systems, scientific fiction, virtual realities

Drawing on Wartofsky, Hasan (1998) writes that primary *tools* are physical and produce changes in the *object*, whereas secondary and tertiary tools are psychological and influence the psyche and behavior of *subjects*. . With respect to Information Systems, Activity Theory opens up the concept that, together with the technology, the information and knowledge it provides should be viewed as secondary tools. . Social and cultural aspects of the community form the basis of tertiary *tools*. In Activity Theory, the historically developed and developing *activity system* is the smallest possible unit of analysis that still preserves its distinctively human quality (Vygotsky 1978). Individuals can and do take part in a number of different *activities* at the same time. . For example, an individual can go for a run to maintain their fitness and converse with a colleague to develop a solution for a work problem.

Furthering Vygotsky's work, Leontiev (1981) developed a conceptual framework for outlining the hierarchical structure, internal transitions and transformation and development of *activity*. In this framework, *activity* driven by a long-term purpose and strong *motives* occupied the highest level of the hierarchy above *actions* driven by specific, short-term *goals*, with *operations,* routine and well known habitual cognitive or behavioral processes, determined by *conditions* at the lowest level (see Figure 2). Whereas *activities* are typically long-term affairs, the *actions* that comprise them have a more limited time span whilst *operations* are often routine and brief. The vertical arrows in Figure 2 depict potential movements up and down the hierarchy. Categorization is subjective: one person's *action* can be another person's *activity*. Leontiev gave the famous example of learning to drive a car. To a beginner changing gears is an *activity* in itself. Changing gears then becomes a conscious *action* as part of an *activity* to drive safely along the road. In contrast, for an experienced driver, changing gears has become a subconscious *operation*, i.e. it has dropped from the driver's conscious awareness, or has been *operationalized* in an automatic car. However this changes when for example something is wrong with the gearbox, when a driver who has only ever driven an automatic car has to drive a manual car. The *operations* that the experienced gear changer uses as part of the *action* of changing gears must be brought back into consciousness for review so that they can be 'seen' and incorporated into the current *activity*.. This is not necessarily an easy process.

Activity	←→	Motive
↓↑		↓↑
Action	←→	Goal
↓↑		↓↑
Operation	←→	Conditions

Figure 2 represents Leontiev's (1981) hierarchical structure of Activity

An Activity Theory analysis identifies the various aspects of *activity:*

> Analysis isolates separate (specific) activities in the first place according to the criterion of motives that elicit them. Then actions are isolated – processes that are subordinated to conscious goals, and, finally, operations that directly depend on the conditions of attaining concrete goals. (Leontiev, 1975/1978, p .66-67 in Kaptelinin, 2005, p. 10)

A complex situation under investigation in an IS research project can be depicted in terms of a set of observed *activities* where each purposeful *activity* is comprised of sets of *actions* directed towards specific *goals* and routine

operations determined by current conditions. Table 1 sets out illustrative examples of *activities*, together with typical *actions* and *operations*. Activity Theory also provides insights into how *activities* can be progressed by making participants conscious of those *actions*, *operations* and *objects* which were taken for granted, i.e. below the level of consciousness rendering them invisible to the *subject*(s). This process of *expansive visibilization.* As will be seen later in the paper, the contexts of these *activities* lie in various Cynefin domains.

Table 1 Examples of Internet-based *activities*, in different Cynefin Domains with typical *actions* and *operations*		
Activity	Maintaining an organization's static website (Web 1.0)	Setting up a new business	Launching a smart phone – application (Web 2.0)
Possible typical Actions	Selecting content for a Content Management System (CMS) Developing a website template Designing the website structure and navigation	Obtaining advice from accountants and business advisors Applying for a business name Obtaining a domain name for the business website Creating a website	Developing the application Disseminating the application through social networking sites
Example Operation	Using a system that automates website content management	Using a system that automates website development	Automating online purchasing and download

For example, the *action* of writing selecting content for a CMS in Table 1 makes no sense unless there is a related *activity: maintaining* an organization's website. The *operation* of adding items to the CMS is determined by local *conditions* such as whether or not the material is text, video, photos etc and is a routine task for experienced website developers. . It is important to note that *actions* are always situated and are impossible to understand fully without consideration of the social, cultural and historical context of the whole *activity*. This implies that even when interest is on an individual *subject*, the *object* of an activity always has a collective element. What appears on the surface to be a relatively simple decontextualized *activity* can indeed be *complex* when its whole context is taken into account and lead to otherwise unanticipated emergent outcomes. Many IS projects fail through the mistake of ignoring the complexity of a particular organizational context when implementing off-the-shelf software (see e.g. the case described by Suratmethakul and Hasan 2005).

Activity Theory accommodates the expansiveness of, and variation within, human *activity*. Kuuti (1995) emphasizes the dynamic nature of *activities*:
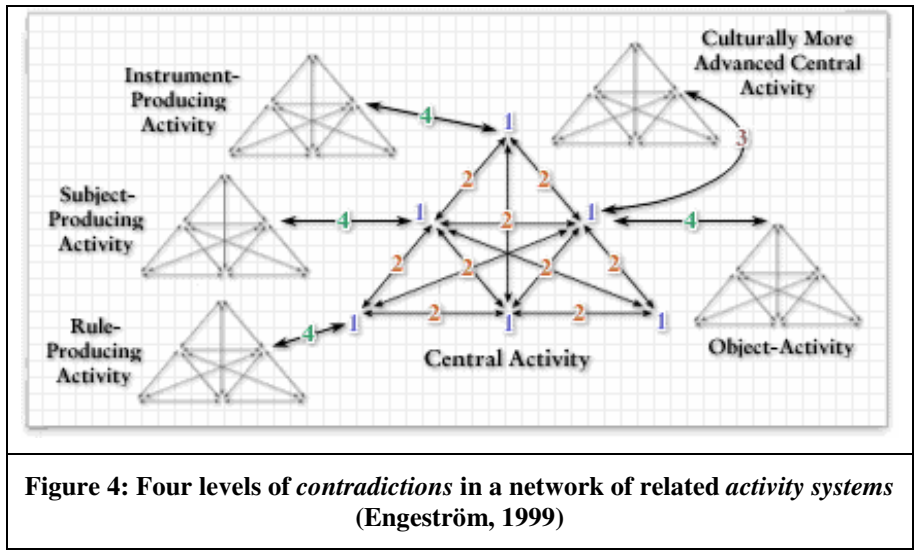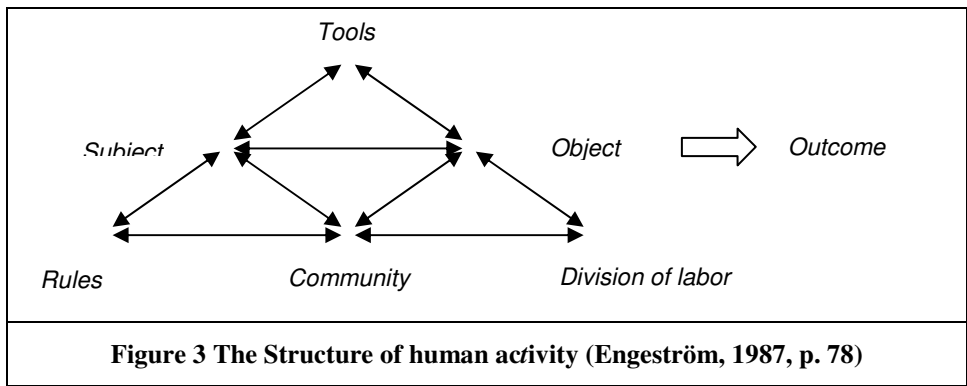
> "their elements are under continuous change and development and this development is not linear or straightforward but uneven and discontinuous. This means that activities have also each a history of their own. Remains of older phases of activities stay often embedded in them as they develop, and historical analysis of the development is often needed in order to understand the recent situation" (p. 23).

Drawing on the examples in Table 1, we can see that improvements in tools change aspects of the *activities* of maintaining a website, setting up a business or developing a phone application. They are now different to what they were 15 to 20 years ago or what they probably will be in 15 to 20 years time. The transitions and transformations inherent in an *activity* are also apparent when one ponders that there may be legitimate alternative set of *actions* that can enable the successful performance of an *activity* and that these *actions* can change as the *operations* that compose them change. In the *activity* of maintaining a website, the *action* of developing the website structure and navigation will vary with the nature of the website. A website that is being designed for staff to access to a company's organizational policies and procedures will differ in structure from a website being designed for the public to access the company's product catalogues. It will be different again, and more complicated, if the website aims to do both. In the discipline of IS, it is common practice in IS development to assess the feasibility of different design solutions to an organizational problem and then choose one solution to implement based on a cost benefit analysis. It is important to note that there may be instances where it is feasible to allow concurrent different solutions (i.e. different sets of *actions*) for and *activity* under different circumstances (e.g. in different countries where cultures vary or in different divisions of a company). It is important however to have a common understanding of the *object* (purpose) of the *activity* at the top of the hierarchy. This last example pre-empts the development of the concept of the collective *subject*. This and the development of the concepts and relating to the

social nature of *activity* have been incorporated into Activity Theory Yrjo Engeström and others as described below. These are all relevant to the complex social and work environments which form the context of IS.

Activities as Systems and Systems of Activities

Often recognized as a second generation of Activity Theory, the thinking of Engeström and the Finnish Activity Theorists looks within activities in the way one would look at a system to find its inner workings. A central concept for IS, a system is a collection of interconnected elements that has a purpose and an identity and capability as a whole that is more than the sum of its parts or elements. Figure 3 sets out Engeström's (1987) familiar triangular representation of an *activity* as a system which separates out the tertiary *tool* (*community*) from physical and psychological *tools* in the *tool*-mediated, dialectical, *subject-object* relationship, adding *rules* as the mediator of the relationship between *community* and *subject* and *division of labor* as a mediator between *community* and *object*. This enables the notion of a collective *subject* such as the work teams which were the focus of much of the research published by Engeström, his students and others. Hasan (2005) writes that such a collective *subject* comprises "a small close-knit group, such as the members of an Intensive Care Unit" (p. 32). Blackler's (1993) research into work *activities* reinforces this, suggesting that the concept of a collective *activity* can usefully be applied to a small team but not to larger entities such as organizations. Kuuti and Virkkunen (1995) emphasize the importance of taking collective activity as a minimum meaningful unit of analysis within organizational work systems. These *activities* occur in the various contexts of Cynefin framework, i.e. the Chaotic, Complex, Complicated and Simple Domains.

Figure 3 The Structure of human ac*t*ivity (Engeström, 1987, p. 78)

Figure 4: Four levels of *contradictions* in a network of related *activity systems* (Engeström, 1999)

Engeström (1987) emphasizes the role of contradictions and tensions within an *activity system* and between related *activity systems* as drivers of change and innovation. *Contradictions* and *tensions* may either be within the system itself or between an *activity* and related ones. They originate from both historical and locally situated contingencies. Engeström classifies *contradictions* into four levels which are placed in appropriate locations in a schematic network of activities presented in Figure 4.

The four levels of contradictions shown in Figure 4 are explained as follows:

- Level 1: Primary, inner *contradictions* (double nature) within each constituent component of a central *activity*, often between the *exchange value* and the *use value* within each.
- Level 2: Secondary *contradictions* between the constituents of a central *activity*, within the subject-object dialectic and within the mediation of this dialectic relationship and the tools used.
- Level 3: Tertiary *contradictions* between the *object/motive* of the dominant form of a central *activity* and the *object/motive* of a culturally more advanced form of a central *activity*.
- Level 4: Quaternary *contradictions* between a central *activity* and its neighbor *activities*.

IS researchers, including Kuutti and Virkunnen (1995), Hasan and Gould (2001) and Engeström (1999) have used frameworks of interrelated *activities* to represent complex organizational situations. The resolution of *contradictions* and *tensions* within and between *activities* acts as a driver of change and development and involves crossing a zone of proximal development (ZPD). Defined by Vygotsky as the "distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (cited in Engeström, 1987, p. 169), Vygotsky regarded the ZPD as also defining "those functions that will 'mature tomorrow but are currently in an embryonic state' " (p. 169). Numerous researchers including Engeström (1987), Lave and Wenger (1991), Daniels et al. (2005), Miettinen and Peisa (2002), and Van der Veer and Valsiner (1991) have explored the nature and utility of the concept of the ZPD. Engeström describes the ZPD as "the distance between the present everyday actions of the individuals and the historically new form of the societal activity that [can] be collectively generated as a solution to the double bind potentially embedded in the everyday actions" (p. 174). The ZPD provides a way of looking at the formation of new *activities*, keeping in mind that the new form of the *activity* might be expanded or contracted as shown in Figure 5.

Figure 5: The zone of proximal development
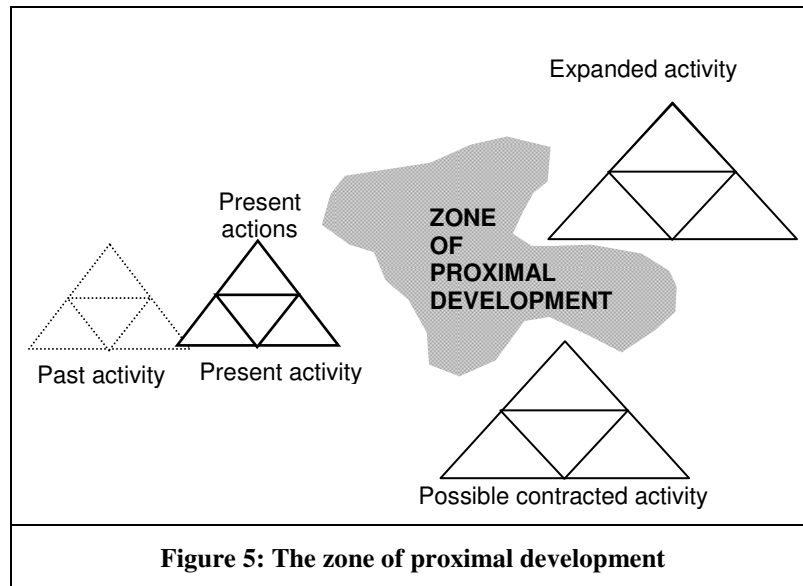
Crossing the ZPD is an *expansive learning* process whereby new *actions* that address the *contradictions* and *tensions* are expansively mastered and incorporated into a new *activity*. The conduct of e-business in the global market place enabled by the Internet provides an example of the dramatic contrast between the old and new forms of business *activity* and points to the new *actions* that those in business have had to master and incorporate into their new *activity*, learning expansively in the process. These concepts of the ZPD and *expansive learning* are particularly

relevant to IS work in Cynefin's Complex and Complicated Domains, where IS professionals address problems for which either existing expert knowledge is required to solve a problem or where new knowledge has to be generated.

Knotworking refers to those movements within *expansive learning* that tie, untie and retie together seemingly separate threads of *activity* (Engestrom, 2000, p. 972). It is work that brings together for short periods varying combinations of people and artefacts to work on the task at hand. During that time the initiative can change from moment to moment as workers make their contributions until a (temporary) endpoint is declared: a *knot* is tied then experienced and evaluated. The work of programmers involved with the Linux and Open Source software movement exemplifies of *knotworking*. It is also worth noting that *knotworking* supports reflection of the kind needed to assess the retrospective identification or *emergence* of the relationships between cause and effect in Cynefin's Complex domain.

Figure 6: Minimal model of two interacting activity systems
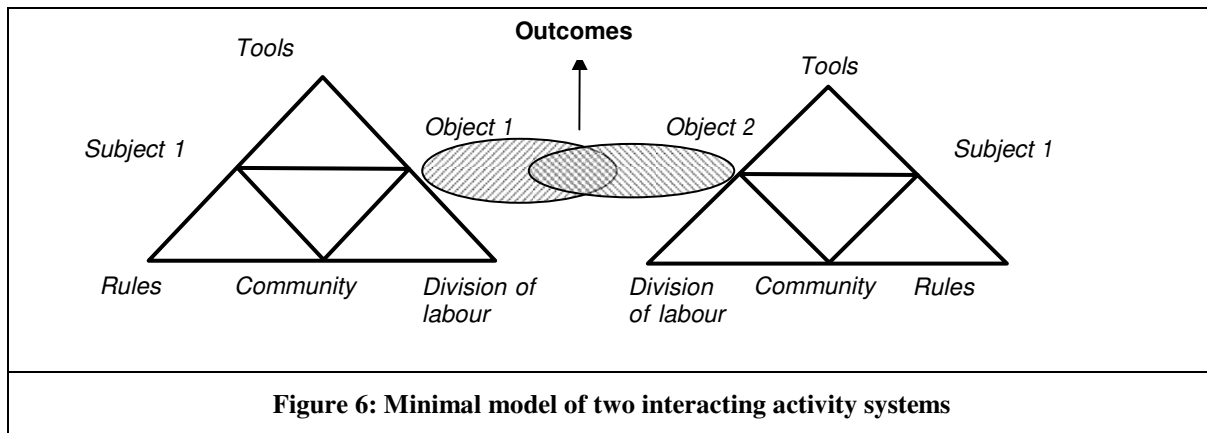
Collaboration in Activity Theory

Increasingly work requires collaborations between previously separate *activity systems*. For example courier companies have collaborated with IS and IT professionals to develop web-based systems that enable senders to track the journey of a package. Within the last decade or so Activity Theory has expanded to accommodate the need to develop *tools* for understanding dialogue, multiple perspectives and voices present in collaboration inherent in many work contexts and other aspects of human *activity* by viewing collaboration as a network of interacting *activity systems*. From an Activity Theory perspective, these networks of *activities* arise from interactions between *activity systems* whose *objects* overlap, that is there are aspects common to each system's *object*. This is represented minimally with two interacting *activity systems* in Figure 6. This incorporates the principle that *activity systems* can transform expansively to reconceptualize their *objects* and *motives* to construct a new shared *object*.

Kuuti (1995), Bødker (1990), Engeström (1999) and others use the concept of *expansive learning* in their research into a variety of work contexts. Following recent work involving interacting *activity systems* and practitioners' efforts to build shared *objects* in banking, health and high tech contexts, Engeström (2007) writes that practitioners facing major transformations in their work *activities* "put themselves into imagined, simulated, and real situations that require personal engagement in actions with material objects and artifacts (including other human beings) that follow the logic of an anticipated or designed future model of the activity" (p. 37). In doing this, as well as visualizing a possible future *activity* practitioners expansively visibilize the future in the Activity Theory sense of making consciously visible to the *subject*(s) the goal oriented *actions* that will comprise the possible *activity* which they see themselves carrying out in the future. The formation of a shared *object*, jointly configured or *co-configured* by practitioners from separate though interacting *activity systems* crosses an uncharted *zone of proximal development*. A successful journey draws on the various subjects' intellectual, professional, experiential and emotional capabilities. It is an *expansive learning* experience that transforms previously separate *activity systems* in a way that ensures that the needs of all *subjects* are met. The interaction between IS professionals and people in work contexts which require information systems tailored to specific needs makes *co-configuration* and *knotworking* particularly relevant for IS.

Co-configuration refers to the work carried out jointly by an organization and its client when together they build and sustain a fully integrated system that senses, responds and adapts to the individuals client's experience (Victor &

Boynton, 1998) work. *Co-configuration* work brings together expert knowledge and real world contexts. Introduced into Activity Theory by Engeström (2007), *co-configuration* work requires "flexible 'knotworking' in which no single actor has the sole, fixed authority" (p. 24). Ongoing mutual exchanges between client, producer and product-service combinations support mutual learning as together and provide the diverse knowledge, skills, practical experience and real world perspectives necessary for a successful outcome. We believe that this type of work occurs particularly in Cynefin's Complicated Domain where the relationship between cause and effect and is known to experts who then apply that knowledge in problematic organizational contexts.

Blending Cynefin and Activity Theory

With the advent of personal computers Activity Theory was identified as a suitable theoretical framework to underpin research in the fields of Human-Computer Interaction (Bødker 1990, Draper 1993, Kaptelinin 1996, Kuutti 1995) Computer Supported Cooperative Work (Bannon 1990) and IS (Hasan 2001, Crawford & Hasan 2006, Korpela et al 2000, Kuutti 1991). Contexts where the Cynefin model has been useful include defense organizations (Burnett et al. 2005), counter terrorism (Lazaroff & Snowden (2006), emergency management (French et al. 2007), knowledge generation (van der Walt 2006; the role of information professionals (Botha 2006); organizational behavior (Mark 2006), environmental issues (Moglia et al. 2008), and futures studies (Aaltonen et al 2005). More recently, the field of IS development demonstrates a variety of contexts that can be described using the Cynefin framework (Hasan & Kazlauskas 2009). We now describe a blending of Activity Theory with Cynefin as an enhanced framework for interpreting cases under investigation in real world contexts.

Activity is a general unit of analysis that can be applied to any purposeful human endeavor regardless of context. *Activity*, as described above, enhances case study research in that it provides a unit of analysis that allows investigators to incorporate, as a matter of course, the whole breadth and depth of relevant aspects of the case: internal and external *contradictions*, *subjective* and *objective* interpretations of events, multiple *motives*, *tool* mediation, implications of change and uncertain environments. A case or series of cases can be analyzed as a set of interconnected *activities*, taking a perspective above that of *goal-oriented actions* and making visible, or perceptible, what is normally not part of conscious awareness. Activity Theory blends well with the Cynefin framework in making sense of and providing a new way of thinking about the broad spectrum of *activities* that comprise the diverse existing and emerging situations and variety of problems that face the field of IS. As *activities* transform, they go through cycles of expansive learning and cross borders, moving among the five Cynefin Domains. The different Cynefin Domains in which different types of *activities* exist underpin the different *tools*, practices and conceptual understanding needed for effective research and practice of IS in each domain. For many years IS development was done as one-off, in-house projects, creating many disconnected systems and resulted in *Chaos*. More recently organizations have invested in ERP solutions to run their operations hoping for *simple ordered* IS support. Through the clockwise Cynefin cycle, the area of systems analysis and design has emerged in the Complicated Domain and matured into *ordered knowable* methods and formal CASE tools are situated in the Simple Domain. While these have been topics of IS research in the past we suggest they are no longer an area where new research is critical.

We briefly examine examples relevant to IS in Cynefin's Known, Chaos and Disorder Domains before examining examples in the Complicated and Complex Domains.

Although it was not always so, Web 1.0 can now be regarded as *ordered* and in Cynefin's Known, or Simple domain. A static website serves to present an image of and information about an organization to the world. Maintaining a static website is a well understood Known *ordered* activity. *Actions* involved in this *activity* might include putting content into a CMS, developing template, designing the structure and navigation, or using package such as Dreamweaver or a publically available platform such as Ning, wordpress etc. Many of these formerly conscious *actions* become largely unconscious *operations* when automated in IT systems.

In contrast, *activities* associated with Web 2.0 social media such as Facebook, Twitter, Youtube, Flickr, blogs, wikis and social sites are evolving and their value is emerging. They lie in Cynefin's Chaos domain. Individuals use these applications to have fun, to communicate and to share photos and news with others. Perhaps it is accessing them automatically / incessantly that has perhaps been operationalized by many. Other examples of IS contexts in the Chaos domain include the network centric advocacy mobilized by the then Senator Barack Obama in the 2008 United States Presidential campaign and the GetUp lobby in the Australian political scene. Because the new Web 2.0 phenomenon only works where users are not constrained by extensive sets of rules and regulations, these social

technologies have been treated with reticence and resistance by formal *ordered* organizations and have been slow to become part of the *ordered* world of work and commerce.. Recent discussion on the ActKM discussion forum shows how organizations usually fail when attempting to implement the social technologies of Web 2.0 in the workplace where the formal 'ordered' structures and restricted access are the norm.

The presence of the domain of Disorder in IS is apparent in the many tales of conflict associated with failed, abandoned, over-run or inadequate IS projects that severely disrupt the operations of an enterprise. It is also obvious in the history of computer programming. As early computer applications grew in size and complexity, the habits of spaghetti coding and a lack of documentation in the early days made such programs unmaintainable and impossible to update. New approaches to the *activity* of programming such as higher generation programming languages, and wizards provided the *order* that guided the activity of programming into the Knowable and Known domains.

Complicated and Complex Activities in Real World Contexts

While activities occur in all five Domains in Cynefin, there are two Domains, the *ordered* Complicated Domain and the *unordered* Complex Domain, are of particular significance to the way we see contemporary IS and IS research. We propose that it is incumbent upon IS researchers to consider this distinction both among the *activities* we study and among our *activities* in studying them. This is important but far from straightforward as the boundary between these Domains is indistinct and porous.

Research in the Complicated or Knowable Cynefin Domain is normally associated with research that follows the traditional scientific method where the explicit or assumed goal is to determine cause and effect or at least correlations between constructs. Research in IS has predominantly used systems thinking to interrelate various chosen elements and has predominantly adopted a reductionist view to investigating such connectivity. The Cyenfin framework draws attention to the idea that activities in this Domain are Complicated but Knowable through scientific investigation. Rigorous research methods have been established for use in such investigations. Although business, governments and every other type of organization routinely uses B2B and B2C applications to survive and prosper, some of these require the higher level of expertise found in the ordered *Complicated* domain. The *activity* of setting up a business is often ordered and knowable: i.e. it is *complicated*. The *actions* of applying for a business name and a domain name for the website include checking to see if the desired names already exist. The new owners must register the business for government taxes such as Goods and Services Tax (GST), often online, decide the business' structure and if desired set up e-business options. Whilst this is a common activity it is complicated with new business owners often seeking expert advice from professionals such as business advisers, accountants, lawyers and others on how to do this and how to use the different online systems involved.

What we are now encountering in IS are contexts that have too many as yet unknown elements to be situated in the Knowable Domain and so need to be considered as situated in Cynefin's *Complex* Domain. *Activities* related to Open Source and agile programming exemplify this (Hasan & Kazlauskas, 2009). *Activities* relating to some Web 2.0 applications can also be considered as situated in Cynefin's Complex domain. eBay is an example of a business whose exponential growth in popularity is well known. eBay's development is an example of an *activity* situated in the Complex domain. Experimentation resulted in beta versions that were trialed and then released to the public. Continuing to operate in the Complex domain, new eBay developments took the form of additional probes - or 'what-if we do this', whose impact is sensed and responded to. For example the first online auction of a car on eBay tested the viability of online car auctions (Snowden and Boone, 2007) and its success was responded to by expansion of online car auctions.

The main attributes of the Complicated and Complex Domains, together with those of typical *activities* in those Domains are summarized in Table 2. The Complex and Complicated Domains are now examined drawing on the Cynefin framework's descriptors of real world contexts and using concepts from Activity Theory that are helpful for working, understanding and researching those contexts in each Domain.

Table 2: Descriptors of Cynefin's Complex and Complicated Domains	
Unordered Complex Domain	Ordered Complicated Domain
Organization: Network-centric forms and emergent practice. Weak central/vertical ties: Strong distributed/horizontal ties	Organization: Matrix structures multiple accountability. Strong central/vertical ties: Strong distributed /horizontal ties
Approach: Probe - Sense - Respond (PSR) and then reward those patterns that are aligned with the purpose	Approach: Sense - Analyze - Respond (SAR) through scientific study
The relationship between cause and effect can only be perceived in retrospect, but not in advance, attractors and boundaries can be used to encourage desired outcomes. There may be multiple causalities which interact and make difficult.	Determining the relationship between cause and effect requires some form of investigation and/or the application of expert knowledge
Labor in this context could begin with a 'what-if' type of probe to investigate what's happening	Labor in this context could begin with a problem that an expert identifies that knowledge suited to solving the problem
Activities are likely to have more emphasis on the subjective in the dialectic	
Subject: Highly motivated Individuals/Small teams	*Activities* are likely to have more emphasis on the objective in the dialectic
Object: Uncovering patterns	*Subject*: traditionally trained, skilled expert(s)
Tools: Secondary Tools are attractors, boundaries	*Object*: Confirming hypotheses, propositions
	Secondary/tertiary tools for activities in the ordered domains are plans, rules, regulations,
Tertiary Tools: organic network-centric organizational forms	*Tertiary tools* are mechanistic organizational forms, bureaucracies, hierarchies
Contexts:	Contexts:
Self-directed teams,	Formal teams, appointed leaders
Indirect rewards and incentives	Direct / formal rewards
Knotworking activities identify the underlying patterns	*Co-configuration* work–group *activities* to bring about 'the concrete from the abstract'

Further, we suggest that many of the problems and failures in IS occur when the differences between the domains are not appreciated and there is mismatch between the problem and solution Domains, in particular where *ordered* solutions are attempted for problems in the *unordered* Complex Domain. The following example is offered. The *activity* of funding research and innovation is often carried out as an *ordered* activity. Applicants expend considerable effort putting together a large submission that details the problem, budget, timetable, expected and outcomes. Proposals are assessed by experts involving further costs in time and effort. Many months later, some applicants are informed that their projects will be funded. Applicants are required to carry out the approved plan or make formal application to change, to report regularly and be accountable. This process is suited to a centralized way of working and allows little room for deviation. This approach fails to recognize the nature of research and innovation whose worth is often only understood retrospectively. Applicants are often at the forefront of dynamic fields such as IS where new problems are constantly emerging as the field evolves. If research and innovation were seen as *activities* in the Complex domain, resources could be allocated to those who have demonstrated capability through their past achievements or who have good ideas without insistence on detailed applications that lay out detailed plans and identify specific outcomes. Worth may only be seen in retrospect but there would be less cost. The Probe –Sense-Respond focus would be on the purpose of the activity, ie to explore, innovate, and create.

As we stated earlier there has been a tendency in IS in the past to seek *ordered* answers to research questions. This was appropriate when the problems studied were *ordered* or required *ordered* solutions. There was also a desire for IS to establish its credentials as a legitimate field of research by adhering to traditional scientific research approaches. We claim that we are now past the time that IS no longer needs to prove itself and that we can expand the focus of IS research to include more complex issues than are normally studied. Such expansion moves us from Mode 1 research where problems are set and solved in a context governed by the interests of a largely academic community to Mode 2 where knowledge production is carried out within the context of application as proposed by Gibbons et al (1994).

The Mode 2 form of knowledge production is interdisciplinary, problem-focused and context-driven (Etzkowitz &

Leydesdorf 2000). As the environment becomes more open, more dynamic and less predictable, the context of the *activities* we study and the way we study them increases in complexity. Snowden (2002) finds the characteristics of self-organization, non-linearity and emergence from complex adaptive systems useful for studying and working in such contexts and has incorporated them into the Cynefin framework. . In everyday speech *complicated* may not seem much different from *complex* and an *activity* not that much different from an *action*. In the Cynefin framework and Activity Theory respectively these distinctions are critical when we compare *complicated* but *ordered* ways of acting with ways of acting in the *unordered* Complex Domain. In practice most organizations see themselves as *complicated*, but not *complex*, and accordingly implement *ordered* structures and processes. We suggest that most organizations are indeed *complex* and getting more so. In IS we use structured systems analysis and design methodologies to develop the enterprise systems tools that support this *ordered activity*. Through the lenses of Cynefin and Activity Theory we see that these systems assume that outcomes are predictable and, being transaction based, they pay more attention to *actions* rather than *activities*. This leads to greater efficiency, reliability, repeatability and accountability, which are all very desirable in *ordered* knowable environments but insufficient for innovation and adaptability in *complex* environments.

When *complicated* but *knowable activities* turn to *complex* ones it is no longer enough to pay attention to *actions* rather the purpose of *activities* must be revisited. A recent example is found in the disruption to plane travelers from the Icelandic volcanic ash. Delayed flights cause complications but these are normally managed, the airlines have procedures to deal with these and passengers know that, while annoying, these do occur. In this example, however, the length of the delay, the extent of the volcanic ash over Europe and the uncertainty of the danger, moved the problem from *complicated* airline scheduling issue to a *complex* situation where many alternative *activities* emerged (eg power boats ferrying people across the English Channel). What was previously an *action* (getting from point to point as part of an *activity* such as having a holiday or doing business) became the *activity* of solving traveler problems and making new business for many small companies who seized the opportunity to make some income.

In addition to unanticipated one-off events such as the example used above, there are many situations that are inherently *complex* where activities are continually in an *unordered* state. Such areas of interest to IS involve new uses of ICT by virtual teams, self-directed work units, informal groups and distributed communities. The emerging application of the Internet designated as Web 2.0 and beyond support *activities* in Complicated and Complex Domains and regularly cross the porous boundary between them. Global networks exist with professional, inter-professional (see e.g. Kazlauskas & Hasan 2010) and social agendas networks support by systems such as LinkedIn, Google Groups, Ning and, even Facebook. Informal organizations exist within and among formal enterprises and these are often the difference between survival and disaster in crisis situations (Ali 2007). Topics of virtual teams, social technologies and communities of practice are common among papers at IS conferences. Advocacy groups, such as Green IT, use a combination of web 2.0 tools for multi-tasking and, interconnected activity and need a greater breadth of understanding by IS researchers.

The mode of operating an enterprise effectively in the Complex domain is not to attempt to impose order through rules, and regulations but to put in place attractors and set boundaries within a fertile environment that allow emergence of patterns of innovative activity. The emergence of online auctions such as those offered by eBay is a case in point. While *ordered* workplaces standardize desktop tools, task design and best-practice procedures, work *activities* in the Complex Domain can be mediated by primary, secondary and tertiary *tools* in the form of attractors and boundaries. Attractors can take the form of more worker choice in the primary *tools* available to them on the desktop, secondary *tools* such as more autonomy in making decisions on work practice and tertiary *tools* such as more flexible working conditions. For example, the use of mobile phones to transfer images of patient injuries between medical personnel attending the patient and specialists some distance away. The 'attractors and boundaries' approach gives work-teams more authority to self-organize and the self-determination to uncover the patterns that enable them to deal positively with the underlying contradictions within and between elements of *activities* through *knotworking* their crossing of a *zone of proximal development* between their *activity* as it is currently conducted or not yet established and the new form it may take as the underlying patterns emerge.. Participants in *activities*, which are self-organized have a sense of ownership, direction and satisfaction that fosters good performance.

Research into Complex Activities

In IS we tend to study things that are *complicated*, or things perceived as *complicated* and so *knowable* in the Cynefin sense in that we anticipate and look for cause and effect relationships using empirical research methods. Our message in this paper is that many recent important and interesting problems in the realm of IS are in the

Complex Domain. To date most such problems are either ignored as too hard to study, reduced to simpler forms by ignoring critical aspects or studied using research methods and techniques that are inappropriate to the Complex Domain, where research should seek to uncover unanticipated states and relationships. Just as practical *activities* in *complex* situations require appropriate *tools* and solutions so research projects investigating *complex* issues and situation require appropriate methods and techniques. A major challenge comes from the porous and fuzzy boundary between the Complicated and Complex Domains as an *activity* may legitimately be perceived by some as *complicated* and *ordered* and by others as *complex* and *unordered*. Movement regularly occurs across the border in both directions. When researching a *complicated* case, the number of variables which cannot be understood may unexpectedly increase to the point where the case should be considered *complex*. Alternatively increased understanding of a *complex* case may produce order from *unorder* moving it into the Knowable Domain. However, the message in this paper concerns the tendency for researchers to avoid the study of *complex activities* or not to treat them as *complex*. We propose that many future significant IS research projects will take place in the Complex Domain.

The Complex Domain is aligned with collective knowledge creation, sharing and utilization (Snowden 2002). In Complex situations the relationship between cause and effect can only be perceived in retrospect, but not in advance. There is here a reliance on the detection and leveraging of emergent patterns, rather than pre-planning and design. With stronger horizontal ties than ones in hierarchies, teams in network-centric configurations better suit *activities* in the Complex Domain. Collaboration within and between these small and agile self-directed teams creates and leverages information to increase the organization's competitive (Hasan & Pousti 2006). The capability to do this results from developments of ICT but is more about people and culture than technology recognizing the value of human relationships, commitment, engagement and purpose, as critical to the success of shared endeavors (Crawford et al 2009). Crawford and Hasan (2006) comment that there is copious evidence that Activity Theory is one of the only frameworks for IS research that can be applied in situations which involve complex, dynamic, emergent knowledge-intensive work in groups or communities supported by socio-technical systems.

The blend of the concept of *emergence* in the Cynefin Complex Domain with *activity* as a unit of analysis, demands that consideration be given to appropriate research methods and data analysis techniques that allow issues and findings to emerge rather than be decided beforehand by researchers. Research techniques to investigate problems the *unordered* domains are dealt with on the award winning "Qualitative Research in Information Systems" pages of the Association for IS (AIS)[2]. These include ethnography, participatory action research, systems thinking and modeling (see e.g. Senge 1994), complex adaptive systems, soft systems methodology (Checkland 1981). We also suggest the Q-methodology (Brown 1990), with its focus on subjectivity, experiments using team gaming (Hasan &. Verenikina 2009) and the Delphi method (Linstone & Turoff 2002). Qualitative and iterative methods can be followed by more quantitative patterns testing when the *activity* moves to the Complicated domain.

Conclusions: Changing the way we think about IS

Changes in technology and maturation of its use generates many different contexts for IS researchers to investigate. It is therefore sensible for IS researchers and professionals to acknowledge these differences and to ensure that they have ways of looking at, and successfully working in, these diverse contexts. The set of lenses researchers use needs to be able to adjust focus so to speak. We suggest that blending Cynefin together with Activity Theory provides this set of lenses and affords a view of the world that is beneficial for IS. Appreciation of this blend can guide our understanding of what IS can be and what role ICT can play in building the future of humanity at the individual, collective, societal and global levels of inquiry.

The breadth of practice in the field of IS covers all the Cynefin Domains. The lens of sense-making using the Cynefin framework, provides a more flexible means of approaching problems and situations in the IS space. This gives us realistic expectations of outcomes of interventions in such situations and justification for choosing appropriate methods for working towards a resolution of the problems. It is just as problematic to tackle a *simple* problem with a *complex* solution as it is to approach a *complicated* or *complex* situation with over simplistic methods and to expect *simple*, complete solutions. The hierarchical framework of Leontiev (Figure 2) establishes *activity* as a general high level construct appropriate for the analysis of situations in all the Domains. This allows us

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[2] www.aisnet.org

to raise the focus of study-above the level of goal-oriented actions but also provides depth down to the level of operations where routine work is often automated by ICT systems.

Since its beginning with the work of Vygosky, Activity Theory has been accepted as providing a rich and general understanding of what people do. As a unit of analysis, *activity* is both *subjective* and *objective*, is purposeful and is mediated by three different levels of *tools*. Each *activity* takes place in a context, analysis of which underpins the identification of the *contradictions* and *tensions* within an *activity system*. These contradictions and tensions drive change and innovation. Not only is it valuable for IS professionals to view much of the change in their *activity* as driven by *contradictions* and *tensions* within *activity systems* and their resolution as a process of *expansive learning*, but it is also valuable for IS professionals to reflect further on the nature of contexts they work in. There is benefit in asking: Does a context lie in one of Cynefin's knowledge Domains: Simple, Complicated, Complex or Chaotic? Is an *activity* moving among different Domains? When is it desirable to encourage movement from *unorder* to *order* and when should we relax the need for *order* and allow the self-organization appropriate to a *complex* context?

The diversity and dynamism of events, situations and environments brought about by differences in our knowledge of the relationship between cause and effect challenges contemporary social science researchers including those in multi-disciplinary fields such as IS. Whilst there are traditional modes of studying human enterprises in IS using traditional Mode 1 scientific methods, we suggest that there is a need for a holistic theoretical framework to underpin team-based multidisciplinary Mode 2 studies of socio-technical real world phenomena, ranging from well-ordered to chaotic, from understood to yet to be understood: a need for both Google earth satellite and street views (a ground level 360°). Blending the two generates a broader and deeper understanding of *activities* in real world contexts by retaining the complexity of complex spaces. The Cynefin framework provides a ways of locating work or research contexts thereby enabling adaptation to contextual diversity in general and, when appropriate, to the conditions of a single Domain in particular.

We are not saying that every problem is *complex* nor that every *complex* problem should be left in the Complex Domain. However, we do contend that there are cases when it is sensible to remain in an *unordered* domain. Using the blending of Cynefin with Activity Theory enables us to decide when this is the case and give us guidance on how we can conduct Mode 2 multidisciplinary research in the complex space. Is this research into an organization's purpose built information system (*ordered*) or research into the dynamic social networks, or social information systems, afforded by the Internet (*unordered*)? Alternative research techniques and methods such as simulations, conceptual systems modeling, ethnographies and historical analyses could complement current empirical work such as the case study method by producing deeper insights that can be fed back to the participants, experts, users etc to allow a richer understanding to emerge.

We see an exciting future for IS as ICT is becoming more pervasive and ubiquitous in the home and work lives of everyone. As a result, a broader range of people, with different social and cultural experience, are now participating in activities that were previously the exclusive domain of experts. For example, CMS for web page development can be used by non IT staff. We believe that a philosophy that embraces a dynamic, holistic and situated approach at both a macro and micro level by blending the Cynefin and Activity Theory frameworks will benefit IS; a field which pervades human *activity* in our modern e-world. What is more these *activities* all have *zones of proximal development* through which we advance through *expansive learning*.

A new age of significance and opportunity for IS has emerged driven by current and future developments in the use of digital artifacts in complex contexts and connecting complex systems. What we have described here is a way of looking at IS that should prepare us for a new breadth and depth of IS research spanning both human activity and technical development in all Cynefin Domains.

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