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Activity Theory for Usability Research

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Usability research requires a strong theoretical foundation to make lasting contributions to the literature. In this study, I argue that Activity Theory¹ is ideally suited for this purpose because it articulates the mediating role of technology in human practices situated in natural environments (Nardi (1996). The mediation and praxis tenets of Activity Theory help to evaluate the totality of the user experience with a complex IT artifact in a realistic context of use (Benbunan-Fich et al. 2011).

First-generation Activity Theory is focused on individual action and is premised on the notion that an activity is carried out by a *subject* (a person or collective), with an underlying motivation to act on an *object*, which can be either an ideal or material, in order to achieve an outcome (Allen et al. 2013). Artifacts play a mediating role in enabling a subject to have an effect on an object (Kaptelinin and Nardi 2006). As such, this theory considers technological artifacts, along with other tools, as mediators of human activity (Karanasios and Allen 2014) and focuses the analysis on the context of use, instead of isolated instances of technology use.

Usability is defined by the International Standards Organization (ISO 9241-11: 1998) as a broad measure of the effectiveness, efficiency, and user satisfaction of the technology. *Effectiveness* is the accuracy and completeness with which users achieve their desired goals; *efficiency* is the amount of resources (time, effort) expended in the process; and *satisfaction* is a subjective measure related to the end users' positive attitudes regarding the comfort and acceptability of use (Hornbæk 2006). More generally defined, usability is concerned with the quality of use of a technological system (Benbunan-Fich 2001).

From the perspective of Activity Theory, usability is a property of the interplay between subjects, tools and objects, and describes the quality of the mediating role of the artifact in specific use activities. When the artifact is seamlessly integrated with the activity it mediates, usability is achieved.

Accordingly, the analytic lenses provided by the tripartite structure of activity-action-operations (Kuutti,1991) can be mapped onto the three aspects of usability as follows: (1) satisfaction is the extent to which needs are met (or not met) at the activity level when using the IT artifact as a mediator; (2) effectiveness is the extent to which the goals are fulfilled at the action level through the use of the IT artifact; and (3) efficiency is the extent to which the interaction with the IT artifact is straightforward at the operation level. See Table.

Table. Activity Theory and Usability

Analytical Structure	Focus of Analysis	Mediating Role of the Artifact	Usability Measures
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¹ For overview and applications to Information Systems see Kuutti (1991), Ditsa (2003) or Kaptelinin and Nardi (2006).

Activity	Motivation (why?)	Does the artifact help in meeting the need?	Satisfaction
Action	Goal Orientation (What?)	Does the artifact work as intended?	Effectiveness
Operation	Move (How?)	Is the artifact easy to use/operate?	Efficiency

In sum, usability consists of achieving “transparency in use,” such that the artifact unobtrusively fulfills its mediator role. The juxtaposition of the tripartite structure of AT with the three dimensions of usability anchors usability evaluations in a solid theoretical foundation and allows researchers to derive implications that transcend the specific IT artifact being evaluated.

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Poverty Alleviation through E-Commerce Development in Rural China: An Activity Theory Perspective

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In the last a few decades, the global community has consistently made the fight against poverty a top priority: In both the *United Nations Millennium Summit* in 2000 and *United Nations Sustainable Development Summit* in 2015, eradicating poverty was listed as the top development goal. From 1978 to 2014, China lifted more than 700 million people out of poverty, becoming the first nation to achieve the Millennium Development Goal for poverty eradication.² Still, to reach its goal to lift its entire rural population out of poverty by 2020, China has to lift at least 11.7 million rural population out of poverty every year in the less than 6 years since 2014, a challenge that can only be overcome with innovative solutions.

We report in this paper the emergence of a new paradigm of Poverty Alleviation through e-Commerce (PAeC). Our research site, Longnan, a prefectural city in western China, was one of the most poverty-stricken areas in China, registering a poverty population of 1.3 million or 53% of its total population in 2011. By the end of 2015, however, Longnan has managed to reduce its poverty population to 0.5 million, or 20.4% of its total population. Longnan achieved its poverty alleviation successes notably through its innovative use of e-Commerce, which was dubbed Longnan Model by media. Studying Longnan's PAeC experiences thus offers us a valuable opportunity to study e-Commerce and poverty alleviation and hopefully offer a "theory of the solution" to the grand poverty alleviation challenges both in China and globally.

When analyzing the qualitative data we collected for this study, we realized that 1) activity theory can be the theoretical lens through which we can view and understand how e-Commerce contributes to poverty alleviation in Longnan and 2) Longnan governments at multiple levels played a key role in this process. Armed with activity theory, we attempt to reveal how the governments play a key role in integrating rural poverty population in the e-Commerce activity system and make poverty alleviation one of the outcome of the activity system. We demonstrate in details how the governments introduce new tools, involve new community members, provide new rules and policies, and re-arrange division of labor for the e-Commerce activity system to produce new poverty alleviation outcome. In so doing, we highlight the roles of governments in both poverty alleviation and rural e-Commerce development activities.

In so doing, we hope to make the following contributions. First, by applying activity theory to PAeC, we attempt to acquire a more holistic understanding of how e-Commerce can help in the global fight against poverty alleviation. Second, it is popularly believed that market-based

² Report on China's Implementation of the Millennium Development Goals (2000-2015). Available from http://www.cn.undp.org/content/dam/china/docs/Publications/UNDP-CH-SSC-MDG2015_English.pdf?download, accessed on Dec. 21, 2016

solutions such as those based on e-Commerce are more likely to lead to more efficient and sustainable poverty alleviation. Our study suggests that governments still can play an active even key role in market-based solutions, thus contributing to literature in market-based solutions to poverty alleviation. Finally, through explicating the evolution of e-Commerce activity system in Longnan, we also attempt to shed new light on sustainable poverty alleviation.

Using Activity Theory with Agency Theory: A Case Study of Work Environment Virtualisation in a Developing Country Higher Education Institution

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The purpose of this study is to understand how a Higher Education Institution (HEI) in a developing country attempted to virtualise its work environment. The nature of work and work environment is rapidly changing in terms of where, how and when people work (Lee, 2015). Despite growing research on enterprise resource planning (ERP) applications in developed country HEIs (Cornford & Pollock, 2003; Fowler & Gilfillan, 2003; Pollock & Cornford, 2004), the literature on HEIs in developing countries has focused on the application of IS to support learning in the learning environment, with little attention on teaching and administrative work (Rodrigues & Govinda, 2003; Tusubira, 2005; Uwadia, Ifinedo, Nwamarah, Eseyin, & Sawyerr, 2006).

IS research on HEIs systems has therefore focused generally on e-learning and the virtual learning environment (VLE) (Adam, Effah, & Boateng, 2016a, 2016b). As a result, less research attention has been paid to the work environment within HEIs. Also, while IS research in HEIs has examined technology virtualisation regarding desktop, server, network virtualisation and so on, less emphasis has been put on work environment virtualisation or the virtualisation of the human work experience of working remotely. It is thus important that IS research in higher education pays attention not only to the learning environment but also to work environment. Moreover, previous Vygotskian theorising and IS research in these directions have mainly focused on a single actor, a dyad of two subjects or a team (Engestrom, 1987) but not as two subjects in a dyadic principal-agent relationship engaged in an activity (Jensen & Meckling, 1976). Though Engestrom (1987)'s main addition to the Leontvian model of activity was to point out the issue of several subjects working on a shared object through some form of coordination, the subjects are not explicitly perceived as principal and agent.

To address these, the thesis employs an interpretive case study approach as the methodology (Walsham, 1995, 2006) and a combined lens of activity theory and agency theories as the theoretical foundation to understand how HEIs in Sub-Saharan Africa can migrate their work environment from physical to virtual as a form of technologically mediated change (Allen, Brown, Karanasios, & Norman, 2013). The findings show that the historical nature of the physical work environment, the inefficiency and delays it causes in the work environment can influence an HEI to virtualise its work environment. The findings also identify two levels of contradictions which pose as challenges in work environment virtualisation using an offshore agent. First, contradictions at the HEI activity system level and at the principal-agent relationship level. The findings indicate that the virtualisation of work environment in HEIs using an external consultant relies on how the HEI and the external consultant work

interactively as activity systems, how the contradiction within and between them are resolved and how they learn from these interactions. The findings show how contradictions caused by role conflicts, staff's fear of elimination and external consultants' limited understanding of rules and procedures can hamper work environment virtualisation. It shows further that a resolution of these contradictions can lead to a virtual work environment that provides the platform for better and efficient information management.

By employing activity and agency theories as a combined lens, the study offers a novel application of activity theory in work environment virtualisation. It is argued that activity theory can be extended with agency theory to offer explanations for contradictions within and between subjects in IS development and implementation. The study is limited by its single case perspective in one developing country. However, future research can compare the experience of different HEIs as well as from a developed country perspective in order to account for contextual differences. The study provides practitioners with insights on how to address the relationship between users, designers and implementers in IS development and implementation process. In particular, it addresses the critical issues in the migration process in terms of social rules, division of labour and community. The study is a first attempt to offer rich insight into how HEIs can virtualise its work environment through a contextual understanding of the principal-agent relationship.

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Following decision making trajectories: activity theory based model of decision making within product development projects.

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Engineering product development is a complex and resource-intensive process (Vianello and Ahmed-Kristensen, 2012; McKay et al., 2016). Advances in digitalisation and globalization have meant that products can now be designed and manufactured in a collaborative environment across large networks of teams, groups and organisations (Fixson and Marion, 2014). Because of the complex character of modern product development and the unpredictability of changes that occur throughout the process, there now exists a context of ambiguity and uncertainty in the development process (Tseng and Jiao, 1998). Challenges in making optimal decisions under these circumstances are considerable, and cases of sub-optimal decision making are well documented (Van Oorschot et al., 2013).

These challenges create an urgent need to identify appropriate work practices and technologies to ensure that decision making processes undertaken during complex engineering projects can be better supported. Academic studies of decision making within these contexts often employ the framework of cognitive psychology (Gonzales and Meyer, 2016). Collaborative aspects of decision making have been investigated within cognitivist frameworks of shared mental models and collective intelligence (DeChurch and Mesmer-Magnus, 2010).

However, within changing and uncertain environments, such as engineering product development, decision making needs to be conceptualised as a non-linear, dynamic, and collaborative process, contingent on iterative interactions of many actors and artefacts across time and space (Sterman, 1994; Zhang, 2013). This paper proposes that the perspective offered by cultural-historical activity theory (Vygotsky, 1980; Engeström, 1987) is uniquely suited to studying decision making practices in product development as it can offer a comprehensive view of this phenomenon. This is due to several characteristics of activity theory which include a networked view of activities, the presence of contradictions and congruencies between and

within activity systems, the presence of the time dimension, and the concept of an ‘object’ of activity (Miettinen, 1998; Kuutti, 1999; Allen, 2011; Karanosios and Allen, 2014).

Activity theory sees product development as consisting of collaborative practices performed by actors engaged in long term activities. Within this framework decision making can be modelled as “*a collective activity system mediated by cultural tools (both material and conceptual), rules and division of labour*” (Engeström, 2001, p. 284) where decisions are steps in a series of interconnected actions, with activity system shaping the direction of decision trajectories (Engstrom, 2001). The conceptualisation of collaborative decision making as a process that follows trajectories that themselves emerge from interactions is useful, particularly in the context of product development projects. In such projects, diverse actors are embedded in complex socio-technical systems and are often unable to comprehend fully how their activities fit in the bigger picture (Sengupta et al., 2008; Hansen and Vaagen, 2016). This view is particularly applicable to explain tensions, disturbances and biases within decision processes which can be conceptualised as a result of underlying contradictions within and between activity systems (Allen, 2011; Karanosios and Allen, 2014).

The long version of this paper will analyse empirical manifestations of contradictions as experienced by product development professionals in two engineering organisations and discuss their implications for collaborative information behaviour and decision making.

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Coming together to change themselves: How chronic disease patients use social media to reshape their roles.

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Doctor-patient interactions have been traditionally characterized by face-to-face interactions as the primary way to exchange information (Gottschalk and Flocke 2005). Thus, doctors were often only source of information for the patients (Hellawell et al. 2000).

However, the patients' use of new technologies changed this. In particular, healthcare field has experienced a high proliferation of social media use (Kane et al. 2009). Interactions afforded by social media enable patients to move from one-to-one and one-to-many to many-to-many communication (Hawn 2009). In this way, patients shape their use of social media to easily exchange health advice and even self-manage their condition (Lederman et al. 2014; Merolli et al. 2015). Sharing information and using patient data as medical facts through social media enable a creation of new models for creating medical knowledge (Kallinikos and Tempini 2014). Actually, patient interactions through new technologies such as social media use may be reshaping healthcare (Hawn 2009). In particular, such developments could change roles and identities of patients (Fox and Ward 2006). This is particularly important for chronic disease patients whose lives and identities can be significantly affected by the disease (Asbring 2001). Despite the importance of patient perspective and increasing patients' interactions via social media, there remains paucity of evidence in health IT (HIT).

HIT literature has traditionally focused on topics such as privacy concerns, interoperability and resistance to change (Romanow et al. 2012). Moreover, so far, HIT literature has paid very little attention to the patient perspective (Agarwal et al. 2010). Context of chronic disease patients offer opportunities afforded by social media for managing chronic diseases and doctor-patient interactions in new ways (Seeman 2008).

Thus, an objective of this paper is to take the patient perspective and explore how chronic disease patients' interactions afforded by social media reshape their roles. Accordingly, we pose and answer our research question: *How do social media afforded patients' interactions (re)shape their roles*". To answer this question, we study two social media health communities for chronic disease patients. In particular, we rely on activity theory (Leont'ev, 1978) to explore our question. Whereas social media as technology affords the use and changes, it is patients who are using it in a particular context. Thus, activity theory is appropriate as it enables us to bring the context and technology together and at the same time not over emphasize any of the two aspects (Allen et al. 2013). In this respect, we follow earlier studies in the context of IS who were guided by activity theory in their research (Korpela et al. 2002). In context of our research, we see patients as subjects who are driven by a motivation to share and learn with their peers by undertaking activities on social media, which we see as tools. In particular, we envisage that this leads to acting upon their doctors and changing outcomes in doctor-patient interactions. In this respect, we see technology and subjects as intertwined and do not only focus on the role of technology (Allen et al. 2013).

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An Activity Theory Approach to Information Systems Development Flow

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Flow is a fundamental tenet of contemporary lean thinking, and is seen as the primary method to transition from agile to true continuous software development (Anderson, 2013; Fitzgerald and Stol, 2015; Olsson and Bosch, 2014; Poppendieck, 2002; Reinertsen, 2009; Tichy et al., 2015). Flow is about managing a continuous and smooth flow of value creating activities throughout the entire ISD process (Anderson 2010; Petersen and Wohlin 2011; Poppendieck 2002; Reinertsen 2009). Managing flow is achieved by using five commonly known artefacts: (i) Kanban boards, (ii), cumulative flow diagrams (CFDs), (iii) burn-down charts (iv) value stream maps, and (v) line of balance status charts (Petersen et al. 2014). Flow encourages collaboration between teams, measurement of value, costs, and technical metrics, and knowledge sharing (Bang *et al.* 2013). There is strong evidence to suggest that awareness and indeed use of flow artefacts is gaining popularity across the ISD community (Anderson, 2013; Dennehy and Conboy, 2016, Nord *et al.*, 2012; Poppendieck and Cusumano, 2012; Power and Conboy, 2015; Reinertsen, 2009).

The existing body of knowledge on flow is limited by the fact that most studies only focus on a specific flow artefact or do not consider that the flow artefacts must operate in an unpredictable, multifaceted, social and context-laden environment (Dennehy and Conboy 2016; Lyytinen and Rose 2006; Olerup 1991; Wastell and Newman 1993). This is particularly concerning in this study as flow practices are not isolated activities; they are influenced by other activities and other changes in their environment.

Activity Theory (AT) is rooted in practice (Schatzki 1998) as it focuses on the relationships between material action, mind and society by exploring the links between thought, behavior, individual actions and collective practices (White et al. 2016). A distinguishing contribution of AT is that it acknowledges contradictions as a means of understanding and change (Engeström 2001; Ilyenkov 1974), a concept that is not explicit in other social theories (Karanasios and Allen 2014). Contradictions generate disturbances and conflicts, as well as innovative efforts to change the activity (Kuutti 1996). Contradictions are viewed in AT as ‘the motor of change’ and refer “to anything within the system that opposes the overall motive of the system, the aim or purpose that subjects within the system are individually or collectively striving toward” (Allen et al. 2013 p. 840). Contradictions manifest themselves as errors, problems, and clashes (Helle 2000; Kuutti 1995). Ultimately, contradictions interrupt the fluent flow of work (Helle 2000). The resolution of contradictions within and between activities acts as a driver of change (Hasan et al. 2010). This study draws on AT to gain insight into mediation via artefacts and goal-directed human activity within its natural context (Cole and Engeström 1993; Kaptelinin 1996). A previous study by Dennehy and Conboy (2016) applied AT as a lens to identify

contradictions and congruencies in the early adoption of flow. The objective of this new research is *to study contradictions and congruencies in mature flow ISD environments*.

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Working with contradictions: Reviewing the use and development of contradictions in activity theory research

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Within activity theory the origins of ‘contradictions’ and ‘tensions’ (Engeström 1987; 2001) lie in Ilyenkov (1974) and Leont’ev’s (1978) ideas around internal contradictions as historically accumulated dynamic tensions between opposing forces and their roles as a motor of dialectical development and change. Tracing these ideas further back, they had ostensible links to Marxism—in particular around the division of labour in society and the use/exchange-value of production. The latter is captured in the example of the contradiction a doctor faces concerning her/his instruments as a source of healing and commodity to be sold for profit: “*every Doctor faces this contradiction in his or her daily decision making, in one form or another*” (Engeström 2005, p. 95).

More recent framing of the concept of contradictions were advanced in ‘Learning by Expanding’ (Engeström 1987), where Engeström introduced contradictions as a ‘double-bind’—“*a contradiction which uncompromisingly demands qualitatively new instruments for its resolution*” (Engeström 1987, p. 175) and articulated different levels of internal and external contradictions. By doing so, he evolved, and positioned, contradictions as a key component of contemporary activity theory—evidenced by its extensive use in the fields of organisation and management studies (e.g. Engeström & Sannino 2011), information systems/management (e.g. Karanasios & Allen 2013), communications (e.g. Spinuzzi 2012), human-computer interaction (e.g. Nardi 1996) and education (e.g. Murphy & Manzanares 2008), amongst others.

A key aspect of contradictions is that their recognition delivers insight into the qualitative change and development possibilities of activities (Vänninen et al. 2015). As contradictions arise, or are observed, they expose the dynamics, inefficiencies, and most importantly, opportunities for change and action (Blackler 2009; Helle 2000; Holland & Reeves 1996); precipitating the development of an activity (Karanasios 2017). By doing so they reveal opportunities for creative innovations for new ways of structuring and enacting the activity (Foot 2001) and learning (Engeström 2001). Engeström (2001) explains how contradictions can lead to innovation and transformation in an activity system:

“As the contradictions of an activity system are aggravated, some individual participants begin to question and deviate from its established norms. In some cases, this escalates into collaborative envisioning and a deliberate collective change effort. An expansive transformation is accomplished when the object and motive of the activity are reconceptualised to embrace a radically wider horizon of possibilities than in the previous mode of the activity.” (Engeström 2001, p.137).

Therefore, importantly, for debates surrounding structure and agency (e.g. Giddens, Bourdieu), contradictions and tensions provide a lens for understanding how deviance from established rules and norms occur (Allen et al. 2013). This process is cumulative, rather than final. In this view, contradictions are a cultural-historical force, which destabilises activities, leading to

constantly evolving and transforming activities, in which “*equilibrium is an exception and tensions, disturbances and local innovations are the rule and the engine of change*” (Cole & Engeström 1993, p. 8). The process of using contradictions to promote learning and change is referred to as ‘expansive learning’ (Engeström et al. 1999)—which according to (Engeström 1987) “*should be understood as construction and resolution of successively evolving contradictions*”; it is the learning of “*what is not yet there*” (Engeström, 2011, p. 74).

Despite contradictions being one of the most commonly employed concepts in activity theory studies, we identify three key challenges in current literature concerning them. First, despite Engeström’s (1987) conceptualisation, the definition of contradictions in the extant literature is often left vague and ambiguous; as a consequence there appears to be a lack of consensus on what they are, how they may be analytically observed and even what terms and language are used to define them. Often the definitions and interpretations are left for the reader to resolve and terms are used interchangeably or only mentioned briefly. As a result, as noted by Engeström and Sannino (2011, p. 368), “*there is a risk that contradiction becomes another fashionable catchword with little theoretical content and analytical power*”. Others have noted that it is underdeveloped and theorized in the contemporary literature. For instance, Foot and Groleau (2011) note that “*contradictions are collapsed into a singular, generic construct, and the generative force of the different levels of contradictions in socio-organizational relations is overlooked*”. Second, approaches to identifying contradictions have not been discussed in detail in the extant literature. Engeström and Sannino (2011) suggest that they should be analysed through their manifestations, as the contradictions cannot speak for themselves. These manifestations can be treated as articulations or constructions of contradictions, through their recognition, articulation and construction into words and actions (Hatch 1997). Nonetheless, this is underdeveloped in the literature. This means that approaches and methodological developments to identifying, teasing out and uncovering contradictions diverge. Significantly, this has not been elaborated upon in the literature, which is surprising given it is a commonly used concept. Third, there is little understanding on what type of contradictions are being identified, and critically how they are resolved and lead to transformation. That is, a link between their use in the extant literature and their theoretical motivation (e.g. Engeström’s 1987, 2001; Ilyenkov, 1974; Leont’ev, 1978) seems to be missing and/or vague.

These challenges raise concerns around the application of contradictions and subsequently their theoretical value. As a result, their use may be limited, undervalued and in some cases leading researchers to obfuscate contradictions with problems. Motivated by these challenges we undertake an interdisciplinary review of the activity theory literature—focusing specifically on the disciplines of Information Systems, Organisation and Management Studies and Education. While there have been reviews of the use of other activity theory concepts—such as Engeström and Sannino’s (2010) study of expansive learning and Murphy and Rodriguez-Manzanares’ (2008) review of educational technology—this is the first review of contradictions and tensions across disciplines to discuss these themes in an enlarged way.

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Why do IS researchers create alternative activity system diagrams to Engeström's framework?

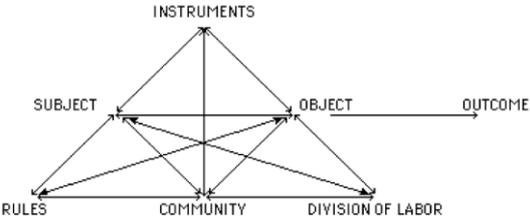
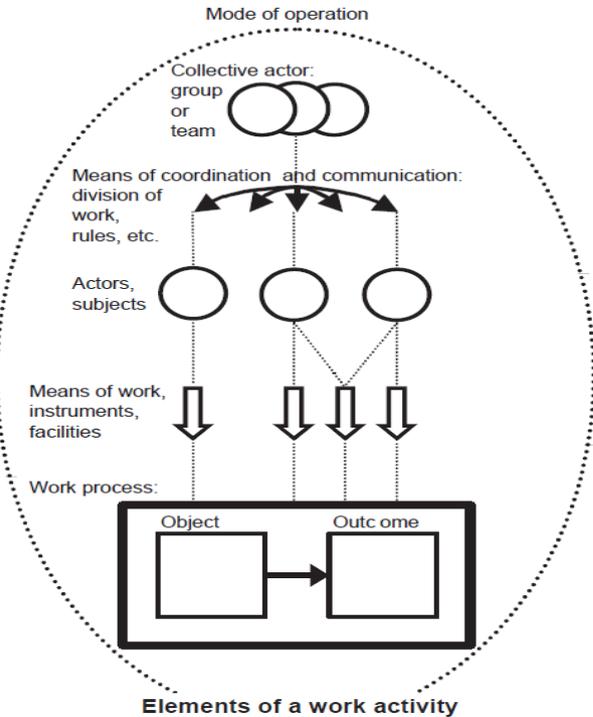
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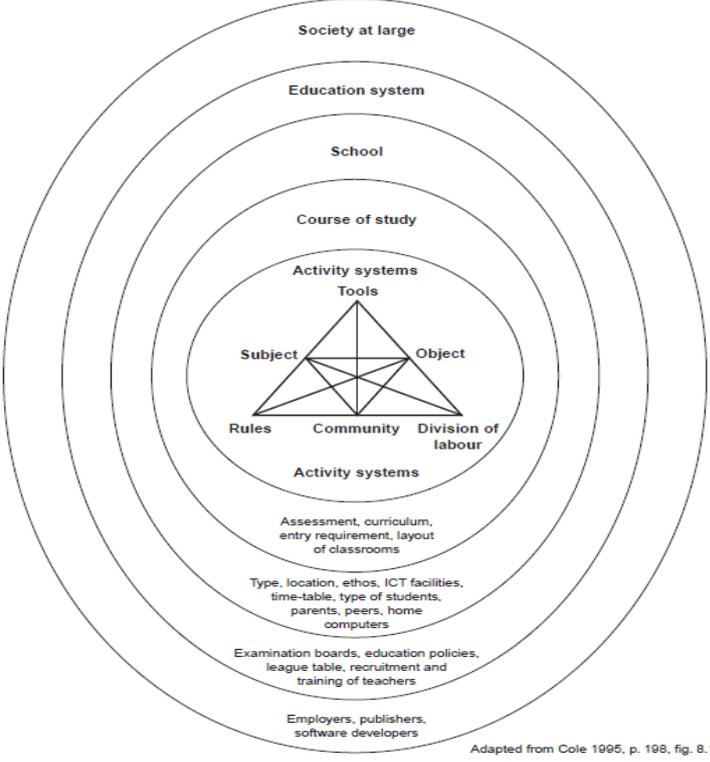
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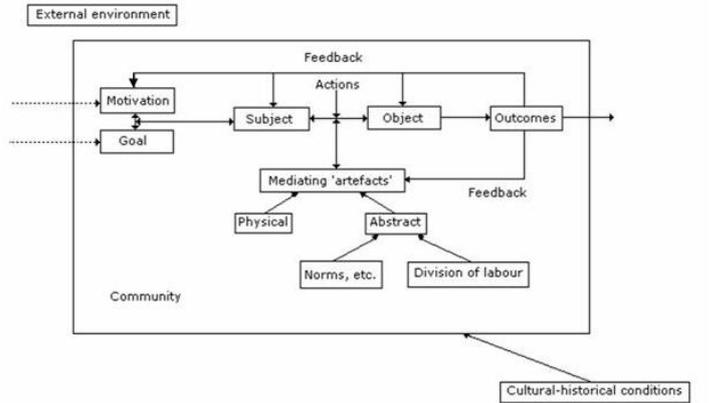
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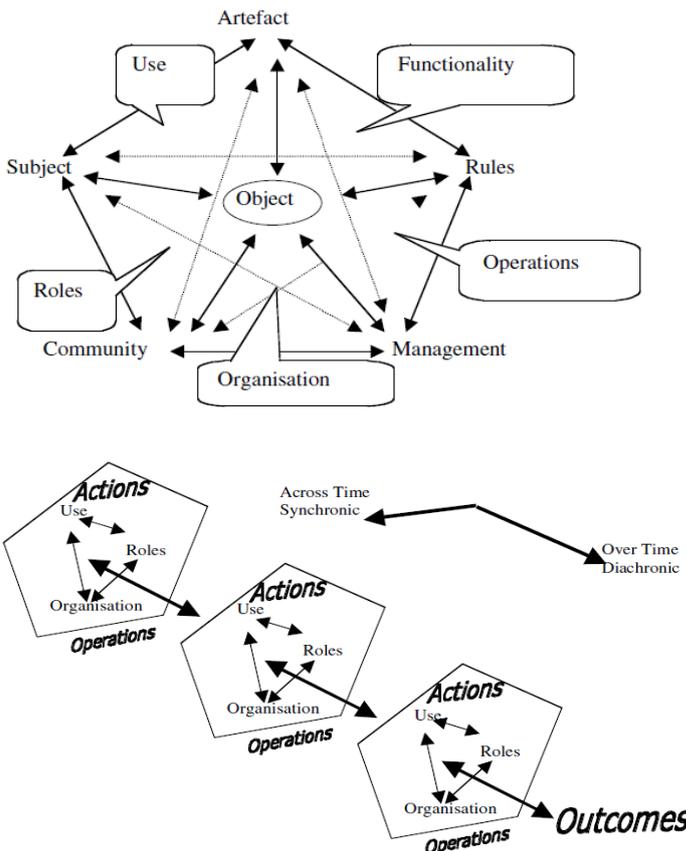
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Engeström's triangle (Figure 1) is often used in IS, but we present examples of other AT diagrams. Do other diagrams help IS scholars understand, use, progress or contribute to activity theory in an IS context, and/or present findings in IS papers? Are other diagrams needed to conceptualise modern IS in activity systems?

<p>Engeström (1987)</p>  <p><i>Figure 1. The mediational structure of an activity system (Engeström, 1987, p. 78)</i></p>	<ul style="list-style-type: none"> • An individual/group (subject) has the motivation to transform an object (e.g. material artefact, problem) into an outcome using tools (e.g. language, IS) within a community comprising rules (e.g. laws, norms) and division of labour (e.g. task allocation, power).
<p>Korpela et al. (2000)</p> 	<ul style="list-style-type: none"> • Shows how the activity of each actor/subject contributes to a collective work process, which comprises objects and their outcomes and forms a shared object for the collective. • Engeström model contribution: <i>"... simplified by ignoring non-mediated relations, highlighted the dissimilarity of the elements by depicting them by different symbols, highlighted the difference between individual and collective elements by presenting various subjects and their instruments explicitly, elaborated on the 'social infrastructure' or 'means of coordination' [beyond rules and division of labour], and underlined the systemic relation between the elements by 'mode of operation'."</i> • Generic images in the figure opposite are replaced with project-

	<p>specific graphics (e.g. people dressed for each role) when Korpela et al. do action research so real stakeholders understand the <u>activity system</u>.</p>
<p>Lim (2002)</p> 	<ul style="list-style-type: none"> • Lim argues activity theory, in the case of IS-based education, “<i>fails to look at the broader context in which ICT is situated—the school, education system and society-at-large</i>”. • “<i>The activity system of the ICT-based lesson, with its interacting components, is in the innermost circle. The next circle represents the activity system of the academic course with elements such as mode of assessment (tools), curriculum (object and tools), layout of the classrooms and ICT rooms (rules), entry requirement to the course (rules and community), and roles of course participants (division of labour and community). The next higher level of context or activity system is the school where the course is situated...</i>”.

<p>Wilson (2006)</p> 	<ul style="list-style-type: none"> • “<i>I became ... dissatisfied by the ... static character of the [existing] diagrammatic representations. Certainly, flows of information, action, influence, etc., are represented ..., but the process is not altogether clear.</i>” • Combines Engeström’s model and Leont’ev’s activity-actions-operations and motive-goal-conditions concepts. • Not all aspects are explained. Wilson’s separation of physical and abstract artefacts is consistent with Leont’ev notion of tools. • Links ‘goal’ to ‘motivation’ because a goal “<i>promotes activity, not something that is directly affected</i>”
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	<p>by activity”, so both “establish the preconditions for activity”.</p> <ul style="list-style-type: none"> • Adds direct links from ‘abstract’ tools to division of labour and rules to reflect how tools mediate links between all components.
<p>Stevenson (2008)</p> 	<ul style="list-style-type: none"> • Aims to develop a model of pedagogy derived from activity theory • ‘Activity pentagon’ shows a ‘pedagogical’ activity system using Engeström’s triangle reorganised to add direct links between rules and artefacts (tools), rules and management (division of labour) and management and artefact. • Focuses on actions in IS-based activities, analysed based management’s ‘organisation’ (e.g. grouping) of and ‘roles’ assigned to subjects, IS ‘functionality’ intended by designers, possible ‘uses’ of IS by subjects, IS-based actions afforded/constrained by ‘operations’ (management resource allocations). • The second diagram shows the ‘full model of pedagogical activities’, made up of: <ul style="list-style-type: none"> ○ Over time: A sequence of actions aimed at achieving outcomes ○ Across time: ‘slices’ represent the evolution of the interplay of roles, tools and organisation, conditioned by the context

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