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General Introduction and Experiments from Nigeria and Finland

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Abstract

This paper investigates if the Activity-Theoretical methods of work development used by Engeström and others can be transformed into a day-to-day methodology for information systems practitioners.

We first present and justify our theoretical framework of Activity Analysis and Development fairly extensively. In the second part we compare work development with information systems development and argue that in its less technological areas, the latter can potentially use the same methodologies as the former. In the third part, small experiments on using Activity Analysis during the earliest phases of information systems development in Nigeria and Finland are reported.

In conclusion, we argue that the experiments were encouraging, but the methodology needs to be supported by further illustrative examples and training material. We argue that compared to currently used methods in the earliest and latest "phases" of systems development, Activity Analysis and Development is comprehensive, theoretically well founded, detailed and practicable.

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Activity Theory, work development, information systems development, Nigeria, Finland

INTRODUCTION

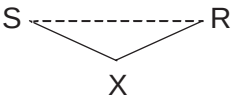
In the field of Information Systems (IS), most studies inspired by Activity Theory have been IS researchers' theoretical reflections on what IS development is about (e.g., Bødker, 1991; Bødker, 1997; Hasan *et al.*, 1998; Kuutti, 1991; Nardi, 1996). In this paper, we examine whether Activity Theory, more specifically an applied methodology called *Activity Analysis and Development*, can be transformed into a day-to-day methodology for information systems practitioners. Our methodology is a modified version of Developmental Work Research (DWR) which has been used in work development in Finland and elsewhere for more than a decade (Engeström, 1987; Engeström, 1990; Engeström *et al.*, 1999).

Although information technology projects are currently one of the most common sources of change in workplaces, IS professionals are neither the only "change agents" there, nor usually well trained in coping with the increasingly non-technical aspects of their job. Thus we want to study if more general work development approaches can be adapted to IS development, without reducing work development into IS development only, but also without trying to make IS professionals into jacks-of-all-trades in work development.The paper is structured as follows. Since we use a slightly different model from what has been applied by others, we need to briefly introduce the basic concepts first. Readers who are mainly interested in the empirical aspects can skip the theoretical sections and return to them afterwards if the concepts need some clarification. The concepts are defined and discussed in section 2, in which we first present a model of the systemic structure of work activity, based on Engeström's well-known model but presenting it in a more illustrative form. We also discuss the idea of networks of activities, and argue that in certain cases it is necessary to supplement the activity level of analysis with wider scopes of analysis. The conceptual framework is then applied in section 3 to compare IS development as a work activity with Developmental Work Research interventions, pointing out various potential ways of applying Activity Analysis and Development in IS-related domains. In section 4 we present an experiment in using activity analysis in an early phase of an IS development project in a severely constrained context in Nigeria. Section 5 presents a similar experiment in a continuing education setting in Finland. Finally, we conclude by summarising the experience from the experiments and discussing its relevance in wider terms.

ACTIVITY ANALYSIS AND DEVELOPMENT: THE THEORETICAL FRAMEWORK

The originators of Activity Theory presented some highly abstract general propositions of the nature of human activity. The most basic one is Vygotsky's argument that all human interaction with the world is *mediated*, either by material tools or by immaterial signs (Figure 1; Vygotsky, 1978, p. 40).

Figure 1: Vygotsky's general presentation of mediated action (S: stimulus, R: response, X: mediation by tools and signs).



While Vygotsky's proposition was dealing with an individual subject, Leontiev (1978) introduced a three-level model differentiating between non-conscious operation, individual action and collective activity (Table 1; Engeström et al., 1990, p. 140).

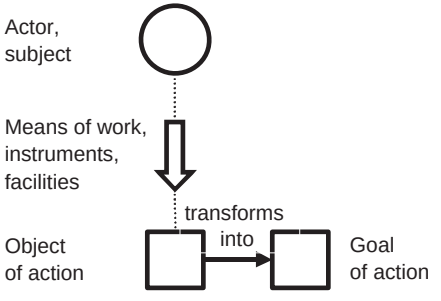
Table 1. Leontiev's three-level model

UNIT	DIRECTING FACTOR	SUBJECT
Activity	Object/motive	Collective
Action	Goal	Individual or group
Operation	Conditions	Non-conscious

Engeström (1987) developed Vygotsky's and Leontiev's abstractions into an applicable model of the systemic structure of human activity. He based his argument into a phylogenetic hypothesis. That is, according to Engeström, that animals have *non-mediated* relations between 'individual', 'environment' and 'population', but in the course of the genesis of human species, these direct relationships were replaced by *mediated* relationships – tools emerged to mediate between 'individual' and 'environment', rules and rituals between 'individual' and 'population/community', and division of labour between 'environment' and 'community' (Engeström, 1987, pp. 73–82). Since he did not support this proposed genesis of human activity by empirical evidence, it remains a hypothesis. Therefore we derive basically the same model in the following through more straightforward logic (Korpela, 1994).

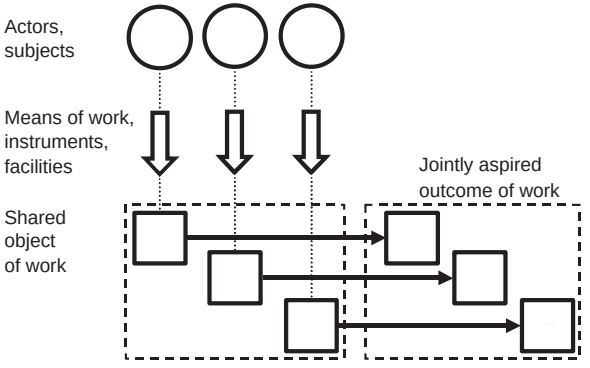
In Leontiev's model, the elements of an *individual action of work* are the subject (individual person), the object, the mediating instruments and the goal (Figure 2). For instance, a carpenter applies a hammer and his skills on some planks and nails in order to construct the scaffolding for a building; a researcher applies a word processor in order to transform her research results into an article.

Figure 2: Individual action of work.



However, as Leontiev (1978) emphasises, individual human actions can only be understood through the *collective activity* which they are part of. The carpenter constructs the scaffolding so that a group of construction workers can jointly, through their separate actions, build a house; the researcher wants the article to be published in a book which requires a large amount of coordinated actions by many individuals. In general, in order to produce any socially relevant outcome, we usually need the inputs of several individual actors working on their respective parts of the joint task (Figure 3).

Figure 3: Individual actions merging into a joint activity.

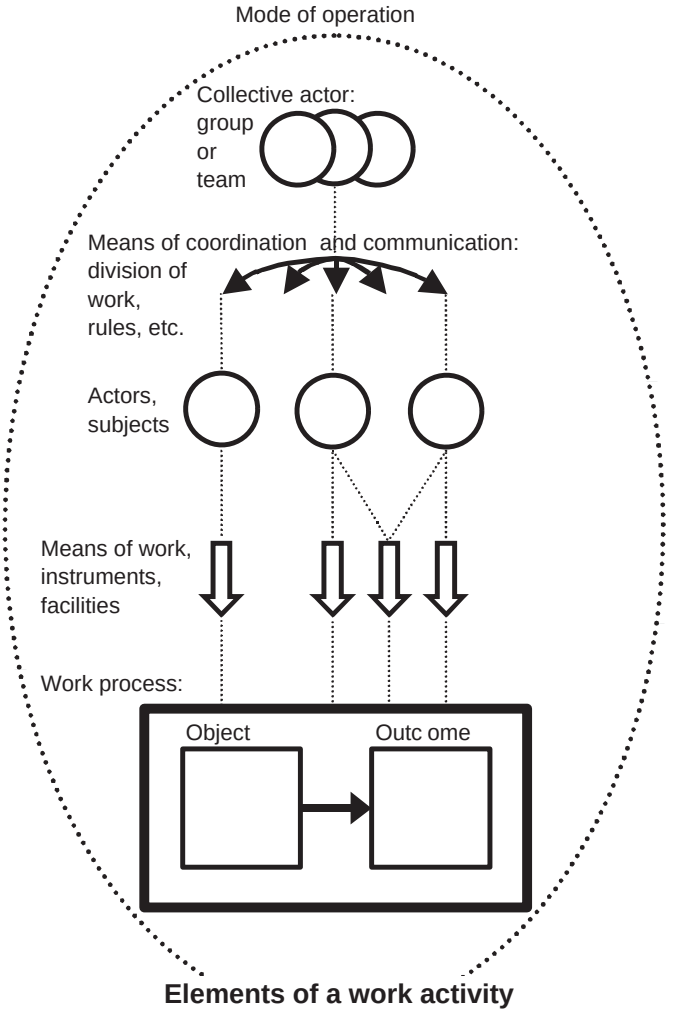


Leontiev emphasises that the *motive* of a collective activity is in its shared object – or more specifically, in what the object transforms into during the activity. For instance, the motive of a construction activity is to transform the raw materials into a house; the motive of scientific writing is to transform research results into a publication. Individual actors engaged in the activity may or may not be conscious of the collective motive, but it is yet the shared object and its transformation into the jointly produced outcome which defines an activity.

Engeström's main addition to this Leontievian model was to point out that when several subjects work on a shared object, there need to be some form of coordination between them, and this coordination is also *mediated* by what he calls "social infrastructure" (Engeström, 1987, p. 190) – rules and division of labour (Figure 4). While individual actors act on the object of work through means of work, we can regard that the group taken together as a *collective actor* (work community in Engeström's terminology, or a team) applies these *collective means* or instruments so that the individual actions are directed to produce a joint outcome

In addition to the rules and division of labour mentioned by Engeström, we can think about several other kinds of *means of coordination* required in order to merge the individual actions into a collective activity. As a method for identifying such means, we should think about what kind of mediated relations are required between the collective actor and the other elements of the activity. Between the actors, we need means of communication; the distribution of the means of work among the actors is governed by relations of control or "ownership of the means of production" if you like; the distribution of the outcome among the actors may be completely different from the division of labour between them and governed by other relations; and so forth.

Figure 4: Collective work activity as a systemic entity.



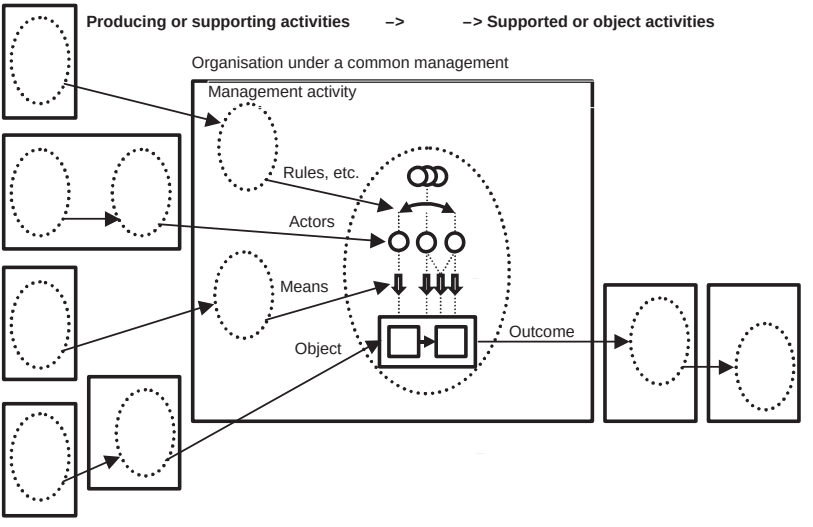
As Engeström emphasises, work activity is a *systemic* entity. A system is defined as a whole which is more than just its elements taken separately – for instance, all the parts of a bicycle as a heap on the floor are not a system, but the same parts put together in a specific way make them into a system, a new entity called bicycle which has new properties like "rideability" which the heap did not have. In the same way, there must be a relative fit between the elements of a work activity, a *mode of operation* (Figure 4). If, for instance, a publication activity is based on Microsoft Word 2000 as a shared instrument, but one of the co-authors can only use WordPerfect 5.1, then

the collective activity does not operate properly and may even break down. In general, the *misfit* or contradictions between various elements, or between one element and the common mode of operation, is the main source of dynamism in the model. Some element lags behind the others and needs to be "improved" in order to better fit the mode of operation; after a number of such small improvements, the entire mode of operation starts to lag behind the most "advanced" elements, and a new balance, a new fit must be found through a new mode of operation.

We wish to emphasise that the egg-shaped model presented above is basically equivalent to the triangular model presented by Engeström (1987, p. 78) and widely applied in Developmental Work Research. Our contribution is that we have simplified the model 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", and underlined the systemic relation between the elements by "mode of operation". We think that our notation can especially help in reminding of the multi-actor nature of an activity, which has often been reduced into single-actor models in DWR projects.

Engeström introduced another new level of analysis that we regard as highly important and under-utilised; namely, the concept of *activity networks* (Figure 5; cf. Engeström, 1987, p. 89).

Figure 5: A network of activities, split by organisational boundaries.



Most often the outcome of an activity is not intended for the same collective which produces it, but to be "consumed" by some other collective in some other activity. Construction workers do not build houses for themselves only; researchers write publications for the scientific community to make use of. The *supported or object activities* of an activity (the right-hand side of Figure 5) are its "reason for existence", its socio-economic justification which sets the requirements for it.

Likewise, the component elements of any activity – objects, means, actors, rules, etc. – are not

usually produced in the same activity, but acquired from other activities. The "raw materials" and tools can be the outcomes of some material production activities, while actors can be "produced" by some educational and reproductive activities, and the rules and other social relations by political or management activities and long-term socio-cultural processes. The *producing or supporting activities* of an activity (the left-hand side of Figure 5) define the latter's viability or sustainability; the latter cannot exist without the former.

For the sake of simplicity, in Figure 5 we have depicted only one object activity for each activity, and only one producing activity for each component of an activity. In real life, of course, the means of work of an activity for instance are not usually produced by one single other activity, but by many different activities. It is also quite common that there are loops in the network – we will return to this in later sections. We suggest that similarly to the relations within activities, the relations between activities in a network are also mediated, by *means of networking* like business agreements, marketplaces, roads, telecommunication, and so forth.

We have argued elsewhere (Korpela, 1994) that the network of activities, the "metabolism of use-values" in a society, is conditioned by "wider scopes" which sometimes need to be taken into account in the analysis (cf. Walsham, 2000). Activity-level views can be linked with societal levels of analysis by using Tobach's (1991) concept of *integrative levels* (Korpela, 1994, pp. 93–100, 207–215). For the purposes of this paper, we introduce the *organisational* or institutional level of analysis only (Figure 5), and leave financial and societal levels of scope for later studies.

It is a simple every-day observation that *organisational boundaries* are an important fact that affects how seamlessly or otherwise the activity networks operate. From an Activity-Theoretical point of view, we can define an organisation or institution as a *group of activities that are coordinated and controlled by a common management activity*. In other words, the management activity of an organisation is the *primary source for the rules* applied within and between the other activities of the organisation. Conversely, we can identify an organisation – an informal community, a department, a company, a branch of administration, a state – by identifying a management activity which sets the rules (or some of the rules) for a number of other activities. Of course, any baseline activity can belong to many organisations at the same time.

When a producing activity and its object activity are located within the same organisation, the relation between them is by default governed by more straightforward rules than if they belong to different organisations. Boundary-crossing activities are an especially interesting phenomenon, which we will discuss later on.

We wish to emphasise that the framework of analysis presented above is useful for a static snapshot, while the real issue is to continue from analysing the current mode of a work activity and its network into analysing the *tensions or contradictions* within the current mode, and further into *cyclic development* of the activity or network, as in Developmental Work Research interventions.

WORK DEVELOPMENT VS. INFORMATION SYSTEMS DEVELOPMENT

The term *Information System* has two widespread meanings. In day-to-day parlance, it is used simply as a synonym for a *multi-user computer application (multi-user software package)*. In Information Systems Science, it includes both *technological and social elements*, either as two separate systems or as a social system containing technological elements (both manual and computer-based), depending on the definition (Avison, 1997; Davis, 2000).

While we strongly agree with the need for a social dimension, we think that an information system in the latter meaning is not necessarily an autonomous *system* in itself – in the way a system was defined in the previous section. We argue that the basic systemic entity that defines the "fit" or "appropriateness" of information technology is the *collective human activity*, especially a work activity, within which IT is utilised.

In this framework, information technology applications are just one part of the means or instruments required in a given work activity. Even when put together, the IT bits and pieces required in a work activity do not necessarily form an autonomous information *system*. If the object of a work activity is data and the outcome is information, then we can speak about an *information activity*, otherwise the information processing aspects are subordinated to and dispersed within the main work process.

Thus, regarding what is usually tried to be captured in the term *information system*, we speak about:

> "the use of information technology (manual or computer-based) in a collective work activity, either as means of work or as means of coordination and communication, or between activities as means of networking."

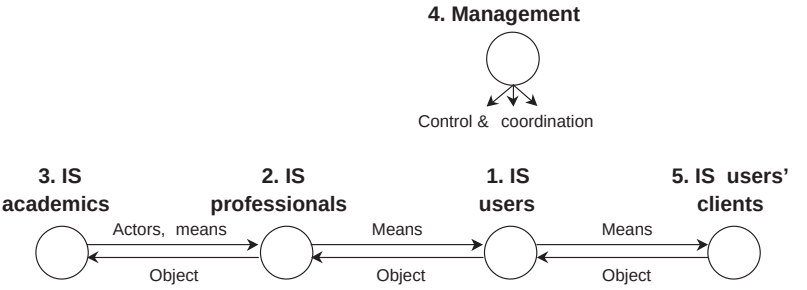
We accept that our expertise is mostly about *computer-based* information technology. The various software artefacts included in the definition can be either single-user packages or multi-user packages (applications; the "information systems" of every-day parlance), as long as they are required in the collective work activity in order to achieve the joint outcome.

Correspondingly, we define that:

> "Information Systems Development (ISD) is the process by which some collective work activity is facilitated by new information-technological means through analysis, design, implementation, introduction and sustained support, as well process management."

We have discussed ISD as an activity in more detail elsewhere (Korpela *et al.*, 2000a). For the purposes of this paper it suffices, to emphasise that Software Engineering and ISD are two closely related but separate fields of enquiry and practice. An ISD process usually, but not always, contains some programming or software engineering of individual "bits and pieces" of the information-technological facilities that are not readily available, but ISD deals increasingly with *adjusting and integrating* prefabricated pieces to fit the needs of a specific work activity (Lyytinen *et al.*, 1998; Russo, 2000).

Figure 6: The main stakeholders/activities and relations around IS development.



The various stakeholder groups within the core network of activities around IS development are depicted in Figure 6 (Korpela *et al.*, 2000a; Korpela *et al.*, 2000b). Activity Theory, Developmental Work Research, or more specifically Activity Analysis and Development (ActAD) can be used in a number of different ways by different stakeholders, as follows.

1. **IS users** can use activity analysis and development as a methodology to analyse and develop their own work activity. If, during a work development process, they identify a need for improved information-technological facilities, they can invite IS developers to participate in the process and design the required facilities for them. Quite often the very work development process can start from an every-day understanding that the information-technological facilities of a work activity are lagging behind what they could be. In this case, a wise team can propose to its management to launch a holistic work development process and analyse the requirements for a new IS from a more general viewpoint – rather than release a straightforward bid for tenders. Most probably even in this case the work development process will lead to improvements in the other component elements of the activity as well, not just the IS facilities – training for the actors, changes in the division of labour, etc. The methodology suggests that the IS users would invite their clients and other important stakeholder groups as well into the development process, in a bigger or smaller scale depending on the case.
2. **IS professionals** can use activity analysis and development in two ways.

a) Like IS users, they can use it as a methodology to analyse and develop **their own** *work activity (IS development). They can invite their facilitators (IS academics) or clients (IS users) to participate in the process if that is considered useful.*

b) They can use it as a methodology to analyse the **IS users'** *work in cooperation with the users, and to participate in the latter's work development process as facilitators who specialise in designing improved IS facilities for them. In other words, activity analysis and development can be used as a methodology in every-day IS development. In the rest of this paper we present some experiments on this approach.*

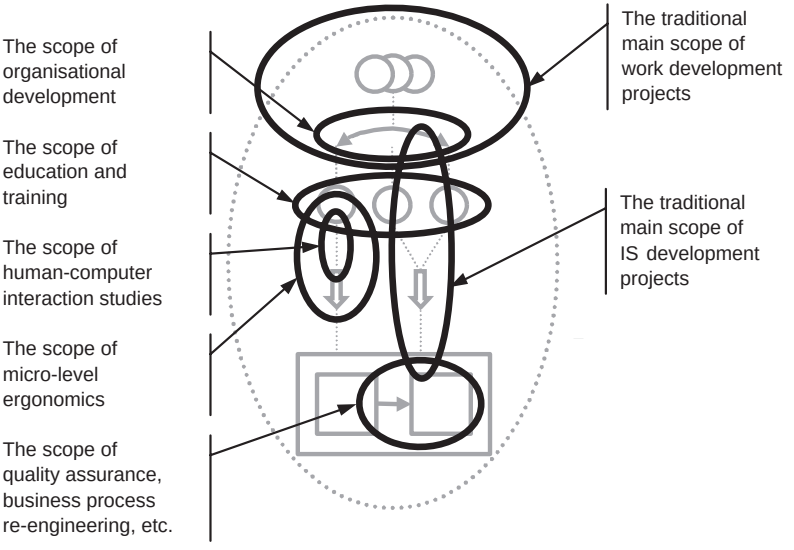
3. **IS academics** can also use activity analysis and development in two ways (Korpela *et al.*, 2000b).

a) Like IS users and professionals, they can use it as a methodology to analyse and develop **their own** *work activity (IS education and research). Likewise, they can invite facilitators (e.g.*

experienced work development experts) and their clients (students and IS practitioners) to participate.

b) *They can use it as a methodology to analyse the* **IS practitioners'** *work in cooperation with the practitioners, and to participate in the latter's work development process as facilitators who specialise in designing improved ISD methods and techniques. In other words, activity analysis and development can be used as an action research methodology. We have presented such a research programme in Nigeria elsewhere (Korpela et al., 2000c; Mursu et al., 2000; Soriyan et al., 2000), and a similar research plan has been proposed to study ISD in the healthcare sector in Finland (Eerola and Korpela, 2000).*

Figure 7: Comparison between work development and IS development.



There are many kinds of developers and consultants focusing on various aspects of work activities (Figure 7; Korpela *et al.*, 2000a). "Work developers" and IS developers are not exactly the same people, but both researchers or consultants in Developmental Work Research projects and IS developers in cooperative IS development projects are external facilitators who engage in a collaborative activity with their clients in order to jointly improve the latter's work. Both of them need to have a holistic approach on the work activity in question, and to take information technology as one – but only one – of the subordinate elements that can be changed in order to "improve" the work activity as a whole. IS developers may thus potentially use the same methodologies as "work developers", although probably in lighter versions because of the narrower scope and more stringent time constraints in their projects.

In the next two sections of this paper we present some experiments in which Activity Analysis and Development (ActAD) has been used as a rapid, holistic analytical method during the earliest

phases of ISD in order to capture the relevant aspects of the context for a would-be information system, jointly by IS professionals and would-be users.

FIRST EXPERIMENT: ACTIVITY ANALYSIS FOR PRIMARY HEALTHCARE SYSTEMS DEVELOPMENT IN NIGERIA

The authors of this paper have been involved in a Joint Nigerian-Finnish Project on Health Informatics since 1989. The project is a collaborative undertaking by the Obafemi Awolowo University (OAU) Department of Computer Science and Engineering, Ile-Ife, Nigeria, the OAU Teaching Hospitals Complex, and the University of Kuopio Computing Centre, Finland. A jointly developed rudimentary hospital information system has been in operation in the teaching hospital since 1991 (Daini *et al.*, 1992) and the partners have recently embarked on a new phase to develop a full-scale "Made-in-Nigeria Primary Healthcare and Hospital Information System (MINPHIS)".

It has been repeatedly pointed out that IS development methodologies designed for the affluent industrialised countries are not appropriate to the severely constrained conditions of developing countries without adaptation (Avgerou, 1996; Walsham, 2000). The two partner universities have thus established a research project to develop "Made-in-Nigeria IS development methods", as action research within the practical MINPHIS project (Korpela *et al.*, 2000c). In the research project, selected "Northern" ISD methods and techniques are modified and tested within the practical project by the researchers. The existing practice and needs in Nigerian software companies are studied in parallel by a combination of survey and case methods (Soriyan *et al.*, 2000). The methodological part received partial funding from the Academy of Finland for 1998–2001.

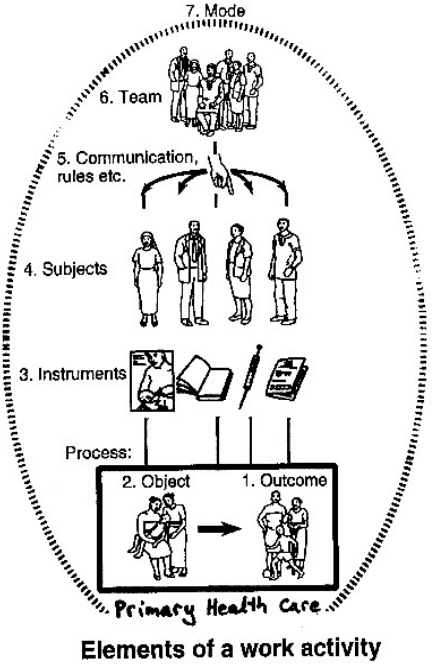
During the preparatory phase of the research project, Activity-Theoretical analysis had given rise to a successful experiment in community involvement in the early requirements analysis for a primary healthcare (PHC) information system (Korpela *et al.*, 1998). The researchers discussed whether Developmental Work Research could provide a practicable methodology for Nigerian IS developers more generally as well, but even the more straightforward versions of the activity framework (Korpela, 1994; Korpela, 1997) were regarded as being too abstract by the Nigerian researchers.

In May 1998, we arranged an experiment to test whether activity analysis can be used at all in the early phases of cooperative IS requirements analysis in Nigeria. In a teaching health centre in Ile-Ife, a three-hour workshop was held to analyse the need for and feasibility of a primary healthcare information system. The Nigerian participants included one young physician, four senior nurses, one medical records officer, and three computer professionals cum researchers from the local university. Three Finnish researchers attended too. In order to make the analytical framework less abstract, a Finnish researcher had prepared illustrated skeletal activity models of (a) primary healthcare delivery in Nigeria (Figure 8), and (b) information processing within a PHC setting (Figure 9), in addition to generic diagrams (earlier versions of Figure 4 and Figure 5).

The Finnish researcher explained the illustrated diagrams as being examples based on layman understanding of the healthcare providers' work: "As you know, healthcare is needed to promote health and to prevent and cure diseases – we have illustrated that by having this sick child and worried family and neighbours as the starting point here (Figure 8), and as the objective of health-

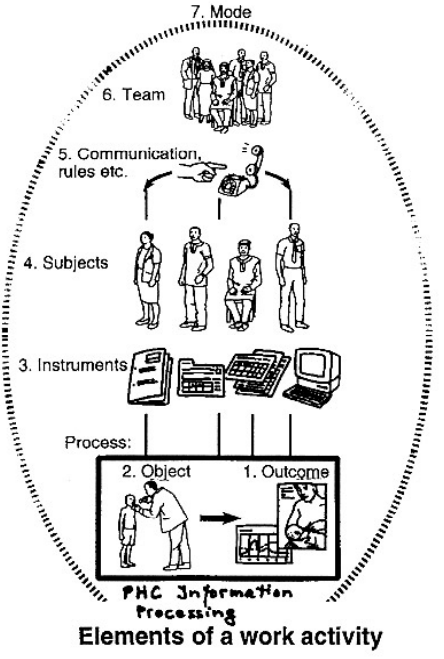
care, we have this healthy and happy community here. Many people are required in order to achieve that objective – for instance, here we have a voluntary community health assistant, a doctor, a nurse, a medical records man. They need different skills and tools in 'transforming health problems into health' – the volunteer may need this breastfeeding promotion material, the doctor his theoretical knowledge and drugs, they all need the patient's health records, etc.".

Figure 8: First picture used in Nigeria.



He carried on with the other diagram: "Since we are today specifically dealing with the information needed for good healthcare, we have this other picture about what is needed to produce such information for all who need it. In this case I suppose that the starting point is that we have this day-to-day healthcare delivery going on here (Figure 9), and the objective is to collect data from that process and to turn it into useful information like statistics and health promotion materials here. Now about the people needed in the information processing, I suppose that at least the nurses are involved and of course the medical records officers, and maybe managers like this oga here, and if at some point we are going to use a computer then we need computer professionals. In order to produce the information, we have seen that you are using at least case note folders and these blue index cards and …".

Figure 9: Second picture used in Nigeria.



After having gone through the two illustrated diagrams, the researcher suggested that the participants may use them as inspiration and a checklist when studying the requirements for improving the existing paper-based information system in the health centre, possibly by means of IT as well. He distributed copies of the diagrams and a generic handout/checklist prepared earlier (Korpela, 1997). The checklist included the following questions to identify the main constituents of the central activity:

- 1a. **Outcome:** What services or products do we produce?
- 2a. **Object and process:** What raw materials or prerequisites do we start from? How do we produce the services or products from the inputs we have?
- 3a. **Instruments:** What kinds of physical tools and knowledge, skills etc. do we need for this work?
- 4a. Subjects: Who are we – what different kinds of people are needed to produce these services or products?
- 5a. **Social relations and means:** When we work to produce the services or products, what kinds of rules, division of labour, communication etc. apply between us?

The following questions were included to identify the network of activities:

- 1b. **Outcome:** Who needs our services or products? For what do they need that – to produce some services or products to some others?

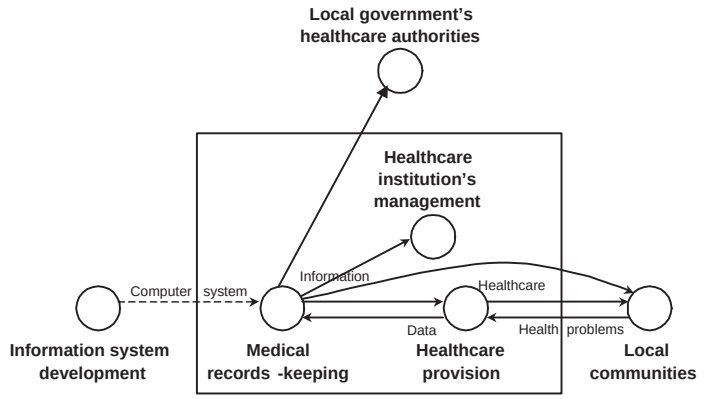
- 2b. **Object:** From whom do we get our "raw materials"? How do they produce what we need?
- 3b. **Instruments:** From whom do we get the tools and knowledge we need? How do they produce that?
- 4b. **Subjects:** Where do we come from – who educates and raises the kinds of people needed here? How does that happen?
- 5b. **Social relations and means**: Who sets the rules for us? How are the rules generated?

There was very little discussion and the Finnish researcher was sure that the experiment had failed. During the next weekend however, the healthcare people met informally between themselves to discuss the matter, and the Nigerian computer people also met separately.

Another joint workshop was held four days after the first one. The nurses and the physician now presented a detailed analysis of the PHC activity in their own health centre, each one reporting on one of the activity model's elements. They criticised some terms (e.g. 'subject', 'instrument') for being too artificial, and told that it would be more reasonable to move from the object and outcome first to the 'doers' and only after that to the means, contrary to the order of the checklist. They also emphasised that the means must be understood in a very broad way, including for instance the health centre building, which is very crucial for healthcare delivery. In general, the healthcare providers' analysis of their own work activity was very rich and insightful, while the analysis of the information collecting and processing activity was less detailed, and the analysis of the network relations was at a stage of some initial remarks, pending more time.

The computer people also presented the outcome of their elaboration, but there was some confusion about whether they were analysing their own activity as systems developers in the project, or the day-to-day information processing activity of the medical records personnel of the health centre. The Finnish researcher tried to clarify the difference by sketching a drawing about the chain of activities on a blackboard (an edited reproduction is presented in Figure 10).

Figure 10: Main activities around PHC information processing in Nigeria.



At the end of the workshop everyone agreed that the illustrated diagrams had provided an inspiring starting point for grasping the context in a systematic way, but the network diagram should also have been presented as an illustrated example, not as an abstract model. The healthcare

professionals were eager to continue from the analysis to the developmental aspects as outlined in the checklist handout.

The Nigerian researchers later utilised the activity network diagram in a presentation at the Computer Association of Nigeria's annual conference to discuss the role of health informatics in the country. In this case the audience – computer practitioners and managers – could easily grasp the relevance of healthcare information processing and their own potential role in it from the network analysis, but it was more difficult to apply activity analysis to the computer professionals' own work, for instance in identifying the tools and skills required in it.

SECOND EXPERIMENT: A GROUP EXERCISE AT A HEALTHCARE INFORMATION SYSTEMS COURSE IN FINLAND

The second experiment was conducted in Finland from late August to mid October, 1998, during a one-year continuing education course on Healthcare Information Systems for a mixed group of healthcare professionals (mainly senior nurses involved in computer projects), computer professionals (from hospitals and vendors of healthcare applications) and teachers from healthcare polytechnics. The participants had about 5–20 years of work experience each and were from all parts of Finland, meeting once or twice a month in Kuopio. The course was coordinated by the Finnish author of this paper, and was the first of its kind in Finland.

The objective of the experiment was to study whether activity analysis is a suitable method for systems developers and healthcare professionals to jointly analyse the context and requirements for improved information-technological facilities for a given work activity.

The participants were divided into five groups of 4–5 persons – one or two healthcare professionals, one or two computer professionals and a teacher. Each group was assigned to make a requirements analysis or feasibility study on a real-life problem in the real-life organisation of one of the participants. The other group members were not familiar with the target organisation beforehand. A maximum of about ten working days of net time during two months of calendar time was available, including three days for preliminary and final reports to other groups. The task was to specify what kind of new or modified IT artefacts need to be procured or developed, what kind of training and education organised, what kind of modifications made to the work processes and the rules, etc., in order to "improve" the work and service in question in relation to the problems identified during the exercise.

Eight months earlier, in the beginning of the course, the participants had been given a one-hour lecture of the basic concepts of activity analysis for a homework exercise on studying the historical development of the use of information technology in their workplaces. The participants were now reminded of the framework by briefly introducing the illustrated diagrams used in the Nigerian experiment. Three researchers from the Centre for Activity Theory and Developmental Work Research, University of Helsinki, as well as a physician presented case studies and principles of prior work development projects in healthcare to the participants. However, the groups were not required to use any specific methodology during the exercises. Some participatory and object-oriented IS analysis and design methods were also briefly introduced to them.

All groups arranged 1–3 future workshop type of half-day meetings with key stakeholders of the

work activity in question, as well as about the same amount of working meetings for themselves. Two of the groups arranged a familiarisation tour to the workplace. The groups were able to grasp the unfamiliar contexts and problems surprisingly well within a very limited time scale, and to make suggestions on highly relevant further action in the organisations in question. This was contrary to the expectations of some seasoned Developmental Work Research experts, who had doubted whether any meaningful developmental processes could be completed in such a time frame by groups which were mostly outsiders to the workplace.

However, none of the groups tried to apply activity analysis independently. After or during the first workshop in each group, the course coordinator sketched his understanding of the context in question into a rough network diagram and in one case into a more detailed activity diagram as well. Two of the groups carried on the analyses into more breadth and depth, two others made use of the analyses as such in their reports, while one group relied on a more traditional information flow chart.

In the evaluation of the course, the participants unanimously graded the multi-professional group exercise as 'very useful' or 'useful'. Although it was regarded as a 'fairly correct decision' that the groups were given "free hands" methodologically, most participants considered the Activity-Theoretical frameworks and methods useful for their own work, and suggested that the next course should spend more time in training the methodology properly.

DISCUSSION AND CONCLUSION

The experiments showed that it is *not impossible* that activity *analysis* works as a checklist for a group of IS professionals and end-users trying to grasp the context for a would-be information system – even in the severely constrained context of Nigeria. Two small experiments are of course not enough to prove that the analytical framework were *generally* appropriate as an every-day tool for IS practitioners. On the contrary, the experiments suggest that there are certain preconditions for "non-experts in Activity Theory" to use the analytical framework successfully.

Firstly, it was imperative to illustrate the conceptual schema by real examples – abstract triangles as such did not inspire the analysis. The Nigerian experiment already contributed to making the terminology more concrete (compare Figure 8 with Figure 4; cf. Korpela, 1999), but there remains more to do. For non-experts to quickly grasp the idea of the framework, there should be a well worked-out *real life example*, a case consisting of at least two interconnected, fully analysed and illustrated familiar activities as well as the core network around them. The activity network should also be illustrated by examples from real life. It is also important that the example documents the method by which the analysis proceeds – that is, how the checklist questions were used in identifying the elements and network relations in the real-life case in question. Although the framework is very generic, the model case should deal with IS use and development, to make it more readily applicable to IS projects and practitioners.

Secondly, even when a relevant illustrated example was available, it was not easy to analyse "somebody else's activities" or the networks of activities. Clearly, applying the analytical framework to an unfamiliar context requires some more *training* than what was given to the participants of the Finnish experiment. On the other hand, the experiments indicate that it is not necessary to always have a "hard-core work development expert" in a comprehensive development project –

for feasibility studies and rough requirements analyses, an IS professional (systems analyst) with some training in activity analysis should be able to guide the analytical process and to sketch rough diagrams for others to modify and fill with details.

The two small experiments described here had many limitations. Neither of them was a real-life IS development case by ordinary IS practitioners – there was a research bias in both experiments. Most importantly, the experiments did not proceed from *activity analysis* to activity *development*, which will be the real test for the usefulness of the approach. Likewise, the "wider contexts" beyond the organisational level were not analysed.

In conclusion, one should ask: *"So what? Does activity analysis and development provide something new to participatory or cooperative IS development?"* We think that there are three main responses to this question.

Firstly, a limitation. Activity analysis and development is applicable in the *earliest and latest "phases"* of the information system lifecycle – from problem identification to rough requirements analysis, and again when readily-made bits and pieces of IT are introduced to a work activity through adaptation, integration and training. The more technical aspects of IS development we approach, the less activity analysis and development can contribute, and the more we need methodologies adapted from Software Engineering. There is currently a gap between the less formal, innovative methods like activity analysis, and the strictly formal methods of Software Engineering. We suggest that *use-case modelling* (Jacobson 1994), operating on the level of an individual action (cf. Table 1 and Figure 3), can become a bridge between activity analysis and software engineering. However, more empirical research is needed on the interplay between activity and action level methodologies of design.

Secondly, the methods currently used in the earliest and latest "phases" of IS lifecycle are fuzzy and theoretically shallow. Activity analysis, especially activity network analysis, provides a *theoretically well founded, detailed and practicable procedure* for studying the context of a would-be information system in a systematic way, identifying "misfits" or tensions within and between the elements as sources for development.

Thirdly, activity analysis and development is a *comprehensive* framework and methodology that guides developmental efforts to be broad-based, rather than limited to information technology only. Especially in the analysis of a single activity, the methodology suggests interventions in the domains of education, work process, division of labour, communication, etc., in addition to technological interventions, in a balanced and situated way.

The crucial issue is, whether the methodology is suitable to be applied in day-to-day IS projects by information systems professionals, without the presence of highly trained work development researchers or consultants. To that end, further action research is required in different kinds of full-scale IS development projects in which IS practitioners try the methodology in practice.

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