

History as Part of Context

Manasawee Kaenampornpan and Eamonn O'Neill

Department of Computer Science

University of Bath

Bath BA2 7AY

{cspmk, eamonn}@cs.bath.ac.uk

Context awareness is an important concept for a usability of ubiquitous systems. However, the research area of context [Chen and Kotz, 2000, Dey, 2001, Kaenampornpan and O'Neill, 2004] is quite undeveloped and does not have well established methods and techniques. We propose Activity Theory [Engeström et al., 1999] as a framework for providing a better understanding of context in the design of mobile and ubiquitous computing systems.

Activity Theory

In order to derive principled design methods for developing ubiquitous systems, we need to understand the context in which such systems will be used. This means that we need to understand what elements have impact on users in performing their activities in the ubiquitous world. Humans cannot fully understand the full moment-to-moment richness of other humans' activities, states, goals and intentions. Yet they manage successfully and fluently to interact in many highly contextualised ways. Therefore we suggest that a relatively simple model of the influences on users' activities will be adequate for representing context in the design of a ubiquitous system. Moreover, a simple model has the additional advantage that it is easy to use by the designers of the system.

We have chosen to use Activity Theory [Engeström et al., 1999] as a framework to understand users' contextualised activities. The reason for using Activity Theory is that it uses a simple standard form to represent concepts such as roles, rules and tools, which have important impacts on users' activities. Moreover, Activity Theory also maps the relationships amongst the elements that it identifies as having an influence on human activity.

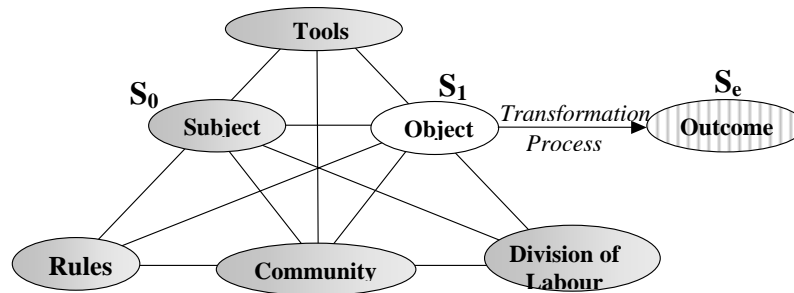


Figure 1 Triangular Structure of Human Activity introduced by [Engeström et al., 1999]

Figure 1 shows that Activity Theory allows us to capture information about the current situation, (S_0) and the outcome (S_e) once the activity is performed. However, it does not provide an adequate account of a user's current object or intention (S_1). People often refer to experiences in the past while performing their current activity. Therefore, we have extended Activity Theory by adding the concept of History, illustrated in Figure 2. History is modelled as a set of states in the past. Each past state is represented as an Activity Theory model, which captures the context of past activities. This information includes the initial state (S_0), intention (S_1) and outcome (S_e) of the activity.

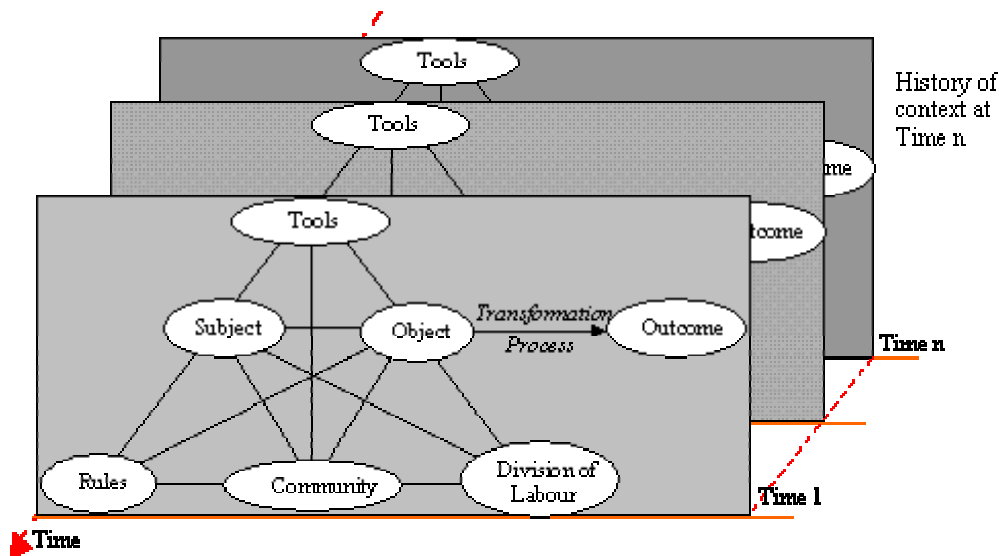


Figure 2 Extending Activity Theory to understand user's activity in mobile and ubiquitous world

In developing a model of the user's context, we first collect information on each element in the Activity Theory model. This information may be collected from sensors or databases. At this stage, the Activity Theory model (Figure 1) is used as a guide for the designers to what types of information to take into account. Secondly, this information is used to model the context of the user's current activity (S_0). This model does not include the user's intention or goal (S_1), as we cannot sense such information. Thirdly, the context model references the history, which records the user's context in achieving his/her goals in the past, in order better to infer the user's current goal. This results in a refined context model that includes an understanding of the user's goal or Object (in Activity Theory terms); see Figure 3.

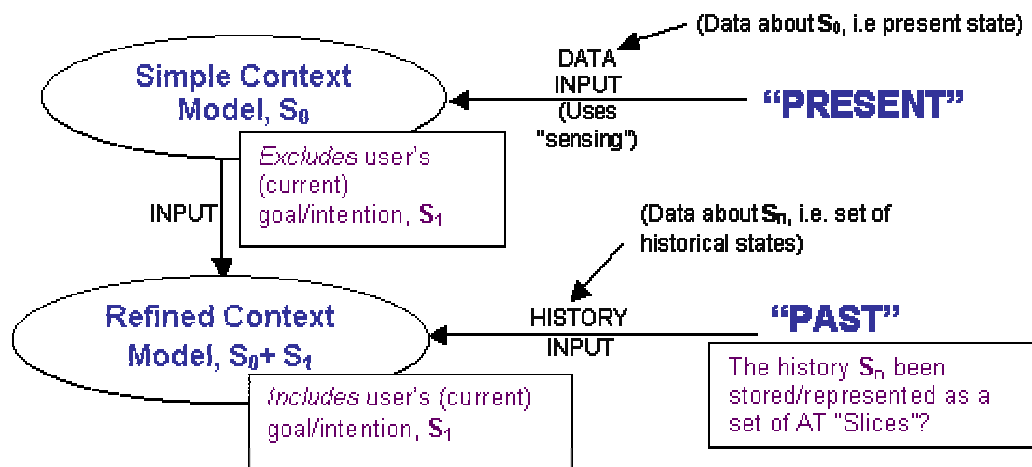


Figure 3 Referring user's current goal, S_1

Reference

- Chen, G. and Kotz, D. (2000) A Survey of Context-Aware Mobile Computing Research Dartmouth College, Department of Computer Science TR2000-381
- Dey, A. K. (2001). "Understanding and Using Context." *Personal and Ubiquitous Computing* 5(1): 4-7.
- Engeström, Y., Miettinen, R. and Punamäki, R.-L., Eds. (1999). *Perspectives on Activity Theory. Activity Theory and Individual and Social Transformation*, Cambridge University Press.
- Kaenampornpan, M. and O'Neill, E. (2004). *Modelling context: an Activity Theory approach. Ambient Intelligence: Second European Symposium, EUSAI 2004, Eindhoven, The Netherlands*, Springer. p. 367