

Patterns as artifacts in user-developer collaborative design

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Abstract. During a research project to study the work of system developers implementing groupware in an organization it was observed that they lacked resources to support this work, that would help to realize the organizational vision for how groupware would facilitate more collaborative ways of working. Specifically there were no usable design models which would mediate the activity of developers and users and enable them to collaborate in design work. It is proposed that design patterns may have the potential to be such mediating artifacts and that they satisfy certain criteria drawn from the conceptual framework and method of activity theory.

1. Background to the research project

This position paper is based on findings from a research program carried out at “GreenFam”¹, an international non-governmental organization which campaigns for human rights, between 1997 and 2002. The objective of the research was to observe the work of the in-house IT department – the “ITP” – on a project to implement LOTUS NOTES™ (Notes) as a tool for information sharing within the London-based centre and throughout the global organization. I worked in the ITP as a participant observer during the early stages of the project (1997-1998) and then returned three years later to evaluate three of the collaborative information spaces in use (Guy, forthcoming - unpublished PhD thesis).

The shortcomings of traditional methods of systems development have been widely discussed within the field of human computer interaction (HCI). The development of groupware tools within a global environment escalates the problem to another level. Developers have to understand the complexity of cooperative work in context, appreciate cultural diversity and may have no direct access to user

¹ Names have been changed in order to protect the identities of the research partner and the people working there.

communities to investigate work practice. From the beginning of the project it was evident that the developers at GreenFam lacked resources to support their work. The customary process of “rolling out” customizable software was useless in a context where the need for information sharing was contested by some users. An alternative approach of intensively “working with users”, involving prototyping and group meetings over a period of several months, was felt to have too high an overhead to be practicable in every case due to the time and resource constraints on their work. When the evaluation was carried out it became evident that the databases had not been very successful in facilitating a more collaborative style of working, which had been GreenFam’s motivation for the project.

2. The gap between vision and achievement

The vision for a new way of working with groupware at GreenFam had been set out in a document² which evaluated different software alternatives before the project began. A scenario envisioned a future way of working where information captured in Notes databases during the course of a campaign would be used as –

“... an in-house tool for the initial stages of campaign planning; as a tool for organizing the international strategy meeting; as a key platform for planning and coordinating the development of the campaign; as a central forum for the exchange of ideas, problems and planned activities; as a resource in the implementation of the campaign; and as an important resource for the final evaluation.”

Databases would also be available to future campaign workers as a repository of past experience –

“All of this collective experience is not lost, however, because a new campaign is just being planned. The project manager has just been appointed but she feels completely overwhelmed by the task she is facing. In the circumstances it seems like a good idea to browse through the databases of a couple of old campaigns and see how the people before have tackled these issues.”

The vision was communicated top-down from the GreenFam management and was embraced by the ITP. For them the scenario served the purpose of “a prototype of ... future-directed action – in which the future is more than the blindly inevitable fact of succession in time and includes some envisioned goal as its content” (Wartofsky, 1979, p.141). Although in Wartofsky’s sense the vision set out in the document was a “mode of action”, it was prescriptive only for the ITP in their role as software developers and, by default, as the agents of change. It was not a vision that was *shared* in any real sense by many software users as it contradicted current practice in some teams. Many individuals took responsibility for managing their own cases and networks of personal contacts, and did not perceive a need to put information in common: where information was shared existing tools such as email were preferred to the overhead of adopting a new tool and way of working. The Notes vision was also a challenge to the widely-held belief that individuals were overloaded with information, which was a threat to their effectiveness as well as a source of work-related stress.

² Appendix F: Hypothetical Case Study of the Use of Groupware for a Country Campaign, internal GreenFam consultation document *GreenFam Groupware Proposal*, 1996.

Wartofsky (1979) proposes three types of artifact that mediate human action and this class is developed by Engestrom (Engestrom, 1990) into a three-level hierarchy, mapping on to Leont’ev’s (1981) hierarchy of activity . Primary artifacts are tools used directly in production to mediate the relationship between the subject and object of activity; secondary artifacts are representations of modes of action – models - used to preserve and transmit skills in the production and use of primary artifacts; tertiary artifacts are imaginative or visionary and give “identity and overarching perspective to collective activity systems” (Engestrom, 1990, p.174). The artifact schema has been further developed within activity theory (Engestrom, 1999a; Collins *et al*, 2002) to include four types of artifact, as shown in Table I.

Artifact class	Primary characteristic
What	~ Contributes a <i>means</i> of achieving the object
How	~ Contributes to <i>understanding how</i> to achieve the object
Why	~ <i>Motivates</i> achievement of the object
Where-to	~ Motivates <i>evolution</i> of all elements in the activity system

Table I. Hierarchy of mediating artifacts (Collins et al, 2002)

In the GreenFam project the text describing the idealized vision of future work with Notes was a tertiary or “Where-to” artifact, articulating the project goals and orienting action. The Notes databases are an example of primary or “What” artifacts – the designated tools intended for users to work collaboratively with information, and the object of the development work of the ITP. The problem at the heart of the project was a lack of appropriate secondary “How” and “Why” artifacts – models that could mediate between developers and users and be used to turn the vision into a shared understanding and direct co-constructional activity. As Bertelsen (2000) has described, secondary “design artifacts” are key in the work of design where people from different professional backgrounds, with different motives and worldviews must cooperate in creating something new.

3. The third generation of activity theory – interacting activity systems

Activity theory (AT) gives us another theoretical tool to understand the problematic relationship between developers and users, especially when reinforced by organizational structure and historical development as it was at GreenFam. The worlds of the groupware developers and groupware users can be understood as separate activity systems that must construct a shared object in order to be able to collaborate in the design of computer support for work.

Engestrom identifies three moments in the evolution of how the unit of analysis is conceived in AT (Engestrom, 1999b, 2001). Briefly, the first generation centered

around Vygotsky’s development of the idea of mediation, where artifacts mediate the relationship between the subject and object of actions –

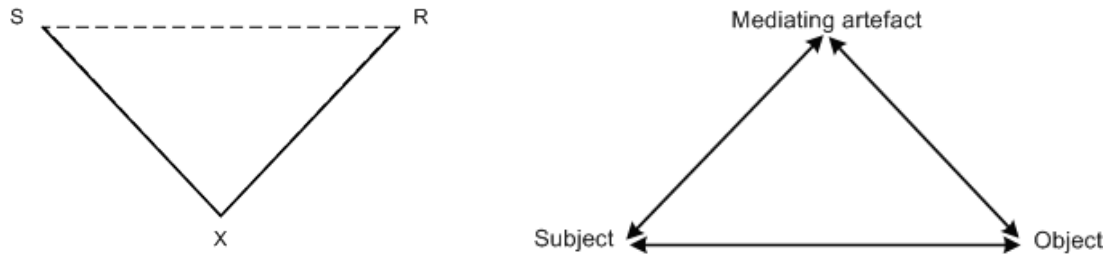


Figure 1. Vygotsky’s model of mediated action and its reformulation (Engestrom, 2001)

With Leont’ev’s (1981) theoretical work on of human activity as collective, social activity the unit of analysis situated individual actions in their collective context. This was developed by Engestrom into the model which is generally used in HCI and CSCW studies, shown in Figure 2.

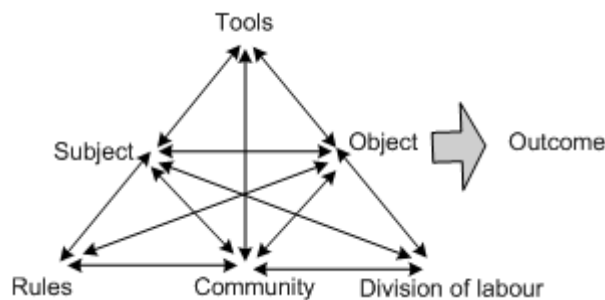


Figure 2. The general structure of an activity system.

The “third generation” of AT is the ongoing research agenda proposed by Engestrom (2001, p.135) to take AT forwards – “The third generation of activity theory needs to develop conceptual tools to understand dialogue, multiple perspectives, and networks of interacting activity systems.” A representation of this proposed, augmented unit of analysis is shown in Figure 4 below –

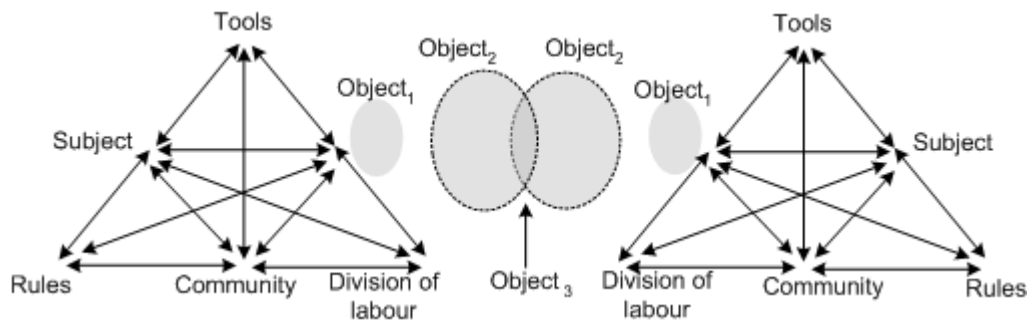


Figure 4. Two interacting activity systems as a minimal model for the third generation of activity theory (Engestrom, 2001)

In the GreenFam Notes project the object of work for the developers was to create a design template for information sharing tools. In several cases such tools contradicted the object of user activity – the ways that work got done using existing practices and tools. The lack of secondary design artifacts – models of current and future ways of working and of configurable design solutions – precluded users and developers collaborating in design. If Figure 4 is applied to the activity systems of developers and users the different objects of the two systems need to be moved towards “a potentially shared or jointly constructed object” (Engestrom, 2001, p.136) - a collectively constructed representation of the features of and ways of using groupware tools that can be used in design.

4. Patterns of mediated work as secondary design artifacts

In this paper I have identified a lack of shared models that can mediate between the activity systems of developers and users as a central problem in collaborative groupware design. If Figure 4 above, is to be used as a tool to understand collaborative system design work, what types of representations are needed to function as a shared design artifact that can be used by users and developers?

In order to satisfy the requirements of collaborative design work it follows that such artifacts must satisfy several conditions:

- The models must be equally accessible to developers and users and be a *lingua franca* for dialogue and communication between individuals from different activity systems.
- They must be intermediate models that can bridge the gap between a vision of a future way of working with new tools and existing practices. It should be possible to use the same representations to describe current and historical ways of working as well as to visualize and construct work which does not yet exist.
- They must support representation and reconciliation of the dynamic and contradictory features of mediated work.

One of the benefits of a lengthy program of research in one organization is that after a while strong, recurring patterns of what works and what does not can be identified as they develop. For example, there were a few instances where Notes databases were used by teams as a real shared information space and became integrated with their work. Such examples were always associated with an enthusiastic individual who acted as a facilitator and took on the responsibility of posting information to the database and directing other team members to it. Crucial to this work was the ability to make use of the preferred tool of the organization, email, to send hyperlinks in email messages which, when clicked, took the recipient directly to the document in the database.

The work in progress of the research project is to represent these findings as a pattern language, following the work of the architect Christopher Alexander (Alexander *et al*, 1977; Alexander, 1979). It is beyond the scope of this paper to provide a proper description of the design patterns concept – for an introduction focusing on workplace patterns as a representational medium see Erickson (2000). Very briefly, Alexander's language is a hierarchical set of interrelated design patterns which range in scale from regional planning (e.g. **THE DISTRIBUTION OF TOWNS**) to the detail of building openings (e.g. **SMALL PANES**). The example of the database facilitator role that I have described above could be represented as related patterns of different scales – **FACILITATORS ARE KEY**, **EMAIL ALERTS** and **HYPERLINK DIRECT LINE**. These patterns both describe a successful practice in the use of collaborative information spaces and become part of a user-developer toolkit from which patterns can be selected to fit a design problem in its specific context. For a more detailed discussion of how patterns can be generated from fieldwork observations at GreenFam see the companion paper which has been submitted to another workshop at this conference (Guy, 2003).

Patterns, as conceived by Alexander, have the potential to satisfy the conditions for mediating representations outlined above. One of his motivations was to create a language that was shareable because “Anyone who takes the trouble to consider it carefully can understand it” and check against their own experience (Alexander, 1979, p.269). Patterns, if formulated properly and grounded in the concrete can be both used and written by users and developers as a collaborative activity. A pattern is a “three-part rule, which expresses a relation between a certain context, a problem and a solution” (*Ibid*, p.247). It is thus both descriptive and prescriptive in that it can be reused over again wherever the context makes it relevant.

Lastly, Alexander's concept of a pattern as a design solution which reconciles a system of forces which is its proper context resonates with the activity theory concept of inner contradictions as the motor force of activity systems and the driver of development. The pattern **FACILITATORS ARE KEY**, for example, reconciles a conflict often observed in groupware (Grudin, 1988) which is that it may be rejected by users because those undertaking the work of placing information in common may not be those who directly benefit from it. It does this by explicitly creating a role of facilitator and specifying that this should be recognized as part of the facilitator's job description and rewarded. The pattern **EMAIL ALERTS** makes a virtue out of the fact that users are still engaged in using email for information sharing by using it as the tool for directing them to the new information spaces.

5. Conclusions and further work

This research is currently been written up as my PhD research thesis and is due to be completed early next year. In the thesis I discuss how patterns can be part of the developmental, interventionist method of activity theory, as well as presenting findings from the GreenFam field study in the form of patterns – an embryo pattern language for the use and design of groupware, that can form a corpus with other design patterns currently being produced by researchers in the field of CSCW. Developing a design pattern language within the framework of activity theory is a novel attempt to create tools that have the potential to structure the description of context in a way which is usable by users and developers, but which can also be used in interventions in activity systems to design new solutions to problems. Further work needs to be done in order to ascertain how successful this approach is as an attempt to operationalize activity theory as a practicable design methodology. Both the GreenFam patterns and the method of using patterns as a design in user-developer collaborative work need to be tested in practice.

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