

From Patterns of Use to Design Patterns: A Method for producing new design patterns from user activities

Nikolaos Avouris, Nikolaos Tselios, George Kahrmanis and Georgios Fiotakis

Human-Computer Interaction Group, University of Patras, Greece,
avouris@upatras.gr, {nitse, kahrmanis,
fiotakis}@ee.upatras.gr

Abstract. In this paper we describe a novel method for producing interactive systems design patterns from ethnographic studies involving these systems. It is argued that this process can lead to traceable production of design patterns. A software environment, ColAT, that can support the proposed process, is also described.

1 Introduction

Design Patterns (DP), an approach that was originally inspired by work in architecture and town planning, have been proposed in many design disciplines, among which in interactive systems design (e.g. [1],[2]). DPs are used to describe a design problem and a solution for this problem in a particular context, together with the rationale for that solution and the positive and negative consequences of using it [3]. “The pattern is, in short, at the same time a *thing*, which happens in the world, and the rule which tells us how to create that thing, and when we must create it” [4]. In interactive systems the *thing* may take various forms according to users’ behavior and context of use. So DPs for interactive systems have to take into consideration the users’ behavior that might be related to them. Generation of new design patterns has always been a prime concern of practitioners in the field. In an activity-centered design approach, design patterns could be derived after effective study of alternative design decisions and their impact on typical user activities. So DPs are directly associated to *patterns of use (PU)* by typical users. This relation between DPs and PUs is the subject of this paper. In particular, we describe the process of identifying PUs that are subsequently the foundation for defining new Design Patterns. A key aspect in this process is a given *activity*, which is mediated by tools. The feature of the tool that is the focus of a design pattern must play an important role in this activity. Users’ interaction with this feature should be monitored. Ethnographic studies involving typical users are essential for observing the effective mediating role of the tool in the context of the activity. In figure 1 we outline the process. Artifacts a1, a2, a3 etc are the tools that are used by the typical users in order to accomplish a certain task. These may just be alternative design decisions related to a given problem. Users are monitored as they interact with the tool and various patterns of use (PU) are identified. These are finally abstracted to a design pattern (DP) that describes the design and the

corresponding result in the form <pattern-name, context, problem, solution, related-patterns>. In addition, the DP approach can be used for design of activities, instead of just design of artifacts, as in the case of networked learning [5].

In the rest of the paper, we describe our experience with observing human activities and how these observations can result in patterns of use of artifacts that can subsequently produce design patterns of a class of artifacts or of activities. We put emphasis on the process of identifying the patterns of use from monitored activities. The main emphasis of our research is on collaborative activities that involve more than one actor, mediated by technological artifacts.

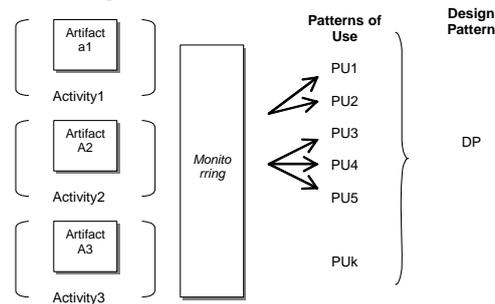


Figure 1. The process of deriving new Design Patterns

2 Patterns of Use in Ethnographic Studies

It is argued that a design pattern for an artefact should be derived from effective observation of typical users engaged in meaningful activities. In ethnographic studies of this nature, a prime consideration is to collect data about the activity without interfering with the users. A logfile, that takes usually the form of an ordered list of events occurred at the user interface of a software tool, may be produced by the tool itself without requesting any user intervention. It contains however a record of the activity of one or more actors, from the rather restrictive point of view of their fingertip actions. However a lot of contextual information relating to the activity, as well as results of the activity, dialogues among the actors, etc., is not captured through this medium. So information in other media needs to be recorded and taken in consideration. In the following we present an environment, originally used as an ethnographic tool, which is proposed as adequate environment for capturing patterns of use in a systematic way that can lead to design patterns.

The *Collaboration Analysis Tool (ColAT)* is the environment that is used for building an interpretative model of an activity in the form of a multilevel structure, following an Activity Theory approach [6], incorporating pointers and viewers of various media. ColAT permits fusion of multiple data by interrelating them through the concept of universal activity time. The analysis process during this phase, involves interpretation and annotation of the collected data, a multilevel description of the activity.

The ColAT environment, discussed in more detail in [7], uses the form of a theatre's scene, in which one can observe the activity by following the plot from various standpoints. The *Operations view* permits study of the details of action and interaction, as

recorded by a logfile, while other media like most typically video and audio recordings, capture dialogues, other behavioural data of actors (posture, gestures, facial expressions etc.). The automatically generated logfile can be expanded in two ways: First by introducing additional events as they are found in the video and other media, and by associating comments and static files (results, screen snapshots etc.) to specific time stamped events. Second, more abstract interpretative views of the activity may be produced, as shown in figure 2: The *Patterns of Use (PU)* view permits study of purposeful chunks of action by various users related to the tool in consideration, like a chat tool in collaborative learning, while the *Design Patterns* view abstracts their main characteristics. This three-level model is built gradually: the first level, the *Observations level*, is directly associated to log files of the main events, produced and annotated, and is related through the time stamps to the media like video. The second level describes *Patterns of Use* at the actor or group level. In fig. 2 the typical environment of ColAT for creation and navigation of a multi-level annotation and the associated media is shown. The 3-level model is shown on the right side of the screen, while the video/audio window is shown on the left-hand side. Other features shown in fig.2, include a toolbox for defining viewer *filters*, through which a subset of the activity can be presented, related to specific *actors*, *tools* or *types of events*, this facilitates isolation of PUs in the observations.

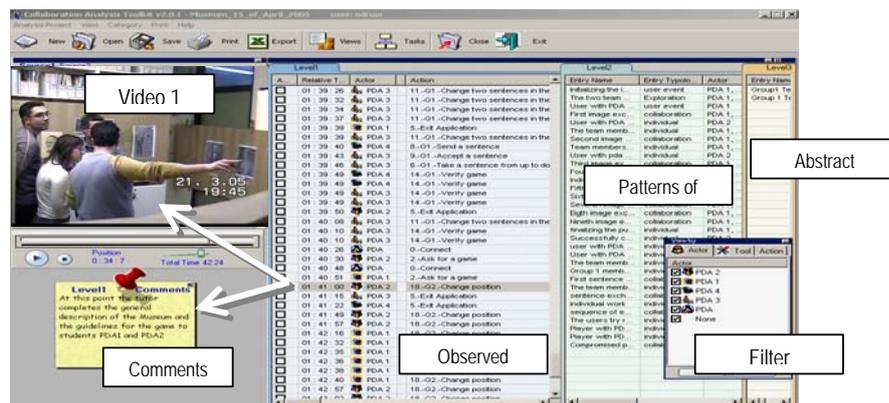


Figure 2. The ColAT environment: Multi-level view of observations-patterns of use-abstract patterns

The original sequence of events contained in the logfile is shown as level 1 (*Observations level*) of this multilevel model. The format of events of this level in XML, is that produced by Synergo, ModellingSpace, CollaborativeMuseum and other tools that adhere to this data format, while definition of a common format that includes requirements of other learning tools logfiles, like those generated by CoolModes, FreeStyler, etc [8] is in progress. Thus the output of these environments can feed into ColAT, as first level structure. A number of such events can be associated to an entry at the *Patterns of Use level 2*. Such an entry can have the following structure: <ID, time-span, entry_type, actor(s), comment > where ID is a unique identity of the PU,

time-span is the period of time during which the action took place, type is a classification of the entry according to a typology, defined by the analyst, followed by the actor or actors that participated in the execution, a textual comment or attributes that are relevant to this type of action entry. Examples of entries of this level are: "*Actor Y contests statement of Z using the chat tool*". The process of abstracting the observed PUs is facilitated by the environment through the filters (see *Filter* tool in fig.2).

3. Discussion

In this paper, we argued that in order to derive effectively design patterns of interactive artefacts, we should use user-centred approaches that can lead to authentic cases of use of alternative designs and observe the patterns of use that are produced. These should be subsequently abstracted and related through a cause-effect approach to the specific design (artefact) and context of use. These can lead to the rational of a new *Pattern* that is related to this design problem. Correlation to the user profiles can support the abstraction process, while automatic techniques for mining usage data can be also be combined with video and other contextual information. The presented environment ColAT can facilitate the process. One of the main advantages of this approach is that relates the process of DP writing to the raw data and observed patterns of use that have lead to this decision, so facilitating tracing back DP definition.

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