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Finding Patterns in the Fieldwork

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Abstract. This paper considers the potential of using *patterns of cooperative interaction* to support the development of general design principles drawn from a range of work settings. It reports on the development of patterns from ethnographic studies in a number of work environments. Our particular interest is in the possibilities surrounding the use of *patterns* as a means of organising, presenting and representing this growing corpus of ethnographic material and in the contribution this might make to CSCW design In this paper we focus on outlining some of our experiences and difficulties in developing patterns from ethnographic studies and present some initial ideas towards the development of a pattern language to exploit the experience gained from a decade of field studies.

The use of ethnographic studies, from a variety of perspectives (Ackerman & Halverson, 1998; Bardram, 1998; Bowers & Martin, 1999; Hughes et al., 1992), has been a regular and routine feature of CSCW research for a number of years as research has attempted to inform the requirements and design of cooperative systems through studies of 'real world real time' work (Hughes et al., 1997). Despite being strong advocates and supporters of the method (Hughes et al., 1994) we also acknowledge persistent problems in meeting the needs of developers and deploying the results of ethnographic studies in design. To some considerable extent the arguments about ethnography and workplace studies have moved on from 'what are workplace studies for?' (Anderson, 1994; Plowman et al., 1995) to how these studies can best be utilised for design. As Bannon argues;

> ". a critical issue for research lies in determining ways of transforming the ethnographic material in such a way that remains sensitive to the practices of designers themselves and thus can readily be used by them in the design process " (Bannon, 2000, p 250).

Many ethnographers would add, *"while still remaining faithful to these rich descriptions of real-time situated work"* to this statement. The tension between the need for designers to develop the abstract structures underpinning computer systems while being informed of the rich everyday character of work has become one of a number of central issues of CSCW research. This issue has emerged against a backdrop of alternative approaches to the development of CSCW systems including participative approaches (Schuler & Namioka, 1993) and those from a more theoretical design orientation (Nardi, 1996) where theory is often seen as having a much more central role. The tension between study and design has sometimes been characterised as simply one of communication between fieldworkers and designers. Subsequently, researchers including ourselves have developed variations in methods (Beyer & Holtzblatt, 1998; Viller & Sommerville, 1999); presentation mechanisms, frameworks and notations (Hughes et al., 1997; Hughes et al., 1995; Twidale et al., 1993) in attempts to bridge this apparent divide.

While efforts have been made to ensure that field studies are better communicated to developers and designers the community has also amassed a substantial corpus of fieldwork material. Studies of work have routinely been reported at CSCW conferences and many projects currently undertake an ethnographic study as part of their development. However, what has been learnt from all of these studies is less clear and very little *systematic* consideration has been afforded to the thorny problem of developing a corpus of good design practice and experience drawn across this growing body of research. This, in turn, touches on the fundamental question of the more general role of ethnography in design as well as difficult academic and practical issues regarding the generalisation of ethnographic findings (Hughes et al., 1994). Over the years a considerable corpus of workplace studies has been generated. As this corpus continues to develop the issue becomes one of how the, to this date little discussed, 're-examination of previous studies' (Hughes et al., 1994) can be facilitated productively. While researchers may be exploring the development of general design principles and guidelines the extent to which ethnographic studies can contribute to the formation of general concepts and principles of systems design remains an open question (Pycock, 1999).

Developing useful and applicable general guidelines for systems design is a thorny issue, as it requires a balance to be struck between the need for the emergence of *general* principles and the central importance in ethnographic studies of *detailing* everyday situated practice. If we are to provide more general design principles, techniques need to be uncovered that facilitate generalisation from ethnographic studies and that allow the results of such studies to be married with more general statements of design. This paper seeks to address this problem

by presenting our experiences of exploring the potential offered by *patterns* as a means of presenting ethnographic work. We do so firstly by exploring the discovery and construction of *patterns of cooperative interaction*—patterns of cooperation and IT use that recur across a number of settings.

In this paper the patterns we develop and present focus on our ongoing ethnographic research and draw from a number of ethnographic studies of different work environments (Bentley et al., 1992; Blythin et al., 1997; Bowers et al., 1996; O'Brien & Rodden, 1997; Rodden et al., 1994). It is not the intention behind either the notion of patterns or the development of a pattern language that these should guide *fieldwork* in any way[1]. The patterns we document are drawn from the fieldwork as grossly observable patterns of activity and interaction. The intent behind the construction of these patterns is that they will serve both as a means of *documenting* and *describing* common interactions, and as a vehicle for *communicating* the results of a specific analysis to designers—to be drawn upon and used as a resource for design. The presentation of different patterns of interaction seeks to allow different *general principles* and issues to be presented alongside *specific* material drawn from empirical studies. Thus rather than seek a simple translation from the specific of the empirical work to the general of the design principle we are seeking to explore mechanisms that allow both to be present and available to designers and developers.

Patterns and Pattern Languages

The origin of patterns lies in the work of the architect Christopher Alexander, outlined in two books, *A Timeless Way of Building* and *A Pattern Language* (Alexander, 1979; Alexander et al., 1977). Patterns are attempts to marry the relevant aspects of the physical and social characteristics of a setting into a design; they provide a facility to share knowledge about design solutions and the setting in which such a solution is applied:

> "..every pattern we define must be formulated in the form of a rule which establishes a relationship between a context, a system of forces which arises in that context, and a configuration which allows these forces to resolve themselves in that context" (Alexander et al., 1977)

Patterns are then a way of conveying to designers some sense of the application domain. They are,

> " .ways of allowing the results of workplace studies to be reused in new and different situations ways of representing knowledge about the workplace so that it is accessible to the increasingly diverse set of people involved in design. " (Erickson, 2000b)

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1 This is not to say that, after a period of time, patterns that are found to be more robust should not be used to focus requirements gathering activities Indeed, this use of patterns may prove of high utility to those with less experience of conducting fieldwork

There are, however, a number of rather different conceptualisations of patterns. Perhaps the most notable usage of these is patterns within the software engineering community where design patterns (Gamma et al., 1994) and pattern code books (e.g. Cooper, 2000) are increasingly popular. While inspired from Alexander's original work the notion of patterns has moved from the original conception suggested by Alexander. In fact, within the use of patterns suggested by this community, patterns tend to be prescriptive in nature offering template solutions to problems. These "reuse templates" tend to be less flexible than those originally suggested by Alexander where the patterns were intended to be used as a resource to be drawn upon.

We wish to exploit patterns in the much looser spirit suggested by Alexander's original work where familiar situations were used to convey potential architectural solutions. In fact, the observed reoccurrence of familiar situations lies at the core of our argument for patterns. Designers often encounter situations that are similar to previous ones and one justification for this focus on patterns is a particular take on notions of re-use—where the emphasis is on drawing from previous experience to support the collection and generalisation of successful solutions to common problems. As Alexander suggests;

> "each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice".

Another rationale behind patterns - and one that perhaps both attracts and repels designers - is Alexander's notion of 'quality' ('The Quality Without A Name') and the idea that "a pattern is a solution to a problem in a context". Here 'quality' refers not to some mystical characteristic but to features of systems that ensure that they 'really work', that they fit with the social circumstances of use. Interestingly this is also part of the rationale for the turn to ethnography in systems design. (Crabtree et al., 2000).

The appeal of patterns for interactive systems is that they provide a flexible means of presenting design solutions and in recent years the notion of patterns and pattern language has become increasingly popular and influential in a number of disciplines related to system design. Patterns have been examined in software design (Gamma et al., 1994) and in the HCI community (Erickson, 2000b) as a means of recording design solutions. A number of researchers (Coplien, 1998) have also suggested the application of pattern techniques to convey different forms of organisational structure.

In the following sections we outline our own efforts to uncover and present *patterns of cooperative interaction* derived from a corpus of ethnographic studies. The main body of work consists of ethnographic studies of work and technology undertaken in the last ten years by researchers from Lancaster, for example in air traffic control (e.g. Bentley et al., 1992), small (Rouncefield et al., 1994) and banking (e.g. Randall et al., 1995). However, the corpus also includes well known studies undertaken by other researchers at other institutions, for example in

London Underground Control (Heath & Luff, 1992), the accountancy department of a catering firm (Anderson et al., 1989), ambulance control (Martin et al., 1997; Whalen, 1995), and the fashion industry (Pycock & Bowers, 1996).

Within the HCI/CSCW communities there is no single definition of what patterns are, how they should be presented, what their purpose should be and how they should be used. We started by considering that in finding patterns we were looking for examples of repeated, grossly observable phenomena in ethnographic studies, describing them with reference to their context of production and seeking a way to present them using a standard framework. The program to find patterns of cooperative interaction can be seen as one way in which the *'re-examination of previous studies'* can serve to provide a resource for systems design. The discovery and presentation of patterns hopefully may be a way through which the important findings of different studies are highlighted and presented in a manner that is more accessible to the CSCW community at large.

Developing Patterns in Practice

While considerable literature exists documenting patterns of different types little is said in the pattern community about the genesis of patterns. It is unclear how patterns come into existence and how these should be generated. The core of most descriptions is that a series of "pattern workshops" are held where patterns are identified and expressed using some form of pattern language. In this paper we wish to explicitly document our experiences in uncovering patterns and the development of a pattern language to express patterns to designers.

When seeking to outline patterns of cooperative interaction much of our early work focused towards the discovery of potential patterns based on the illustrative vignettes often used in the reporting of ethnographic studies of work. The earliest work centred on whether the major findings, in terms of grossly observable phenomena, from ethnographic studies could be presented as sets of problems and solutions according to a template based on the presentation format used by Alexander for presenting his architecture patterns.

Although every search for patterns means beginning with looking for specific examples in context it is also equally clear that a pattern gains increasing credibility through being found to be present in more than one setting. This led us to search for patterns and repeated patterns firstly within particular domains. For example, the domain of control rooms was selected due to its prominence in particularly the early field studies of work and technology. The technique was to identify one example of a grossly observable phenomenon within one control room study and to examine the others to see whether similar examples of the same phenomena could be identified in these. While it became clear that while recurrent examples might be found within a domain it was equally clear that there

were a number of examples of similar patterns to be found in studies of banking, or hospitals or small offices and so on.

In the following section we document our experience in developing a language to express our patterns. Before we develop a pattern language it is worth reflecting on the role we anticipated the pattern language playing within the overall process of design.

Patterns as a lingua franca of design

In seeking to uncover patterns we began by looking at how the major results from ethnographic studies could be presented as problems and solutions according to a template very similar to that employed by Alexander. Alexander's original pattern languages focused on presenting patterns as solutions to design problems. The broad structuring principle was that each pattern responded to a particular design problem. The pattern language presented the problem addressed, the solution suggested and provided links to other problem-solution structures within the pattern language.

However, even on the crudest of initial inspections it is not clear that the problems to be solved are routinely observable as part of a field study. While it is easy to envisage designers developing solutions to problems informed from studies of work it is not clear that the problem to be solved will always be the same or that these problems are an inherent part of the current setting. However, pattern languages do more than provide a template of ready made solutions and much of the popularity of Alexander's patterns is that they provide a ready resource for others to draw upon. In fact, the pattern language's principle role is often that of a communication device. Indeed Erickson (Erickson, 2000a) suggests that the principle role of a pattern language is as a *lingua franca* to be used by a number of designers, within a project.

In his paper *"Supporting Interdisciplinary Design: Towards Pattern Languages For Workplaces"* Erickson (2000b) outlines and discusses some patterns he has derived from an ethnographic study of a consulting firm as reported by Belotti and Bly (1996). Erickson describes a number of patterns, most notably focusing on three: *Maintaining Mutual Awareness*, *Locally Mobile Workers* and *Receptionist as Hub*. He draws attention to the fact that this is just the beginning of such work. Most notably, he does not present these patterns according to a format which approximates to that employed by Alexander. Instead, he simply provides a paragraph of description for each pattern. These outline the basic details of the phenomenon in question and sketch out the relationships with other patterns in that setting.

Taking Maintaining Mutual Awareness as an example, Erickson describes how it is crucially important that the workers in the consulting firm maintain an awareness of what one another are doing even if their projects are different. This

allows for the range of expertise to spread across different projects and help and advice to be shared. Erickson describes how mutual awareness is maintained by *"activity patterns"* such as *"Doing A Walkabout"*, where a worker has a stroll round the office looking at what others are doing. Furthermore, how it is supported by *"spatial patterns"* such as a *"Central Scanning Station"* where people bump into one another and may instigate useful conversations about their work.

Erickson's work is clearly more oriented to the description of workplace phenomena rather than to providing design solutions. Although, it must be conceded, the patterns he describes are meant to represent things that *work* in that setting. This appeared to be a good model to follow, at least in the initial discovery of patterns. However, importantly, Erickson provides little treatment of the question of generalisation. Rather, he considers how these patterns might be useful as broad design themes. Our challenge was to consider how we may provide more structure to allow patterns to be more generally used but maintain the commitment to their use as a descriptive device.

Moving from Design Patterns to Descriptive Patterns

Our first attempt at using patterns exploited a series of ethnographic studies of the use of technology in people's homes. Although agreeing with the broad motivation suggested by Erickson our aim was to outline a vehicle for presenting the major findings of these studies. We took the structure used by Alexander in his architectural patterns as our starting point. Our aim was to see if this could be used as a uniform style for presentation. These patterns followed Alexander's structure in that a recurrent problem is presented with a solution to that problem. The format used was an HTML presentation to make it accessible (figure 1).

However, although these patterns provided support for the representation of the setting a number of key observations emerged that were a result of the problem orientation of Alexander's original patterns.

- ***Expressive power was limited.*** The attachment of the pattern with a problem meant that features of the study needed to be presented in terms of the problems they addressed or solved. While the vocabulary of problems and solutions made sense for designers it was felt that large parts of the study could not readily be expressed in this way.
- ***The application domain was limited.*** The utility beyond a study undertaken as part of a particular design project became problematic. As a consequence of the strong orientation to problems and designed solutions we noticed that once we sought to apply the pattern language outside a project we were familiar with our ability to capture the essence of the setting reduced significantly.

These two limitations required us to seriously reconsider how we may want to use patterns and the sort of patterns and pattern language we wished to develop.

While the focus on problem-solution as a central structuring concept had immediate appeal to our target audience of designers we strongly felt that its limitations prohibited the presentation of studies to such an extent that the use of Alexander's patterns and indeed of the design patterns suggested by the software engineering community would not meet our purpose in presenting ethnographic studies of work.

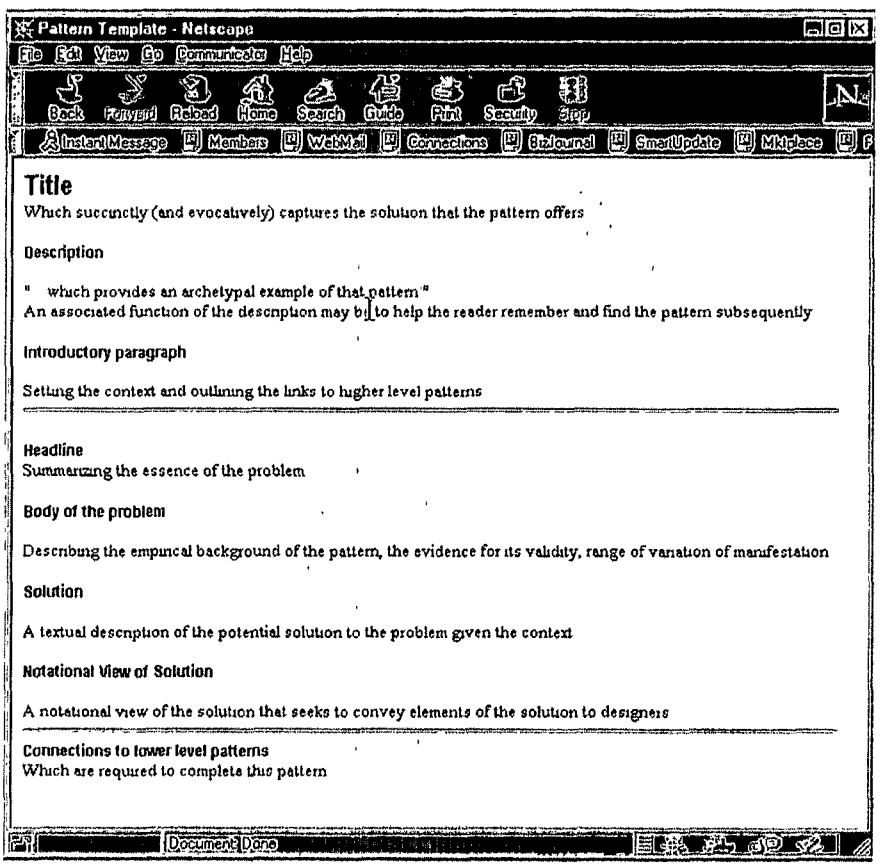

Figure 1. A problem oriented pattern Template.

The development of patterns presented in this paper represents a rather different focus than in this initial work. It also represents a turn away from the current approach to design patterns. In order to break free of the current limitations of patterns we sought to move away from problems as the defining characteristic of patterns. While the concept of problems has a resonance for design patterns and makes sense in terms of the overall process of design it is less clear that a pattern language oriented around problems would be of utility in presenting studies. Consequently we have focused on the development of

descriptive patterns that convey the nature of settings to those who may seek to develop technologies that are sensitive to the nature of work settings. The aim of these patterns is to act as a general resource for developers to be drawn upon when they are seeking to build systems for a particular setting rather than to suggest a particular working arrangement as being more appropriate than others.

In order to meet the needs of patterns for presentation we shifted our consideration to finding patterns as recurrent phenomena in ethnographic fieldwork without necessarily making judgements as to the 'success' of the arrangement of people and artefacts undertaking some activity in the given context. Sometimes it may be appropriate to contrast similar examples where one case seems to work better than the other, however at this stage this is not to be taken as a prerequisite for including an example as a pattern. The idea is to firstly discover patterns as recurrent phenomena and to make these patterns available to designers. The arrangement of patterns according to a particular framework and outlining their implications for design is deliberately postponed until some point after this initial process has been completed to a satisfactory extent.

Identifying Descriptive Patterns

Given that we had abandoned the notion of problems as central structuring mechanisms the identification of appropriate descriptive patterns raised a challenge for us. How might we identify particular patterns from the large corpus of fieldwork available to us? What sort of pattern language might we develop to convey these patterns and how might we present these to users? In order to address this issue we decided to focus on an exploration of not only previous studies undertaken at Lancaster but also a collection of other studies reported in the literature. Our aim in considering a wide range of studies was to directly tackle the issues of generalisation by seeking to uncover ***generally recurrent phenomena*** that can form the basis of a descriptive pattern language.

As a starting point for uncovering patterns we focused on control room studies. This combined studies such as the London Underground Study (Heath and Luff, 1992) with other control room studies (ATC, Ambulance control) some of which we were directly involved in. This cross examination of studies suggested that there was a certain degree of cross-over in terms of similar major findings in the different control rooms studied. For example, Hughes et al. (1993) draw attention to the use and display of flight strips as a public artefact, Martin et al. (1997) also discuss co-ordination around public screens showing the state of ambulance deployment, and Heath and Luff (Heath & Luff, 1992) point to the use of shared artefacts as a means of coordination in the London Underground. Furthermore, these studies are concerned with such features as the ecology of the settings studied and how co-workers achieve and maintain an awareness of one another's work.

Our success in the examination of studies drawn from control rooms initially suggested that one way in which patterns might be arranged was according to domain, and it appeared sensible to begin with control room patterns. This also suggested a solution to how the question of generalisation might be tackled. Here we had similar situations where similar types of phenomena were reported. For example, we could extract the *use of a public artefact* as a basic pattern and describe three similar but different examples of it from three control room studies. Common domains of study offered a good initial candidate as a means of generating potential descriptive patterns.

However, it also became clear that adopting a rigid idea of domain as a manner of organising sets of patterns might not be altogether satisfactory. For example, studies of call centres (e.g. Martin, 2000) have drawn attention to the public display of various call waiting and answering statistics for a group of operators to clearly see. Furthermore, it was clear that other potential patterns we were discovering and extracting fell across domains. For example, we described a pattern, *Artefact as an Audit Trail* (discussed later), which related to the observation that in certain studies researchers noted that paper-based artefacts acted as stratified records of the work that had been completed in relation to them. They would attract amendments, signatures, date stamps and other attachments that indicated who had done what work on them, why and at what point in their life-cycle. This record of work incorporated in the artefact was readily accessible to workers in the given setting. Our examples of this potential pattern however came from the disparate settings of Air Traffic Control, with the flight strips displaying this property but also from observations about invoices in an accountancy department of a catering firm (Anderson et al., 1989) and had potential in describing the use of documents in hospitals (Fitzpatrick, 2000).

Due to the fact that as we attempted to discover and delineate patterns we were beginning to find potential patterns that had instances that were clearly cross-domain it appeared sensible to abandon the notion of organisation around domain. We had always acknowledged that organisation around domain brought with it inherent difficulties of definition. Control rooms seemed attractive as a single domain because there had been a number of studies of these, however we were aware that, for example, a nuclear power plant control room might be rather different to control rooms that managed the deployment of vehicles or transport. And when we looked at other domains, we were ending up with categories like *offices*, which we readily acknowledged covered a very large range of settings. While abandoning this type of organisation around domains it is worth noting that we were open to the possibility that certain patterns might be more representative of certain settings, groups of studies, user groups and so forth, however we considered that similarities or groupings of patterns might be derived from the collection of patterns rather than being an organising principle from the start. At

this stage we wanted to pursue a different type of organisation that could apply across a range of patterns.

Outlining Principles of Generation.

Trying to uncover descriptive patterns within the fieldstudies under examination soon highlighted the need for some set of guidance. Although we were focusing on grossly observable features as the core of the genesis of the patterns it was unclear what sorts of features provided a set of readily understood patterns and what features were of most significance. In order to provide a focus on the issues of importance to designers (our eventual target audience) we turned to our previous work in outlining a framework of presentation in order to develop a set of generative principles. These principles broadly divided into two main sets.

- ***Spatially oriented features*** that focus on the physical nature of the work and the observable arrangements within the workplace.
- ***Work oriented features*** that focus on the principles of social organisation used to structure and manage the cooperative work.

The purpose of a focus on these features is to seed potential patterns and to use this as a means of highlighting the grossly observable features of work.

Spatially oriented features

These principles seek to foreground the observable arrangement of work and physical nature of the work setting.Three key features are of particular importance and can be expressed as key questions

- Resources- what are the various resources in the setting used to support the work taking place and how are they shared.
- Actors – who is involved in the cooperative work taking place and how do they orientate to each other.
- Activities – what are the main observable techniques for structuring activities and how are these represented.

Work oriented features

These principles seek to foreground the socially organised nature of work and how these are manifest in practice within particular settings. For simplicity we have again focused on three key features drawn from previous work on a framework for presenting fieldwork.

- Awareness of work—how and through what means are those involved in work aware of the work of others, how do they exploit this awareness and how do they make others aware of their own work?
- Distributed Coordination—how do those involved in the work coordinate their activities and what practical techniques do they use to do this?

- Plans and procedures—what techniques do those involved in the workplace use to orient their work in practice to the formal plans, procedures, representations and artefacts of work?

Developing a Descriptive Pattern Language

The basic principles underpinning the generation of patterns were now agreed in terms of the spatial principles (actors, resources, activities) and the social organisational principles (Awareness of work, Distributed coordination, Plans and procedures). These basic principles provide a key set of concepts to drive the identification and highlighting of descriptive patterns. In seeking to identify descriptive patterns by looking for evidence of these core principles within the field study provides a means of starting the development of patterns. However, these basic generative principles are not necessarily the best way of presenting patterns to potential developers and allowing comparison across them.

The identification of descriptive patterns progressed through one more stage of evolution to the development of a basic descriptive pattern language that allows patterns to be conveyed to potential designers. The basic ways in which patterns were to be described and presented took the principles of generation as a starting point. However, there was a desire to re-cast and even extend the framework to capture the main aspects of the proposed patterns in a manner that allowed designers to make sense of the patterns as quickly as possible. What was needed was a structure that represented a common demonimator for describing and presenting the identified patterns.

To develop an agreed pattern language all members of the research group independently produced a list of all the features that were required to describe a pattern. Through the presentation and discussion of these individual frameworks a set of potential pattern languages were proposed and then refined as different patterns were presented from the fieldwork. After some discussion the following framework was settled upon. This pattern language combines the different features of the principles of generation to allow different features of the identified descriptive patterns to be described. The identified fields within the agreed pattern language are:

- **Cooperative Arrangement:** The cooperative arrangement details in very basic terms the *actors* and *resources* that are constituent of the pattern of interaction: the people, the number and type of computers and artefacts, the communication medium(s) employed and the basic *activity*.
- **Representation of Activity:** This describes how the activity is represented, for example, in technology or as a plan and may address the relationship between the activity and the representation. This is related to *plans and procedures.*
- **Ecological Arrangement:** This has the form of one or more pictorial representations of the pattern. For example this may include *abstract*

representations, plan views, information flows, copies of paper forms, screen shots or photographs. There may be good reason for these to be fairly abstract as the real detail may be found in the referenced studies themselves if this is desired. This explicitly addresses the *spatial* characteristics.

- **Coordination Techniques:** This details the type of practices, procedures and techniques employed in carrying out the activity/interaction and how and in what way coordination is achieved. This is related to *awareness* and *distributed co-ordination.*
- **Population of Use:** This is related to an idea of domain, but instead seeks to capture something about the user group. For example, is it organisation-customer or a small team of co-workers in a control room.

It should be noted that, whilst the above fields are intended to highlight different characteristics of a pattern, they are not intended to be orthogonal, and indeed in some cases will be very strongly related. Further, whilst we have identified a common framework for describing patterms, depending on the primary focus of a particular pattern, more attention may be devoted to particular fields, as appropriate.

For each identified pattern a set of illustrative examples drawn from the field studies is presented. This arrangement is designed to promote comparison across pattern examples drawn from different fieldsites. A further challenge is to at some point derive generic overviews for patterns, however as discussed later we do not feel that it is appropriate to attempt this at this stage. This basic descriptive structure is outlined in figure 2. The reader should note that the table is presented for summary pusposes while the vignettes are presented in HTML as web pages.

Pattern Name

	Fieldwork vignette # 1	.....	Fieldwork vignette # N	Generic overview?
Cooperative Arrangement				
Representation of Activity				
Ecological Arrangement				
Coordination Techniques				
Population Of Use				

Figure 2. The pattern language descriptive structure

The pattern Language in use

The identified pattern language held considerable promise but how might it be used to present different field studies? This section briefly presents examples drawn from a range of field studies. The aim of this section is to convey the potential utility of the pattern language to emerge from the process described in the previous sections. This section illustrates how the pattern language can be used to present generally observable features to emerge from a set of field studies.

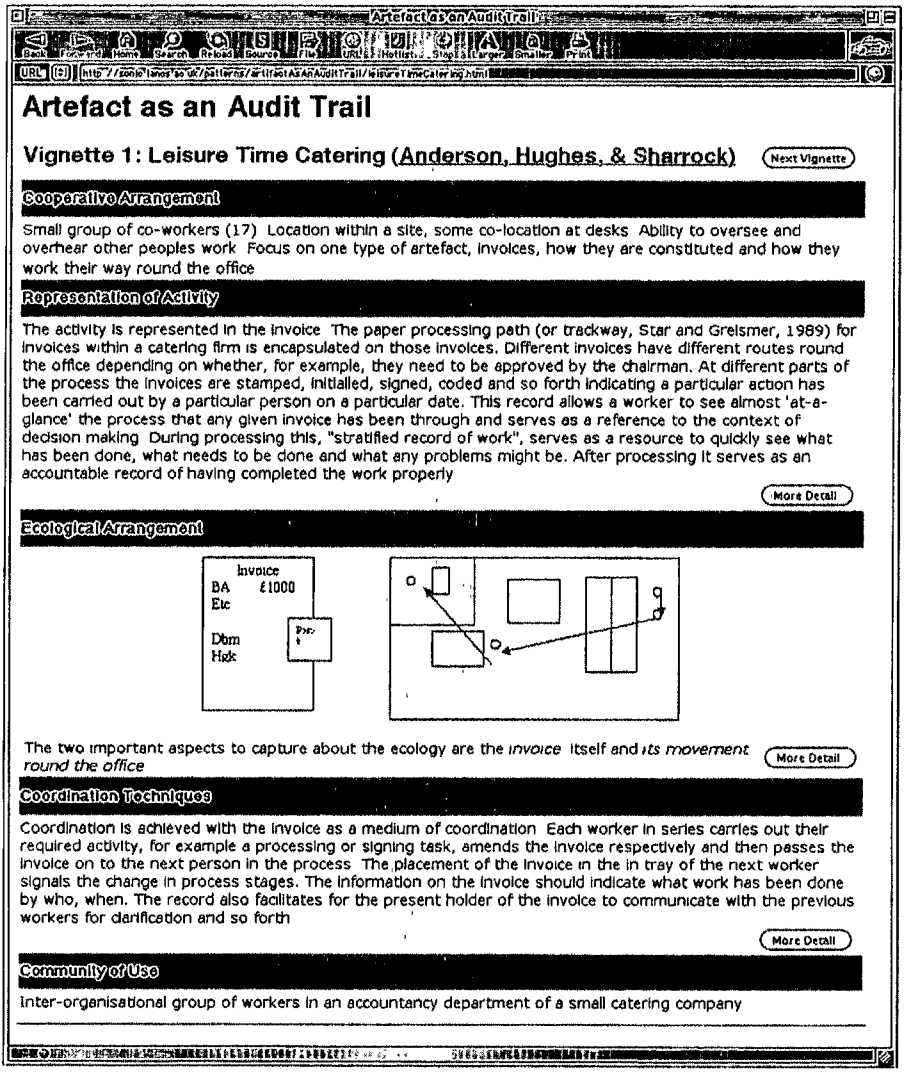

Figure 3 *Artefact as an audit trail* pattern, vignette 1: Accounting.

Pattern 1 - Artefact As An Audit Trail

This pattern is presented based on two different field studies. As indicated when it was introduced earlier we believe that other instances occur in the literature, however for economy of space we provide only the two examples here. The pattern is concerned with how artefacts gather annotations, etc. that are representative of the process of work completed in relation to them. Vignette 1 is drawn from a field study of an accounting department of a small catering company (Anderson et al., 1989) (figure 3). Vignette 2 for this pattern is drawn from a study of air traffic controllers (Hughes et al., 1992) (figure 4). The patterns have been developed and presented here as web pages, allowing access to further detail to be provided via hyperlinks. The further detail may take the form of the original study report, fieldwork notes, video clips, photographs, etc.

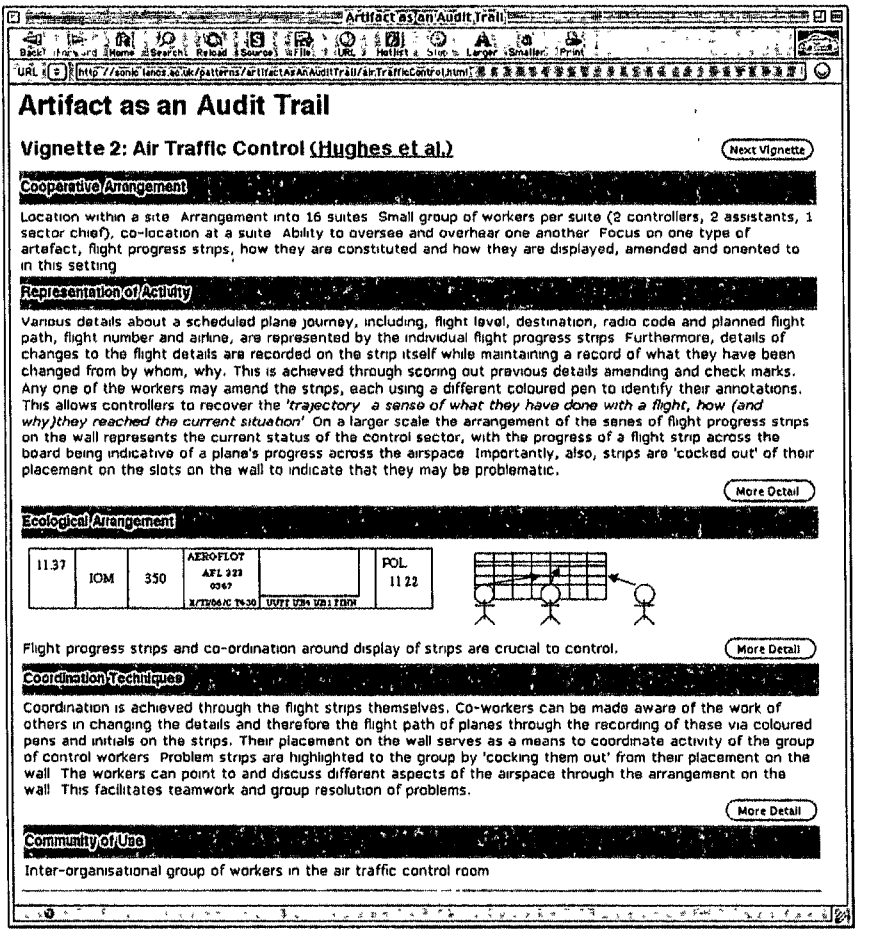

Figure 4: *Artefact as an audit trail* pattern, vignette 2 Air traffic control.

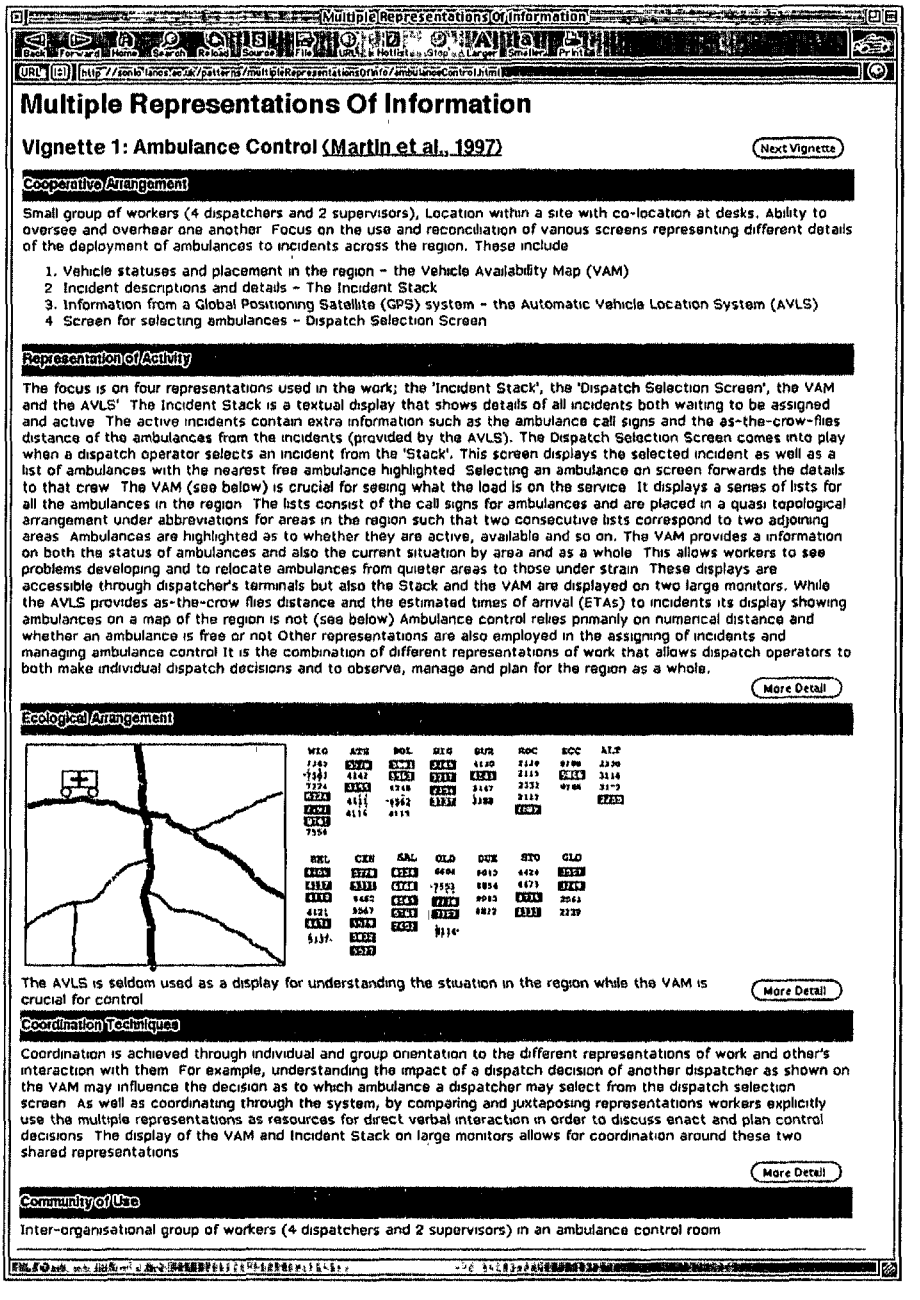

Figure 5: *Multiple Representations of Information* pattern, vignette 1: Ambulance control.

This pattern is presented based again on two different field studies. It is concerned with how multiple views onto information are used in different settings to support the understanding of often complex and dynamic data. Vignette 1 (figure 5) is drawn from a study of ambulance controllers (Martin et al., 1997), and vignette 2 (figure 6) once more from air traffic control (Hughes et al., 1992).

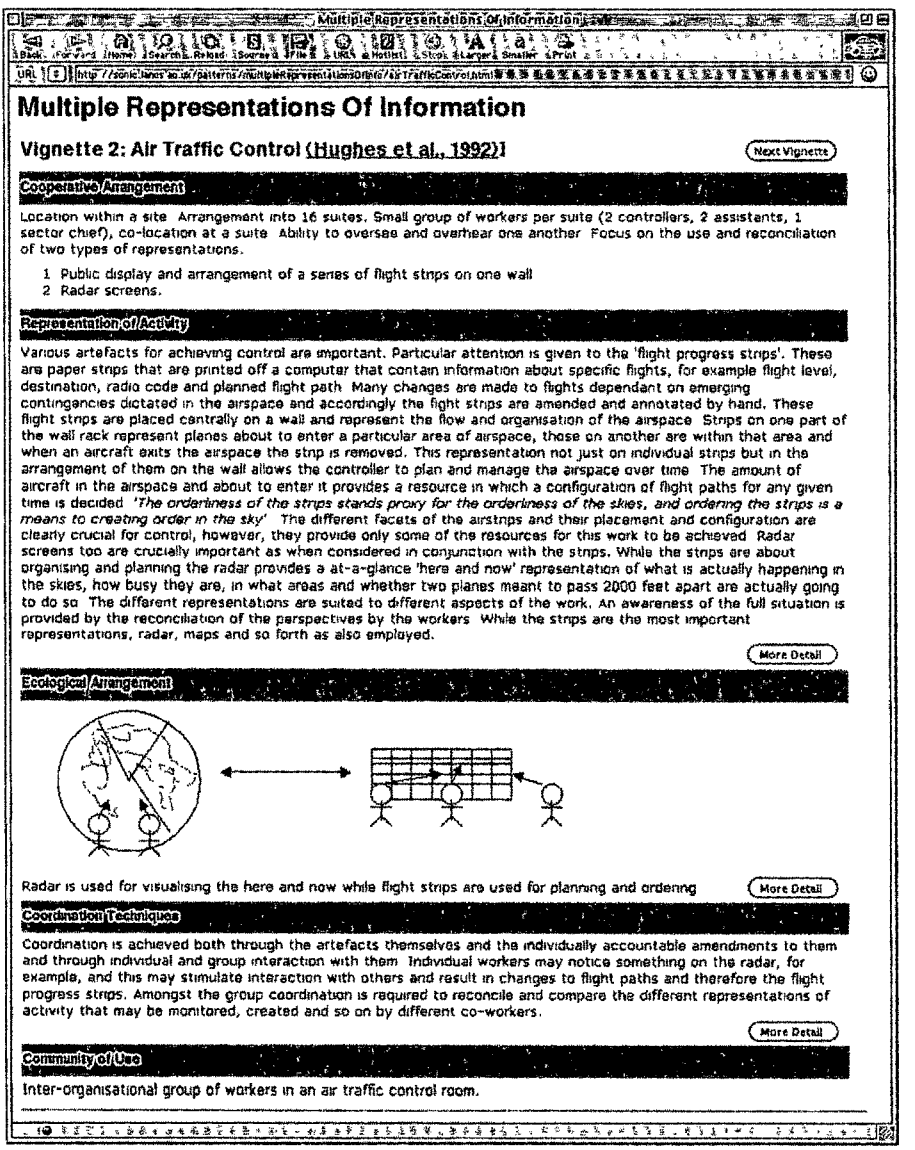

Figure 6: *Multiple Representations of Information* pattern, vignette 2: Air traffic control.

Conclusions

This paper has presented our experiences of developing a pattern language that can be used to present field studies. The focus of this work has been on a move away from the problem orientation within Alexander's original work to consider the use of patterns as communicative devices. This places the developed pattern language in contrast with the broad range of design patterns used within the Software Engineering community where strongly solution-oriented patterns have been developed.

Our use of patterns as a presentation device shows some promise in allowing us to represent a corpus of field studies in a manner that is accessible to others. However, a number of challenges still remain to be resolved:

- **The generation of more patterns** is an important next step. We have currently used the pattern language to develop patterns from approximately 10 different studies and are in the process of constructing a substantial corpus of patterns. However, we need to encourage others to make use of the pattern language in order to develop a more diverse set of languages and are currently seeking to engage with others in the development of a pattern database.
- **Handling large numbers of patterns.** As patterns emerge and are generated how do we handle large numbers of patterns? How are they structured and what relationship will patterns have between each other. For example, we suggest that it should be possible to write a more generic description for patterns that will act as an indexing device to the set of field study examples outlined in the previous section.
- **Structures and taxonomies of patterns** may become a useful device. However, we have deliberately avoided suggesting a structuring of patterns or the relationship between patterns as we feel that these should emerge once a number of patterns have been developed and put to use. We also feel that these structures may well be developed to meet particular circumstances arising from their use in design and that the next stage of our work will involve engaging with designers in the use of these patterns.

The work reported here represents our initial steps in developing a pattern language and should be seen in that light. We believe that the work holds some considerable promise in allowing the CSCW community to exploit the considerable experiences gained from field studies over the last decade. Although a number of issues remain unresolved in the development of patterns it is clear that they do offer considerable potential and we will be building upon our experiences to develop more patterns, and we hope that this paper provides the groundwork for others to do likewise.

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