Informing the Requirements Process with Patterns of Cooperative Interaction

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Abstract

The need to understand the social context within which work to be supported by computer-based systems takes place is broadly recognised within the RE community. Ethnographic studies have been used in particular to inform the requirements process from a social perspective. To make this accessible to requirements engineers, work in this area has focused on how to integrate and communicate ethnographic findings on a per project basis but scant attention has been paid to how findings from individual studies may be generalised and re-used for the purposes of RE in new settings. This paper is intended to introduce our resource of Patterns of Cooperative Interaction to the RE community. These patterns specifically compare and contrast a variety of ethnographic findings, discuss their relevance to design and provide an introduction to the analytic sensibilities of such studies. We discuss how we developed patterns of interaction from a corpus of ethnographic studies, illustrate a selection of these patterns and suggest how the patterns collection can be used by requirements engineers as a means of highlighting potential social issues that are or relevance to the system requirements and as a means of generating requirements that support social interaction.

1. Introduction

The requirements engineering community has seen a growing recognition of the importance of the social and the need to understand the setting within which systems are placed [15, 20, 26]. The 'turn to the social' in system design arose out of a dissatisfaction with existing methods of informing system design as offering an overly abstract consideration of the system development process and a simplistic analysis of the nature of work. Dissatisfaction with orthodox methods of requirements capture produced pressure to develop more appropriate methods of analysing work activities and their settings as a means of informing system design, making end-use a much more prominent feature of system design. In particular, requirements engineering has turned to ethnographic studies of work to inform and guide the requirements process [23, 26]. As ethnography has been used within RE, techniques and approaches have emerged which seek to facilitate a marriage between the nature of studies of work and the needs of the requirements process [4, 27]. Such work has been useful in aiding ethnographers to communicate their studies in such a manner that they are seen as more relevant and accessible for RE, and reciprocally it has aided in sensitising RE professionals to the importance of social aspects of socio-technical systems. However, while ethnographic studies of diverse settings have been presented for over ten years in the literature (see [14] for a review) what these represent as a *body of work* has always been considered a thorny problem.

The insistence by ethnographers on the situationally specific attention to detail of their studies has been both the selling point for their studies and a factor which has hindered take-up in the wider RE

community. Those working in RE may well appreciate the merits of ethnographic studies in producing illustrative vignettes, 'stories' or 'sensitising' of the application domain but determining exactly which aspects of which studies are relevant to the project they are currently working on is a more difficult proposition. Similarly, while many are agreed on design as an inter-disciplinary problem, and where ethnographers are available working in concert with RE practitioners on projects, favourable results may be achieved. However, what happens when this type of cross-disciplinary set up is not in place?

Our work on *Patterns of Cooperative Interaction* has been specifically oriented towards this problem. In this project we have deliberately looked at the findings of a number of ethnographic studies of work and technology and extracted descriptions of similar cooperative practices arising from comparable workplace configurations across different studies. These are presented as instantiations of more generic patterns and are compared and contrasted. This aids in bringing the analytic concerns of the ethnographer to a wider audience and demonstrating how findings from the corpus of studies may be used as a resource for considering socially oriented design issues in novel settings.

The work on patterns is part of the on-going process of evolving a closer connection between ethnographic studies of work and requirements development. This work builds upon previous experiences on the use of frameworks for the structuring and presentation of ethnographic material [12] and the use of methods to guide the requirements process from an ethnographic perspective [26]. From this perspective patterns may be seen as a complementary or substitute resource which allows ethnographers to better communicate their findings to systems developers, however, we also believe they can serve as a readily accessible resource for requirements engineers.

2. Overview: Why Patterns?

Traditionally the success stories of ethnographic studies being incorporated in RE have detailed situations in which a reciprocal relationship between ethnography and design builds up, with the relationship being managed through interaction between workers of the two disciplines [13,23]. The ethnography is presented, discussed etc., allowing requirements engineers to sift through for issues pertinent to design that they can then direct the ethnographer to elaborate on, or focus on the next time they are in the field. Thus historically, ethnography has seldom been incorporated systematically in a systematic requirements engineering approach.

While a systematic description of data, data flows and repositories, entities, relationships, objects and so forth is definitely very useful in producing systems, and arguably necessary, the same is not true of the data in ethnographic descriptions. Although, often ethnographers and requirements engineers may use notions like process and classification-ontology with which to orient to each other's work[1] in many cases the notion of being systematic in a socio-technical system description is seen as possible but just not sensible in terms of a number of factors. These include the need to address issues of *coping with detail* (much of which may be unimportant from an RE perspective)[2], *prioritising requirements*, *generalisation*, and *presentation across a number of studies of work*.

[1] E.g. in terms of process the ethnographer can augment conventional data flow diagrams with descriptions of interactions and activities that support the data flows. In terms of classification-ontology the ethnographer can look at the practical usage of classifications in order to aid in their refinement.

[2] Although this depends on the engineering task in hand, what might seem over-rigourous and over-engineered in one area may be a requirement for another domain such as safety critical systems.

At Lancaster, we have been working for a number of years to address many of the often cited issues regarding the problems of involving social analysis in more traditional requirements processes. These include the length of time that ethnographic studies can take, the level of detail provided by workplace studies, and the difficulty of abstracting away from the specific to general design principles and guidelines [27].

Early research focused on the process of ethnographers and requirements engineers working together [10]. Over time, as more and more studies were conducted, the focus of research in this area switched to how the presentation of ethnographic studies to the RE process can be structured to improve the communication of important social features of the work under study [12]. More recently, we have developed a systematic approach to social analysis called Coherence [25-27] that links social analysis with a more structured requirements engineering process.

As the corpus of ethnographic studies of work has built up, we have found that a number of features occur time and time again across different studies in different domains (the features were readily, or *grossly observable*). Efforts at structuring the presentation of ethnographic fieldwork exploited this so that, in particular, the presentation framework [12] structured ethnographic fieldwork into three *dimensions* of work. The dimensions can be seen as recurrent themes around which the identified features can be organised.

- *Distributed coordination* is concerned with how tasks are performed within the broader context of the organisation, as steps in continuing processes, and as part of a division of labour. Workers rapidly build up an understanding of what constitutes their work, and what is "somebody else's". Looking at work from this perspective is useful for understanding the roles played by different individuals as they collaborate together.
- *Plans and procedures* focuses on how the organisation supports distributed coordination through job descriptions, workflow diagrams, instruction manuals, etc. Of particular interest here is the way that work in practice can differ from documented procedures.
- *Awareness of work* refers to how individuals perform their tasks so that what they are doing is made 'visible' or 'available' to others. Two people working alongside each other will have a good impression of what each other is doing, without being explicitly informed by their neighbour.

Coherence presented these dimensions as social viewpoints in an extension to the PREview viewpoint oriented requirements method [24]. Rather than expecting requirements engineers to conduct ethnographic studies (but naturally not precluding this as an option), Coherence provides support for social analysis by providing questions to focus attention on various social features of work, as identified in the presentation framework

Patterns of Cooperative Interaction, too, draw inspiration from the presentation framework as this forms part of the template in which the patterns are presented. However patterns, with their emphasis on socio-technical configurations and their attendant processes and practices, also acknowledge the influence of spatial characteristics of work settings. Our second strand of inspiration, of course, comes from work on patterns, beginning in architecture and urban planning with the work of Christopher Alexander [1,2] before branching out, in various translations, into various realms of computer science [5,6,7,8]. In section 3 we present our 'take' on Alexander's work.

In providing background we want to differentiate our work from the work of others on patterns but crucially we want to demonstrate how it differs from other approaches which integrate ethnography and RE. These differences mean that Patterns of Cooperative Interaction can serve as an addition to

the systematic socially-oriented analysis of Coherence or instead as a 'lightweight' (easy to apply, ad hoc) resource for aiding the identification of important social aspects of configurations and enabling design considerations for a variety of practitioners. Patterns, it is envisaged, help to make socially oriented material more accessible and usable over a variety of situations.

Effectively communicating social requirements to the RE process, either via an ethnographically informed method such as Coherence, or directly from ethnographic fieldwork, should now seek to address a number of research challenges.

- **Coping with detail.** The detailed information provided by ethnography is both a strength and a weakness of the approach. Access to this detail is important, but it must also be possible to abstract away from it.
- **Prioritising requirements.** Once social requirements are identified from fieldwork, it is necessary to provide means of determining their relative importance for the current context.
- **Generalising from individual studies.** Generalisation is a thorny issue for ethnography, but for requirements engineering it is vital to be able to draw lessons for future developments.
- **Presenting a number of studies of work.** As more studies in various domains are conducted, it becomes more important to draw out the similarities and differences between their findings.

We argue that our collection of Patterns of Cooperative Interaction provides a flexible resource for both ethnographers and requirements engineers in a variety of situations addressing the above issues [19], however in this paper our primary focus is on their utility for the latter user group. Thus far, we have presented work [17,18] that demonstrates how ethnographers may derive and use patterns as communicative devices, and as ways of prioritising requirements and envisaging design solutions, here we are interested in reaching out to requirements engineers. We provide the necessary background and demonstrate, through examples of two patterns (from our collection of ten), how aspects of work can be focused on and requirements generated.

It is our hope that through doing this and through our recent dissemination work, which has made our collection interactive[3], we can begin to fashion our patterns into a truly communal resource. It should be stressed, however, that our use of the term *pattern* differs somewhat from that popularised by the design patterns community [8].

3. Patterns and Pattern languages

Patterns are increasingly popular in the software design community as a means of encapsulating knowledge about elegant solutions to recurrent problems [8]. Their origins, however, lie in the field of architecture and the work of Christopher Alexander [1,2]. Alexander's patterns bring together the relevant aspects of the physical and social characteristics of a setting into a design. They facilitate the sharing of knowledge about design solutions and the setting into which such solutions are 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" [1]

Whilst the concept of patterns has been applied in a number of areas, including HCI [6], organisational structure for software development [5], and analysis [7], the most prominent and

[3] Our collection is now presented as on-line, editable wiki pages allowing other professionals to easily add to, comment on and refine them.

popular usage of patterns is in software design [8]. This particular notion of patterns has shifted from Alexander's original work which inspired it. In fact, design 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 whose patterns were intended to be used as a resource to be drawn upon in different ways in different projects.

Another rationale behind patterns is Alexander's notion of 'quality' ('The Quality Without A Name') [1] 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'; fitting with the social context in which they are used.

In our work we have returned to patterns as originally suggested by Alexander, where descriptions of recurrent situations were presented to suggest possible architectural solutions. In fact, the observed reoccurrence of familiar situations, where similar but situationally tailored solutions may be applied lies at the core of our argument for patterns. 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". [1]

In the following sections we outline our own efforts to uncover and present *patterns of cooperative interaction* derived from a corpus of ethnographic studies. We then reflect on our collection and demonstrate through reference to two patterns how they generate design considerations. Following this we discuss our experiences of use and suggest ways in which they may serve requirements engineers in their work. The main body of work consists of ethnographic studies of work and technology undertaken by researchers from Lancaster and elsewhere, for example in control room settings [9, 13, 16], offices [3, 18] and banking [17].

Patterns of cooperative interaction are intended to communicate grossly observable features of the social nature of work, which have been observed in a number of settings. Basically, ethnographic studies have often stressed how particular social practices mesh with particular socio-technical configurations to enable the achievement of work. Our patterns our meant to convey this knowledge.

Our main concern was to be able to present these findings in a format that could facilitate their communication from ethnographers to designers. This bears many similarities with Erickson's view of pattern languages as *lingua franca* for design [6].

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.

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 approach embodied in design patterns. While structuring patterns around 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 such a pattern language would be good for presenting fieldwork studies. Consequently we have focused on the development of descriptive patterns that convey the nature of settings. Within the description we do note how particular configurations work well, or where aspects of them give rise to problems but the appropriateness or success of a given configuration can only be judged in specific contexts. The personnel, their abilities, training, the task, the technology, the organisational context and so forth all impinge on success. Patterns should be a resource that enables designers a ready and more basic

access to understanding how such relationships play out and impinge on design considerations. The aim of these patterns is to act as a general resource for designers to draw upon when they are developing requirements for a particular setting, rather than to suggest that a particular socio-technical configuration is in all cases more appropriate than others, and can be applied wholesale as a design solution.

3.1. Identifying Descriptive Patterns

As a starting point for uncovering patterns we focused on control room studies such as the London Underground [9], ATC [13], and ambulance control [16], some of which we were directly involved in. We found 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. [13] draw attention to the use and display of flight strips as a public artefact, Martin et al. [16] also discuss co-ordination around public screens showing the state of ambulance deployment, and Heath and Luff [9] point to the use of shared artefacts as a means of coordination in the London Underground. Other general categories of findings across the studies were also found, such as how co-workers achieve and maintain an awareness of one another's work.

3.1.1. Principles for Generating Patterns. Trying to uncover descriptive patterns within the field studies under examination soon highlighted the need for some set of guiding principles. 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.

3.1.2. Spatially oriented features. These principles seek to emphasise the observable arrangement of work and physical nature of the work setting and can be thought of as the features that relate to the socio-technical configuration. 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.

3.1.3. Work oriented features. These principles focus on the practices that accompany socio-technical configurations, i.e. how people act and interact to get the work done given the

configuration. They highlight the socially organised nature of work and how these are manifest in practice within particular settings. We have again focused on three key features drawn from previous work on a framework for presenting fieldwork, namely: awareness of work; distributed coordination; and plans and procedures.

3.2. Developing a Descriptive Pattern Language

The spatial and work oriented principles above therefore form the basic principles behind the generation of patterns. These basic principles provide a key set of concepts to drive the identification and highlighting of descriptive patterns. In seeking to identify descriptive patterns, looking for evidence of these principles within field studies provides a means of starting the process. However, these principles are not necessarily the best way of presenting patterns to requirements engineers, or for allowing comparison between 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. What was needed was a common structure for describing and presenting the identified patterns.

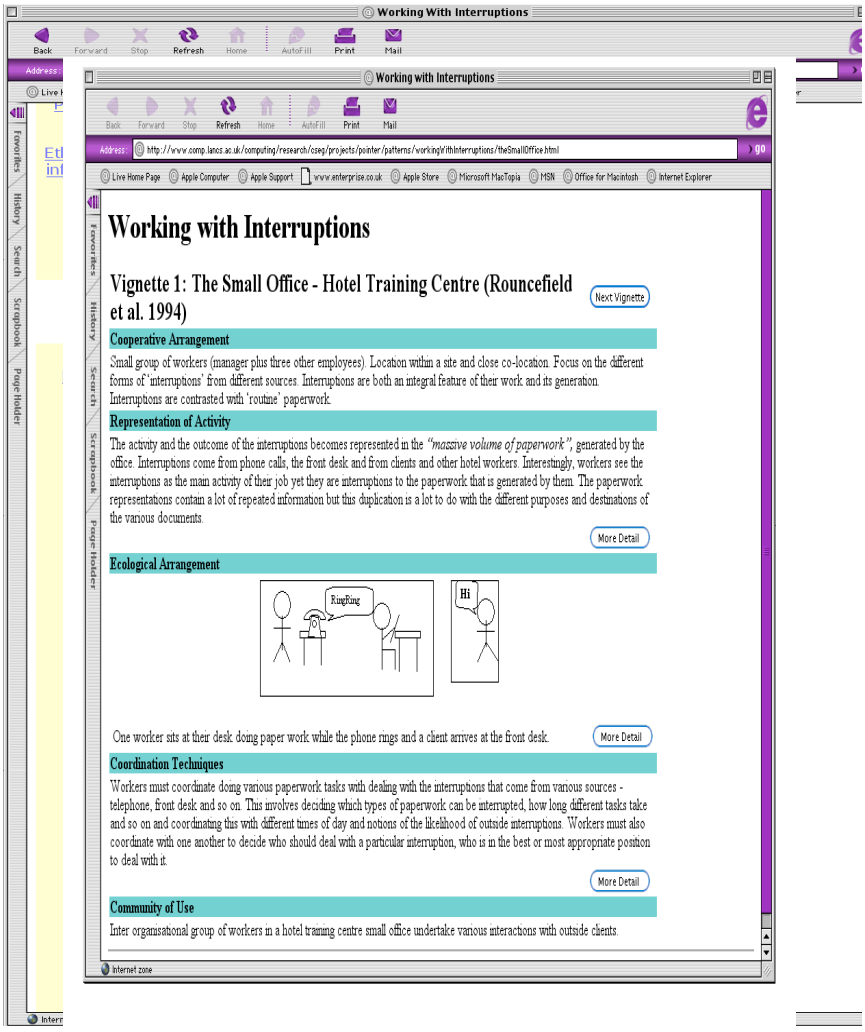
To develop an agreed pattern language all members of the research group independently produced a list of all the features that were required to describe a pattern. Through the presentation and discussion of these individual frameworks a set of potential pattern languages were proposed and then refined 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 identified. For each identified pattern a set of illustrative examples drawn from the field studies is presented in order to promote comparison across examples drawn from different field sites. This basic descriptive structure is reflected in figures in the next section which are screen shots from our collection. The 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 other 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.*
- **Community 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.

3.3. The Patterns Collection

In a general sense, the Patterns of Cooperative Interaction collection provides a different point of access to the corpus of studies. This access arrangement places findings as the entry point into the material rather than access through the studies themselves, or through conference proceedings, or searches of abstracts. The patterns are presented in a structure which seems to make pragmatic sense. They are presented in a series of web pages with the full list of patterns on a front page. The full list is currently as follows:

1. Artefact as an audit trail
2. Multiple representations of information
3. Public artefact
4. Accounting for an unseen artefact
5. Working with Interruptions
6. Collaboration in Small Groups
7. Receptionist as a hub
8. Doing a walkabout
9. Overlapping Responsibilities
10. Assistance Through Experience



Each pattern name is a hypertext link which takes the user to a front page for the pattern in question. This front page contains various information. Firstly a high level description of the phenomena is provided under the heading *"the essence of the pattern"* subsequently below this are three more sections entitled *"why useful?"* *"where used?"* and *"dependability implications?"*. *Where useful* details (in basic terms) why we have chosen to draw attention to the pattern (the particular phenomena). *Where used* details the two plus specific fieldwork settings we have found examples of the pattern in, and also some preliminary remarks on similarities between the settings. *Dependability implications* is used to make some comments about what the identification of the pattern may mean for certain questions concerning 'good', usable, dependable design. Again, as they are named in the 'where used' section, the named specific examples on this screen serve as hypertext links to the individual study examples of the patterns, the *vignettes*. Navigating to this level, the reader accesses a greater level of specificity/particularity.

Each instantiation (vignette) is described according to the five topical headings: "cooperative arrangement", "representation of activity", "ecological [illegible] "community of use". These were developed as describe[illegible] collection we are making the reference of each instanti[illegible] vignettes and intend on making the actual studies (wher[illegible]

Our patterns are best viewed on-line as we specific[illegible] browseable, web-based resource. However, to provide [illegible] are patterns are, in this section we provide more detail[illegible] our patterns focus on work practices and interactio[illegible] configurations give rise to these, facilitate or constrain[illegible] look at different artefact designs and placements a[illegible] interactions (*Public Artefact, Multiple Representations*[illegible] *Accounting for an Unseen Artefact*). The rest of the [illegible] fo[illegible] 'ork' a[illegible] an[illegible] *abor*[illegible] *Do*[illegible] *ies,* [illegible] ex[illegible] oup'. Int[illegible]

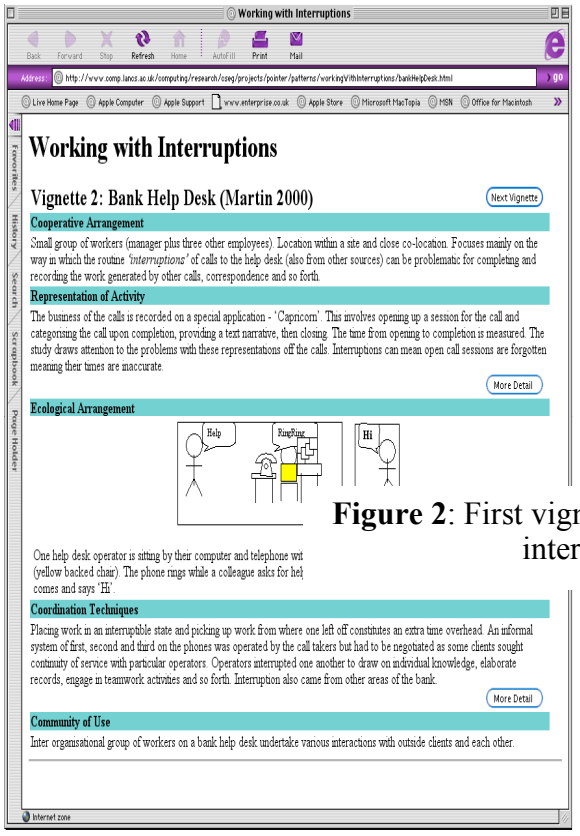


Figure 3: Second vignette for 'Working with interruptions'

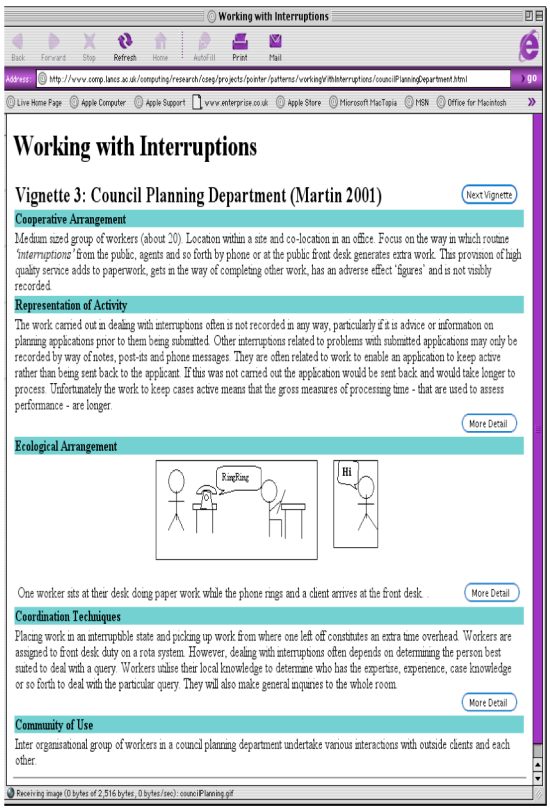


Figure 4: Third vignette for 'Working with interruptions'

Figure 2: First vignette for 'Working with interruptions

The first specific vignette was provided by Rouncefield et al. [22] in a paper actually called "Working With Constant Interruption". The study was of a hotel training centre reception desk and focused on how the frontline reception work (face-to-face and over the phone) produced 'massive volumes of paperwork'. Slightly ironically the 'frontline' work became a set of 'interruptions' which had to be managed skilfully in order that the paper work could be successfully completed and forwarded.

The second study focuses on the work of a software help desk in the bank. This time the concern was once again with the management between the work required to deal with the interruption and the work it produced. Here, however there was quite a strong focus on the call recording system and the requirement to record calls in various ways.

The third vignette is derived from a local government council planning department where the focus was particularly on a contrast between interruptions from an inside source and those which were external. Inside source interruptions were often positive in that they could be negotiated and often were about sharing knowledge and expertise. External were unpredictable, often either inappropriate or directed to wrong staff member but still had to be dealt with. Taken as a whole the pattern provides considerations for such service work settings. For example, designers should concern themselves with the separation or interleaving of other work (e.g. paperwork) with the work of dealing with interruptions - what is interruptible, what needs to be separated, should there be a separation of jobs, or by shift or whatever? Furthermore, it raises questions on the utility of rigorous interruption (call) recording procedures and suggests organisations may gain from screening and filtering interruptions.

With the full Working With Interruptions example we have tried to provide a flavour of what we are trying to achieve with the patterns - building up a collection of findings where similar phenomena are grouped together. In the vignette summaries we can see that certain issues and problems are highlighted - which can provide a useful design resource when encountering a novel situation with similar features.

Our second example is "Accounting for an Unseen Artefact" (figure 5). Here we only provide the front page for reasons of space. This pattern deals with the now fairly familiar set up where an operator interacts with a system while dealing with a customer or client over the phone. Such a set up is routine in call centre work across various service industries as well as control centre work.

The pattern focuses on the 'role' of the system in the interactions between operator and client, considering the ways in which it guides the interaction, how operators communicate aspects of the system, its informational requirements and so forth. And furthermore, how the caller orients to the system and system use (or not as may be the case).

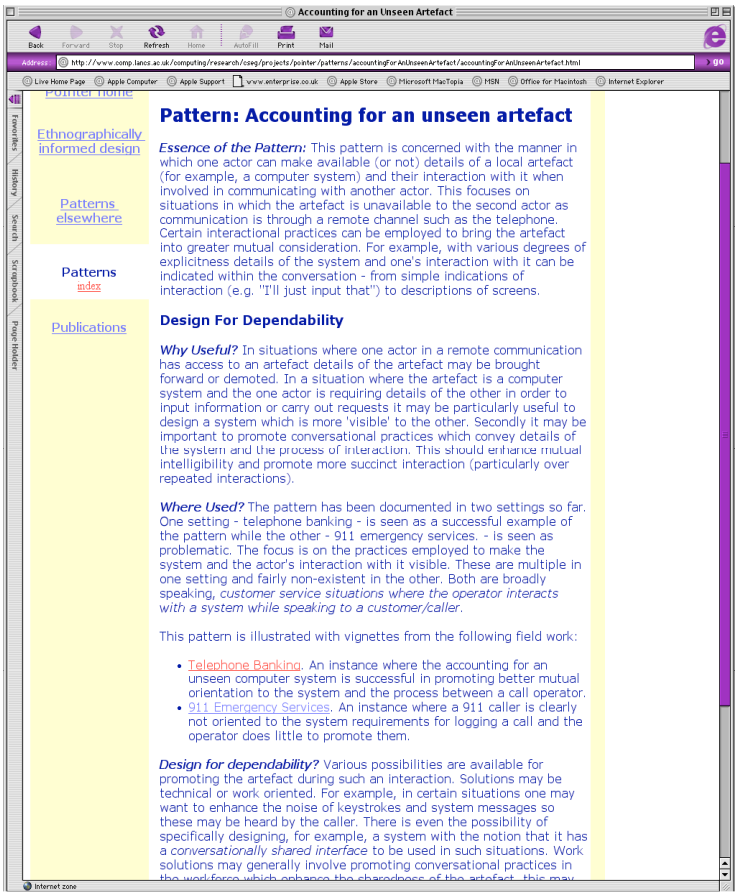


Figure 5: Front page for "Accounting for an unseen artefact"

The two vignette examples actually present contrasting cases. The first provides examples where system use is skilfully embedded within interaction between operator and caller in telephone banking. It is not that difficulties never occur, but rather that operators employ techniques to orient callers to aspects of the system and its required interactional sequencing such that over repeated contacts callers are seen to configure their talk to achieve business smoothly. Also of interest is the translation work done by operators in reconciling diverse customer perspectives with required organisational process. This situation is contrasted with an analysis of a call to a 911 emergency line [28] where the operator is seen to orient more to the requirements of the system to the detriment of managing the business of the call - providing a swift response to a medical emergency. This leads to a tragic outcome as the call is prolonged. Taken as a whole the pattern provokes issues concerning support system design, operator skills and training (e.g. concerning how the system is made accountable (visible and reportable) within interaction) and the need to understand caller characteristics. The pattern aids in an exploration of pertinent issues for work and technology design in call centre work.

3.4. Specific Uses of Patterns in System Requirements Engineering

Patterns are intended as sensitising devices for requirements engineers that can aid them in understanding the *social* and *spatial* aspects of work and settings that ethnographers highlight as

important for design. We envisage three possible scenarios of use of the patterns collection by requirements engineers.

1. At the very beginning of a project where social interaction is involved, the requirements engineer may scan the patterns collection to get an overall impression of what has been important in previous projects and hence what he or she might look out for during the requirements engineering process.
2. During a project after some observations of work have been made, the requirements engineer may attempt to classify and organise these observations by 'fitting' them to the patterns in the collection. He or she is then prompted by the pattern language for the other relevant information about the situation (the representation of the activity, ecological arrangement, etc) that may be relevant to that situation.
3. After a pattern has been discovered and located within the patterns collection, the general pattern information and the vignettes associated with the pattern tell the engineer how the pattern is manifested in other settings and hence provide some clues as to the requirements that might be generated in this case

We will illustrate this with a small example that makes use of the 'working with interruptions' pattern that we have described in this paper. Consider a situation where we are developing the requirements for a student information system that is to be used in a university setting. This system will manage confidential student information, collects information from a range of sources and is used by different users who cooperate synchronously and asynchronously. Many of these users work in public offices and have regular contact with faculty staff and students.

A short period of observation has shown that interruptions are common so the 'working with interruptions' pattern is consulted to discover the commonalities with other comparable situations and the questions that should be answered for that specific setting.

From the vignettes associated with the pattern, the following questions emerge:

- What is the cooperative arrangement in the setting where the system is used?
- How is the activity represented so that users can 'start where they left off' when an interruption occurs?
- What is the physical arrangement of the office and how does it contribute to supporting the working practice?
- How do different users coordinate their work?
- Who are the users?

The answers to these questions do not generate requirements in themselves but they provide an effective starting point for discussions with users and other stakeholders about the system. For example, in our own setting, the physical layout is designed so that desks face the door of the room so that those entering see the backs of screens. Discussion with staff reveals that this arrangement means that, when they are interrupted while dealing with confidential records then these records are not visible to the person who has just entered the room.

Further examination of the patterns reveals that an important issue when dealing with interruptions is often finding the best person to deal with that interruption. Where workers share a

room this is not a problem but is more difficult when people work in physically separate areas. As this is the case in this particular situation, we may generate a system requirement as follows:

- The system shall include a facility that allows users to discover other users who are making use of the system.
- The system shall support a 'query broadcast' facility that allows a user to broadcast a query to all other connected users and to receive responses from them.

While, of course, these requirements could be derived by a sensitive analyst, we would argue that an approach that is simply based on the work tasks carried out (that is, the use cases of the system) is likely to miss this type of social requirement that can be identified through the use of patterns.

4. Conclusions and Future Work

This paper has presented our initial work on developing a pattern language of cooperative interaction for informing the RE process of findings from ethnographic fieldwork. In contrast with the prescriptive style of software design patterns, we have created a descriptive pattern language for the purpose of communicating ethnographic fieldwork to the RE process. Patterns are generated from basic spatial and work oriented features and presented in a common format to facilitate understanding and comparison between patterns.

The basic principles behind the generation of patterns of cooperative interaction are derived from previous work in this field which concentrated on structuring the presentation of individual studies according to a presentation framework, which also led to the development of the Coherence method for social analysis. These framework-based approaches were found wanting in a number of areas concerning the actual process of engaging with ethnographically informed requirements in the RE process. We believe that our pattern language shows promise in addressing these areas as follows:

- **Coping with detail.** The descriptive structure of the patterns, coupled with a minimal common language of description, serve to present abstract descriptions of the features of each pattern. Creating the patterns as HTML pages allows us to make use of hypertext links to provide more detailed descriptions such as found in field notes, research papers, and other multimedia sources from the study such as scanned documents, video clips, photographs, and so on.
- **Prioritising requirements.** When considering the relative importance of social requirements presented in a set of patterns, the reader can make use of the extent to which each pattern matches the current context of concern. The closer a pattern fits the workplace under consideration, the more relevant the findings will be for any system being develop for it.
- **Generalising from individual studies.** Findings from an individual study can be considered alongside similar findings from other studies, and hence adding to their general applicability. This is achieved simply by presenting findings in the pattern format, describing features of the fieldwork under the headings in the descriptive structure, making use of the common language of description.
- **Presenting a number of studies of work.** By its very nature, the pattern language *is* a means of presenting a number of studies of work alongside each other. We see our descriptive pattern language as a powerful approach for collecting a number of studies together and presenting a corpus of related fieldwork.

We believe that patterns of cooperative interaction show great promise as communicative devices between ethnographic fieldwork and RE. However, this hypothesis is not something that we can verify on our own or in a simple case study. The very nature of patterns is such that their utility cannot be verified by their discoverers because they are too close to them and their usefulness or otherwise only becomes clear once a number of users have tried experimented with them and discovered their strengths, weaknesses and scope.

For this reason, we have created a web based repository of such patterns to allow the broader community of fieldworkers and requirements engineers to engage with these patterns and attempt to make use of them in their research and requirements engineering. We have designed the web pages to allow user editing and welcome new patterns, new vignettes from existing patterns and comments on people's experience of using the patterns.

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