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IT Design for Amateur Communities

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Abstract

The concept of community is receiving increasing attention across organizations and throughout the entire society. Voluntary association, creation of value, and solidarity in community contexts get more and more appreciated and nurtured within companies and other organizations. At the same time, lack of community is raised lately by Western sociologists as a major source of alarm while the large participation possibilities provided by the Internet are seen as a hope for remedy.

This thesis aims to contribute in the area of technology design for communities by seeking to gain understanding of voluntary community work and to design artefacts in support for such work. Community work is studied through an ethnographically-inspired approach for empirical observation of community activity and the artefacts that support it. Field study of 'voluntary working order' was conducted in several voluntary communities: amateur radio and three student organisations. In studying such working order, one must renounce a set of assumptions that are commonly made about work, starting with the very idea of remuneration as a basic motivation. Instead, challenge as a major motivation is proposed for work in voluntary communities. To draw inspiration for future design, an examination is made of the way this motivation is reflected in the features of technology created by the communities for their own use, in the working contexts of the field settings.

Lessons learned about amateur work are then used and refined while reflecting on amateur-work-oriented design of IT artefacts conducted within a student organisation, with a particular interest in self-sustainability of participatory design practices in such settings. Practices of participatory design are re-considered in the context of voluntary work, the absence of the employer-employee conflict, the challenges and learning trajectories of the members. As development is done by members of the student community, design interventions for self-sustainability of amateur software development are described and reflected upon. A generic approach is proposed for action aimed at self-sustainability in amateur settings.

The socio-technical features that resemble across the communities studied and practices experienced are then grouped under the generic name of the perspective developed in this thesis: "Amateur Community". The perspective is proposed as a point of departure for further study and design intervention in similar communities. Comparisons are made between Amateur Community and other approaches such as Community of Practice.

Keywords: amateur, volunteer, community, work, amateur work, participatory design, software development, challenge, contingency, pioneering, public, personal development, learning, hands-on learning, self-sustainability

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My mother used to knit long at night so she could help me become a student. She wanted me to be a medical doctor, now I am about to do something about the ‘doctor’ part.

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Contents

Chapter 1
Introduction: Goals and Related work

1.1 Community and voluntary work

The concept of community is receiving increasing attention in a variety of disciplines in relation to work, knowledge and society at large. Voluntary association and contribution are core values implicit in many understandings of community. Technologies have long played an important role in modern communities (Mynatt et al. 1998). While playing major roles, technologies are not inherently helpful for communities. Carroll and Rosson (2001) review work that suggests a correlation between the decline of community in the American society, found by Putnam (2000) and the activity of watching television.

Nurturing communities is increasingly considered more effective than trying to implement an organization-wide technology. After experimenting with "organizational memory" systems based on knowledge storage and dissemination, companies are switching to letting their employees do the work of propagating knowledge and experience naturally in what Wenger and (1998) calls "communities of practice", social aggregations often based on voluntary association and voluntary work (see also Lave and Wenger 1991, Brown and Duguid 2000, Brown and Duguid 1991, Muller and Carey 2002, Millen and Muller 2001). Many such aggregations are independent players in the economy, forming what the Economics literature calls "the third sector", generally referring to non-for-profit associations for various purposes.

The intricate relationships between community and technology are also dependent on the incentives for work. An immediately apparent feature of voluntary work is that it has a completely different set of incentives than waged work. Orlikowski (1992) has shown that the motivation and reward of work can have important influences on the interpretation and acceptance of the technologies used in a setting. This suggests that, as communities based on voluntary work are gaining more focus, a reconsideration of the technologies designed for communication and collaboration in industrial settings should take place as well. Certain technologies may work in similar ways to support both voluntary and employed work, but others may be used differently. The design of technologies that support voluntary work is likely to encounter constraints specific to voluntary settings, different from design constraints in waged work settings. It is the goal of this thesis to study such specifics.

1.2 Objectives

This thesis will investigate the *intertwining of social and technological aspects* (O'Day et al. 1996) of *communities based on voluntary work*, with the goal of designing better information technology support for such settings. The thesis is grounded in the research tradition of Computer Supported Cooperative Work (CSCW), Participatory Design (PD) and generally Human-Computer Interaction (HCI).

The thesis will attempt to gain better understanding of the *motivations of voluntary work* and their relations with *community endurance* and *technology support*. Such motivations will be examined both at individual level and in the context of community, together with the design rationale of the technologies that support the respective voluntary work. Since many volunteers are not professionals of their trade, the term "amateur work" will be used throughout the thesis to mean "voluntary work". Different connotations of the word "amateur" will be examined later on.

Community life and voluntary work co-exist with employed work, study and family life. Members communicate with their community using the Internet and other communication means from home, school or the workplace. As communication is one important role of the technology, we will focus our interest on *geographically distributed* communities, where face-to-face encounters are not an everyday option. Even in co-located communities, the flexibility demanded by other personal obligations (family, study, work) results in constraints on voluntary work that reduce the possibilities for face-to-face encounters. To make more evident the technological constraints imposed by geographical distribution, the settings considered for study and design in the thesis are all distributed over large areas.

Another thesis objective is *designing to support voluntary work* in geographically distributed communities. Such design will be done against the background of what is learned from field study of community work. More general than design cases, proposing *generic design techniques* for such settings is a desired result.

Since voluntary work does not generate revenue, resources of voluntary communities can be very scarce. Design interventions can bring resources to the community that will not be there after the designers leave. This can result in unrealistic designs that count on more resources than the community possesses. The need to avoid such situations leads to another objective of this thesis: *self sustainability* of the socio-technical contexts in which design will take place. The setting should be able to sustain the practices and technologies introduced during design by counting only on its own resources.

1.3 Terms

1.3.1 “Community”

As expressed by Mynatt el al (1998), “the notion of community has a long and complicated history to social scientific theorizing”. The early understanding of the term ‘community’ was based on the rural community, characterized by spatial proximity, ongoing face-to-face interaction, and shared institutions and was used as an illustration of an obsolete, pre-modern social formation. Later work in sociology and urban planning reconsidered the positive aspects of “community”, which was still perceived as existing even in modern societies. Community was then seen as a small-scale social group, crucial to social life for promoting social integration, mutual support, etc.

Mynatt et al. extract three broad defining features of community: *locality* (in the sense of small-scale social group, but not in the sense of spatial locality), *meaningful and multi-layered relationships* between community members, and *dynamism*, perpetual development for community reproduction and adaptation across generations.

While according to the considerations above, defining “community” comes as a complicated task, we will attempt to extract an understanding of community from settings that are a-priori perceived as communities and, before that, use a definition that functions as a ‘ladder to throw away’ after being climbed, i.e. after the communities in question have been studied and better understood. Inspired from Mynatt et al, we can assume some necessary conditions for a social group to be a community based on voluntary work:

- A shared interest in doing voluntary work in a certain domain, according to certain values. This bounds the locality of the community and also expresses a shared responsibility in respecting common values[1].

- A set of means of communication with the other members, including a way to find out about the existence of other prospective members who also have that interest. This makes sure that the relationships between members exist at all.

This set of conditions does not include prerequisites for community reproduction (or endurance as we will call it later on). Instead, aspects of voluntary community endurance within specific communities will be an object of study in the thesis.

1.3.2 “Amateur”

The word “amateur” is often used in a pejorative sense in everyday speech to denote “novice”, “unprofessional”, “bad approach to work” or “bad quality of work”[2]. However, upon close examination of people who talk of themselves as being ‘amateur’, authors like Fine (1998) and Stebbins (1979) have found that the skills of e.g. amateur mycologists, actors, baseball players and archaeologists range from novice-level to an expertise that rivals their professional counterparts. Moreover, certain amateurs are at the same time professionals in the related occupation, and yet others have been or aspire to become professionals in that activity (Stebbins calls them post-professionals and pre-professionals respectively). Sciences like astronomy still depend on the work of amateurs for their progress.

Stebbins finds amateurs as being situated “on the margin” between work and leisure[3]. He sees amateurs as being related to the corresponding profession, from which they draw influence and sometimes exercise influence towards, and to a “public”, which benefits their activity. This complex of social relationships is called by Stebbins “the professional-amateur-public” (PAP) system.

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[1] The Latin origin of ‘community’ has two components: “cum”=together and “munus”= given, gift, as in “volunteered” but also as in “responsible”

[2] The word “user”, in wide use within HCI today used to have similar pejorative senses, as in “drug user” (Grudin 1990)

[3] The French origin of ‘amateur’ denotes “love” for the respective activity

The use of ”amateur” in the thesis to denote voluntary work has a number of reasons: first, the term suggests parts of the motivation for work: pleasure. Second, the term implies that amateurs do work, and sometimes do it at a ‘professional’[4] level, which is important in the context of “computer-supported cooperative work” as a research field that has work as one of its essential study objects. Third, drawing from Stebbins, the term puts amateurs in a social context in relation to the respective profession and its public.

Some immediately apparent features of amateur work have already been suggested: the different incentives for work in comparison to professionals, the sense of ‘flexibility’ of work (times and duration of work, availability for meeting with amateur peers, etc) due to other obligations of the amateur, the geographical distribution of amateur group work due to the aforementioned flexibility and, often, due the lack of a permanent ‘amateur work place’ for the whole group.

1.4 Research questions

The questions addressed by this thesis are as follows:

- What are the aspects of amateur work that relate to technology and community endurance?
- How can amateur work be supported with design of information technologies?
- How can the practices of designing and implementing information technologies be made self-sustainable in an amateur setting?
- How can the study of amateur work and technology contribute to CSCW community understandings and research programs? How can the CSCW ‘community’ research agenda be improved?

[4] Throughout the thesis, single quotes are used to denote figurative senses that the author wants to convey, while double quotes are used to cite from other authors and to quote data collected from the field (setting members’ spoken or typed words, quotes from amateur community publications, etc)

1.5 Structure of the thesis

The *first, empirical part* of the thesis comprises *ethnographically oriented field studies of amateur work and technology*. *Chapter 2* presents a study focused on work of *radio amateurs*, members of a world-wide voluntary community. The main interest is to understand the immediately-apparent community endurance. Several features of amateur radio work, such as challenge, contingency and pioneering are emphasized and an understanding of *community endurance* is drawn based on these features. *Chapter 3* presents a study focused on work and information technology used by geographically distributed members in three *international student organisations*. Findings of Chapter 2 are considered in regard to their resemblance with features of the student organisation work and technology.

Chapter 4 represents the *design-intervention part* of the thesis. It focuses on *amateur work-oriented design* of artefacts for supporting voluntary student work as examined in Chapter 3. Several *problems and specifics* related to the *introduction* and *self-sustainability of participatory design practices* and *amateur software development work* are reflected upon.

The *resembling findings* from Chapter 2 and 3, as well as lessons from their application in Chapter 4 are then discussed and refined in the *discussion Chapter 5* to constitute a *generic perspective* of *"amateur community"*. Unlike existing CSCW perspectives such as "network community", the "amateur community" perspective developed here is not grounded in a specific kind of technology, but in a specific kind of work: amateur work. The result is compared with perspectives such as *community of practice*. Finally, general *conclusions* are drawn from the perspective developed, answering to the research questions posed.

1.6 Computer Supported Cooperative Work (CSCW)

Computer-Supported Cooperative Work is an interdisciplinary research field initiated in 1986, focused on how people work and how technology can support cooperative work (Grief 1988).

CSCW has its origins in the field of Human-Computer Interaction, which in turn began from ergonomics, or "human factors". While the multidisciplinary character of HCI implies contributions from psychology and computer science, CSCW takes into account the social context of work involving more than one user, hence sociology and computer science are the principal disciplines that contribute to CSCW. However, defining CSCW more precisely than an intuitive understanding like ‘research on software used by multiple users’ has sparked debates and difficulties.

1.6.1 Understandings of CSCW

“Groupware” is the generally used term for denoting software that supports groups, but many authors reject the idea that CSCW is limited just to that, and question the practical possibility of defining a ‘group’ (e.g. Bannon and Schmidt, 1991). Howard (1988, cited by Bannon and Schmidt) uses the term “strict constructionists” to denote the designers of groupware. They are mostly focused on solving technological problems of providing multi-user facilities, and are not much concerned with the concept in which the application will be used (and, according to Bannon and Schmidt, they are mostly designing for their own group). According to Howard, the remainder of the CSCW field is formed by “loose constructionists” coming from various disciplines. This view is reflected in the double-track organisation of the biannual CSCW conference, one track is concerned with technical issues, the other with social-technical issues. In that ‘language game’, this thesis is a “loose-constructionist” endeavour.

Starting from problems in understanding “cooperative work”, authors such as Hughes et al. (1991) prefer to see CSCW as a paradigm rather than a discipline. They see all work as socially organised, hence even seemingly individual work falls within the CSCW domain. As Schmidt and Bannon, they too conclude that CSCW is not only limited to groupware and that its contributing disciplines are affected in “large areas” by CSCW. They contend that CSCW research should affect the way *all* computer support systems are designed. As such, instead of seeing CSCW as a specialised sub-discipline of HCI, they view CSCW as a paradigm change for both computer science and sociology. The change is not as pronounced as a Kuhnian (1962) “paradigmatic shift” but, due to profound influences to all the disciplines involved, the term ‘paradigm’ is “not out of place”.

Schmidt and Bannon (1992) propose to define CSCW as *design* of support for *articulation work,* which is defined by Strauss (1985) as “the numerous tasks, clusters of tasks and segments on the trajectory of tasks needed to be meshed”. They point out that when tasks are “uncertain”, task allocation and articulation cannot be planned in advance. A classic example of such a ‘task-uncertain’ environment is the domain of office work.

This thesis will investigate ‘computer support for amateur work’, in geographically distributed cooperative settings that will be examined and characterised as “amateur communities”.

1.6.2 Theoretical debates in CSCW

Currently neither HCI nor CSCW have a widely recognized theoretical framework. Besides the “articulation work” perspective mentioned above (also known as “coordination theory”), a number of theories were proposed for use by researchers who work in the two related disciplines.

To better ground the methods used, the theoretical debates that have led (among other things) to their adoption in CSCW will be shortly reviewed.

1.6.2.1 Human actors. Critique of the cognitive approach

Cognitive science has been widely used in HCI in the early years but it has been criticized by papers such as “From human factors to human actors” (Bannon 1991) calling for humans to be seen as active actors rather than collections of cognitive processors in a wider ‘human-machine system’ model, typical for the ergonomics tradition.

1.6.2.2 Being-in-the-world and the language-action perspective

Other criticisms of cognitive science went further to argue against the rationalistic (Cartesian) philosophical tradition at its basis. Instead of the mind-body, subjective-objective rationalistic dualism, Winograd and Flores (1986) proposed a Heideggerian perspective based on the fundamental unity of being-in-the-world. According to that perspective, implicit beliefs cannot all be made explicit, and meaning is fundamentally social. One cannot have a stable representation of the situation (one is “thrown” into the situation). Winograd and Flores are concerned with Artificial Intelligence, which they characterize as “an attempt to build a full account of human cognition into a formal system”, which, in the light of Heideggerian thrownness, can never be completed. In a similar manner, one can reason that accurate ‘human-machine system’ models are impossible to abstract a priori. Another important consequence of the being-in-the-world perspective is that *language is action*: one does not simply state a fact or describe a situation when speaking; one *creates* the situation.

Based on the latter consequence of being-in-the-world, Winograd and Flores propose the language-action perspective as “a new foundation” for IT design. Speech acts have a central role in the language-action perspective, and are at the core of the system they created, “the Coordinator”, designed to support group work, more specifically “conversation for action”. Although the system as such has generally been considered to have failed, the debates that it sparked in the HCI and CSCW research communities made the language-action approach very influential. One of the major debates was generated by the “situated action” perspective.

1.6.2.3 Situated action and the criticism of formalisms

The situated action perspective (Suchman 1987) came as another major criticism to cognitive modelling of human-machine systems. Suchman argues that human action, although using initial plans, is profoundly situated, hence it is impossible to devise a complete model for user action when designing an interactive system. If a system assumes a certain plan for the user action, that system will stop responding appropriately when the user stops acting according to the initial plan. This results in human-machine communication breakdown, and the user gets to see “false alarms” or is taken through long “garden paths” which make it hard for the user to understand the point where the breakdown has occurred. As different from assumptions made by the cognitive approach, plans are inherently vague and are more of a resource for further action than a precise description of the action taken.

Suchman’s work marks a milestone beyond which entire classes of CSCW systems based on modelling of human activity started being criticised for not taking into account the situated character of the activities they attempt to support. Examples include workflow systems, based on abstract process models, generic ‘plans’ of organisational activity flow (studied by e.g. Bowers, Button and Sharrock, 1995), organisational memory systems, based on storage of organisational knowledge (discussed by Bannon and Kuuti 1996, Hughes et al. 1996).

Interestingly, the language-action perspective proposed by Winograd and Flores for modelling communication can be interpreted (and has been expressed by the authors, op. cit., page 75) as a simple workflow based on “universal distinctions such as requesting and promising” (Flores et al. 1988 cited by Suchman, 1994). This sparked a well-known debate between

Suchman and Winograd in the international CSCW journal (Suchman 1994, Winograd 1994).

Suchman draws on Winner (1986) who argues that the artefacts like bridges can have politics by e.g. not allowing busses (the transportation mean of the poor) to pass under them, therefore making sure the poor (and, among them, the African-Americans) will not reach a certain area. In a similar manner, Suchman's argues that the system of categories in the language-action perspective "has politics" in that it is an expression of a 'hidden political agenda', due to being imposed for reasons of "discipline and control" to the members of the organisation.

1.6.2.4 Ethnomethodologists' critique of theoretical zeal. Technology in working order. Ethnography in CSCW

There was a further point in Suchman's criticism of Winograd's position. That position is described by Suchman as a claim that "theory-driven design will produce coherent systems and practices" (page 186). Suchman emphasizes the opinion that CSCW design should not depart from theory (speech act theory in the case at hand) but from the contextual details of the supported work (see e.g. Bowers, Button and Sharrock, 1995 page 52).

Attention to work detail as preferred to "theoretical zeal" has also been emphasized by Button (1993) when observing that sociologists who advocate the 'social construction of technology' (including actor-network theorists such as Latour, Callon, Woolgar, Law, and including Woolgar's interpretation of the above-mentioned Winner) are often preoccupied by their theoretical arguments on sociological issues like gender, economics and actor-networks, while the technology whose construction they describe is "vanishing in misconceived problems of sociological description". Social constructionists, Button argues, do not account for the *use* of technology but for the *context* in which technology is used, i.e. they are not really interested in technology, but in sociological theory. Similar with Suchman, Button argues for an account of *technology in* the production of *working order*, drawing from ethnomethodology (Garfinkel 1967), the branch of sociology focused on accounting for the production of social order in everyday situations, which are all considered to be unique.

Such an approach to technology in working order, and other, similar lines of thought focusing on work situatedness and contextual detail resulted in a large corpus of CSCW ethnographies (ethnomethodological and otherwise). Accounting for the working order of various settings (e.g. the International Monetary Fund, Harper 1997), studying CSCW technologies introduced in work settings (e.g. Orlikowski 1992), or socio-technical evolutions in settings (O'Day et al. 1996) were all major themes of such empirical approaches. More discussion of ethnography will follow in the Methods section below.

1.7 Methods

Research described here used a combination of ethnography and participatory design. Ethnographically-inspired study of amateur work and technology is employed to learn about the ways in which amateurs in general and volunteer students in particular do work, devise IT tools to support their work and put these tools to use. Participatory design was then used to devise new tools together with the students.

1.7.1 Ethnography

The two field studies described in this thesis were conducted used an ethnographically-inspired approach to study voluntary work and technology. Non-employed work is still little understood in CSCW. There is, to date, no CSCW account of amateur work as introduced here. To gain more understanding of its nature, incentives, relations with technology and other features, more detail needs to be added to the existing CSCW corpus of work study.

1.7.1.1 Work

To justify our interest in what was termed as "amateur work", a discussion of the "work" term is needed. What exactly constitutes work has been hard to define within sociology. Grint (1991) comments on work as follows:

> Work tends to be an activity that transforms nature and is usually undertaken in social situations, but exactly what counts as work is dependent on the specific social circumstances under which such activities are undertaken and, critically, how these circumstances and activities are interpreted by those involved.
>
> (Grint 1991, page 7)

There are thus many kinds of work and one cannot define work in general, without considering a certain social setting. Finding out about work is an empirical task. What constitutes work *for the members*[5] *of the setting* under study is then the approach to understanding work that Grint proposes, and ethnographic orientation concurs.

1.7.1.2 Ethnographic orientation

Without claiming to be as strict and detailed about accounting for social order as ethnomethodological ethnography, the ethnographic orientation used here and in other CSCW field studies draws from the following guiding principles:

- Prolonged observation of the *naturally-occurring* setting, and/or
- Participant observation in the setting
- Focus on the details of work, social interaction and organisational (or community) life
- Characterize work, social interaction and organisational life in the terms in which members themselves use and understand ("member categories")

In attempting to account for the working order of the setting by using the member categories, ethnography is resisting premature theorising. This theoretical scepticism will be exemplified later on in the works of Suchman and Button. Taking an ethnographic orientation implies to understand *how* work is done and related to technology, not only *what* is being accomplished.

Given the situation of little study of amateur work in both CSCW and sociology, approaching amateur work with an ethnographic orientation, like in the research reported here, is suitable due to the attention paid by ethnographic methods to the work detail, *in situ* and *in vivo*.

1.7.1.3 Social study of amateur work and technology

As we will see, terms like "work", "workshop", "working group" are ubiquitous in the member language of the settings studied. For them, their activity constitutes work, which we will refer to as amateur work. There will be a special focus on 'technology in amateur work order': in every amateur

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[5] By the word "member" we will denote both "setting member", usual in ethnographic discourse, and "community member"

setting studied, the technology used will be considered in detail. Besides the inherent importance of technology as aid to work, further reason and perspective for studying technology is given by the assumption that, in order to understand how to do good design for amateur settings, we must learn more on how such settings *design for themselves* (even if they might not consciously and specifically refer to the act of shaping technology as ‘design’).

It is intuitively clear that without a wage incentive, bad design will be sanctioned by volunteers. In that sense, examination of a historical account of how designs of IT and other artefacts have evolved in the context of the work that we learn about with an ethnographic orientation, can give a valuable insight for further design for amateur settings. As such, a number of technologies will be considered with a historical, ‘evolutionary’ perspective in the settings studied, in order to understand the rationale that lead to their design. Each ethnographically oriented account presented here will have two parts:

- The usual (in CSCW) account of working order.
- A second account, focused on illustrative historical evolutions of certain artefacts from the setting.

1.7.1.4 Debates on Ethnography in CSCW

In ‘scientific method’ terms, ethnography can appear as a puzzling method at first. Issues like the (often) lack of theoretical modelling of the studied site, internal and external validity, repeatability of inquiry, lack of possibility to assess the quality of the data using statistical analysis all make a ‘traditional’ scientist find it hard to understand just how an ethnographic study can be of use to any research discipline. Kuhn (1962) would probably argue that the traditional scientist ‘lives in a different paradigm’ than the ethnographer.

However, it is easy to foresee the difficulties in ‘constraining’ a social setting in order to carry out a traditional, repeatable ‘controlled experiment’, with strict control over independent variables and experimental treatment, and reliable measuring of dependent variables. Since CSCW mostly asks questions involving groups (which are hard not to be regarded as situated social settings in the sense suggested by Suchman, 1987), the field is likely to run often into this problem, hence it is difficult to ignore ethnography as a methodological option.

Nevertheless, the practical issue of how to go from ethnographic detail to design recommendation remains (see e.g. Hughes et al. 1994). Plowman, Rogers and Ramage (1995) ask this question directly in their title: “What are workplace studies for?”. They contend that “fieldworkers are only too aware that their practical offerings are meagre and commonsensical comparing with their rich and poetic accounts of the workplace”. They exemplify classical workplace studies such as the one reported by Heath and Luff (1992) that CSCW has learned important lessons from (i.e. peripheral awareness) but the particular design implications made by the paper were all but forgotten.

The agreement by Plowman et al. that “workplace studies carried out primarily to understand a particular working practice are making a valuable contribution to the body of CSCW knowledge in their own right” is encouraging for our quest to account for amateur working practice. They show that many ethnographic studies count as ‘basic research’ for CSCW (e.g. the classical Suchman, 1987 which, as expected by Hughes et al. 1991, impacted both CSCW and the contributing discipline of sociology), “*informing* CSCW design through raising awareness of important conceptual issues and questioning taken-for-granted assumptions about work activities and how they should be supported”.

The ‘Lancaster CSCW group’ have been involved in long-term ethnographic workplace studies accompanied by design. Hughes et al. (1994) present several practical problems with ethnography in system design. The attention to detail is hard to *scale* beyond a small group, to organisational level. The *long time* taken to acquire understanding of working order makes ethnography hardly applicable in today’s software engineering practices and project pace. Finally, the *role* of the ethnographer in a more commercial setting is problematic since ethnography is committed not to disrupt the setting while much of the motivation of IT is to reorganise work.

Related to ‘IT as reorganisation of work’, Grudin and Grinter (1995) saw the debate between Suchman and Winograd as a dialog between a conservative ethnographer and a daring designer. They contend that, due to their grounding in the current practice, both ethnography and participatory design (reviewed below) will tend to come up with conservative design implications (“the ethnographer’s dilemma”, further discussed by Button and Dourish, 1996). As such, Grudin and Grinter claim, revolutionary designs, with a large impact are not likely to be results of such methods (but see Whittaker, Terveen and Nardi 2000, for a criticism of the majority of HCI publications proposing inventions instead of building on prior work).

However, ethnography and participatory design are widely viewed as an integrated work-oriented approach used to acquire a detailed understanding of the work order in the setting (ethnography), and then to do design for the setting in close cooperation with its members (participatory design).

1.7.2 Participatory design

Participatory design (PD), also called “work-oriented”[6], “participative” or “cooperative” design is a set of theories, techniques and practitioner accounts that have as their central theme the involvement of software users as full participants in the process of software design and throughout the software lifecycle (Greenbaum and Kyng 1991, Muller and Kuhn 1993, Muller, Hallewell Haslwanter, and Dayton, 1997, Muller 2001). PD originated in Scandinavia in the context of strong trade unions, with a main focus on workplace democracy and workers’ power to influence decisions on their work and workplace, in well-known experiments such as DEMOS and UTOPIA. Although many interpretations of PD focus mainly on the improvements in software quality given by user participation in design, and on techniques of involving the users (economic and managerial aspects of PD), the aspects of workplace democracy and worker empowerment (political motivation) are still of importance in most PD work.

1.7.2.1 Theoretical base according to Ehn

Drawing on many years of practice in the early Scandinavian PD experiments Ehn (1988) lays out a theoretical foundations of PD. In the perspective developed by Ehn, work-oriented design shares the criticism of the rationalistic tradition, and most of the philosophical foundation with the language-action perspective and situated action. The foundation includes Heidegger’s being-in-the-world and ‘language games’ from the late Wittgenstein.

[6] Using “work-oriented” will allow us to paraphrase “amateur-work-oriented” to emphasize the differences between voluntary and waged work and its implications in understanding theoretical foundations of cooperative design

For Ehn, design is “the dialectics of tradition and transcendence”, a definition that encompasses a careful balance between the existing and the new. Heideggerian being-in-the-world and throwness (discussed shortly in 1.6.2.2) provide a perspective on the individual use of artefacts, while the social context of design and use is seen through a Marxist notion of “dialectical emancipatory practice”. While the Heideggerian approach provides a perspective on the local artefact use and the Marxist approach brings a perspective on the more global-social context, communication and interaction in the design process is understood with Wittgensteinian language-game glasses. For design to be effective, the designers and the users must build and share a common ‘language game’ (and indeed, a “form of life”), developed in design-by-doing. Design has a language game of its own but that should have enough *family resemblance* with the language-game in which the design is intervening.

As a common point of the three foundational perspectives, Ehn notes great similarities to the understanding of acquisition of skill (related to Wittgensteinian understanding of ‘tacit knowledge’ and ‘creativity’). Based on these foundations, Ehn discusses design as both art and science (echoed by e.g. Winograd 1996), design throughout the software development cycles (not just an initial phase of ‘specification’) and in use, “the tool perspective” on the computer artefact (emphasizing the skilled worker as being in control of the tool, as opposed to the new artefact leading to de-skilling) and the “collective resource approach” that assigns trade unions a specific role in design.

1.7.2.2 PD and voluntary work

Having reviewed the foundations of participatory design and its political agenda, we can reflect on its suitability for design for voluntary work, based on immediately apparent features of such work, most importantly on the absence of a wage incentive. There are two contradictory kinds of reasoning we can make at this point (in advance of field study, and without participatory design practice).

First, a wage incentive (or actually fear of losing that job and wage) can sometimes be the only motivation of a user to keep using a system although she or he does not like its features. The risk of such a system being rejected in the context of voluntary work is thus intuitively higher. This makes PD a preferred choice for design in a voluntary setting: the design is done together with users, paying careful attention to the working order as it was achieved by members.

Second, the wage incentive is structurally connected to the employer-employee tension resulting in class struggle, an essential concept of Marxism, and the source of conflict as an essential of participatory design (see Bødker 1996 for a discussion of conflict). Absence of class struggle can be regarded as reducing the fundamental Marxist tension between tradition and transcendence. However, many PD instances do not strongly connect PD to a political agenda in general and to issues of class struggle in special.

1.8 Related work

1.8.1 HCI/CSCW and 'community'

The interests of CSCW in various understandings of 'community' mark a shift of the understandings of 'cooperation' and 'work' in CSCW as a research field. Whereas the early years of CSCW focused largely on cooperation at the 'workplace', which was usually understood as 'group in industrial organization' or 'group in research laboratory' (often the one of the researcher), since the mid-1990s CSCW conferences (e.g. 1996) included workshops on cooperation in CMC systems like MUDs, and "the explosion of participation in the Internet" (Mynatt et al. 1999) was indicated as an argument for paying more attention to what goes on outside the 'nine-to-five' understanding of work and cooperation. This interest in HCI/CSCW fields concretised in two directions known as 'community network' and 'network community'. These directions will be reviewed below, along with other alternatives that emerged.

CSCW sometimes uses the term 'non-work' to denote 'cooperation outside the workplace' (e.g. Muramatsu and Ackerman 1998). Many such 'non-work' studies have been at pains emphasizing that their informants 'do work' (e.g. Mynatt et al. 1999 pp. 222). With its interest in voluntary work, this thesis will concur with these efforts of 'promoting' non-employed work in CSCW. Its approach to work was described in the Methods section.

1.8.1.1 Community networks

Doug Schuler is among the initiators of the "community network" movement (Schuler 1994, 1996), started from the alarming signs of decrease in social interaction and participation in American society (Putnam 1993). Networks built for inhabitants of certain geographical areas, mostly using Internet infrastructure, are seen as a “participatory” medium, as different from media that are less open to participation by society members (radio, TV, print). This medium is used to foster conviviality and culture, education, democracy, health, economic equity, opportunity and sustainability, information and communication in the respective geographical area. The network is thus an alternative to the “great good (public) place” (Oldenberg 1991), less and less apparent in the American life.

The software at the basis of community networks is referred to as “public software” and later, in the dedicated CSCW conference workshops and tutorials (Schuler 1998), as “public CSCW”. The researcher is both a designer and a social activist, and many research considerations are followed by agenda for action. Participatory Design (reviewed in the Methods section) and techniques of strong user participation are recommended for the design of the public software.

Experiences along the lines of community networks are described by Carroll, Rosson and their colleagues (1995, 1996, 2000). They are specifically looking at how participatory design was applied in one of their community projects (2000), discussing the learning process and evolution of the participants through various roles in design. Evaluation of community software is also on their agenda (Carroll and Rosson 2001).

1.8.1.2 Network communities

Mynatt and her colleagues (1997, 1998, 1999) propose the term “network community” to denote “robust and persistent communities based on a sense of locality that spans both the virtual and the physical worlds of their users”. The concept is suggested for HCI and CSCW research as a contribution in studying collaboration. ‘Network community’ is derived as an abstract notion from the study of media spaces (multimedia environments connecting geographically dispersed spaces, see e.g. Gaver 1992) and MUDs. The notion is thus an archetype, denoting an ethnographically-acquired understanding of what media spaces and MUDs are “an instance of” (Mynatt et al. 1997).

Network communities are technologically-mediated, and techno-social constructs. Among their “affordances” are: persistence, periodicity, boundaries, engagement, and authoring. The questions studied by Mynatt et al. are related to the physical-virtual boundary negotiations, support for social rhythms, the emergence and development of community. They draw design implications for network communities based on their experiences with several such settings.

O'Day and her colleagues (1996, 1998) augment the network community discussion by their description of participatory design experiences in a school-oriented MUD where "distinctions between users, developers and designers are blurred". They analyse the social-technical design circle given by their design experience and emphasize four aspects of the social-technical interdependence: relying on a social practice to simplify technical implementation, designing technical mechanisms to achieve a social objective, similar tools with different social effects, co-evolutions of social and technical mechanisms. They conclude that designers should not attempt local optimisations, but "balance" the whole socio-technical system.

Like many other authors (e.g. Kollock 1996, Andrews 2002, Goodwin 1994) some Network Community proponents are oriented towards designing online communities (e.g. Mynatt et al. 1998 view Network Community as "a goal for design"), rather than studying activity within and designing for existing communities, as in this thesis and in e.g. O'Day et al. (1996).

1.8.1.3 Community visualisation, awareness and navigation

Erickson (1997) observes that "virtual community" has been applied to a large variety of systems: synchronous chat systems (IRC) asynchronous conferencing systems, usenet news, MUDs and MOOs, etc. He argues that the framework of community offers little guidance to the interested researchers. Instead, he proposes "genre", a notion that is not so much focused on the nature and degree of relationship among community members, but on the purpose of communication, its regularities of form and substance, and the institutional, social and technological forces underlying these regularities.

As an application of this concept, Erickson and colleagues (e.g. 2002) present a tool based on "Social translucence", which makes "collective activity visible". Other tools for visualising presence and supporting navigation in large online communities are presented by Donath (2002) and Smith (2002).

1.8.2 CMC and communities

Although most the questions addressed by research on Computer Mediated Communication in various disciplines are not directly related to the objectives stated here, it is important to mention research of CMC systems conducted within various disciplines for reasons of historical precedent in areas such as “online communication” and “virtual community”. Hiltz and Turroff (1978) were CMC experts long before CMC gained wide prominence, and could foresee its future spreading in *The Network Nation*. While they later writings (1993) characterized their early predictions as over-optimistic, their work can be read as suggesting the emergence of yet another set of ‘spanning technologies’ that would enable daily community life.

Rheingold (1993) provides a widely-cited participant observer account of life in the CMC-based community called “WELL”, suggesting, for the first time, a community based almost exclusively on CMC; “the virtual community”. Rheingold reviews successful CMC systems, along with the military research, grassroots movements and other historical accidents that lead to milestone CMC developments such as computer conferencing (technical infrastructure of the WELL), usenet (known today as “news”), Arpanet (the precursor of Internet), BBS (bulletin board system), IRC (Internet relay chat), MUD (multi-user dungeons, see also e.g. Curtis 1992), and even the French Minitel, which provided widely-used Internet-like services like chat over France Telecom phone lines well ahead of the Internet gaining prominence.

Among the CMC systems mentioned, MUDs attracted a large part of research. Taking MUDs out of their original gaming realm and transforming them into learning places and otherwise putting them to use in real-world activities (Bruckman 1998, O’Day et al. 1998) are efforts worth mentioning in our voluntary-work-oriented context.

1.8.2.1 Motivations for voluntary contribution

From the early reports on virtual communities such as Rheingold’s, the question on why do their participants contribute to the ‘common’ good of the community were raised. Similar questions will be addressed here, so a more detailed review is in order.

In his parallel between the virtual and the traditional rural community, Rheingold (1993) talks about “barn raising” when referring to collective action taken by the members of communities such as buying a new server for the WELL (page 27). He also wonders what makes the members contribute to such activities, and what makes them contribute responses to everyday requests for information, which, suggesting an answer, he calls “horse trading” in a “social contract” based on reciprocity: if one member contributes good answers or posts interesting information, an eventual question asked by the member will be replied with similar quality. Rheingold thus views voluntary online cooperation as a “gift economy”, where the reciprocity characteristic for any market takes a form of building something “between” members, rather than a calculated “quid pro quo” (page 59).

Kollock (1999) takes Rheingold’s thoughts further. Kollock starts by wondering why e.g. professionals contribute ideas in online conferences with peers when they could charge high fees for such contributions on the consulting market. Kollock works against the framework of “social dilemmas” illustrated e.g. by cooperation theories like Axelrod’s (1984). The dilemma comes from possibility that “free riders” or “lurkers” use the contributions of others without ever contributing themselves. The social dilemma comes from the fact that if everyone tends to free ride, there are no more contributions, and no more community.

In what Kollock calls “the economies of online cooperation” he uses the term “public good” to denote what is built “between” the community members. He argues that the costs of producing public goods are lower in digital media due to sending being quasi-free, while the benefits are higher due to having a large number of recipients, thus “digital goods” are a privileged sort of public goods. Kollock later illustrates such a digital good with the example of the “impossible public good”: the Linux operating system, which today rivals commercial products. Linux is developed and distributed for free by a community of programmers since 1991. Kollock exemplifies the temptations to free-ride by using Linux without contributing to it.

When it comes to motivations to contribute to the public good, Kollock enumerates several motivation components: (i) the likelihood of meeting in the future (drawing from Axelrod’s theory of cooperation) resulting from well-defined community boundaries (drawing from Ostrom, 1990), (ii) the effect that a good contribution has on personal reputation, (iii) a sense of efficacy, of positively affecting one’s environment (drawing from Bandura 1995) (iv) that the group or another person has a need for the contribution, i.e. altruism of the contributor, which is thought to be very rare (Kollock gives an example from Rheingold where programmers contribute software to the WELL after the need for the software was discussed) and (v) the attachment that the member has towards the group ("individual and collective outcomes are merged and there is no social dilemma"). He emphasizes his belief that literal altruists are extremely rare cases, hence his whole list of voluntary motivation components can be read as an alternative to an altruism-based explanation. In related research, this time focused on usenet cooperation, also framed by "prisoner dilemma" and "tragedy of the commons" theories, Kollock and Smith (1996) conclude that it is "amazing" that the Usenet works at all.

Conclusions drawn by Smith and Kollock are discussed by Nonnecke and Preece (2000) after a demographic study of lurkers in email distribution lists. One of their conclusions is that in high-membership mailing lists, abstaining from contribution (posting) is a matter of sparing resources (e.g. the time and attention of the readers). They assert that "a resource-constrained model (like the model used by Smith and Kollock) may not apply to online groups".

1.8.2.2 Other research questions related to electronic communities

A large part of the CMC research is only tangentially related to the communities based on voluntary work that this thesis will be focused on. This is mostly due to a predominant interest in "immersion" into a "cyberspace-like" system based on a "consensual hallucination" (Gibson 1984) that takes participants away from the real world, into a virtual world where game-playing and experimentation with alternate identities are the norm. While such issues may present novel questions to psychology and sociology, this thesis is interested in voluntary work taking place in the real world, and the support that IT systems including CMC can provide for it.

CMC systems captured the attention of psychologists (like Rheingold himself) and sociologists. Perhaps the best-known psychological investigations of online behaviour are the works of Turkle (1984, 1995). The issue of "alternate identities" (see also Rheingold 1993, chapter 5) is among the favourite questions of CMC-interested psychologists. While defining and maintaining more identities, some CMC users are deceiving others about their real identity including e.g. their real gender. Also important, and related, is the amount of time spent by the CMC enthusiasts in interacting with others over CMC systems, leading to a "digital life", also referred to as "boundary crossing behaviour".

Issues of on-line ethnic and gender “identity and deception” are also addressed by the sociological studies of CMC, of which representative examples can be found in the collection by Smith and Kollock (1999). Other questions addressed are power (social order and control), social structure and dynamics, and collective action took by members of computer-mediated communities.

Chapter 2
A Field Study of Amateur Radio work

2.1 Introduction

Chapter 1 has established our interest in *socio-technical* aspects of *geographically distributed* communities based on *voluntary* association and voluntary work. Researchers of related aspects examine the intertwining of social and technical sides of the community (O'Day et al. 1996), chart archetypical features of online communities and make recommendations for IT design (Mynatt et al. 1997, Mynatt et al. 1998, Mynatt et al. 1999), study how online communities are managed (Muramatsu and Ackerman, 1997) or make recommendations on how online communities could be better managed (Pargman 2000).

This chapter will introduce Amateur Radio, a worldwide community using radio for their communication, and having radio as their main interest. Few studies of Amateur Radio operators (Hams) could be found, in different fields such as the history of communication (Douglas 1987), or linguistics (e.g. Gibbon 1981, 1985). Along with Ham-specific technological discussions, a number of historical retrospectives could be found in magazines and websites published by the community itself.

The main concern of this chapter is *community endurance*, the aspects that enable the community to thrive over a long period. Ultimately, endurance is an important component of the community "success". This area has not been directly addressed in the CSCW and CMC literature, but there exists a fair amount of related work. Mynatt et al. (1998) suggest that a network community should offer a "range" of possibilities for its members to address during their membership. They also suggest the importance of considering both the "real" and the "virtual" sides of a community in assessing and designing for community endurance. Their suggestions are based on experiences with MUDs and Media Spaces, which they bind together under the archetype they call "network community".

However, such cookbooks of design implications cannot guarantee that a community will thrive. The member motivation to participate in a community and to contribute to its 'public good' is important for community endurance. In their studies of the usenet, Kollock and Smith (1996, Kollock 1999) have been concerned with the pragmatic advantages one derives from being member in a community, and used sociological (Ostrom 1990) and mathematical (Axelrod 1984) theories of cooperation while investigating this question. Along the same lines, Rheingold (1993) sees the cooperation in the WELL virtual community as a “gift economy” (page 56).

More recently, Carroll and Rosson (2001) ask for more numerous and detailed evaluations of community networks, since existing evaluations (e.g. Kraut et al. 1996) do not show an increased socialisation and strong ties among their subscribers, thus the virtual community endurance is likely to be low. This comes in contradiction with suggestions made by classical virtual community literature (e.g. Rheingold 1993), considered “anecdotal” by Carroll and Rosson (page 374). In other words, although the community network gets ‘wired’, there is a risk that nothing much will happen apart from “better home shopping” as their title implies. If communities that share a physical location (community networks) are found inefficient on methodical evaluation, one could reason that geographically distributed communities are even more at risk.

How are we to go about studying community endurance? One can do that without assuming community “success” through an ideal proposed by a theory, be it mathematical or sociological, or by a democratic “participation” principle. Instead, one could follow the members of a well-established, globally distributed community and the practices they engage in, and see what, for them, constitutes appropriate participation, appropriate contribution, suitable help from technology and ultimately community endurance and success. This chapter will describe such a study, carried out in the Amateur Radio community. Although they are not a computer-mediated community, the interest in studying them is fuelled by many features that are relevant for our community endurance concern, as well as for other concerns specific to this thesis.

One immediately apparent feature of the Ham radio is its interest for communication, long before the Internet age. Studying how such communication and social interaction take place in this specific community, on its specific medium –radio- can help us better understand technology-mediated community activity. The geographical distribution of the amateur radio community is world-wide, again, long before the Internet has facilitated the formation of other globally-spread communities. The field study attempts to learn more on how such distribution is managed by the community. The first amateur radio enthusiasts started to transmit and tune in to radio waves almost a hundred years ago. Since then, the community has grown and continued its activity despite legal changes in administering the radio wave spectrum, or the exponential growth of the Internet. The field study seeks to understand the ingredients of such a remarkable endurance, that many net communities would aspire to. Amateur radio is hence taken here as a *perspicuous instance* of a well-established, long-lived geographically distributed, technology-centred and technology-mediated amateur community.

This chapter is organised as follows. First the methods and the field setting are introduced and discussed. Since talk is of central importance in the community, we will examine in detail a radio connection. After that, an interim discussion will be made on how the nature of the radio medium affects communication and cooperation. One of the results of this analysis is that we cannot treat the radio medium in isolation, indeed a skilful combination of media is used by the members to accomplish their goals. The member goals and motivations are addressed in detail in the next section, that looks at different forms of amateur radio work. The basic view of community endurance develops, based on the observation that members prefer, in various ways, to 'live on the edge' in radio-related matters, i.e. to explore the possibility of realising radio connections in conditions that are not totally favourable. To get inspiration for design in such settings, these results are then used to examine the rationale of specific tools and technologies developed by radio amateurs in their activity. The chapter ends with a round-up discussion that considers the basic features identified as relevant for community endurance and amateur work, which will be developed in subsequent chapters.

2.2 Method and Setting

The fieldwork reported in this chapter was conducted over the period from 1996 until 2001. During this time, extended periods of contact (e.g. up to 2 months at a time) have been spent in the company of radio amateurs. Observation has included sitting in on local radio club meetings, open-ended interviews with 12 radio amateurs, listening in, as well as being around when live radio contact is made (over 150 hours). The research has involved study in Romania and Sweden, alongside reading background technical literature and amassing a corpus of related documents (e.g. local, national and international regulations and specifications of best practice, copies of magazines, radio connection confirmation cards, radio station logs). Recordings of radio-talk, and transcriptions, have been made. In addition, the author attended a course for new radio amateurs seeking an elementary licence. Throughout, permission and consent have been obtained from all participants. The study did not include “Citizen Band” (CB) radio, which has more relaxed transmission rules and requires no official license, as more dedicated amateur operators were thought to exist within ‘mainstream’ Ham.

Access to sites in both Romania and Sweden brought the opportunity of a comparison; it was expected for example for radio operators in Sweden to posses more advanced equipment. As it will be seen, radio connections to many other parts of the world were encountered during the study, without finding major difference between these areas in regard to the focus of the study. However, like in most ethnographies, claims for ‘external validity’ cannot be made.

All the operators followed happened to be male, which is (unfortunately) representative for the amateur radio population. Female trainees were encountered at radio clubs though.

2.3 Talk on the radio

2.3.1 Introduction to the community. Rules and codes

Radio amateurs (Hams) share a passion for communication and for the means to achieve it over the radio waves. They communicate on globally reserved radio frequency ranges. Specific national bodies maintain codes of rules and regulations in accordance to which radio amateurs can be awarded a succession of operating licenses of several classes, gaining the right to emit on an increasing number of frequency ranges. As distinct from transmission, international regulations stipulate that radio reception is free for everybody, on any frequency.

The radio amateur movement started at the beginning of the 20th century with regional “radio networks”, which turned into well-known “calling frequencies” when communication could get a global dimension. Radio transmitter-receiver equipment (called “transceiver” by Hams) used to be shared in “radio clubs”. More recently, technology advancements have made it possible to produce transceivers owned by a single person, and to build transceivers at home. Nevertheless, most radio amateurs are part of a radio club, which in turn form the amateur radio "federation" in the respective country. This formal organisation also has a communication role, as it will be seen later on.

Talk on the radio is organised around 'connections', listening out for the opportunity, making them and maintaining them. In this subsection, we will use an example connection to illustrate some specifics of Ham radio communication. For an easier understanding of the transcripts, a short introduction of amateur radio call signs and codes is in order. More explanations will be made later on while commenting upon the transcripts.

Every radio amateur is officially registered with a unique call sign (can be referred to as just "call"). The call sign is usually made of a group of letters indicating the country, a digit indicating the region, and a further group of letters uniquely identifying the operator in the region. For example, YO3GHI[7] stands for an operator in the Bucharest region (3) of Romania (YO). When registering, operators also indicate a nickname by which they wish to be addressed.

The call sign system is one of many amateur radio code systems. Such codes are useful in Morse telegraphy (referred to by Hams as CW), still widely used in Ham communication, where it is essential for messages to be short. The codes 'permeated' to radio amateur voice communication (which they call "telephony"). In telephony, codes (and sometimes names) may be pronounced using the phonetic alphabet (alpha for A, bravo for B, charlie for C, etc)[8], which is useful if the transmission or reception conditions are poor,

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[7] Throughout this account, the first part of every call sign (denoting country and region) has been preserved, while the second part has been changed for anonymity reasons, and replaced by three alphabetically consecutive letters. Operator nicknames mentioned here are fictional as well, and start with the same letter as the fictional part of the nickname (e.g. Andy for YO3ABC).

[8] In our radio transcripts, letters not pronounced in the phonetic alphabet are shown in capitals. For example, in most local connections YO was pronounced in the Romanian equivalents of "why oh" rather than using the phonetic alphabet ("yankee oscar"). As a country code, YO is not pronounced in the phonetic alphabet and is sometimes omitted because it is obvious in a connection between two operators in the country.

but it is frequently used in better conditions as well, due to routine, as well as for training purposes.

2.3.2 Opening a connection. Appropriate and inappropriate intervention

The following connection has been recorded while listening to the radio traffic together with operator Andy (call sign YO3ABC). The connection is mediated by a radio “repeater” which is a Ham-built radio automaton that amplifies and re-transmits all the traffic that it receives. This connection is short-distance. Such local radio communication usually takes place on Very High Frequency (VHF). VHF is also called 2m (two meters) by the radio amateurs, due to its specific wavelength (which determines the aerial sizes). It requires low emission power (thus cheap equipment) and works reliably for local traffic in most weather conditions, even more so when a repeater is available.

```
1.  Andy: YO five bravo charlie delta YO five bravo
     charlie delta de YO three alpha bravo charlie
     mobile
(12)[9]
2.  Colin: YO three alpha bravo charlie mobile YO
     five charlie delta echo mobile
3.  Andy: YO five charlie delta echo mobile de YO
     three alpha bravo charlie mobile. here is
     operator Andy and my QTH at the moment, stable
     for about five years from now on, is in the
     student hostels “Observator”. Microphone to
     You.
4.  Colin: three alpha bravo charlie mobile, YO
     five charlie delta echo mobile. Good evening.
     I am in (a village) in the Maramures
     mountains. Operator Colin. Base QTH is Baiut,
     bravo alpha india uruguay tango, also in the
     Maramures county. YO three alpha bravo charlie
     mobile, YO five CDE mobile
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[9](12) denotes a 12 second pause.

Let us interrupt the unfolding record of the traffic to give more detail about what is going on in the connection. In the turn no. 1 Andy is looking for the operator with the call sign YO5BCD. The called party's call sign is then followed by the word "de" (meaning "is addressed to by" and omitted by operators most of the time) then the call sign of the caller (Andy's call sign, YO3ABC followed by the indication that he uses a *mobile* transceiver). This form of calling (YO5BCD de YO3ABC) is required by the amateur radio rules. The formal code of rules also recommends that every turn should begin and end with the pair of call signs arranged in the order callee-caller.

After waiting 12 seconds, another operator than the one called (YO5CDE, Colin) responds to the call (turn 2). Colin has left the 12 seconds to pass in order for the called operator (YO5BCD) to have time to respond. This is routine practice when connections are initiated, as well as leaving breaks between the transmissions, for others to intervene during the connection if necessary.

At the end of turn 2 it is clear for all operators who listen to the frequency that a radio connection is established between Andy and Colin, and this will make the other operators refrain from intervening on the frequency unless there is an emergency. Transmitting at the same time with an operator who is already engaged in a connection will result in radio interference (known by Hams as "QRM"), so little or nothing meaningful will be heard by any of the 'present' operators. Such an act is a breach of the rules and will be severely sanctioned with expressions such as "bumping over [somebody] on the frequency". Sometimes this act may be due to a badly tuned transmitter, but that technological incompetence will be regarded with equal irritation.

To avoid disruption due to interference, operators may decide to switch to another frequency in order to gain 'more space' for their communication. Nevertheless, there exist a small number of "call frequencies", i.e. entry points in a frequency domain, and devices like the VHF repeater only support one frequency.

Turn 2 leads us to observe the opportunistic nature of the initiation of many amateur radio connections. Colin responds to Andy although he was not called. Beginning later connections in the frequency was somewhat 'incremental': Colin was called by another operator, David, who later was called by Ed, etc. Later on Colin called Ed and Andy called David. Therefore Andy's call for YO5BCD (who turned out not to be present) has seeded an entire sequence of further communication on the repeater. It turned out that many other operators were listening, but they did not know of each other's presence.

Careful listening to the traffic before intervening is thus indispensable. "Pressing the emission button" attached to the microphone of each transceiver is an act that needs to be regarded with responsibility, because, if other operators are present (and again, you can never know about all who are present) it 'consumes' from an important resource of the group of operators, the radio frequency. Informants described pressing the emission button for the first time as something they will never forget. One informant remembers his forehead sweating in the memorable, emotional moment.

2.3.3 Call sign particulars, nickname and location

Let us go on commenting upon our connection. In turn 3, Andy reveals his nickname and his location (called QTH in Ham radio). In longer-distance traffic, the QTH is indicated using a formal notation that divides the globe in several "locators", but Andy indicates it colloquially, assuming that his communication peer is living in the same city (since he is connected to this repeater). Andy details on his location stating that it is temporary, explaining that his different call sign prefix (YO3) than the usual one in the region (YO5) because he came to do his university studies in the region. Besides being an explanation, this also has a promotion value. 'Off the air', he remarks to the researcher (during the break between turns 3 and 4):

> `I'm GHI, here in Cluj there's only one (person) from Bucharest with YO3 who works around here`

His call sign enables Andy to 'stand out', thus be better known in the local community. By the word "works", Andy means 'makes radio connections'. The verb "to work" is often used by radio amateurs in both English and Romanian, and most probably in other languages, to describe their activity in radio traffic. "Working with" someone, means 'making a connection with' that operator. Gibbon (1981, 1985) makes a detailed commentary on the amateur radio language and idiomaticity though his interests are different from our community endurance concerns.

The "QTH" code that Andy used for 'location' is part of the "Q code" used by radio amateurs, always pronounced without using the phonetic alphabet.

In telegraphy QTH means ‘my location is’ or ‘what is your location’ if transmitted as a question. Another element of the Q code that is used frequently in this chapter is “QSO”, which denotes a two-way radio connection such as the one that is just being described. Its ancestor in telegraphy actually means, “Can you communicate directly?” The expression “eyeballs QSO” means ‘face-to-face meeting’!

While passing the microphone to Colin at the end of exchange 3, Andy, who is a younger operator, uses a plural form of “you” available in Romanian, to express respect towards his peer, who is most probably more experienced. In exchange 4, Colin tells his nickname and indicates that he is not located in his officially registered QTH, which he refers to as “base QTH”. As that is not a well-known place, Colin spells its name (“bravo alpha india uruguay tango”=Baiut) and indicates the region.

2.3.4 Equipment description. A radio experiment

5. Andy: YO five CDE de YO three ABC mobile, yes I am happy that I manage to talk to you, I never talked to somebody as far as Maramures, err, I am at my first connection with somebody there. Err I use a RTP with zero six, maximum zero seven Watts with own antenna. Errr, but the zone is very well chosen. Anyway, I don’t think we can hear each other directly
6. Colin: Would you like to try directly? Depends on your antenna, if it is directive
7. Andy: yes, yes, wait a second, I have a Yagi with five elements
8. Colin: on forty-five five hundred
9. Andy: OK, I’ll make three calls there. But I don’t know really if it still works, I’m not sure, I think the cable is broken. Let’s try for fifteen seconds, if not, we get back on the repeater, OK?
10. Colin: yes, OK

In turn 5, Andy expresses his satisfaction about talking for the first time to the remote area where Colin is located, as the distance between the two operators is 200 km, quite long for VHF communication. Andy proceeds to describe his equipment (transceiver and antenna, called “working conditions” by Ham, related to the communication referred to as “work”). He uses a 0.6-0.7 Watt former police radio transceiver that he adapted to work in amateur radio bands. His remark “the zone is very well chosen” refers to his location up on a hill, close to the peak where the repeater is installed, therefore his connection with the repeater is likely to provide high transmission quality, in spite of the low power of Andy’s transceiver.

At the end of turn 5, the two operators start a little experiment. By “hearing each other directly”, Andy refers to a connection that is not mediated by the repeater. If that would work out, it would result in an important achievement for Andy: reaching out at 200 km with a power of less than 1 Watt! This is much more exciting for him than connecting via the repeater because, even if the connection itself is long-distance, the ‘sub-connection’ from Andy to the repeater is short range. Instead, the repeater is far away from Colin, thus the sub-connection is a bit more spectacular for his part, though the longer sessions of listening to the traffic had revealed that Colin was routinely connected to this particular repeater.

It is interesting to note in the turns 6-10 that the two operators do not go through the formal “YO3ABC de YO5CDE” at the beginning and end of each turn. Also (not indicated in the transcript), the pauses that they leave between the turns are shorter. This is partly because the two operators are conscious that their prolonged interaction takes ‘repeater time’ from other operators; therefore they want to get over with it faster. After checking on the necessary equipment in exchanges 6 and 7, the two operators decide to try the direct communication on the well-known VHF call frequency (145500 MHz indicated by Colin in turn 8). The testing strategy is agreed upon in turns 9 and 10, although Andy expresses reservations in turn 9. After connecting his transceiver to the directive antenna, Andy makes the “YO5CDE de YO3ABC” calls on the VHF call frequency but gets no response. He comments:

> I don’t think it works now, ‘cause some drunken blokes found it funny to go up on the roof and they tripped up on my cable.

Such experiments are not uncommon in the amateur radio connections. In a quest for realising exciting connections such as the low-power, long-distance QSO attempted here, operators employ a variety of cues that enable them to understand how exciting a connection would be. The QTH of the peer operator is one such cue, denoting the distance that was achieved. The peer equipment description, especially its power, is another such performance cue. If an operator is only *listening* to an unfolding connection, he gets an understanding of how remarkable a connection can be if he will call one of the talking operators or the other, as well as an understanding of how remarkable is the connection that he or she is just listening to.

2.3.5 Giving “control report”. Talking about the weather

As they went into their experiment, Andy and Colin overlooked customary exchanges of other such ‘performance cues’. To introduce them, we will resort to transcript fragments from other connections. An ideal connection does not only cover a long distance with a low emission power, it should also be clearly and strongly received. The “control report” gives operators a measure of how well their signal is received by their communication peer. Control reports on VHF repeaters range from Q1 (worst) to Q5 (best). It is customary for the operators to comment on the control report, providing further information or justifying the reasons for which the report is not Q5. The Q4 report in the turn below is remarked upon as follows:

```
Brian: Delighted to hear you, errr, Q four, a
   continuous buzz comes whenever the repeater
   there opens, I don’t know what’s the matter,
   until now I didn’t encounter such a thing on
   [this repeater], but, errr, I can’t explain it
```

The verb “to come” in the turn above is yet another Ham-specific idiom, meaning ‘to be received’.

Another important ‘performance cue’ is the weather, especially in longer-distance short wave (SW) radio communication, based on the radio wave’s reflection on the ionosphere. The equipment needed to work in SW is more sophisticated, more expensive and often Ham-specific. The emission license needed for operating in SW is superior and harder to obtain comparing to the one needed to work in VHF. Spectacular world-wide SW connections can be realised in certain atmospheric conditions, occurring at certain times of the day, when the ionosphere layer fulfils specific reflection criteria in a particular direction. In such conditions Ham operators say that “there is good propagation” to a particular geographical area. Many SW connections include details about the weather at both ends.

Arthur [in Stockholm, Sweden]: roger, roger, thank you, thank you very much. Very nice to see you here. How is the weather in England? Here it’s quite nice today. Yesterday was very bad, but today it’s excellent.

Bob [in Wigan, England]: Aaaah, pleasant time, Arthur […] It’s a bright morning, a little bit of cloud in the sky, but a very-very bright sunny morning, I can imagine at the present time, it’s only early yet, I can imagine the temperature, it’s gotta be around maybe six or seven plus, but I think it will improve as the day goes by. It’s looking to be a very very nice day, Arthur, QSO

This is more than idle chatter. The enthusiasm shown by Bob about the “bright morning” with only a “little bit of cloud” is related to the excellent conditions for propagation in such weather. Indeed, such a bright morning might not be appreciated otherwise, at a temperature of only +6-7 Celsius.

2.3.6 Thanking and closing the connection

In Arthur’s turn above, he thanks Bob for a very good control report given earlier, “five by nine” which, in SW denotes best readability (5) and maximum strength (9). Thanking, especially thanking for the connection, is yet another customary feature of radio connections. It also happens during the short re-opening of the repeater-mediated VHF connection between Andy and Colin, after the “direct communication” experiment failed:

11. Colin: YO three alpha bravo charlie mobile YO five charlie delta echo mobile
12. Andy: YO five charlie delta echo mobile YO three ABC mobile. Errr, I didn’t, didn’t hear anything, I guess that nor did You.
13. Colin: No I didn’t, never mind, we’ll do it some other time. It was a pleasure, and I hear you later. YO three alpha bravo charlie mobile YO five charlie echo delta mobile, all the best and Happy Easter
14. Andy: five charlie delta echo mobile YO three alpha bravo charlie mobile. […]. Thank you

```
very much for the QSO and I hope to meet you
again. Seventy-three and all the best
```

Colin re-opens the connection formally in turn 11, Andy responds in 12. In turn 13, Colin starts closing the connection (‘hear you later’ is a literal translation of a Romanian idiom used by Hams; the analogy is with ‘see you later’). When closing the connection, Colin repeats the call signs to emphasize, by this formal act, to the other operators present (some of whom have may have just tuned in) that the frequency will soon be free. In turn 14 Andy politely thanks for the connection and uses the old telegram code “73” for ‘best wishes’. Using 73, as well as sending non-encoded wishes such as “Happy Easter” (see turn 13) are routine practices in radio connections.

It is to be noted that in terms of length (14 turns) the exemplified connection is not typical. We have shown above that the radio frequency is an important resource. The interesting experiment performed justifies the QSO length, as well as the fact that it is a local connection, using VHF, which does not propagate over long distances, so it is not likely to disturb operators over large areas

2.3.7 Logging and the QSL card

At the end of our illustrated QSO and the comments it brought about, it is important to note that before going to a new QSO, amateur radio operators log their connections in a “station log”, especially on SW. While an entry is required of operators, it is not a burdensome piece of documentation and can often be useful as a record or reminder in its own right.

Also, if the connection has been important for any of the parties, the respective operator will ask for the exchange of QSL cards (QSL means “I confirm reception” in telegraphy). The card is similar to a postcard, featuring pictures or symbols from the location of the operator or radio club, with special fields prepared for filling in the call sign of the connection party, the date of the QSO, the frequency used, and the mode (signal encoding) used to communicate. QSLs are usually sent via radio clubs, which form batches of cards addressed for a certain country and send them regularly by surface mail to the Ham federation in that country. QSLs are sometimes sent personally, through occasional messengers who happen to travel in that country. A QSL can arrive months or years after the connection, producing a pleasant recollection of the QSO.

2.4 Interim analysis: the amateur radio media

2.4.1 The radio medium as seen through the current results on community endurance

Let us turn off our radio receiver for a while and reflect on what we have learned so far. Mynatt et al. (1998) propose examining the affordance (Gaver 1991, Gaver 1992) of the communication system used by a certain community. We will see below that, upon such analysis, it is difficult to understand why the amateur radio community has thriven for so long.

Communication on the medium cultivated by radio amateurs has *brevity* as its norm. Authors like (Muramatsu and Ackerman 1998) would characterize interaction on the medium as social without necessarily being sociable, similar to the players in their game MUD. This, then, would not be an incentive for an enduring community (indeed, players do not stay in the respective game MUD more than 6 months on the average).

The channels provided by the communication medium are often unreliable, or, if they are reliable they are made unreliable by the members like in the experiment we encountered, and in many others. Due to the finite nature of the radio frequency range, the number of channels offered by the medium is severely limited. Oppositely, Mynatt et al. (1998) ask for the network community system to be optimised for predictability and to offer multiple modalities (page 138).

Members can conceal their presence, listening without contributing, which authors like Kollock and Smith would call “lurking” and see it as a cause of what Ostrom calls “the tragedy of the commons”: making use of other’s contribution without contributing oneself, leading in the end to individualistic acts that bring about the community decay. Since others can conceal their identity as well, operators have to do a lot of listening to understand who is already present (or at least, who wish to reveal their presence), in contrast with the “awareness-richness” principle of Mynatt et al. (1997, 1998). Furthermore, authors like Sproull and Kiesler (1991) would notice that there is a lack of backchannel cues in the unidirectional (simplex) radio communication, in a similar manner with plain text, and one would be tempted to conclude that, like in text-based ‘networks’, only weak social ties will form.

Judged from these perspectives, amateur radio communication should not have lead to the well-established community that we know about. Even if the strong rules provide for a good management of the medium (no matter if we see the status of these rules as tacit code of conduct or as state laws), the communication on the radio bands cannot bring the 'social ties' and the social debate that the virtual community enthusiasts are hoping for. To understand the endurance of the Ham community, we must look outside the radio medium and see how the radio medium is used in concert with other media.

2.4.2 Communication and experimentation media

In a remark expressing a rare event, an informant says:

> `I even dictated schematics on the radio wave.`

In most cases, when something needs to be debated, when transceiver schematics need to be copied or discussed, it is much easier to wait for the regular (e.g. weekly) radio club meeting than to try to use the local repeater.

Beginners draw specific advantages from the radio club meeting: they have an opportunity to interact and ask questions while they may not yet be able to transmit on radio due to not having passed the license exam, possessing a receiver but not a transmitter, or simply not having dared yet to press the emission button. It is technically easier to listen than to talk on radio, also because procuring or building a receiver requires much less effort than having a transmitter.

However complex the uses of the radio medium, it is clear by now that we cannot treat it in isolation from other media used by the community. We have already seen some of the roles of the face-to-face radio club meeting. Hams make use of several other media: post to send material such as QSLs between clubs or between national federations, magazines to publish important trends, achievements and designs, etc.

One of the member's 'business card' comes to illustrate the variety of communication media used. The card has several elements that made it stand out from common cards: first, the call sign is written under the name. The call sign reveals a lot of information in itself due to the data that is officially attached to it: nickname, location, radio club address, etc. Besides the normal address and phone contacts, a variety of other modalities were indicated: e-mail, fax, telex. While personal e-mail may not be so rare today, it was quite rare for a Romanian at the time the card came into the corpus of study material (1997). Even today, the form yo3ghi@internetdomain stands out, emphasizing the identity of the owner as a radio amateur.

The early adoption of new communication media, the openness for communication in any available medium may come as a surprise at first sight. Indeed a community outsider might assume that, since they are passionate about the radio medium, Hams should be proud about using only radio. However, having learned more about the nature of the communication on radio, we can now make a difference between what, for Hams, is a communication medium and what is an *experimentation* medium. One can experiment with his equipment searching for better ways to tune it or for radical new ways to construct it or one can search for other members who can provide opportunities for interesting connections. All the Ham efforts finalize on the radio medium, but other media are skilfully used and combined to accomplish the final achievements on radio.

That is not to say that radio only carries Ham experiments. The repeater connections are often 'lucrative', featuring e.g. members looking for each other to deal with ongoing matters of interest for the local Ham community such as managing common equipment, like the repeater itself. Hearing somebody on the repeater also denotes their availability for radio matters, which is one more reason to prefer the repeater instead of e.g. the phone (other reasons are small cost, testing the transceiver, testing the repeater). Also, radio is also regularly used as a broadcast medium on country-level reliable SW frequencies to transmit community news in bulletins called "QTC". Of course, after the bulletin listeners can start QSOs to comment upon the news, or take advantage of each other's presence to (shortly) exchange personal news.

As a result of this interim analysis, our approach to understanding community endurance will shift its focus from radio communication to amateur radio work in general, keeping in mind the often experimental character of radio connection work. In the next section, we will consider more analytically aspects of learning, experimentation, research, and 'never-endingness' in the Ham community. We will then attempt an interpretation of such aspects that is thought to provide a better understanding of community endurance.

2.5 Reconsidering amateur radio work

2.5.1 Learning by listening

Many of the study informants indicated listening as one of the first steps in their becoming a Ham. Various circumstances (such as having built a simple radio receiver from a handful of parts) brought them the possibility of listening to low frequencies (thus reliable and easy to tune in to from a technical standpoint) with high traffic, such as the frequencies used by air traffic control or airport control towers. Trying to make sense of the content and the transmission routines is not an easy task, and the abilities acquired can be of great value in later conditions of weak or distorted reception. One of our informants, an experienced operator, often tunes in to such frequencies, as a high-traffic band is “never boring”.

There are, indeed, lots of traffic skills to be learned. Many of the codes and rules are first learned in courses or by reading material. But listening to these rules *as practiced* in radio traffic is indispensable. One of the reasons for this is that many exceptions are made from the rules. Although rules are important, the radio connection is not a predefined sequence of turns. We could see this from our example connection: although it is customary to give connection quality “control report” and to describe one’s equipment, our example connection featured no control reports although they were regularly indicated in other connections taking place on the same repeater. Only one operator described “working conditions”. Instead, the two operators interrupted the connection abruptly without the usual explicit announcement of call signs, thanking, sending 73s and other closing customs. They tried to move temporarily their communication on another channel, as part of their experiment, then came back to the initial frequency, for the closing exchanges.

Traffic interruptions are often ‘exceptional’ from the rules and quite complicated to understand for novices. In the following example, the old and experienced operator Ed (YO3EF) intervenes in a longer, multi-party exchange that he just heard, as he needs to shortly transmit something of importance, then step back.

```
YO2??:… microphone to you moncher, YO nine Fox
   Golf Hotel YO2  (inaudible)
YO3EF/Ed:           echo foxtrot
```

```
YO9FGH: YO9FGH comes back [… long argumentation],
   I prefer not to discuss this anymore, I don't
   know whether it was something or something
   else… OK, Err, long live mister Eddie, with
   the appropriate apologies, microphone to You,
   YO3 echo foxtrot group YO9FGH
```

The last part of the YO2 operator's intervention is inaudible (hence one cannot know his call sign just from the above context). This is because the old operator has intervened at the end of his turn, producing a bit of interference, shortly, to announce only two letters from his call sign (EF). In response, YO9FGH responded at quite some length to the YO2 operator (making things difficult for a learning novice), and then immediately 'passed the floor' to Ed, apologising for making Ed wait for him to finish his argumentation ("long live mister Eddie […] apologies, microphone to You"). YO9FGH's turn ends formally with the two call signs, specifying "group" to emphasize that a (not so common) multi-party connection is going on.

In his intervention, Ed used a well-known SW phenomenon: in the first seconds of transmission, the signal is very powerful and can cover other transmissions on the same frequency. He sent the part of his call sign that distinguishes him best (EF from YO3EF) but not more, in order not to disrupt the traffic. The traffic continued, and his request to intervene was granted at the end of the next turn.

As producing interference (as Ed shortly did) is strictly forbidden, no book of regulations would refer to such a way to intervene. However, Ed's action is acceptable, he knows when interference is socially accepted: if an intervention is necessary, at the ends of turns, when the chance to be produced is low. One can only learn and understand such practices by listening to traffic.

It should be clear by now that one has a lot to learn by listening to traffic. No matter how well one knows the rules, understanding short intervention, learning how to make sense of low-quality traffic and how to make sense of traffic involving inaudible parties, can only be achieved with listening exercise. Improving the quality of radio communication is a broad goal of amateur radio activity, but, as we will see later on, Ham preoccupation for novel kinds of radio transmissions leads to experimental settings, often with poor quality reception. Listening skills are essential during such quests. We are, thus, a long way off from believing that listening without intervening is "lurking" like some authors do (Kollock and Smith 1996). In amateur radio, listening is how one learns. Besides 'civility' and 'common resource sparing' (as indicated by Nonnecke and Preece, 2000), learning is yet another reason for 'luriking'. Further reference to learning in 'communities of practice' will be made towards the end of this chapter and in the discussion (Chapter 5).

2.5.2 Never ending work

The experiment carried out by Andy and Colin has illustrated that the only definitive way to check whether the equipment is working is through making or attempting to make connections. It is only in and through the connection that potential problems and issues with equipment will be discussed and remedies exchanged. As one of the informants puts it

> `I never know whether my transceiver works or not.`

... never, that is, independently of its use in making connections of varying kinds and under varying conditions. Not surprisingly, the frequencies are continuously used for testing equipment. A connection is always an opportunity to check the personal transceiver, and also the repeaters. Sometimes, checking is the explicit goal of the QSO:

> `I've just heard you and I thought I'd say hello to see if my tool works on (the) Cluj (repeater), and I reckon it works since you answered.`

Ham set-ups are often experimental themselves, therefore continuous testing is the norm. In the next example, the operator is using two transceivers to achieve better emission with one of them and better reception with the other. He uses a new transceiver that has good reception but can't transmit to the "five echo" repeater because the new transceiver has low emission. He uses his old transceiver for emission.

> `I managed to get hold of RT four-hundred-eleven, reception is much better on it, but the power is not enough to pass through the repeater in Cluj, five Echo. With five Watts that this one emits, I can only open it, modulation doesn't pass. I keep working with`

> the old XX station. I am working with that now.

This following operator has built a system of rotating antennae to be able to connect to a number of repeaters. He needs a certain power to access the repeater which is 250 km away, i.e. far by VHF standards. He can access multiple repeaters due to his antenna-rotation system so he makes lots of interesting connections.

> Working conditions here, a TRS 501 a final of thirty-five Watt without which I cannot open Cluj, it's quite far, but with it, it works… A system for antenna rotation, one Yagi directive antenna, momentarily oriented to Cluj. So, these are the working conditions… Access possibilities on six repeaters, all around here, and... that's it, sometimes the QSOs are so interesting, I can't decide which repeater to tune to. From time to time I come to Cluj and I am really pleased to have made this repeater connection with you…

The example above emphasizes the importance of Ham aerials. While transceivers can be bought, antennae always need to be built and carefully tuned, therefore they are a major point of interest for Hams. Walking on the street with a radio amateur will make one realise the importance of antennae for the Ham operators. A radio amateur will immediately distinguish the Ham aerials from the normal TV ones. He/she will also notice the antennae used by organizations such as GSM or Internet providers, government services, embassies, etc. The address of a colleague has been indicated to a Ham operator like this:

> Go along street X and you'll see a 7-element Yagi (antenna); that's where he lives.

Improving one's transceiver or antenna by acquisitions and equipment combination is one way to continuously develop one's capability of radio communication. Another way is to do things *differently*, to experiment with various technical solutions. Designs that work well are always shared by word of mouth, at meetings, in magazines or, rarely, on radio. Original designs or improvements bring pride and prestige to the authors.

> You should never be fond of a schema that you copied; you should always make a personal improvement when applying it. (YO)3DEF is now trying to make a frequency divisor based on [this brand new principle]. If it works for him, I'll make a similar circuit, but not an identical one!

Building and tuning more powerful and accurate equipment is thus a continuous Ham concern. As exemplified, "getting hold" of a piece of equipment is an achievement, even if it serves just half of the communication. When enough and proper equipment is available, there are ways to go further with improvements: a more complex and powerful antenna system was presented here. Trying to contribute to classic schematics and creating original designs is another way to progress. Creativity and originality in equipment building and set-up becomes more apparent as the complexity and power of the 'working mode' (VHF, SW, etc) increases.

In such conditions, it is no wonder that people in the surroundings of Ham operators report a sense of "never-ending work" when characterizing what their relative or acquaintance radio amateur is involved in. One of the informants tells the story of his mother in law seeing him soldering and tuning components in his transceiver-to-be, every evening after work. After some time, she reacted:

> Will you ever finish working?

On a similar note, a Swedish radio-amateur's wife wrote the words below on the label of a binder seen in his "radio room". By this she has sketched a cartoon of an antenna.

> Terry's project. The never-ending story.

There is practically no limit to the number of possibilities that could be tried out, no matter how rich or poor the operator is. Operators will always find new ways to build or assemble equipment for existing or for new purposes. The work is never to finish, Hams will always be testing new ideas. To discuss the ideas and to test them, operators cannot do alone; they need to be part of the community, and they need to make radio connections. This then, is one basic element of our understanding of Ham community endurance.

2.5.3 Research for the community and for humanity at large. Other relations with the public

Continuous improvement of radio communication on the part of amateur radio operators comes from the desire to make efficient use of available emission power by achieving high-quality or long-distance connections. Sometimes, ground-breaking solutions are found, which are more remarkable than schematic design improvements. Examples of such new approaches are: new ways to modulate the signal (historically: first in amplitude, then in frequency, with a number of variations for each), new modalities of propagating the signal (by ionosphere reflection in SW, directly or via the moon in VHF), etc.

In 1964, a USA operator held a QSO with an Australian Ham by achieving, for the first time, radio wave reflection on the moon. By that connection, they opened a new chapter in amateur radio: EME (Earth-Moon-Earth). EME, Meteor Scatter and Aurora are high-power VHF connection modes that use the moon, meteor traces and Aurora borealis respectively to accomplish reflection of the radio wave. The reflected wave lands in another place of the Earth where hopefully there is a Ham operator listening. Such techniques need very special directional antennae and of course, more emission power than normal (local) VHF. Most EME set-ups use mobile antennae. Because of the long round-trip, the received signal is very weak so most connections are made in Morse telegraphy (CW). In EME, transmission is made simultaneously in vertical and horizontal polarization (thus pairs of antennae are needed) to supply for the propagation problems encountered irregularly on both. The emission power can be from 100 watt to several kilowatts, which makes the EME set-ups vary a lot. High-performance set-ups use a large number of mobile antennae to beam the signal to the moon. Almost every such set-up is unique, combining a number of innovations. For example, one set-up encountered in the study did not involve combining the two signal components (horizontal and vertical) electronically. Rather, the two components were sent to stereo headphones, whereupon they are *perceptually* combined!

The promoters of novelties like EME are bringing the whole community to a new ‘dimension’, to a new space of infinite possibilities, where new kinds of equipment can be built or assembled, new technical solutions can be tested, etc. One can assimilate the continuous striving for improvement of the radio connection with a research process. As we will see below, members themselves make the analogy. In such an analogy, ground-breaking achievements such as the inception of EME open new ‘research programs’.

Sometimes such steps forward have been adopted by agencies beyond the Ham community. In fact, the well-known radio bands that we use today for broadcast radio are partially the result of such Ham research. Occasionally, legal changes have then modified radio amateurs’ existing practice, limiting access to a particular frequency range. For radio amateurs, this can lead to resentment, even though it may also confirm their perception of the community’s general value. One informant describes this process as follows:

> `First they [=the regulators] took LW [=Long Wave] away from us, we moved into AM [=Amplitude Modulation, Medium Wave], now we have no frequencies left there. We then found SW [=Short Wave, High Frequency]. We have always had a research value for radio.`

Another reason reported by members for their continuous concern with improving their equipment is *readiness* to communicate in even the harshest conditions. Informants have indicated a sense of freedom given by their transceiver, as they are able to communicate even in disaster situations (wars, earthquakes, flooding) when public communication and power services may be down.

Operators see their preparation for such extreme conditions as a contribution to the society at large[10]. The communication autonomy provided by a Ham radio station is much higher than with any public service: ambulances or fire-fighters may depend on their central radio repeater, GSM and other cellular telephony services are dependent on base stations. All such ‘common resources’, while providing for simpler and cheaper ‘terminals’ (mobile phones, on-board radios) are constituting ‘points of failure’ in case of power blackouts or mechanical destruction specific to disasters. Ham plans of action

[10]“Storm watchers” in the USA are a spectacular instance of the Ham communication readiness in case of disasters. They drive parallel with tornadoes and inform the emergency services about the tornado path via mobile transceivers. Emergency services are then able to notify citizens via broadcast radio, in time for them to seek shelter.

and band allocation in case of disaster were encountered in the study, sometimes referred to as “emergency networks”.

The contacts of the community with the external world are more diverse than turning in “research” results or helping in emergency. Many radio amateurs are radio professionals too (working as technicians in broadcasting companies or telecoms). Besides the transfer of research results or the public benefiting from Ham emergency help, there is also a dialog between the community and the rest of the world. The result of one such dialog is the Romanian Ham (and possibly other countries) code and rules and regulations (Romanian Communication Ministry, 1992). Indeed, informants indicated that the code was not simply imposed by the state, but was reviewed by community members serving in the national federation, together with members of parliament. More often than not, workers in the authorities that monitor the correct usage of the radio bands are radio amateurs too, and a friendly warning about a malfunctioning transmitter that mistakenly sends on non-Ham bands would often be issued and acted upon before an official warning is needed.

2.5.4 Collaborative and competitive negotiation of uncertainties

The finality of all learning and equipment improvement efforts is high performance of radio communication. While not all members are obtaining performance, they are certainly admiring the performance achievements of their colleagues, and are well aware of the call signs of such colleagues.

There are many contexts where performance can be obtained and many interpretations of what exactly constitutes performance in the respective contexts. In this section, we will comment in more detail on what, for the members, constitutes performance and how they go about achieving it.

2.5.4.1 Kinds of performance

When commenting on our example connection, we have introduced aspects that affect performance, and ways in which such aspects are conveyed and interpreted by the members. A *long distance* ‘connected’ is the most frequent interpretation of high performance. ‘DX’ is the code used to talk about long distance connections, especially inter-continental. DX (delta x-ray) is used very often, sometimes as part of ‘best wishes’: the Christmas edition of *DUBUS*, a German amateur radio magazine, closes with:

> `Merry Xmas, HNY and good DX in 1998…`

The equipment used, especially if it is *low power* is yet anther ingredient of high performance. Long distance connections achieved with low power, such as the one in our example experiment are among the highest-performance enterprises. Nevertheless, sometimes high power is needed to achieve a connection (e.g. in EME), and the material effort needed to purchase, as well as the complex work to set up and tune a high-power transmitter are well valued by the members.

In Ham contests, the sheer *number of connections* achieved during a given period of time, on a given frequency, in a given transmission mode, in a given geographical region comprise the performance obtained by various competitors. A large number of DX connections is a life-time achievement praised by radio magazines as follows:

> `Two Swedish DXers with 300 countries on CW!`

Having 300 countries worked, especially on telegraphy (CW) is a very impressive achievement, and implies working with rare countries, as well as working over an extended period. The example above also illustrates the *number of destinations* ‘reached’ via radio as an important performance indicator.

Finally, connections made in *difficult modes* are from the start seen as high performance. An informant talks about one of his QSL cards as follows:

> `Right, it is (a connection with) somebody from [the same country]. But look at the (connection) mode. It is EME! If it’s EME, it can be (with) the neighbour from the same block; it’s (still) an excellent QSO!`

A high performance connection is a *unique* event. Repeating a high performance connection between the same operators, in the same locations, with the same equipment is not as exciting for the members as it was the first time, unless some conditions (e.g. the atmospherics) are different. From a performance point of view, ‘a new QSO’ means that something has changed (QSO with somebody else, somewhere else, etc).

2.5.4.2 Cooperation for high performance

A high-performance radio connection is from the outset an act of cooperation between the two parties in the sense that the two operators need each other's presence and skill to achieve performance. Such cooperation can become spectacular when operators go to uninhabited regions. They become a valuable resource for the community, since exciting connections can be made with them:

> Think of an operator who goes to an isolated island with his equipment. He is there for a whole world!

There also exist countries with very few Ham operators, so a QSO with that country is rare. Some islands that belong officially to a country might have status of "separated country" for the international organizations of amateur radio. Operators who can afford it are moving in less Ham-covered parts of the world to make connections from there, achieving excellent QSOs both for them and their peers. A web page dedicated to EME mentions an operator by their former and new call sign

> K6CDE (now AH8XYZ in Western Samoa)

Having made connections to a large number of countries (like the "two Swedish DXers" above) usually implies also connecting to such rare destinations. It is interesting to note that such high-performance stations actually *need* lower performance stations in their quest for performance. A radio amateur promoting EME in a magazine writes:

> You won't regret directing your aerials to the moon because very strong signals come from there… Most European stations are not aware of their possibility to make EME QSOs. Practically, the existence of big gun stations like SM5EFG, W5UV, F4WX gives the possibility to start EME traffic for the ones who don't have Kilowatts and tens of aerials. […]. Big stations are bored of hearing each other. What they would really like is to communicate with small stations, with 100-200 Watt.

Big stations (that is, the operators working with the respective transceiver) "would really like" to connect to smaller stations because that gives them a confirmation that the filtering techniques and used for reception are efficient enough to separate the weak station's signal from the background noise. That also is a measure of how good their antenna is. Similarly, at the transmission part, a connection with a low-power station is a proof of the high transmission quality and efficiency from the big station. In short, a connection with a small station is an important confirmation for the large station's owner, a confirmation that their quest for improving their equipment is successful. As for the smaller station, the same connection is constitutes very high performance, given the low power used.

2.5.4.3 Competition for high performance

When more operators are hearing the same station, and if that station is DX or otherwise high performance for most of them, they will naturally attempt to call it, and sometimes this happens at the same time. Let us review a turn that we have heard before:

> `LX2AB/Adam: (inaudible) is calling DX and standing by (13) the yankee zulu station please, come again, (3) QRZ QRZ london x-ray number two A bravo yankee zulu station, please come again`

The other party cannot be heard, but it became evident from listening to more QSOs in the frequency that LX2AB specifically *picked* the "yankee zulu" station *from a number of* stations that offered a connection after the initial call "is calling DX and standing by". The YZ operator did not respond immediately, so the call was repeated "QRZ QRZ london x-ray number two A bravo yankee zulu station, please come again".

Besides cooperation, high-performance radio has a 'synchronous competition' aspect. Operators transmit as little as possible (to avoid interference) from their call sign (e.g. "yankee zulu"), so the calling operator (LX2AB above) can call the candidate stations in the order that he or she prefers. One of the criteria of choice will be the quality of the signal. For example a signal that is well readable but has little strength may promise a good DX: readability indicates a skilled operator, while low strength can be a cue for large distance.

2.5.4.4 Unpredictable elements in high-performance traffic: Who is on?

Realising high-performance connections is not only a matter of preparing and tuning one's equipment. It often involves simply waiting for a suitable party to show up, and, as shown above, having the chance to be picked by that operator if more are requesting a QSO.

Even if the band is free, one should not connect to just anybody that he or she is hearing. Using a high-traffic world-wide SW frequency to connect to an operator nearby is not considered suitable, as the band is expected to be used for better performance. A station from Balearic Islands was heard in Stockholm calling DX ("delta X-ray"):

> EA6FG: CQ DX CQ calling delta X-ray CQ DX calling delta X-ray echo alpha six foxtrot golf, echo alpha six foxtrot golf Balearic Islands, QRZ DX over
>
> Operator [locally] I am not DX for him […]. Think of it, maybe he's been working on the frequency all morning 'cause he's determined to work Korea today. I shouldn't bother him

By orienting the antenna, an operator can determine the region of the world that he or she wants to attempt long-distance connections with. In the example below the antenna is directed towards North. A world map centred in the location (Stockholm) helps the operator determine where the emitted signal is likely to arrive. The operator traces an imaginary line over Alaska, Canada, arriving in Mexico.

> You see, Americans will wake up soon, and my antenna beams towards them. You'll see how I get those from these islands [shows on the map].

While browsing frequency ranges (different SW frequencies work better at different times of the day) waiting for operators on the other side of the world to wake up, one can also encounter 'false positives' when suspecting a DX opportunity. A weak signal heard may seem to promise DX, but in fact it is just a station nearby:

> Ha, you suspect a really impressive DX and then it turns out that he's here, near you,

he’s just beaming (with the aerial) far away, parallel with you, so you hear him badly.

The large number of events happening concurrently in world-wide traffic make the use of pen and paper indispensable. When listening to the traffic attempting to spot DX opportunities, operators write down the call signs that they hear. The operator looks at his paper and may decide to call one of the parties heard, when the traffic permits it, that is, when nobody else transmits, or by ‘competition’ as exemplified before. If a connection is made with one of the parties heard, the notes scribbled while listening are later on (or concurrently with working on traffic) used for logging the connection.

Working in high traffic is thus a complex thing to do. By now, we know that achieving DX and other high-performance connections implies ‘being’ on the right frequency at the right time, with the right party listening to or participating in the traffic, situated somewhere in the front, or maybe the back of the antenna. All these are uncertainties specific to high-performance radio work.

2.5.4.5 Unpredictable elements in high-performance traffic: How is the propagation?

But uncertainties related to the actions of other operators are not the only ones that can affect high-performance traffic. For a high performance connection to be obtained, radio propagation, determined by atmospheric conditions and specific electromagnetic phenomena also have to be on the operator’s side. We have already seen how operators brief their QSO partners on the weather at their location, since propagation (in SW) is linked to the weather. Sometimes informants complained explicitly about propagation during traffic:

Unbelievable how bad it works this morning. 24 and 28 (MHz frequency bands) are completely dead […]. It should open soon. Around eleven. […] You‘ll see in half an hour, there won’t be any space left around here.

By “it should open” the operator refers to the propagation starting to facilitate connections. On a similar note, a radio club leader says:

We’re all fascinated by propagation mysteries. […] When I realize that there is a good

> propagation with a rare zone, I try to announce it to as many operators as I can. Imagine when you find out that there is Tanzania on frequency X…

Such propagation-related uncertainties are even higher when propagation depends on irregular events such as aurora borealis or the existence of meteor traces comes to add to the uncertainties of high-performance radio work. Lack of suitable equipment also complicate matters, but does not prevent operators to seek high performance. While frequencies can be varied by a tuning knob to switch to better-propagated ones as the time of day changes and atmospherics evolve, aerials cannot always be moved to follow the moon in order to maintain EME propagation:

> Think of an EME operator with a fixed antenna. He has 10 minutes of moon exposure in good days.

2.5.4.6 Uncertainty and community endurance

We are starting to see generic patterns of continuous responding to uncertainties and negotiating contingencies in the whole of amateur radio work. We have previously examined the continuous quest to build and improve equipment. One can keep on trying to improve his or her set-up in a myriad of ways. Similarly, one can keep on trying to browse frequency ranges, rotate antennae, listen to and call for high-performance connection partners in a never-ending fashion. There will always be new destinations to connect to, countries or region still unconnected, operators called who did not yet respond, frequency ranges unexplored, working modes (SW or EME) not tried out yet. Of course, the two infinite endeavours (building equipment and looking for connection opportunities) go hand in hand: for example, one needs to build powerful equipment and large rotating antennae before attempting to connect via the moon.

As already emphasized, these endeavours cannot be pursued by oneself. Peers to make connections with, feedback on the modulation quality, operators who travel to the rare destinations, high-power stations to be intercepted by small antennae, all help the operators in their seemingly infinite quests for new radio achievements.

This infinite quest is, we suggest, a key to community endurance: radio provides large spaces to be explored cooperatively by the community members, and that exploration is seemingly infinite. As long as the quest (in its various forms) is on for the members, the Ham community is likely to endure. The ongoing negotiation of radio-related contingencies *is* the Ham community endurance.

2.5.5 Personal achievements

Continuous exploration of possibilities related to equipment preparation and radio wave propagation, which we have seen in high-performance radio can actually be found in most Ham radio activity. Our example connection, carried out on a reliable, thus low-performance medium (repeater), has shown how operators find an unreliable channel and try it out. The achievements obtained by operators during such experiments may not constitute performance for the community *in general* but constitute important achievements for the operators *personally*. The example connection also features Andy's satisfaction about his first connection to a remote region. In most such cases, a QSL will be requested. An informant explains:

> Of course it's nice to go to the radio club and show them my latest QSL with some remote country […]. But I might not put a QSL on my wall because it is a DX. I might be happy because it is the first connection with a new antenna that I built.

The very significance of the QSL card is usually related to the connection being an achievement for at least one of the parties. Many informants were keen to tell stories on their achievements. In the next example, the operator emphasizes that although a distance of about 400 kilometres is small compared to a DX connection, it represents a long reach when the emission power is only 4 watts (even if "Omu" is a mountain peak, thus accessible easier via VHF radio).

> I came from Gherla to Omu with four watts!

Equally, while getting from Romania to Germany is not a problem with SW, doing it on VHF (which has 2 meter wavelength) is an important achievement:

From Vladeasa I can get to Germany on two-meter!

In many cases, the personal achievement is facilitated by getting access to somebody else’s equipment. Telling the story of visiting another operator, with world-class equipment, an informant recounts enthusiastically that the frequency was so busy with interesting stations that interference (QRM) was produced. He was able to work France, Sweden, Finland and the USA in only some minutes, which other operators take years to accomplish:

QRM was flourishing. In some minutes, I worked with approximately 10 stations from F, SM, OH, W!

It is not possible to send a VHF signal directly over the Atlantic. But sending a signal via the moon (EME) can make it reflect and land on the other side, and that leads to precious VHF connections between Europe and the US. While for EME operators this may be an everyday thing (and not high-performance for some) a first such connection will probably never be forgotten:

Another interesting QSO was the one with W3RS, my first QSO in VHF with an American station.

Unlike in our example connection, experiments can be successful. The following story tells a remarkable and rather unique experiment. Transmitting voice over EME is very difficult due to the long round trip, which weakens the signal to levels where only telegraphy can succeed. But since the French operator was received very well, a *voice* encoding of the signal (SSB, which will be discussed in more detail later on) was tried, and telephony with lunar intervention succeeded.

Since F4AB was coming 599, we tried telephony, it obviously worked, therefore we achieved an SSB connection via EME with control reports similar to the SW ones! I should mention F4AB’s working conditions: 4 KW and 24 Yagi (aerials).

There are thus many directions to go in the vast space of amateur radio experimentation possibilities. Some operators attempt high performance, others are enthusiastic about their first connections using a certain equipment, or using a certain set-up, transmission mode or arriving to a certain destination, remote or new. Most are happy to take advantage of set-up made by peers (at their home or in radio clubs) to achieve these novelties, to get the feeling of working in a new band, or using a new (for them) transmission mode. One does not need to aim for performance to feel the challenge of continuously responding to radio contingencies that arise throughout the spectrum of radio work, from learning, through setting up and improving the equipment, ending in radio traffic work, and then back to the equipment, for continuous improvement.

2.5.6 Challenge and contingency on every strip of talk

Our gradually emerging proposal is to understand amateur radio community endurance through the motivation of its members to work together on radio equipment and traffic. The proposal is seeing the source of such motivation in the large number of contingencies that need to be negotiated when working with radio. Some such contingencies are to be negotiated by skill (e.g. building better equipment), others by experience (e.g. getting to know at what time there might be good propagation to a certain region) and finally others are happening by pure chance and have to be addressed as such, by patient persistence (e.g. who else happens to be listening to the wave).

One could go on forever addressing these contingencies, hence the never-ending character of the amateur radio work. At times, new radio challenges will be taken, with new interesting contingencies to be negotiated, for example: building equipment based on a different principle, taking on a new transmission mode, a new range of transmission power. In all such endeavours, the presence of community peers, to get feedback from on the way to success, to achieve the successes together with, and to report successes to, is essential. If successes are important for the whole community (e.g. the first EME connection) or for the world at large (progresses in broadcast radio, readiness for emergency), the challenge is even greater, the energy and enthusiasm put in to negotiate the contingencies are even higher, and the work is even less likely to look finished.

We will round up this view of challenge and contingency by returning to the radio connection and looking more closely at its generic structure. As seen in the example connection, a QSO will roughly go through the following stages:

- opening, partner call signs
- exchanging nicknames and locations

- reporting on transmission quality
- describing ‘working conditions’
- talking about the weather
- request QSL exchange
- thanking and closing

We can easily exemplify some motivation-full contingencies that every phase of a connection can imply:

- opening, partner call signs: is it a new communication partner? A new region? A new country? A famous operator?
- exchanging nicknames and locations: how far did I get?
- reporting on transmission quality: how well did I arrive there? Is something the matter with my equipment? Did I notice that in previous connections as well? Is something the matter with my peer’s equipment? What could it be? What can be done to fix?
- describing ‘working conditions’: is it a small station that I enabled to achieve performance? Is this connection a remarkable one due to low power used?
- talking about the weather: was it very good propagation due to the weather or is my equipment very well tuned and orientated? Should I attempt more connections in such good propagation?
- request QSL exchange: was this QSO an achievement for me?
- thanking and closing

As we see, in every bit of Ham talk, members can find opportunities for identifying new contingencies to negotiate, or for assessing how well the challenges are addressed. One does not have to participate at the talk to do that assessment. Listening is enough for realising what the fellow amateurs on the frequency have achieved.

Before a final discussion on our interpretation of Ham community endurance, we will take a look at the role played by technology and design in the amateur radio context.

2.6 Tools constructed by radio amateurs

Let us imagine a technology that would allow reliable radio transmission and reception at any time of day, with good readability and strength, with multiple channels, involving cheap, easy to install and easy to tune equipment. Would such a technology be interesting for use by radio amateurs? As much as we know Hams by now, the answer is negative. Such a technology would present no further exploration spaces like the ones encountered in our examination of amateur radio work.

It is true, on the other hand, that Hams may have been, at some point, *developing* our hypothetic 'ideal radio technology'. Doing the minute work of trying out multiple possibilities within the realm of the respective radio propagation approach, the Ham community would have perfected the technology up to a point where it is not that interesting for them, but its easiness of use would make it suitable for the public domain. That suitability may not be entire, the public domain may adopt on a large scale just the reception part: cheap, easy to install radio receivers. In fact, as we have seen, the various bands pioneered by Hams, followed exactly this path, pioneering research was finished, technologies got perfected and transferred into the public domain.

By considering the ideal radio technology, we have contemplated an artefact that the radio amateurs would *not* be interested in. What then, are radio and non-radio artefacts created by Ham, and why were they created? What is it that constitutes for Hams an *appropriate* tool? What is it that helps them in the their quest for new and improved radio communication? How are these tools created? How are they disseminated inside the community? What is, in HCI jargon, their design rationale?

Once we have learned a bit about members' motivation for radio work, looking at *the design of* several Ham *artefacts* can serve our interest in design for amateur communities, as we examine how the members' motivations translate into designing tools and technologies. In this section we will consider the design rationale of tools that were developed by the radio amateurs.

An interesting question can be raised on why these tools and technologies (and not others that were proposed) achieved 'critical mass' within the community. Critical mass is an old theme in CSCW in relation to the adoption of new applications by a 'mass' of users large enough for the application implementation to succeed (e.g. Grudin 1988). A possible answer to this question can already be given in terms of what we learned so far: as any contribution, tools, technologies and other solutions are *reviewed* by other community members in a continuous *research-like, experimentation* process. If a Ham operator decides that a new tool that he or she learns about deserves experimentation (usually by local emulation of the respective contribution, followed by tests), that is already a sign of ‘good review’, which will improve further as experiments succeed according to the Ham performance criteria (good transmission quality, low power used, etc).

2.6.1 SSB

Single-Side Band (SSB) is a historical development from Amplitude Modulation (AM) radio transmission. AM is encoding the audio signal by modulating (adding) it over the amplitude of a sinusoidal “carrier signal”. To spare emission power, Ham operators started to test an encoding without transmitting the carrier signal, instead the carrier is re-generated at the recipient station. This encoding came to be known as “Double Side Band”, as its waveform is symmetrical. The next observation that Hams made is that one can cut the energy consumed in half if only one side of the symmetrical waveform is transmitted. With that, Single Side band was born. Comparing to ordinary AM, SSB consumes much less energy and needs only half of the bandwidth, thus allowing for more channels to be established in the frequency spectrum.

SSB is a prototypic example of responding to community concerns via design. Fundamental concerns of Hams are addressed: sparing of emission power to achieve high performance, sparing of bandwidth to achieve a large number of communication channels in the band. SSB also offers an example of technology that will probably never reach the public domain (another example is EME). Since it distorts the voice a bit, SSB is not suitable for public radio or general-purpose communication; some exercise in listening to SSB is needed. SSB was, though, adopted by other radio services such as in the marine, due to its efficient transmission.

The rationale of SSB is obvious in the light of community values. When looking, with SSB as reference, at other transmission techniques, we will have to resort to more subtle examination in order to understand their rationale.

2.6.2 Connection opportunity notification tools

Notification tools enhance the information available to radio amateurs when they attempt to make high-performance connections. This offers a bit of guidance to operators in their band explorations, without simplifying the task of looking for the opportunity of a connection or performing the connection itself. In other words, such tools support the operators, without automating their most important amateur endeavour.

2.6.2.1 Beacons

Beacons are radio automatons that keep transmitting a certain message on a fixed frequency. When a remote beacon is heard, operators know that there is a good propagation in that direction and that if they start making calls on that frequency, they may achieve high performance QSOs.

Like repeaters, beacons are used in non-Ham areas as well. Hams have their own frequencies so they need to install their own repeaters to ‘re-transmit’ them. This is not necessary for beacons: if a beacon is heard on a certain frequency, it is enough to infer that there is good propagation on Ham frequencies close to the beacon’s. This is yet another example of Hams using public resources to achieve their goals.

2.6.2.2 DX cluster

DX cluster is a software tool employed by the DX operators to find out about the possibility to communicate with the rare destinations. The DX cluster is an Internet server where operators connect to register a DX connection that was just achieved. All other connected users are notified by a beep and, if their conditions are similar to those of the announcing Ham, they can choose to attempt a connection with the operator located in the rare or remote country. Thus the DX cluster helps the task of “announcing as many operators as one can” about the potential of realising remarkable connections.

Before Internet service providers were available, connection to the DX cluster was made via Packet Radio (a data transmission mode developed by Hams). Nowadays connecting to the DX cluster may involve no radio at all; simple remote connection software can be enough.

2.6.3 Artefacts for traffic support

Besides notification tools, a number of other artefacts are employed by Hams to support their core activity: work on radio traffic.

2.6.3.1 Specialized maps

We have already encountered maps centred in the operator location, which help orientate the antenna with more precision. Such maps are mostly used in SW traffic. Other maps used are used to look up the encoded Ham locators which were designed to convey fast and precisely one’s location.

2.6.3.2 Lists and websites

Many operators possess a list of addresses of operators from their country. When hearing a call sign, they may choose to look it up to find out more about the name and location of the designated radio amateur.

The paper-based lists are gradually replaced by web pages. While waiting for a connection opportunity, some of the informants used to browse the Web and to look for the call signs heard. Finding which country a call sign comes from is much easier on the Web. The websites also have the advantage that they are dynamically updated. They also contain more information that can be of importance in high-performance traffic. For example, we found out that the operator heard from the Balearic Islands was working in the local airport, and was originally from USA. It is more motivating to have a QSO with a high performance operator, so the possibility offered by the Web to find out about the achievements of a possible connection peer is important.

2.6.3.3 Moon-following software

EME operators employ various Ham-made or public domain software for finding out where the moon is. Such software tells whether the moon is up, when it will be up, on which direction and on what angle should the antenna be orientated on the vertical plane, in order to beam to the moon. Certain software made for education in astronomy fits well for this job. During EME traffic, such software is consulted regularly to see if the antenna is well-orientated or if it needs a bit of rotation.

2.6.4 Combination of technological means for amateur radio ends

As seen also in the communication media discussion, none of the artefacts encountered performs a task that would automate an operation that is too close to the operators' main challenge of exploring connection-related possibilities[11]. In fact, when such automation can be made reliably, radio communication in the respective domain will probably not be of interest for Hams any more. On the contrary, when traffic still depends on the weather, on the uncertainty of a new principle's experimental character, on the chance of finding a DX opportunity, the interest remains, and no tool can be constructed to address such uncertainties.

Instead of addressing these uncertainties, most of the tools we have discussed are supporting the operators, easing work of secondary importance. It would be cumbersome for an EME operator to compute the moon orbit every time the signal from the moon fades and the antenna needs re-orientation. In a similar manner, using a world map available in a geographical atlas instead of a Ham-specific map would give distorted angles for antenna rotation, requiring complicated corrections.

We are thus seeing a clear delimitation between contingencies that are kept for the members to address (and which can hardly be addressed by machines anyway) and contingencies related to human error in domains that are not of interest (geographical calculus) or contingencies related to lack of information or lack of memory about call signs, etc. This suggests that such delimitations can become important when designing artefacts for amateur settings.

2.7 Conclusions: the perpetual work to make radio work

2.7.1 Never-ending experimentation

Let us summarize what we have learned in the study of amateur work in the Ham community. We have first seen how members make a skilful

[11] One could also compare with Hutchins (1990) and his observation that navigational tools do not amplify the cognitive abilities of their users, but instead transform what would normally be a difficult cognitive task into an easy one

combination of media to achieve their goals of high-performance radio connections using various communication modes. Of these media, the cultivated, experimentation medium is of forefront importance. All efforts are directed towards developing that medium, and its unreliability, contingent or inflicted, is valued.

Hams are ‘bricoleurs’ (Levi-Strauss 1962) of the radio wave. Bowers (1994) has emphasized the ‘work to make IT work’, the work to get a system to work well in its setting, which can make an IT system fail if it is excessive. Hams show that the work to make things work can be the work itself, if one sees the system from an amateur perspective, as Hams see radio. The experimentation in the medium leads to its perpetual development, experimentation can take a multitude of forms and never seems to end. Experimentation is supported by carefully designed tools.

2.7.2 Challenge and contingency

So, what is it that makes the work never ending? The results suggest that this question should be addressed by any designer who tries to understand an amateur setting before design. The answer suggested here is: challenge. Ham challenge can be expressed in generic terms (long distance connection by low power) but several kinds of challenge can be taken by members along the lines of different connection modes (VHF, SW, EME).

At every step of the way, unfavourable conditions - contingencies must be overcome. These contingencies are a sine-qua-non for the existence of challenge: in their absence, the motivation for amateur radio work would not exist. Contingencies take various forms: from the clumsiness of drunks, to the mysteries of propagation, from the hour of day and the phase of the moon to the existence of a remote operator who just happens to listen to the wave. Contingencies are thus *inexhaustible*, leading to the never-ending appearance of such amateur work. Due to operator’s ever-increasing skill in this infinite quest, contingencies are *actionable*, addressable by the member.

New ‘spaces of contingency’ can be opened at any time by trying fundamentally novel approaches such as new connection modes. Sub-communities form naturally in such spaces, providing for a natural management of a world-wide community.

Contingencies of amateur radio work thus confer an intrinsic durability to the community, by providing intrinsic motivation to the individual member to work as a radio amateur. Csickszentmihalyi (1990) would see these contingencies as forming the “challenge that requires skill” that he proposes as the main precondition for the “optimal experience”. However, this would not be enough for the Hams to be an enduring community. Radio challenge addressing is fundamentally *cooperative.* A connection is a cooperative achievement and then thanks are in order at the end of the connection. Cooperation is also evident in radio clubs when building and maintaining common equipment, or when operators are visiting each other.

Another difference from Csickszentmihalyi’s notion of individual challenge is that challenges must be *collaboratively constructed, shared and maintained* by members for such challenges to be the basis of community endurance: individuals must see the same kinds of contingencies as challenging. The radio connection enables members who share the same challenge to find each other, bringing (gratis) a network of contacts, who may be valuable resources of know-how on radio affairs and other kinds of communitarian help. Besides the radio connection, the radio clubs and federations are also venues of finding people who take pride in addressing the same challenge and getting suggestions for new related challenges. Such venues provide well-known entry points for beginners to find peers to share challenges with and learn from. The informal aspects usually associated with the word ‘community’ must not let us ignore the formal organisation of Ham and its roles, from sharing challenge to QSL dissemination.

The ability with which a member has addressed challenge along the years will of course bring prestige to that person. Stories about oneself and about others are often told, and learned from (e.g. getting from X to Y with N Watt, by using Z configured in the W working way). One’s achievements and the stories describing them are forming one’s prestige and are always strongly attached to one’s call sign in a similar manner with the “playing level” prestige in MUDs (Muramatsu and Ackerman 1998).

Orr (1996) emphasized the importance of “war stories” for membership and learning in a community of xerographic machines repair technicians (reps). Such stories are even more important in amateur radio, as a ‘good story to tell’ (to the ‘audience’, see below) at the end of challenge addressing is an integral part of the motivation for amateur work. It would not be very wrong to say that radio amateurs are continuously addressing radio contingencies ‘for a story to tell’.

2.7.3 Research and pioneering. Audiences of beneficiaries. Peer review

There is more to the motivation of radio amateur work than the sharing of intrinsic motivation for addressing challenge. Bruckman (1998) posits that the "power of having an audience" has made personal WWW home pages so popular (pp 71). In a similar manner, the community reception of novelties one discovers in their quest to address challenge is obviously important for the member. Equally important for the same reasons of beneficiary audiences is the contribution one makes to the common, such as building equipment for the radio club, or making a remarkable DX connection using the radio club call sign instead of using one's own call sign.

Radically new approaches make one be a pioneer, opening the ways for even larger audiences of beneficiaries. This 'audience effect' becomes even more pronounced when the beneficiary is the world-at-large, by the creation or improvement of new radio standards (e.g. wavebands), or by helping in emergency situations using the unequalled communication autonomy conferred by the Ham transceiver. Members praising other's stories, or generic statements like "we always had a research value" suggest that, even if one has never contributed to the world at large, knowing that the community as a whole developed, at some point, a radio approach that is now in public use, knowing that a peer has helped the rapid procurement of a drug from abroad for an urgent case, knowing that it can happen one day to oneself, is reason enough to provide audience-related motivation for amateur work.

The analogy with research (for the community and for the public) gives us the opportunity to reflect on the review process that takes place inside the community. Ideas are sanctioned before dissemination in conventional ways (e.g. review before publishing in a magazine) or in Ham-specific ways: efficiency of an equipment improvement can be tested through radio connection, while a brand new challenge proposed for sharing (e.g. EME) is left naturally for the other members to find interesting and choose to attempt its addressing, or find it un-interesting and choose not to address it.

2.7.4 Graceful learning. Canonical descriptions of amateur practice

The skills needed to address radio contingencies can at times be very sophisticated. Challenges need to be *addressable*, or *actionable* by the members. Learning is thus crucial for community endurance, where challenge addressing is of central importance. The low ‘entry level’ of learning-by-listening to the wave using cheap and easy-to-build receivers is helpful in this sense. A graceful learning path can then be followed by the novice: from VHF to SW then experimentation with exotic methods like EME; Aurora, or Meteor scatter. At each stage, interesting new contingencies need to be negotiated.

We have seen the role of stories in learning, as also suggested by Orr. As in Orr’s setting and in many other settings, subtleties of non-canonical practice (cf. Brown and Duguid 1991) such as exceptions from the codes of rules and regulations or exceptions from the codes returned by a copy machine are learned through participation (cf. Lave and Wenger 1991, Wenger 1998). However, the reasons for practice being described in canonical ways in industrial settings are different from the canonical descriptions of practice in settings like amateur radio. Canonical descriptions in employment settings can be thought to represent a contract between the employer and the employee. This is obviously not the case in the amateur setting: the code of rules and regulations was developed from within radio practice, in response to limitations of the radio medium (e.g. intrinsic lack of information about who is just communicating). It later turned into internationally-accepted rules, to which most national rules comply.

While such canonical descriptions of practice can be learned informally (and indeed, regular listening-in to the wave helps their learning), one should not underestimate the role of explicit learning, e.g. in formal lectures at radio clubs, teaching simple schematics and Morse code. Although the notion of community and the theory of Community of Practice suggest informal learning, formal learning and examination still have their place in amateur radio.

2.7.5 The publics and the professionals

As Stebbins (1979) suggests, radio amateurs can be viewed in relation with ‘publics’ interested in radio, and in relation with radio professionals. We have seen that radio amateurs can be radio professionals as well and can affect realities that are related to the community, but are decided upon outside Ham: the control of radio waves, the codes of rules and regulations, the transceiver features. Also, the community relationships with the society at large (through research and help in emergencies) have been illustrated. We have seen how the public can affect the motivation for amateur work of the radio operators. This suggests that one should not try to view a community in isolation, that the public and the professional counterpart should be carefully identified, since the public addressed by an amateur practice can give a hint on important motivational aspects in that voluntary practice, and the professional counterparts may constitute valuable resources in carrying out the amateur work.

In the next chapter, we will encounter amateurs that have a different relationship with their professional counterparts and the public at large. The chapter, as well as the rest of the thesis, will re-visit the themes that we developed when studying amateur radio work and technology: *challenge, contingency, research, pioneering, learning* the amateur practice, the relationship with *professional counterparts* and the *public*.

Chapter 3
Field studies of Amateur Work and Technology in Three Student Organisations

3.1 Introduction

We will now turn our attention to other settings based on voluntary work, by examining socio-technical aspects of work and its technology support in voluntary student organisations. While Chapter 2 has examined especially our first research question, related to *community endurance*, in this chapter we will be preparing to *design for a voluntary setting*, namely a student organisation, by examining work and technology in three student organisations. In the approach outlined by the thesis Introduction, the field study account will be presented in two sections: one section on work, and the other on histories of artefact design within the setting.

First, amateur work in the three settings will be illustrated. Is community endurance affected by similar socio-technical aspects as in Amateur Radio? Is the work in student voluntary settings motivated in a way that resembles the challenges and contingencies that we encountered in amateur radio? What are the differences specific to student work? A description will be made of projects carried out by the organisations, accompanied by considerations related to the motivation for amateur/voluntary work, made through the lens of the radio study findings.

Second, artefacts devised to support the work will be examined. Much of this support is constituted by software used cooperatively across the distributed settings, so we will take the opportunity to compare results to CSCW studies of socio-technical aspects of software adoption and shaping. As in the considerations we make about work, the voluntary nature of the settings considered will affect the considerations we make about software: Why do communities adopt or reject the software? What are the most prominent elements of the possible disputes generated by the new software in the community? How is the software shaped as a result of such disputes? The software will be presented, its evolutions, and various reactions of the members.

In order to examine these questions, and especially to learn more about *community endurance* and *IT design* in voluntary student communities, field study of student organisation work was conducted in three voluntary, geographically dispersed student organisations. The field study settings and methods will be shortly introduced, then the section on work ("Voluntary student work: International exchange projects") and the section on technology ("Software supporting exchange projects") will follow. At the end of the chapter comes a discussion of the main themes, relating to findings from the Amateur Radio community.

3.2 Field Study

The study consisted of open-ended interviews, participant observation, and collection of material published by the student organisations, including historical accounts of their IT support evolutions. Access to the IT systems of the organisations has been obtained to various extents and periods, while access to training and documentation WWW pages was possible at all times (and is public in most cases). Consent for publishing material has been sought, including proofreading of versions of this text by responsibles within the organisations, including IT responsibles.

In one organisation (BEST), the author was a member prior to the existence of research interests. Since access to that organisation's systems and documents has been wider and lasted longer, the largest corpus of data comes from there, and the organisation also provided ground for conducting cooperative design at later stages.

3.2.1 Three Student Organisations

A short description of each association:

- AIESEC was founded in 1948 and its members are students of economy and management. AIESEC has more than 80 national committees ("member committees"), coordinating 800 locations ("local committees"). Student members meet regularly in statutory meetings such as the annual international congress, a smaller "Presidents' Meeting", and several regional congresses.

- BEST was founded in 1989, its members are students of technology from more than 50 technical universities in Europe. BEST stages two "General Meetings" per year (the most important being the "General

Assembly") as well as a variable number of non-statutory, smaller-size workshops.

- AEGEE was founded in 1985, its members are students of any speciality in more than 240 locations (called "antennae"). It also has two statutory meetings per year, the most important called "Agora".

3.3 Community endurance through contingencies in arranging International Exchange Projects

In Chapter 2 we found community endurance to be closely connected to the nature of work done by Hams and its contingencies, research and professional influence aspects. We will now try to investigate whether such a connection between community endurance and the specifics of amateur work also exists in the student communities. In doing so, we will examine work done by volunteer students in the most important projects of the three communities, which are of similar nature and can be grouped under the name 'International exchange projects'.

All three organisations have among their major projects a programme of international exchange, under various names such as "Exchange", "Summer Program" or "Summer University". Such a programme involves local groups (which we will call 'locations' or 'locals') arranging activities for students, ranging from a "traineeship" for one student in a company to "summer courses" for around 25 students. Each location promotes these activities among the students from its university. The students then apply to the promoted activities and some of them get accepted. This results in thousands of students attending activities in a foreign country, hence the international exchange character.

We will now consider aspects of work on the international exchange projects that remind us of aspects of amateur radio work: the contingencies of activity arrangement, continuous concern for improvement (diversity), pioneering, research, and hands-on learning. We will also consider aspects that did not occur or were less evident in amateur radio: exhaustion of challenge and the influence of professions concerned with similar work (professional management in the student case).

3.3.1 Arranging international exchange activities

An author in the anniversary magazine *One Decade and Beyond-AEGEE Europe* (April 1995) describes the arranging of a "summer course" as follows (page 49):

> A summer course for European fellow students? No problem! Let's find lodging places, teachers, classrooms, university facilities, let's organise the leisure programme, the excursions, the parties, a titanic job for a student association that only had 57 branches through Europe and in Milano didn't have any office.

Spaces for lodging are to be found, the university administration needs to be convinced to allocate a classroom, a teacher must be interested in lecturing at the course, free time activities have to be thought of, and all these without having a space to hold meetings, instead, restaurants, classrooms or student hostel rooms are the preferred venues. Few of the arrangement elements are known when the AEGEE "antenna" commits to organize the summer course. Even when such details are settled, they are subject to change, and they often do change.

This 'arrangement uncertainty' is not specific to AEGEE, or to the organisation of courses. For another example: the whiteboard of *AIESEC in Ireland* Member Committee presents the situation of Irish students wanting to attend traineeships overseas (so-called "Student Nominations"; SN). Nominations are separated into "matched" (a SN that was found a suitable "Traineeship Nomination"- TN- abroad), "realised" (the student has already completed the traineeship) and "unmatched" (e.g. a SN that has found no suitable TN). An alarm clock and a 'smoking' bomb caricatures have been sketched near the "unmatched" column. An informant explains:

> Unmatched (SN) forms are like a time bomb!

Unmatched SNs are a continuously aggravating uncertainty problem in the arrangement of traineeship exchange in AIESEC. Things are not much different in BEST, where a supplementary difficulty is added: the BEST summer courses are often free for the students and the maximum fee allowed (set by association rules) is small, thus money will have to be raised through sponsoring. 'Will we raise enough money' is a familiar problem in organisations that depend on sponsorship and is adding up to the uncertainties of arranging events. What’s more, less than half of BEST courses actually ask for a fee. It is the ambition of the organisers to provide the course entirely free for the student. Concern for zero or low fees for the students was encountered in all three settings.

We are starting to recognize aspects of contingency and challenge that we encountered in amateur radio. The hardship of the contingencies negotiated during arranging activities is carefully emphasized by the members, and is sometimes preferred, rather than avoided, just like in amateur radio connection is more precious when realised with low emission power, or without the help of a repeater.

Local groups’ preference to ‘get themselves into trouble’ is further emphasized by the task of organising large events, sometimes outside the ‘international exchange’ programmes. At the 2000 BEST statutory meeting, the local groups from Roma (Italy) and Ljubljana (Slovenia) were competing for the organisation of the next (2001) General Assembly (GA). In comparison to a BEST summer course, where 25 students need to be lodged and fed for two weeks, the GA is a much bigger task, hosting 200 students for one week. While summer courses may have a small fee, the General Assembly is totally free for the participants. When asked by members of the audience what is their main motivation, the delegates of the two locations gave identical answers:

`Challenge.`

The word “challenge” is thus present in the language of the members. We are clearly seeing a resemblance between the radio work and the student organizational work in this sense. Throughout this section we will continue to see the ‘amateur arranging’ character of student work when organising internal events or international exchange projects.

3.3.2 Concern with Diversity

As in the amateur radio experiments with connections and equipment, results of the student organisation field study show a continuous quest to improve the ongoing projects. One aspects of this quest is the concern for diversifying the projects (similar with e.g. the Ham search for new connection modes).

In each organisation, the international exchange project is the ‘largest’ in terms of the number of people involved (participants and organisers), money raised and spent, time spent by members and participating students, etc. At times, the organisations made efforts to diversify their projects. This trend was reflected during the regular statutory meetings, which sometimes made little mention of the main international exchange project. A BEST alumni looked at the statutory meeting agenda and said:

> There's no mention of the summer courses. You wouldn't believe that these people are working for summer courses all year, when they come here and discuss completely different things.

The BEST exchange project, consisting of organizing courses in most locations required little discussion in that meeting, as most of its procedures were well settled. Instead, the association was using the opportunity of the semi-annual general meeting to discuss generic ways of raising money at the global level, new projects, etc.

At other times, the associations discussed the very relevance of the exchange programme as main project (e.g. AIESEC around 1990). Interestingly, members of one organisation would often emphasize their diversification efforts by difference from the other organisations. An AEGEE member writes that his organisation is

> unlike an almost mono-aimed association (AIESEC, Exchange)

Although the diversification efforts were successful to various degrees, the exchange programmes remained the main projects of all three associations and, as the example above shows, they are still used by people outside the organisation to characterize its activity: for many students from outside AIESEC, the association is quasi-synonymous with "exchange", for many students outside AEGEE, mentioning the AEGEE name makes them think of the "summer university" etc. While other activities (e.g. internal meetings mentioned above) are organized, our primary focus will be on the international exchange projects as they are the projects that concern most of their members. We will, however, retain the concern for diversity in activities arranged as resembling the one found in amateur radio.

3.3.3 Contingencies in Global Coordination. Pioneering.

We have already considered 'amateur arrangement' of activities at the local levels and have seen the contingencies that they imply. As the concerns for diversity have shown, arranging is not only a local group matter. Strong preoccupations exist at the international levels of the associations for coordinating the exchange projects. When discussing these preoccupations, we will encounter radio-like aspects such as pioneering and research. We will also encounter and discuss less ‘productive’ aspects of amateur work, such as challenge exhaustion and the trend to ‘always pioneer’.

In 1996, an international group called SPOC was formed in BEST. The group came with the idea of generalising the “Summer Program” (made of “summer courses”) to the whole year, thus allowing for uniform European promotion of activities that did not take place in the summer (such as the “Short Intensive Trainings” that were typically spring events). The organisation accepted the idea, and the group was placed in charge of supervising the process of introducing two new “seasons”: “spring” and “fall”. SPOC baptised the new programme “Vivaldi” as an allusion to the *Four seasons* concerti. Besides introducing a brand new international arrangement, SPOC also had to strive to impose the idea that another body than the international board can do international work on a permanent basis, outside the international meetings. Thus the concept of permanent “international committee” working on a certain topic of interest became established in BEST.

As we follow the SPOC history, we can already notice aspects of challenge introduced by pioneering. Members’ appreciation for having a ‘research value’ is similar with the radio amateurs’ quest to find new communication modes. SPOC does research not only by helping to try out a new international programme, but also by experimenting with project management work in a permanent international working group, which was a novelty at the time, when the only international group that existed (the “board of BEST” including responsibilities such as “president” and “treasurer”), was not project-oriented. Looking at the further evolution of SPOC, we see the committee successfully coordinating the first complete “Vivaldi” year in 1998. By the same time, new committees started to form, adopting the style of long-term geographically distributed international work on a specific topic, pioneered by SPOC.

However, pioneering is not always guaranteed to be fruitful. Members may tend to ‘always pioneer’, i.e. to propose radical changes to the association. We can illustrate this aspect of pioneering by another BEST example. When the first spring season was discussed, a working group was set up in a statutory meeting. The working group insisted on the spring season having another procedure than the usual summer season. A complicated procedure with two sub-seasons was proposed, although it was known that the number of spring activities is lower than the number of summer activities. The next statutory meeting has revoked this proposal, and a new working group has devised a summer-like procedure extended over a shorter period, taking into account specific constraints such as the Easter holidays, etc.

> Because the spring season is still a sort of an experiment and we don't know how it will succeed, we thought that it would be better to have a simple one season schedule, similar to that of the summer season 1997, because that one has been tried out and proven to work.

While pioneering is a welcome source of challenge, the trend to ‘always pioneer’, inventing new concepts and procedures at all occasions is seen as a downside by the members. This is similar to a *review* process that we have seen in Amateur Radio, as a form of ‘pondering’ the perpetual urge for invention and contribution of amateur community members.

3.3.4 Completing a mission

As the Vivaldi concept had been established, the only task left for SPOC was to provide ongoing coordination of course arrangements. By the end of 1998, SPOC was the least attractive committee for members who wanted to work internationally. The reason expressed by a member was that

> SPOC have done their job, Vivaldi is on now.

Indeed, at the end of an arrangement, the challenge is exhausted. This is something that we did not encounter in the Ham community, although it probably exists in less evident forms. Furthermore, we did remark the endurance of the radio-related contingencies (e.g. contingencies that will always be there such as weather and propagation), which make exhaustion less likely.

One way in which students respond to challenge exhaustion is ‘changing careers’, looking for new challenges by changing the project they work on, or simply ‘advancing’ to the international, coordination level of a project. This ‘diversification’ is not only specific to individuals: an entire group can diversify their activity in the ‘concern for diversity’ line already illustrated. Later generations of SPOC members have introduced a quality assurance programme for the summer courses (now called “seasonal activities”), under the name “Greenapple”. The newly pioneered concept required event organisers to have structured discussions with the participants at fixed times before, at the middle and at the end of the two-week course. Summer courses that followed the new procedure were marked with a green apple logo on the course promotion materials (posters, WWW pages, etc), indicating their compliance with the quality assurance programme. We will come back to these compliance logos in a later subsection.

Hams may have made us see a quasi-ideal situation of challenge and pioneering. Their inexhaustible challenge leads to never-ending work, their cooperative following on new, valuable trends helps select out pioneering proposals that are not so valuable for the community. The student organisations show similarities in the motivation for voluntary work, but also differences. We have seen a case of challenge exhaustion, responded to by attempts to challenge diversification. Pioneering for the sake of the novelty as opposed to the value rendered to the association was also noticed.

3.3.5 Hands-on Learning from Peers

We will illustrate the hands-on learning aspects similar to those noticed in amateur radio by an example from the BEST practice. Due to the short term membership of the students, a new aspect, ‘cyclic learning’, will emerge.

Students accepted to BEST summer courses must leave a sum of money called “deposit” to the local group in their university. The deposit is only returned to them if they do attend the course, or if they cannot attend it due to extreme circumstances. The summer 1997 was the first season when BEST implemented a new rule, stating that course-participant students can only get their deposit back if they submit an evaluation of the course attended. If the student did not evaluate, their deposit money were due to the BEST “common account”, payable to the treasurer at the next General Meeting. At the meeting, it turned out that many BEST local groups had returned the deposit to the students without applying the new rule, and many of the respective students had never evaluated the attended course, thus the locations were owing various sums to the common account. Given the size of the phenomenon, the decision was made to only apply the new rule starting from the next year’s edition of BEST’s exchange programme.

This critical incident, along with many others, shows a specific way in which members ‘learn the ropes’ of the organization. Despite the availability of booklets and handbooks of rules and recommendations (with names such as “Corpus Iuridicum Aegensis” in AEGEE), despite voting upon the new rules in the statutory meetings, members do not primarily learn the rules of the international exchange programs by reading booklets or texts of proposals voted upon. Instead, learning takes place when actually arranging the events, from communication with other members, typically co-organisers or international-level co-ordinators. To draw a similarity with amateur radio, while codes of rules and regulations are important in radio (maybe more important given the legal binding of radio communication), learning while listening to peers is prevalent.

‘Learning in doing’ in a ‘community of practice’ (cf. Wenger 1998)[12] has specific aspects in student organisations. It is constrained by the short time (up to 5 years) a student can be active as a member. At the extreme, a student might learn and apply the exchange procedure only once, therefore never getting to ‘teach’ others. A new organisational rule is likely to be disseminated slowly in the association and we can suggest that it will not be applied to a sufficient extent before enough members assimilate it.

The problem of having limited knowledge of the existing association rules leads to another issue reported by members on a negative tone. Due to not being aware of previous work, a working group in a statutory meeting, working to develop programmes like international exchange, can often arrive to the same ideas as another group has found years before. This is known as “re-inventing the wheel” and is seen as a negative aspect, especially in international work.

However, on further analysis, we should note that, as repetition of operations during various cycles of event arrangement has a learning function, so does the reoccurrence of discussion issues in the international work, making new members aware of the long-standing issues in the organisation. As such, the particulars of hands-on-learning in the involved student organisations are based on *cyclic repetition* and in that sense they are different from amateur radio, though it may be argued that the lower-granularity repetition of Ham

[12] The comparison with the “Community of Practice” learning theory will be developed further in Chapter 5

connection practices, or the higher-granularity repetition of Ham events such as radio contests and symposia resemble learning by cyclic repetition.

3.3.6 Aiming at Professional Management

The connection to professionals in the same domain was not very much discussed in the case of amateur radio as a source of further contingencies in the amateur work. Many radio amateurs are close (if not better) in skills to their professional counterparts. In the case of student communities, this is rarely the case and a strong professional *influence* was found, which, as it will be described below, is not always positive. While professional radio technicians are the ‘professional counterpart’ of Hams, professional *managers* are the counterpart of amateur student arrangers of international exchange projects.

Members’ dissatisfaction with inefficient practices such as ‘excessive pioneering’ and “re-inventing the wheel”, as well as their strategic concern for project diversity, quality management (logos of compliance included), their inclination to generalise complicated management processes such as the coordination of an exchange programme, all suggest that volunteer students take professional managers as models of performance and conduct in their addressing of event arrangement challenges. This observation is further supported by the intense contact that the student organisations have with professional management. Student organisations are seen as a fertile ground for fresh recruitments by the industry because their members are likely to have an experience of managing projects and working in teams. A frequent arrangement is a manager giving training about professional practices (how to run a meeting, how to hold a presentation, etc) in exchange for her company sponsoring the respective student organisation event.

Stebbins (1979) proposes the existence of a “professional counterpart” as a common feature of amateurs. To add to that, we can suggest that the professional model taken can shape the challenge of an amateur group or sub-community. The ISO-9000-inspired Greenapple programme has provided an opportunity for pioneering and challenge. When observing this, we have the opportunity to reflect on the origins of a challenge, as well as on the fact that challenge is shaped by education (from training by professional managers in the student organisation events to generic quality management courses in the university curriculum).

It is, though, important to note that this challenge shaping from the professional model does not always lead to success in the sense of the results being appreciated by the community. In 1999/2000, a new international committee was formed in BEST, dealing with marketing and public relations. Along with specific working methods borrowed from professional practice (marketing research, etc), the new group embarked on a quest to change the organisation's logo. The existing BEST logo (see Figure 1, left) was composed of the name of the organisation separated from the map of Europe by a sinusoid (as engineering symbol). When using it as a local logo, the local groups replace the text "BEST" with a symbol of their city or region e.g. a bull is the symbol for the city of Torino, Italy.

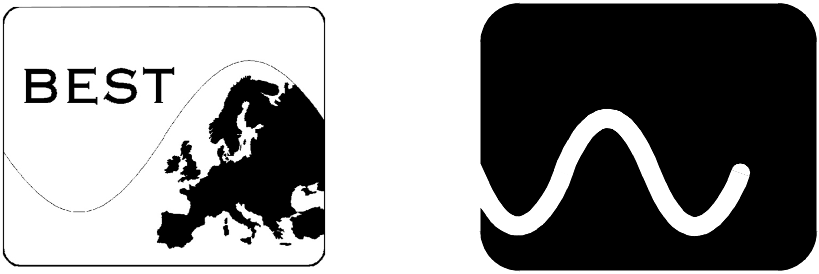

Figure 1 The BEST logo (left) and the logo proposed by "marketeam" in 2000 (right)

By applying rules and recommendations of commercial logo design, the group ended up with a simple logo (Figure 1, right), with very few graphical elements, similar to the logos of e.g. Nike®, Reebok® or Pepsi®, while keeping the sinusoid and "screen frame" elements. The European map, on the other hand, was rejected as a too complex shape for being part of a logo.

After heated debates in the statutory meeting, the discussion was concluded by a presentation made by a delegate from Lund, Sweden. The presentation had several steps:

> (Irony about the proposed logo being suitable for an oscilloscope manufacturer
>
> Show some logos of non-commercial organisations, including the United Nations and AEGEE, all featuring maps and other complex shapes such as olive branches
>
> Show some commercial logos, all made of simple shapes

```
Show the existing and the proposed logos and ask:)
      Where is BEST?
(Plenum applause)
```

It is also a fact that BEST members were emotionally attached to the existing logo and were not prepared to change it easily. Nevertheless, the lesson we can learn from the above argumentation and from the subsequent plenum approval, is that the challenge posed by professional recommendations may be more apparent to the amateur group than the suitability (for the particular amateur setting) of the direction taken by responding to that challenge. This 'professional challenge confusion' aspect did not occur in the Ham study, however, Ham participation in related professional areas (employment in broadcasting companies, radio-surveillance agencies or participation in the drafting of codes of rules and regulations) is important.

3.3.7 Summary: Challenge and contingency in the International Exchange Projects

To summarise this section, we have identified 'arranging' of international exchange projects as an important challenge for the student organisations in question. We have recognized aspects of contingency and pioneering that we encountered in Chapter 2. Challenge *exhaustion* became better emphasized as a hindrance to student amateur work, with challenge *diversification* as one response from members. Pioneering and research were enriched with aspects leading to lower 'research value' of student work, such as "re-inventing the wheel", which was found to be of importance for *learning during cyclic repetition*. Also, we have considered the importance of a 'professional model' in student amateur work, and found that the challenges that a professional model may pose are not always valuable for the student community.

Having identified major *community endurance* themes that we found in Amateur Radio, we can conclude that the community endurance aspects from the student communities resemble those of Ham. Endurance is intrinsically connected to aspects of challenge, contingency and hands-on learning within the amateur work. Specific differences were also found: cyclic repetition, influences from the professional counterparts that come to shape the amateur challenge, etc.

3.4 Software Supporting Exchange Projects

In this section, we will move from the comparisons with Amateur Radio in relation to community endurance, and look more carefully for answers to our second research question, focused on IT design for amateur communities. While in Chapter 2 we reviewed the design rationale of several artefacts, the design *process* was not apparent in the study. The field observations and historical records collected in the student organisation study provide us with data that can be used to characterize the design process. We expect to make use of the lessons on the amateur software design processes encountered here in two ways: (i) to inform more conscious design processes, as well as their self-sustainability (our third research question from the Introduction), in experiences described in Chapter 4 and (ii) to contribute to CSCW/HCI issues on software design and adoption.

Although they use the Internet today for most of their communication (email, chat, WWW document repositories), the organisations have started crafting their own software before employing the Internet as the main communication mean. In all three cases, the software supports the international exchange programs and would be qualified by CSCW theory under the generic label of ‘workflow’: a system that helps the organisation locations keep a predetermined flow of operations as part of the exchange programme, and coordinate between operations of different locations. This section will examine the inception of these software projects, and their evolutions in response to user reaction and technology change.

Of these issues, cooperative software adoption is well represented in the CSCW literature, so an examination of such work is in order. The review will be followed by a description of the evolution of exchange-programme-support software in each of the organisations, with the problems that co-determined the evolution. At the end of this section, a summary of the observations will be made in relation to the two issues described (informing further IT design for student communities and contributing to CSCW discussions of software adoption).

3.4.1 Adoption of cooperative software in the CSCW literature

A great deal of the Computer Supported Cooperative Work literature has addressed the adoption of cooperative systems, which will be of interest here as applied to community software. In a well-known paper, Grudin (1988) suggests a number of major causes for CSCW application failure: disparity between those who do the work and those who benefit from the application, lack of decision maker familiarity with the cooperative applications, difficulty in evaluating applications. Much of Grudin's discussion is about CSCW applications, as he asserts that an organisation will put much more effort in sustaining a new system than in adopting a new application. Grudin has further developed the theme of software adoption in other writings. Notably in (Grudin and Palen 1995) Grudin and co-author examine meeting scheduling applications (also examined in Grudin 1988) in a more successful adoption case.

Bowers et al. (1995) consider the introduction of a new system in a printing shop floor. They emphasise the new system's intrusion in the work procedures already developed by workers ("workflow from within"), hence such intrusive software is labelled as "workflow from without".

Rogers (1994) looks at the introduction of a new system in a flight booking company. She emphasizes the conflicts that arise between members in relation to the features provided by the newly introduced software. One of the main conflicts is related to the usage of the automation provided by a software module, advocated by parts of the management. Employees prefer to do the respective operations as before, because introducing an automated database would lead to procedures far more restrictive than the existing ones. The marketing director, on the other hand, would gain a lot from the existence of a "travel database".

3.4.2 Support for AIESEC Exchange

In examining evolutions of software support for amateur activities in the three student organisations, looking especially at aspects related to IT design for amateur communities and cooperative software adoption, we will take a closer look at the software support for the AIESEC international exchange programme, the "AIESEC Exchange". Similar sections will follow on the BEST and AEGEE exchange support software (3.4.3 and 3.4.4).

At the end of the 1960s, the process of matching "Student Nominations" (SN) forms to "Traineeship Nomination" (TN) forms as part of the AIESEC "Exchange" project (see Figure 2) was still carried out manually in the AIESEC international congress. Each form contains a collection of criteria, and their degree of importance: “required” or “preferred”. Examples of student-related criteria (in a traineeship specification form) are the ability to speak a language, the ability to write in a language, a certain IT skill, etc. Traineeship-related criteria examples are the function of the job offered, the area of the company activity, etc.

TN-In-AT-VI-1999-4	Metropolitan Datenservice m.b.H.
Comments	Metropolitan is the daughter company of one of the biggest insurance companies in Austria
Academic and working background Requirements	Project Management Advanced Computer Programming Advanced computer applications Commercial Computer Programming
Language Requirements	English : A
	German : B
Education Background	Undergraduate
Skills	TCP/IP AIX AS400 ... Internet Users skills PC user skills
Geographical Requirements	Canada United States Austria Czech Republic ...
Date preferences	Start Date: 25.01.99 End Date: 01.01.2004
Duration preferences	Min Weeks: 36 Max Weeks: 78
Fields of Experience	Information Technology
Traineeship Focus preference	Information and Society
Traineeship Details	Working Hours: 09:00-17:00 Amount of hours weekly: 38 Hours. Saturdays work: None
Traineeship description	Department: Software-Development Job Descripton: Programming
Date:	Least Important
Degree:	Least Important
Country:	Least Important
Language:	Important
Academic Background:	Important
Skills:	Very Important
Commitee Information:	LC: AIESEC Wien Tel: (+43-1)nnnnnn Email: AIESEC Wien [xxxx@yyy.at] LC Distribution list: xxxx@lists.aiesec.org
eMail Address:	
sent on	31.01.2000

SN-Te-AR-MZ-2000-5	XXX YYYY
Comments	
Academic and working backgrounds	Introductory Accounting Managerial Accounting Introductory Management / Business Administration ....
Lanuguage and Level	Spanish : N
	English : C
Education Background	University: Universidad Tecnológica Nacional Course: Information System Engineer Degree Level: Bachelors Years: 11 Grad Year: 1999
Skills	Drivers licence IPX Novell TCP/IP MS Dos .... Internet Users skills PC user skills
Geographical Preference	South East Africa West Africa (English speaking) North America English speaking World Spanish speaking world
Date preferences	Start Date: 20.02.2000 End Date: 20.02.2001
Duration preferences	Min Weeks: 8 Max Weeks: 74
Fields of Experience	Information Technology
Traineeship Focus preference	Cultural Understanding Higher Education and Learning
Working experience	Organization: Goverment of Mendoza Title: Asistent Responsibilities: IMPSAR Networkin Administration in the YK2 proyect Duration: 6 Months
Traineeship Focus:	
Business Type:	
Country:	
Duration:	
Date:	
Commitee Information:	AIESEC Mendoza Member: AIESEC in Argentina Phone: 54 0261 nnnn Phone: 54 0261 nnnn Email: AIESEC Mendoza ....
eMail Address:	xxx@yyyy.ar
sent on	06.02.2000

Figure 2: AIESEC TN and SN forms as shown by a recent electronic system (BFO)

3.4.2.1 Annual Automatic Matching

“Negotiation and goodwill” are mentioned by members as important factors in the manual matching process at the international congress (see Figure 3). By this members emphasize that more structure and method was needed in the process. To aid the long and difficult process, the idea came to enter all the forms into a computer (via punch cards at the time) and to write a software that will produce the matched SN-TN pairs at the output. The first such system was ran in the international congress on an IBM mainframe, in 1969.

 

Figure 3: aspects from the matching room in AIESEC International meetings during the 1960s (reproduced from *Link to the 21st Century, a publication of AIESEC's 50 anniversary*, 1998)

Along the years, the electronic matching system has been improved by making use of the succession of information technology progresses. Due to increased IT performance and accessibility, "matching runs" could be performed outside the general congress, and more matching runs per year became a possibility. When PC technology became available, the work of entering the forms was slowly spread from the international bodies to the local ones. For example, in early 1990s, one of the six yearly matching runs done in AIESEC International offices (Brussels) after collecting data from the country committees, was assisted by 50-100 persons, processing a total of 5000 forms.

3.4.2.2 Problems of automatic matching

AIESEC members were often dissatisfied by the results of the matching. There are two major types of problems that were encountered (present in the AIESEC realities and vocabulary to this day): broken matches and direct matching.

A *"broken match"* is never "realised" (the traineeship never takes place) due to one of the parties (student or company) not wanting it any more. This typically happens due to "bad specification of criteria" in the forms. One of the examples reported by members involved a location taking note of the match of one of their SNs from the matching software. By procedural rules, they had to contact the location that wrote the corresponding TN. Due to local circumstances, the traineeship location was late in responding, giving the bad news that the company considered the student's year of study as being too low. Since the student time frame for the traineeship was too close, no other match could be found for them.

"Direct matching" involves locals of the organisation matching SNs and TNs outside the system, leading to a quite large number of matches not being registered in the system. This in turn leads to a lower "official count" of the realised matches at the association level. Direct matches are found using personal contacts of the members (made e.g. in international or regional congresses, or other international events) and specially devised tools such as the "match-TN@" and "match-SN@" mailing lists.

Direct matching is discouraged by the international bodies of AIESEC as it is considered in opposition to the values of the association. AIESEC values demand, for example, that a SN should not be able to pick the country of its TN directly, but leave a number of choices open (indicate a list of the regions such as "French speaking world", etc). Also, two SNs that prefer a certain TN should have equal chances, independent of their location of origin. Of course, by picking a TN directly during direct matching, the AIESEC local has an important degree of control over the TN location, limited by the available choices.

3.4.2.3 Continuous automatic matching. Problems with the common pools

In 1998 AIESEC launched the first WWW-based matching software. INSIGHT was different from its predecessors in several ways. It was designed to support more than the exchange project, allowing the local and national committees to keep track of their members, and their company contacts. Also, locations could use INSIGHT to follow the traineeship after the matching phase, towards student's arrival to the traineeship, post-traineeship evaluation, etc. Another novelty brought by the system was the automatic generation of the Exchange statistics, which AIESEC calls "XMI" (Exchange Marketing Information). In 2000 the statistics consisted of thirteen spreadsheets, presenting different statistical views of INSIGHT data (see Figure 4).

Number of AVAILABLE forms requiring [field of experience], by type of traineeship

Cumulative figures for SNs: one SN can express preference for more than one field of experience

NON cumulative for TNs: a TN can only express one field of work

	ACCN	BUSA	DEVT	ECON	EDUC	FINA	INFO	MAR	OTHE	Total
TN - ITEP	68	93	18	31	66	84	31	276	49	**716**
SN - TDP	9	36	18	10	18	17	154	34	59	**187**
TN - TDP	0	1	7	7	6	0	168	6	27	**222**
SN - YDEP	7	17	46	20	28	8	7	21	23	**57**
TN - YDEP	2	0	14	0	16	0	3	4	5	**44**
SN -	**601**	**1247**	**501**	**887**	**343**	**912**	**504**	**1318**	**494**	**1964**
TN -	**70**	**94**	**39**	**38**	**90**	**85**	**205**	**287**	**82**	**990**

ACCN :	Accounting
BUSA :	Business Administration
DEVT :	Development studies
ECON :	Economics
EDUC :	Education
FINA :	Finance
INFO :	Information Technology
MARK :	Marketing
OTHE :	Other studies

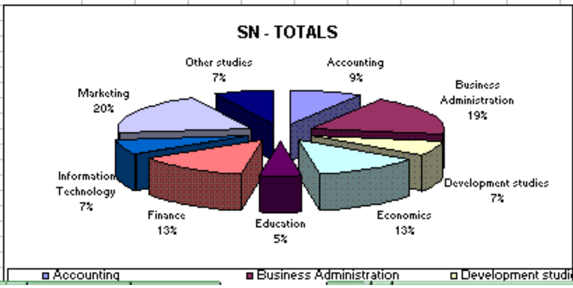

Figure 4: An example of AIESEC “Exchange Marketing Information” (XMI)

The system was also the first to support “continuous matching”, thus eliminating the need for periodic “matching runs”. To keep a large number of TN and SN forms available for matching (called “pools” of TNs and SNs), the system was using a heuristic score attached to each possible match, and it was not reporting a match unless the score was above a certain threshold. The size of the pools has been a constant concern for AIESEC International, the coordinating body of AIESEC. A large pool was needed for a good match to be found, but waiting for a large pool to form was sometimes necessary, and locals occasionally preferred to do “direct matching” instead of waiting. Thus a classical ‘tragedy of the commons’, or ‘prisoner-dilemma’ situation occurred: locals were pursuing their interest by direct matching rather than serving the global interest by leaving their form stay in the pool. Direct matching was of course leading to the decrease of pool sizes and was, in turn, part of the “AIESEC International” concern. However, unlike in the previous systems, members could register direct matches in INSIGHT, thereby allowing the organisation to have a more precise number of the matches made and realised in the XMI statistics.

As the direct matching practices continued, the “INSIGHT International IT team “ team was trying to improve the speed of the matching algorithm. Although backed by professional Oracle® servers well-connected to the Internet in New York, the system speed was a major problem for locals. The IT team sent regular updates to dedicated mailing lists.

> From this moment on, we have drastically reduced the time it takes to match an SN form. The matching procedure of the SN previously took a long time to complete. This was […] because a lot of data had to be searched through and the [...] code was doing this inefficiently. A few parts of the matching engine have been adjusted, and now the time to match an SN form has been reduced to only a few minutes (depending on the forms).

The heuristic used for matching was another major concern:

> The minimum scores that were in place (1st week 95, 2nd week 88, 3rd week 79, 4th week 68) have been removed and now within the first four weeks, the score needs to be as a minimum 60. We have implemented this change to increase the possibility to get a match right away, and hope this will also increase the realisation of results. After the four-week period, any match can take place, regardless of the score

3.4.2.4 Manual Matching emerges from the local level. The local-global debate

In spite of these ‘pool maintenance engineering’ efforts, the significant INSIGHT improvement reported by members came from another direction. An independent group used a different infrastructure (Lotus Notes™) to program a new feature called the “Browse Forms Option” (BFO). The new system was called “ISO-2000”, an allusion to improved quality of the exchange by subtle reference to the ISO-9000 quality assurance standards replaced by 2000, the year of BFO launching. To work with the new feature, locations could choose to publish in BFO their forms that were already registered in INSIGHT. At the moment of publishing, the respective location can also attach comments to the form (which would have been useless for the matching algorithm). Once in BFO, the form can be viewed by other location members, who are browsing through forms. If such a location believes that they may have a matching form, the two locations get in contact and proceed in negotiating the match, and its realisation. As required, the match is registered back into INSIGHT.

Of course, BFO reduced even more the pool of unmatched forms, which decreased the chances for the automatic matching to work properly. Members of the global AIESEC Exchange coordination accompanied the introduction of BFO by the following rules:

1. All International Exchange Quality Standards and Policies should be applied for the facilitation of all exchanges whether through INSIGHT, the Browse Forms Option or any other means.
2. All forms on the "Available" status in INSIGHT can be sent to the Browse Forms Option if no match is received when trying to match using the matching engine
3. The current system should continue to be used as the main tool for matching forms and that a match that is generated by the matching engine is an official one.

   If a match occurs, members should have the commitment to the match and cannot reject the match without a valid reason in order to get to the Browse Forms Option.

   The usage of the system and the rejection of matches will be closely monitored. Penalties will be applied to those members misusing the system in any way.
4. Use the Browse Forms Option in an ethical, fair and non-discriminatory way. The option should be used in a way that allows equal opportunity to exchange for all members of the organisation regardless of the member's

> country or territory or level of Internet access.
>
> All members should strive for as much diversity in their exchanges as possible and not give preference to certain countries or organisations.

The rules are giving priority to the automatic INSIGHT matching over BFO, and urge members to respect the values of the association when doing manual matching by browsing forms. Members of the international level of the organisation see the manual matching as a potential source of discrimination and unfairness due to its similarity to direct matching, which, as illustrated above, is seen as conflicting with the association's values.

3.4.2.5 Automatic and Manual Matching as equal alternatives

Automatic and manual (BFO) matching were brought to equal footing at the end of 2000, when AIESEC launched a new version of INSIGHT, called INSIGHT II. The major feature brought by the new system is that the automatic matching (called "match" in the system) and manual matching (called "search" in the system) have equal footing. As shown in the system documentation:

> When using the search option you can adjust your […] form before searching. This allows you to adjust any criteria that were preferred on the […] form (required criteria cannot be changed). You cannot do this using the matching engine
>
> The search option can show you an unlimited number of forms, whereas the matching engine will only ever show you up to three forms. This means the search option will allow you to look through much more of a range of forms to find the one that you want.

Both options are slightly different from the previous INSIGHT matching. The "match" option allows the member to choose between three forms. The "search" option gives even more flexibility to the user, by allowing them to adjust criteria before searching, and by showing a maximum number of search results.

3.4.2.6 Access problems and solutions

Another problem reported by AIESEC locals was that they could not access INSIGHT in the first place. The scheme used by INSIGHT involved AIESEC international granting passwords to the national ("member") committees, and those committees granting passwords to the local committee presidents, who in turn gave passwords to their members. When one of the 'rings' of this chain was failing, many local members found themselves "locked outside INSIGHT". INSIGHT II addressed this problem by giving "logins" to WWW users who could pass a test on INSIGHT usage, thereby obtaining a "user certificate".

We will comment on these software evolutions, problems and solutions after reviewing their counterparts and alternatives in BEST and AEGEE.

3.4.3 Support for BEST's seasonal courses

3.4.3.1 BEST's form of manual matching of students to events

Around 1992, BEST tried to increase the popularity of its summer courses (SCs) and introduced the possibility for students to apply to 3 courses instead of just one. Students indicated the three courses in order of preference. Organisers ("Local BEST Groups", or "LBGs") indicated the "ranking list" of accepted persons, also in order of preference. The ranking list had an "accepted" and a "waiting" list section. If a student was "accepted" to more than one course, she/he could only go to the course that was higher on her/his personal preference list. By this, his/her place in other courses that accepted her/him was 'freed up'. This resulted in one other student being promoted from "waiting" to "accepted" on each of the respective course lists. Even before the software support, the process of going through the student and organiser list and deciding 'who goes where' became known as "optimisation".

The first optimisation was run in the spring statutory meeting of BEST, in 1993 (Bratislava). As described by a participant:

> `Geoff and some other guy were sitting by a computer, in a [separate] room, trying to assign applicants to summer courses. From time to time some delegate would go in there and try to persuade them with a bottle [of`

```
alcohol] or so to put one of [the students
from his university] in some participant list
[of a course desired by the student].
```

As the timing of the optimisation did not always coincide with the General Assembly, the task of performing the optimisation was given to a Local BEST Group called the “common centre” (or “CC”) of the Summer Program.

The “optimisation” was just one step in a process perfected by BEST over the years, called the “application procedure”. The phases of the procedure were also known as the “deadline structure”. Deadlines were often referred to as “DLs” and were dates set for announcing the course, preparing a common poster, distributing promotion leaflets, mailing paper applications by written by the students (see Figure 5). In the first editions of the Summer Program, the deadlines were a subject of heated debate in the statutory meetings. The procedure was continuously recorded in a “Summer Program Handbook” or “SP Handbook” containing rules (including DLs) and recommendations (marked as “R” on the tables) updated every year.

An early edition of the SP Handbook states:

```
I.9. Accepting the applicants: The final decision
   about the accepted applicants is always [made]
   by the organising LBG, with the help of the
   [optimised] list received from the Common
   Centre (CC.)
```

Thus the “optimised list” sent by the CC is only “help” for the organisers. The organisers have the possibility of “adjusting” the optimised list by moving applicants from “accepted” to “waiting” status and the other way around. Their final decision made in this way could not be further altered by the common centre unless one of the “waiting” students that the LBG promoted to “accepted” status was also promoted by other organisers. This event was rare and was solved by the CC on a first-come first-served basis. The result of the optimised list adjustment by the organisers (and checked by the CC to eliminate such conflicts) was known as the “final list”.

Table 1: A typical BEST Summer Program “deadline structure” (for the summer 1995, prepared at the Timisoara GA, 1994)

DL	8	Dec.	Thu	Send title, dates of SC (for the SP-poster and SP-leaflet) and the name and the contact address of your SC responsible	e-mail
DL	12	Dec.	Mon.	Receiving the data of the poster for correcting	e-mail
DL	15	Dec.	Thu.	Deadline of correcting the data on the poster	e-mail
R	17	Jan	Tue.	Send your SC-leaflet to all the LBG’s	mail
DL	31	Jan	Tue.	Arrival of the SC leaflet, SP Poster & SP leaflet	mail
R	10	Mar	Fri.	Last day to apply for the SC’s	
R	20	Mar	Mon.	Send application forms to SC organisers	mail
DL	3	Apr.	Mon.	Arrival of application forms to SC organisers	mail
DL	14	Apr.	Fri.	Send the ranking list to CC	e-mail
DL	20	Apr.	Thu.	Optimised list from CC	e-mail
GA	3	May	Wed	Start of the GA in Patras	
DL	3	May	Wed	Bring every invitation letter of accepted and waiting lists students Adjustments to the lists [operated] by the CC	
DL	5	May	Fri.	Arrival of the final lists to every LBG	e-mail
GA	10	May	Wed	End of the GA	
DL	15	May	Mon.	Deposits[13] paid and [student participation] confirmation sent to the organisers	e-mail
R	18	May	Thu.	Send info to the participants	mail
DL				3 weeks before the course – Send info to the participants	
DL	2	Oct.	Mon.	Send the activity-, financial reports and evaluation	
DL	31	Oct.	Tue.	Last day to give back the deposit	

Our Recommendation (R) is to mail 14 days in advance of a DL and e-mail 2 days in advance, so you have time to check if the mail/e-mail has arrived.

[13] See the section ‘Hands-on learning from peers’ for explanation of “deposits” as guarantee of participation to BEST activities

3.4.3.2 Automatic matching with manual adjustments. Several versions

While, as we have seen, the 1993 optimisation was still subject to negotiations, the 1995 optimisation was a formal algorithm ran in the Grenoble common centre based on structured lists submitted by the organisers by email. The structured lists were produced by a software that had to be run locally by the LBGs. Some locations failed to download or run the software correctly. To respond to that and to other problems, the association decided to introduce a WWW version for 1996. As the WWW was still a novelty in many universities, the new WWW system was carefully tested at the end of 1995. The 1996 web version brought several improvements. To avoid problems of name misspellings, every student was uniquely identified by a code of five digits and could login in the system by indicating a 'password' made by five digits more.

For the first time, the optimisation problem was identified as the "stable marriage problem". The source used to study the algorithm was Sedgewick (1990). Chapter 34 ('Matching') describes the stable marriage problem as follows:

> We assume that we have N men and N women who have expressed mutual preferences (each man must say exactly how he feels about each of the N women and vice versa). The problem is to find a set of N marriages that respects everyone's preferences. […]. A […] natural way to express the preferences is to have each person list in order of preference all the people of the opposite sex.

Identifying the problem implied making the correspondence between 'students and course places' and 'men and women' and creatively observing that the problem and its algorithmic solution still make sense if the preference lists are not of equal length (3 for the lists made by students, around 25 for the lists made by organisers).

Although automatic matching via the stable marriage problem was adopted in BEST, the old amendment stating that the automatically produced lists of course participants only constitute guidance to the local organisers, and they are free to change them. Thus the BEST form of matching is 'automatic, with manual intervention'.

APPLICATION FORM

Please, fill out one application form for each course you want to attend. Attach the form to your CV and the right motivation letter, and mark the right course on it.

Filled by the student with capital letters

First Name:	**Personal code:**
Last Name:	Sex: ☐ Male ☐ Female
Nationality:	Passport number:
Date of Birth:	Year at university:

University:	
Department/Faculty:	

1. Title of the course:	
City:	Do you need a visa? ☐ yes ☐ no
2. Title of the course:	
City:	Do you need a visa? ☐ yes ☐ no
3. Title of the course:	
City:	Do you need a visa? ☐ yes ☐ no

Home address:	Studytime address:
Phone:	Phone:
E.mail:	E.mail:
Period to use :	Period to use:

For BEST use only

English level: ☐ good ☐ satisfactory ☐ poor	Ranking comments:
BEST involvement: ☐ yes ☐ no	
Home LBG comments:	

Figure 5: Application form for BEST summer courses, one of the last paper versions

3.4.3.3 "Optimising the optimisation": debates on the automatic matching

After this theoretical identification, the optimisation was subject to further refinement attempts. The initial mission of the aforementioned SPOC group was to improve the algorithm by making it allocate more places for students coming from the universities of more "active" LBGs (hence the original meaning of the SPOC acronym, "Summer Program Optimisation Committee"). To quantify the LBG activity, SPOC proposed a score calculated by applying coefficients to various components:

```
- number of free places offered in the activities
  of [the] LBG for students from other BEST
  universities […]
```

- quality of the activities (based on a formal evaluation […])
- respecting the engagements of the LBG towards BEST (keeping deadlines, respecting procedures, money debts towards the common account, etc.)
- extra credit for organizing internal [meetings, e.g. General Assembly, workshops]

The idea of the score was vehemently rejected by the LBG delegates to the next statutory meeting (Veszprem, Hungary 1996). They did not feel comfortable with their activity being quantified in a single number, and with these numbers being compared. As a result, the idea was never applied and the optimisation remained unchanged to this day.

3.4.3.4 Statistics

Another novelty brought by the SP 96 WWW system was the idea of statistical pages. Now that all data was stored by a WWW server, it became possible for the members to see the summer courses most requested by the applicants, the Local BEST Group who has attracted the most students from its university to apply to summer courses abroad, etc. The lists have more than once become a reason for celebration. Looking at the lists, the coordinator of a summer season sent this email to the LBGs:

> Hello, Europe!
>
> Yes, we have more than 3000 applicants for summer 1998!!!
>
> At 13.55 CET there are 3004 applicants with 7104 applications and since the deadline for applications is tomorrow night, there are definitely more to come!
>
> One other great thing is that almost *all* the LBGs have now [made] the applications through Internet. Special praise goes to those few exceptions who a couple of days ago seemed not to reach the rate of 50% web applicants, but that have in the last days overreached this percentage by far!!! Well done! :)

Long live BEST!!!!

Besides showing enthusiasm about the large number of students receptive to the BEST exchange programme, the coordinator is also happy to find that the electronic system is preferred by the students

Top 10 Scs according to no. of applicants

Applicants	No.	Course
345	5	Chania, Multimedia Systems and Modern Applications
267	1	Barcelona, Management of Innovation
261	26	Stockholm, Ecology and Environmental Technology
256	16	Lisbon, Intelligent Robotic Systems
241	9	Eindhoven, Sustainable Development - The Life Cycle
226	32	Valladolid, Multimedia Technologies
216	30	Torino, Space and Telecommunications
208	17	Lisbon, Thermodynamics, Art and Society
204	33	Veszprém, Solar energy Technology
197	23	Patras, Total Quality Management
194	6	Cluj, Cooperation Through Internet
181	21	Lund, Packaging Design - Dressed For Success
157	13	Helsinki, Technology in Enviromental Protection in Forest Indust
148	12	Ghent, Speech Processing
146	24	Roma, From Biosystems to Bioprocess Engineering: an Interdiscipl
144	8	Copenhagen, Physics and Electronics at Cryogenic Temperatures
144	34	Warsaw, Information and Environmental Management
136	4	Gothenburg, Sustainable Development- a System Prospective
129	31	Trondheim, BEST of Biotechnology
129	2	Bratislava, Artificial Intelligence - Selected Topics
121	22	Napoli, Advanced Materials and Manufacturing Technologies
120	14	Kosice, Industrial Waste Management
115	20	Louvain-LN, Multiphase Fluid Flows and Heat Transfer
110	15	Liege, Electromagnetic Fields Modelling
107	11	Lille, Packaging: Materials and Technologies
105	19	Ljubljana, Geothermal and Other Renewable Energy Sources
98	18	Ljubljana, Beyond Understanding: How to Learn Natural Sciences...
94	7	Coimbra, Corrosion Control
86	25	Stockholm, Applied Optics
85	3	Brussels, Photonics for Computing and Sensing
83	28	Tampere, Electron Microscopy and Other Research Methods in the...

...

summer99

Application statistics

This is the by date sorting.
Sort by title or by number of applicants.

NA= number of applications
M= male (only for electronic applications)
F= female (only for electronic applications)
EU= from EU (political statistix)
NEU= from outside EU

NA	M	F	EU	NEU		Activity
22	9	13	16	6	view	Cracow - Holidays on Horseback III
141	90	51	103	38	view	Warsaw - Consequences of using different sources of energy
161	65	96	72	89	view	Madrid - New Architecture in Madrid
57	34	23	37	20	view	Gliwice - Gray side of the World
259	147	112	143	116	view	Barcelona - Change Management
201	120	81	97	104	view	Valladolid - Quality, Crisis Management, Ecology... Be an eng
235	166	69	144	91	view	Torino - Sports & Technology
196	96	100	113	83	view	Chania - Quality: A View To The Future
353	267	86	202	151	view	Athens - Teach Yourself Java 1.1 Programming in Athens
260	159	101	186	74	view	Eindhoven - The Dutch Waterworks: the battle against the sea
prom-only						Warsaw - BEST Sailing Meeting
49	35	14	30	19	view	Kosice - L.O.S.T. - LunAtic Outdoor Survival Trekking
290	176	114	210	80	view	Lisbon - Connectivity, Information and Knowledge :Chaos or Sy

Figure 6 The Summer 1996 BEST Summer course statistics, and the 1999 version

3.4.3.5 More than support for matching

The GA (General Assembly, statutory meeting) following the first WWW-supported optimisation (Tallinn 1996) saw a lot of enthusiasm for the new system, from its author receiving standing ovations to jokes made in the "speaker's corner" about optimising the numerous couples of BEST member-lovers using the system (the humour of the joke can be further illustrated by the fact that the delegates who made the joke, as well as the average GA participant, were not aware of the name -stable marriage- of the computing problem used to model the situation).

The enthusiasm and appreciation for the new system using the world-wide infrastructure that was still perceived as novel (the Web), resulted in plans for a new system that was thought to be of even more help for the Summer Program, and its generalised year-round structure, Vivaldi. The new WWW system gradually supported most of the phases of the Summer Program (later, Vivaldi season), see Table 2.

Table 2: Procedural improvements and gradual introduction of IT support in BEST's seasonal courses program

	Summer Program 1993	**SP 1995**	**SP 1996**	**Summer 1997 (stat of Vivaldi)**	**spring season 1998**
Local group data	Paper	Paper	paper	WWW	WWW
Activity announcement	Fax	e-mail	e-mail	WWW	WWW
Student access codes	-	-	e-mail, local management on paper	WWW, local management on paper	WWW, local management on paper
Short application (name of the student, courses applied to)	Mail	mail	WWW	WWW	WWW
Long application (CV, motivation letter)	mail	mail	mail	85% WWW 15% mail	WWW
Ranking by organisers	mail	locally-run software, results by e-mail to common centre	WWW	WWW	WWW
Optimisation	manually accomplished in the General Assembly	ran in the common centre (CC)	ran in the "optimisation centre" (OC)	automatically triggered at server	automatically triggered at server
Optimisation results	Disseminated during General Assembly	e-mail to local groups	WWW	WWW	WWW
List adjustment	locally, fax	Locally, e-mail	WWW	WWW	WWW
Confirmation of participation by the student	Fax	e-mail	e-mail	WWW	WWW
Confirmation of student attendance by organisers	-	-	-	WWW	WWW
Evaluation by students, organisers, teachers	mail	mail	mail	WWW	WWW

1, 2, 3, Caramba!

Read the Vivaldi Handbook ONLINE!
A must read for every LBG member involved in Vivaldi matters!

Join SPOC! and see how people left, or tried to leave.

summer97

View season details

Enter/modify data	View data	Other documents

Activities information Hide

Enter/modify data	View data	Other documents
New activity in Timisoara	All activities (public, internal)	Season's files: (leaflet, small poster, ...)
"Management Information Systems" information		Activities' leaflets (if any)list

Applications Hide

Enter/modify data	View data	Other documents
Code management: by last name, by code, by first name For other **code** matters, go to the Private Area (press Back or use this link)	AFs for "Management Information Systems"	Web application for students (NOT to be used by the LBGs)
	AFs from/for all LBGs/activities	
AFs from Timisoara		

Ranking lists Hide

Enter/modify data	View data	Other documents
"Management Information Systems" ranking list	"Management Information Systems" ranking list	
	Ranked students from Timisoara	
	Ranking lists for all activities/LBGs	

Optimized lists of optimized activities Hide

Enter/modify data	View data	Other documents
	"Management Information Systems" optimized list	Legend about the optimization
	Unofficially accepted students (optimized list) from Timisoara	
	Optimized lists for all optimized activities/all LBGs	

Final lists Hide

Enter/modify data	View data	Other documents
Adjust the final list of "Management Information Systems"	"Management Information Systems" final list	
	Officially accepted students (final list) from Timisoara	
	Final lists for all activities/all LBGs	

Confirmation/extra acceptance Hide

Enter/modify data	View data	Other documents
Accept extra to "Management Information Systems"	"Management Information Systems" participants' list	The Never-alone Guide
	Participants' list from Timisoara	
Confirm participants from Timisoara	Participants' lists for all activities/LBGs	

During and after the activities: attendance, evaluation, deposit Hide

Enter/modify data	View data	Other documents
Confirm attendance to "Management Information Systems"	Attendance to "Management Information Systems"	Make the BEST presentation during your activity.
	Address List of "Management Information Systems"	Attendance certificate
Enter new evaluation for "Management Information Systems": organisers, professor	Deposit return and evaluation situation of students from Timisoara	
	Attendance/deposit return to/from all activities/LBGs	
	Evaluations for "Management Information Systems": students, organisers, proffessors	
	Student evaluation statistics for all activities	

This page has been generated with JML

Figure 7: Interface for Local BEST Groups (acting both as course organisers and as 'senders' of students to other courses) in the "Johnny" system

The new WWW system, arbitrarily baptised “Johnny” (and further ‘personified’ by members, including joke-proposals for BEST presidency) contained in its interface the “season structure” with links to perform the respective operations (see Figure 7).

3.4.3.6 Hands-on learning by using the software

Along with the WWW system, the link to the formal Vivaldi Handbook (formerly Summer Program Handbook) was revised. There are many signs that the members prefer to use the software without reading the handbook. Here is one example. A local organiser has sent an email to the season co-ordinator:

> According to Johnny it seems like he will take people from the waiting list and put them on the accepted list automatically. This doesn't fit our plans for the perfect summer course.
>
> We strive to have as many countries represented as possible and also equal amount of boys and girls, which will not be possible if Johnny behaves in this stupid way.
>
> We have now done as Johnny told us and entered people on the waiting list but we would prefer to be able to choose who gets the vacant place.

The system implemented the rule of the final list of participants being made “with the help of” the list displayed by the system, as required by the old rule, mentioned above. After being informed about this, the organiser replied:

> I didn't know this. Sorry if I seemed to be rude. This adjustment possibility is great! (I just wanted to avoid future comments from the participants that we accepted too many from this or that country...)

3.4.3.7 The local-global debate, BEST version

The above example also shows that the local concerns for balancing the number of girls and boys and balancing the international spectrum of participants was very different from the concerns of list optimisation existent at global BEST levels.

Another example that illustrates this discrepancy between local and global concerns is related to showing the course preference of the students to the organisers. In the initial version, the organisers were only able to see that the student applied to their course, but did not know if the application was first, second or third choice. The spring 1997 statutory meeting saw a proposal to make the choice visible to the organisers, on the grounds that it used to be visible before (see Figure 5) and that the student choice is a legitimate criterion for organisers to use when they make their own list of preferred participants. After the proposal was approved by a tight vote margin, the programmers of the optimisation protested: this was violating the assumptions of the mathematical model used. In other words, the stable marriage problem assumes that the 'men and women' do not know each other's preferences, because knowing them would affect their decision and that would not be fair for the other side. Still, programmers had to implement the change, and show the student choices to organisers. In the years that followed, many organisers ranked only students that had the course as first choice, thereby ensuring that the optimisation will not change their preference list. The General Assembly in 2000 (Stockholm) approved a new rule (again, by a tight margin), to hide the information, out of fairness for the students.

Other debates around the system existed, with similar local-global conflict patterns. At the beginning, the student identification codes were only valid once; students had to take new codes from the LBG in their university every time they wanted to apply for a course. In 1998, SPOC as program coordinators, and the programmers introduced the possibility for a student to re-use their code in the next seasons, as a matter of convenience (not having to get a new code, to re-enter their personal data, etc). The locals questioned this decision, arguing that the student might graduate and illegally use the code while not being a student any more. The whole debate was deepened further by a suspicion that some LBGs used to informally "sell" codes to students, to balance their budgets (so called "travel agency problem"). In a statutory meeting (Chania, Greece 1999) a proposal was passed for LBGs to "activate yearly the registration codes of the students".

It later became apparent that many of the LBGs voting “for” the proposal were motivated to do so by another reason than the possible graduation of the student. The group of programmers (by now constituted in the “Information Technology Committee” or ITC) had not been aware that many groups had had problems in tracking the codes that they had given away to students. After new code tracking features were provided, a local group member sent an email:

```
Subject: Re: Johnny: new code tracking tools
[…] Thanks!!!! […] you did a great job ...
Maybe it's easy to do but it's very useful for
the LBGs, thanks :-)
```

3.4.3.8 Features not requested

While other features (e.g. ability to print out all applications for a course at once) had been vocally requested, no member asked for a feature that would support better code management, which was seen as useful afterwards. This trend to ‘live without’ features is further illustrated by the ability of the members to ‘live with’ bugs. Programmers saw that many internal errors of the software, discovered on the software logs, were surely visible to the users but were never reported. To address that, an error form was shown whenever an internal error occurred.

3.4.4 Support for AEGEE’s Summer University

AEGEE’s summer university is in many ways similar, in terms of procedure, with the BEST summer programme. Software is employed for entering and centralising applications (like in BEST, a student can make 3 applications), central application processing for ‘matching’ (called “pre-selection” in AEGEE), dissemination of matching results in the association, etc. As major points of difference, the summer university is only meant for AEGEE members (as opposed to any student in BEST universities), and there is an application fee, which is due to the AEGEE treasurer.

3.4.4.1 Problems with access and technological heterogeneity

The large number of AEGEE “antennae”, and the diverse kinds of levels of access to IT and Internet connections in their respective universities imposed a great deal of effort for accommodating “antennae” that do not have a permanent internet connection or did not have access to more than a DOS terminal. The application designed to respond to these conditions, called LAMA, is distributed on CDs (along with many documents the organisation), and ran locally on PCs. For the 2000 Summer University, the "infrastructure requirements" were specified as follows:

- participants ideally have an e-mail address, and it is useful if they can access the world wide web (especially for the application and the SU evaluation this is desired). However, neither is required.
- sending locals must have a working e-mail address. They need web access once in order to fill-in the address registration, apart from that it is nice & useful to have web access, but not required. A computer must be available in order to install & run the SU application software.
- organizing locals must have/ provide a working e-mail address and must have web access.

  (In special cases where Internet access is completely unavailable individual solutions can be found.)

Student applications are often centralised by locals on diskette, or submitted by e-mail in a special format. Email centralisation of applications was still the "main tool" in 2000, and even the WWW "application assistance" is generating and sending an email internally. The paper applications have been "outruled" in AEGEE by 1999.

The large number of AEGEE members poses important problems for accessing the systems. Membership cards, printed annually, are thought of as the future way of authentication in the AEGEE systems. At present, members report: "locals tend to notoriously loose passwords e.g. during [local] board change". A mechanism of having members who can issue passwords for other members (similar to AIESEC's) has not been successful. The association replaced it with a system of "export passwords" that are sent out repeatedly with email reminders.

3.4.4.2 Automatic matching in AEGEE. Heuristic and debate

The AEGEE form of "matching" (the correspondent of BEST's "optimisation") is called "pre-selection". The pre-selection presents each organising local with a list of applicants, out of which they make the final selection. The main difference between pre-selection and the BEST "optimisation" is that the organiser preferences are not known at the moment of matching, therefore instead of matching 'participants' to courses, the pre-selection matches 'applicants' to courses, aiming at two goals: (1) to make best use of available summer university places and (2) to greatly respect the priority of the 3 applicant wishes.

The algorithm used for the pre-selection is a heuristic. WWW documents show a great deal of preoccupation of the SUCT ("Summer University Coordination Team") with the details of the heuristic, as well as showing their efforts to explain the heuristic to the rest of the members. The two main heuristic alternatives considered are explained as follows:

```
-- Method 1: Best for participants first choices --

Send everybody to his first choice and then
reduce the number of SU that are
"underbooked". With this distribution some
organizers will have an insufficient number of
applicants to compose the desired selection
(motivation, nationality, sex, age...), while
others have a huge surplus (up to 1:10). After
the shift of some participants from their
first to second or third choice approx. 90% of
the applicants are sent to their 1st choice.

-- Method 2: Best for organizers --

Applications are distributed equally, all
organizers have "enough" applications to
weight sex, nationality, age etc. Then rise
the number of first choices. In the end
approx. 70% of the applicants are sent to
their 1st choice. (Here we are still working
on adding some optimizing for the distribution
of "nationality/sending local" and "sex", but
```

it is still unclear if this can produce significant improvements.)

Effects of the methods on application data is carefully studied by the SUCT and then presented to the association in graphs an charts (see Figure 8). A strong emphasis is put on graphs showing the main organiser concerns, which are similar to the concerns we encountered in BEST: weighing of participant sex, nationality, and age.

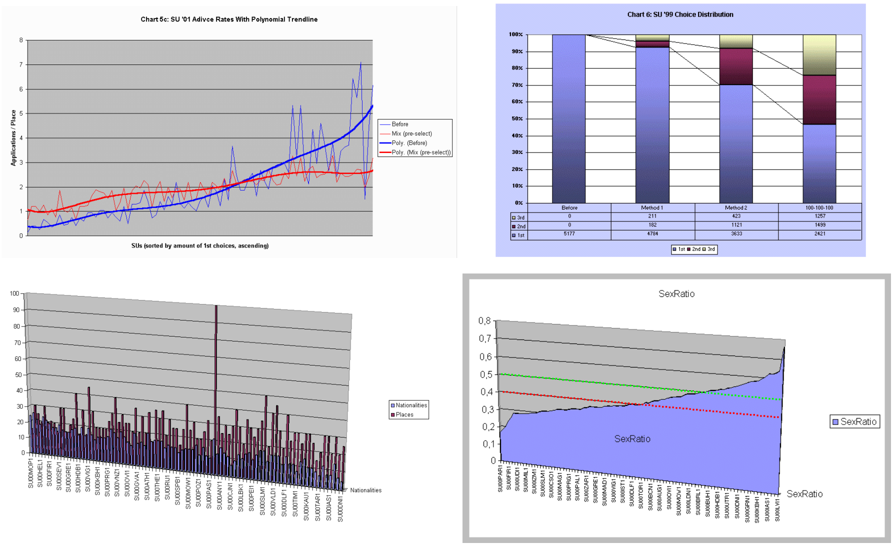

Figure 8 Studies of various pre-selection methods in AEGEE: approximation of trend lines given by the application/places ratio when applying different methods (up left), 1st, 2nd n 3rd choice distributions when applying alternative pre-selection methods (up right), number of nationalities and places for the summer courses in 1999 (low left), ranked sex ratios in the same year with optimal mean (0.5) and real mean (0.4) indicated (low right)

In the 1999 pre-selection, the designer wanted to introduce a student-friendly feature in the pre-selection procedure, which was rejected by the association, which demanded a repetition of the pre-selection:

> […] a SU organizer would only receive a certain percentage of applications in excess to the available places; all "cut-off" applicants would have the advantage to receive an early notification of the fact that they should plan their summer differently […]. This

> was, however, strongly opposed at the [statutory meetings] and enforced a re-design and re-run of the pre-selection.

3.4.4.3 Problems understanding the matching

In other accounts, IT-concerned AEGEE members report that the locals had problems understanding the "ins and outs of the pre-selection problem, especially its limitation to produce the 100% wanted list of applicants". Locals also showed concern that the pre-selection "eliminates applications". To address such concerns, showing that the pre-selection only "distributes" applications, the software had to be extended with "browsing and lookup functionalities [showing] status information for applicants, sending locals and organisers" (see Figure 9).

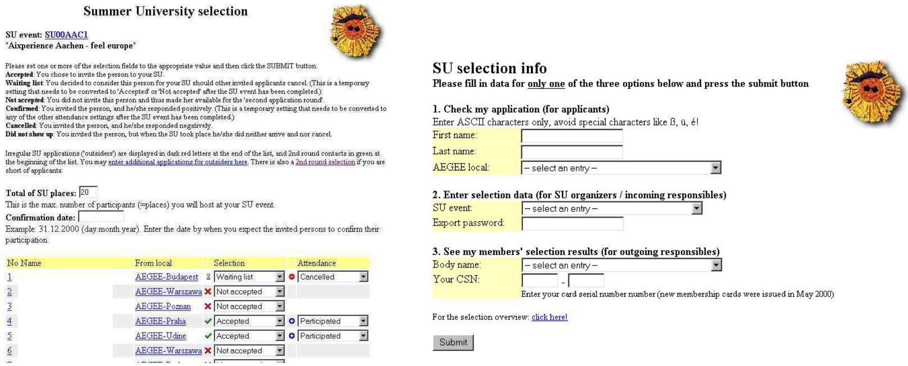

Figure 9: WWW support for participant ranking and the marking "no-shows" by organising locals in AEGEE (left, applicant names have been removed for anonymity reasons), and checking the selection information (right)

3.4.4.4 Progressive system growth from the "matching" core

Further extensions of the WWW support for the Summer University were done to address the issue of student "no-shows" to the courses (the correspondent of the BEST deposit mechanism). To track down locals with higher number of no-shows, a new web interface (see Figure 9) called "selection and attendance" was tested in 1999 and ran as part of the official procedure in 2000. The 2000 version of LAMA, the local software, also includes a "Participant management" (PAM) module for participant registration, management of lodging and participant fees. Also, similar to BEST and AIESEC, statistical pages were compiled. Finally, a new WWW module was introduced, helping organisers to fill up their course places with people who were not accepted to other events.

While discussing these popular extensions of the software, an AEGEE IT coordinator uses a maxim to explain the members' trend to ask for more features once they know that the data is, or can be made available:

```
Appetite comes [by] eating!
```

3.4.5 Summary: evolution of software in the 3 organisations

After considering field observations in relation to software inception, adoption and shaping, we will now proceed to summarize the observations in regard to our second research question (IT design in amateur communities) and to current findings in the field of CSCW.

3.4.5.1 Software inception

In answering the questions posed in the section introduction, we will now trace some resemblances between the cases considered. First and foremost, when looking at how the idea of new software comes into the communities, the cases share an interesting aspect of *matching algorithms* as the inception of the software support. Concluding that "student communities start software from a matching algorithm" would of course be a hazardous statement; nevertheless, this pattern as encountered in the three settings deserves further analysis.

Our question asking 'how does the software evolve' in communities raises another interesting pattern. While, as members put it, "appetite" for new software features "comes by eating", i.e. by using the existing features, the new features share one aspect: many new features are focused on browsing the data that was initially collected for 'feeding' the algorithm. At later stages, data with no 'algorithmic' value is added to the system, either supporting coordination in the exchange procedure phases other than the matching, or adding more information to the matching data, which is not useful for an algorithm, but is can be used by a human during 'manual' matching (see AIESEC "comments" field in the BFO form).

To offer an explanation for the transition from automatic, algorithmic features to manual matching features, we should notice another pattern: the software is developed by *volunteer programmers*, members of the setting. Data show an intense interest of these members in theorising the algorithms, refining them by studying various alternatives and their consequences, etc. The algorithms undoubtedly pose a *challenge* to the respective members. When relating to our previous observations on amateur work, the volunteering of work to develop the new software becomes easier to understand, thereby offering an explanation to the 'system inception from algorithms' phenomenon.

3.4.5.2 Software adoption

As in previously illustrated cases (see "marketeam" and the BEST logo), the member-programmers' challenge to put up algorithm-based systems does not translate into a successful system for the community. In many cases, members explicitly reject the matching algorithm and go around it, like in the "direct matching" in AIESEC, a similar phenomenon in AEGEE known as "the two-pigeons-for-two-pigeons syndrome", or BEST organisers preferring only applicants that ranked their course as first option. Members often show or express lack of understanding of the matching mechanisms, despite the efforts of the algorithm-interested people to explain "the ins and the outs". Local organisers react to the software due to the challenges and contingencies they face when arranging events locally: finding a traineeship that is suitable for a student, having a balanced summer course participation in terms of gender and nationality, etc. Having these problems solved by a 'black box' algorithm is contrary to their "strive for the perfect" arrangement, thus contrary to their challenge.

We see here automation as a reason for rejecting software, or at least central features of the software. Going along the lines suggested by this pattern, we can suggest 'wrong kind of automation' as one more cause for the failure of the automatic meeting scheduling examined by (Grudin 1988). Indeed, the word 'automatic' is not any more part of the description of the successful meeting schedulers studied by Grudin et al. (1995), and one of their informants explicitly refers to "browsing" as a quality that leads to the application success.

Comparing with cases presented by Rogers (1994) and Bowers et al. (1995), we find similar patterns of disputes about the new software. Lower organisational levels prefer less restrictive procedures, while higher levels prefer formalisms and (as in the case presented by Rogers) automatic (algorithmic) data processing. However, in the cases illustrated, disputes are not only based on practical, managerial, 'arranging' issues. Some conflicts come from concerns for the values of the association (mostly advocated by the global coordinators, but not only) and the day-to-day contingencies faced by local event organisers. In the cases considered, the global coordinators tend to propose more ‘participant-friendly’ features, as perceived through the lens of the association values. The initial limitations imposed by the AIESEC Exchange coordination team on the usage of “Browse Form Options” state that BFO should be used in an “ethical, fair and non-discriminatory manner”. The debate on whether the organising BEST locations should see the applicants’ preference ranking for their course, as well as the revision of the association’s decision after some years, ending up with “fairness for the student” participants, also shows such a ‘value dispute’.

A notable aspect related to adoption is constituted by members of the presented settings not having a complete grasp of the organisational procedures supported by the software. ‘Hands-on learning from peers’ favoured in comparison to the reading of booklets is probably a cause of this phenomenon. One of its results can be a mistaken rejection of the new software or at least intention to reject, like we have seen in BEST.

Another problem with adoption is related to the very installation of software components in the locations (see AEGEE’s “annual CD”), or the access to the software from a certain location. Hierarchical password assignment was problematic in AIESEC and AEGEE (confirming the suggestion made by Bowers (1994) on the role of access mechanisms in the work to make a new system work). Free registrations of accounts (e.g. in BEST), accounts granted after a “certification test” (AIESEC) and “export passwords” (AEGEE) are options that performed better. They are all less secure, suggesting that accounts are more important for identification than for security in such settings.

3.4.5.3 Software shaping. Challenge conflicts: member-developer, local-global

Despite the negative reactions, the new software is not completely dropped by the considered associations. As Grudin would suggest, the organisation-wide “system” stands more chances to survive than a group-wide “application”. By their reactions, the community members shape the system ‘away from the algorithm’, transforming it into a primarily information-sharing system. Gradually, the locations increase their “appetite” for new features and see *other* values of the information presented, related to addressing *their* contingencies, like ‘which accepted students from my university have really attended the event?’ Rather than being of central importance, the algorithm becomes one of many system features. It is just offered as an alternative (e.g. in AIESEC “match” is an alternative to “search”) or members are able to override the algorithm results (as in BEST).

Following this socio-technical design circle (O’Day et al. 1996) we can now propose ‘challenge conflicts’ as an important aspect of community software design. We have already illustrated the dispute between the ‘global values’ and the ‘local contingencies’, which is likely to come from the conflict between the challenge taken by coordinators and the one taken by local organisers. The conflict between the ‘matching algorithm challenge’ taken by the amateur programmers and the ‘event arrangement challenge’ taken by the local organisers has been a major force in driving the design of the system. Thus developers take a major role in the considered cases, their challenge (striving for algorithm perfection) is different in nature from the other members’ (“striving for the perfect” event). While developer inclination is not typically an issue in the design of software in professional settings, we can propose a major role of amateur developers’ challenge in design for voluntary communities.

Giving more attention to amateur developers’ challenges and contingencies is therefore a suitable direction for the community software research. While writers like Raymond (1999) and other open source enthusiasts can be read as ‘the challenge for perfect software’, such a challenge cannot be seen in isolation from other members’ challenges, not related to software development when they exist in a community (which is not the case with open source communities). In the illustrated cases, developers do not have a ‘reigning’ role with ‘absolute powers’ and responsibilities such as in MUDs (Curtis 1992, Pargman 2000). Instead, their challenge is an important design constraint, but has to be co-exist with other member’s challenges.

3.4.5.4 Sparing volunteer developers of extra work

One of the most important software design consequence of developers being members of the community is that other members may not demand new features from them, for sparing them of extra work. There is indeed no contractual obligation between the two. Instead of asking for new features, members might try to manage the difficulties of the existing software and take them as part of their day-to-day contingencies (see the “support for code management” example in BEST). Furthermore, members were seen not to report bugs and, given the low level of expertise of members in the organisation realities, it is not always clear for a member if a software behaviour is a bug or a feature!

3.4.5.5 Accountability of challenge

Besides challenge conflicts, we can observe challenges that are shared by the almost entire spectrum of association members. While not being part of conflicts, such community-wide challenges, often related to core values and projects of the community, do also play an important role. As an example, in the illustrated cases, members show an interest for the statistics of the exchange project applicants and participants. Such software features make possible celebrations surrounding the data they show (see the BEST case) or professional analysis (see the AIESEC marketing statistics), etc. Suchman (e.g. Suchman 1994) talks about workflow systems as ‘technologies of accountability’, not just in the monetary sense of the word ‘accountability’, but in the sense of one part of the organisation being accountable to others in terms of keeping track of things that are still to be done, or things done already. While Suchman’s term is intra-organisational, Bowers et al. (1995) suggest that accountability should often be seen as an inter-organisational matter. By looking at the transformation of the community software from a ‘matching software’ into an ‘information sharing software’ supporting the coordination between locations, we can recognize the intra-organizational pattern suggested by Suchman. However, the features supporting the assessment of how much the community met its global, community-wide challenge suggest another kind of accountability support from software, which we could call ‘self-accountability’, different from the inter-organisational accountability in that it involves the community as a whole, not just its locations.

3.4.5.6 Learning by engaging with the software

Besides hands-on learning from peers, engagement with the software becomes an important source of learning about the procedure supported by the software. The table of deadlines illustrating the BEST application procedure (Table 1) is ‘transferred’ to the main page of the WWW support for the exchange program (Figure 7). A system interface thus replaces parts of a handbook, presenting relevant rules for the respective procedure phase (see also the AEGEE selection interface example, Figure 9).

In Chapter 2 we noted that formal handbooks of rules and regulations have an important role in learning about the community, along with the 'learning in doing'. Transferring such handbooks, or relevant parts of them, to the system suggests an important role that the software can play in a transition from formal learning to 'learning in doing'.

3.5 Conclusions

The results of this field study suggest that there are many resemblances between amateur radio work and voluntary student organisation work. As aspects of work were found to be intrinsically connected to community endurance, our view on community endurance (our first research question from the Introduction) has been strengthened and enriched in this chapter. Aspects of challenge and contingency, research, pioneering, hands-on learning are present in the student organisation work, which strengthens our view on community endurance. This chapter has contributed also in emphasizing differences (or more pronounced features) compared to amateur radio work: conflicting challenges, importance of member-developers, challenge exhaustion, cyclic research and learning, professional influence. We will now reiterate these differences, and try to look into their origins.

Challenge conflicts come from a higher heterogeneity of challenge in student organisations: it can come from contingencies of local arrangement, contingencies of global coordination, contingencies of software development, application of marketing principles and other professionally-related teachings, etc. While the challenge of achieving high-performance radio connections can be of many sorts, this is not a case of heterogeneity in the sense expressed here: pursuing this challenge in one connection mode will not interfere with other members pursuing it in other modes. Oppositely, the student organisation case has shown conflicting challenges, resulting in debates such as 'local-global' and 'member-developer', which played an important role in shaping the IT tools.

Member-developers are present in Ham radio as well as in student organisations. However, the organisation-wide character of the software developed in the student organisations considered drew attention on the fact that voluntary developers have an important role in software shaping. Chapter 4 will consider design for member developers.

Challenge exhaustion is a quite surprising novelty after seeing the ‘infinite spaces’ of radio contingency in Ham. Challenge exhaustion can be a real threat to a certain practice in a voluntary setting: if none of the members see the challenge any more, the respective activity may not endure. Consider for example software development and maintenance. If there are no challenges left there, if all the needed software is done and the members who implemented it finish school or see no point to stay in the absence of challenge, there may be nobody to fix a bug or provide a new feature. Given the role of member developers, as well as software design being done inside the student organisations, Chapter 4 will develop a more sustainable perspective on software design and development in a student organisation.

“Reinventing the wheel”, in cycles of research and pioneering that may not seem useful at first sight, but are of great importance for learning, is new comparing to amateur radio. This may be an effect of the short-term membership of student organisation combined with hands-on learning.

As a generic origin of the differences between amateur radio and student organisation work, we can propose the lower level of skill that students generally have in comparison with their professional counterparts (managers or software developers). Students do not have the time to develop to high levels during their short membership, hence there are stronger influences from the professional sector, as well as specific learning patterns. In many ways, the Amateur Radio community is more of an ‘ideal’ amateur community, in comparison to the student settings. Having the ideal in mind, and the ‘detected imperfections’ of the student communities should help us understand endurance in the student community case as well.

Aspects like challenge exhaustion and challenge conflict might not constitute differences as such. While they may be present in amateur radio, the fact that they were found in student communities is important for our second and third research questions, related to IT design and self-sustainability of design and development practices respectively. In the next chapter follows a description of how the lessons learned from the field studies were applied in the practice of IT design for a student community.

Chapter 4
Amateur-work-oriented design

4.1 Introduction

Study of the student organisation work and technology in Chapter 3 has reinforced our sensitivities to challenge, research and pioneering that were encountered in Amateur Radio. We have illustrated aspects of challenge in the work of the student communities presented, as well as in the software that the settings created for the work support. Challenge as learned from Amateur radio has been enriched in a number of directions: challenges can conflict, can be exhausted, can be driven by outside (professional) models, which play a role in educating the challenge. We have then seen how challenges contribute to the inception and shaping of software in the three student organisations and noted the specific role of amateur developers during this process.

This chapter will present a reflective account on a five-year experience of software design in the BEST voluntary student organisation introduced in Chapter 3. The experience will be viewed through the lens of Participatory Design principles and values, which became increasingly conscious to the author and to some setting members during the experience. The chapter aims to contribute to the corpus of PD research in voluntary settings, to propose future directions for such research, to propose PD strategies specific to such settings based on the amateur work perspective developed in Chapters 2 and 3 and to enrich that perspective by reflection on the long-term experience described.

From the outset it must be noted that the author is no longer an observer in the setting. Not only is he an active participant, but at times he is the leader and sometimes the only person who does active work. As it will be seen later on, the author is not just a collaborator, but also a tutor and a ‘challenge educator’. The perspective thus shifts from the ethnographic orientation taken in Chapters 2 and 3 towards an ‘action research’ perspective in the spirit of work-oriented design (Ehn 1988), similar with the one taken by the Xerox group (e.g. Suchman, Blomberg, Orr, and Trigg 1999) and other PD practitioners who use ethnography and participant observation in the early stages of their work.

4.1.1 Participatory design and community

Participatory Design (PD) has been in wide use in industrial and governmental settings in Europe and North-America. A wide range of techniques and tools have been developed, based on a strong theoretical framework.

Due to involving users early in the design process, PD appears to be a suitable approach for designing in communities and organisations based on voluntary contribution. Indeed, unlike many employed workers, volunteers can refuse to use a software tool if they do not like it, and early involvement of volunteers in design can bring their inputs and thus help to avoid such a rejection (and in general, can lead to a better result of the design).

In spite of the perceived suitability of PD in voluntary settings, there are very few accounts of participatory design done in such settings. In a paper at the 2000 Participatory Design Conference, Trigg (2000) can only find two such accounts, besides his own: the work by McPhail, Constantino, Bruckmann, Barclay and Clement (1998) and the work by Bentson (1990). Even if such accounts are few in number, there are interesting similarities between them, many of which seem to differentiate PD in non-profit settings from classical PD for employed work. Such similarities will be reviewed in a later section.

In the for-profit sector, there is a growing preoccupation about participatory design of software support for informal structures called “communities of practice” (linked to the homonymous theoretical concept by Lave and Wenger, 1991) for knowledge management (e.g. Muller and Carey, 2002), but, although membership and contribution in such communities is voluntary, the common aspects with PD in non-profit volunteer settings has not yet been explored.

4.1.2 The issue of self-sustainability in PD

The main focus of the ‘PD lens’ used in this chapter will have a special orientation towards the long-term sustainability of PD practices in the setting after the author intervention. Sustainability is one of the six principles of the MUST method proposed by Kensing, Simonsen and Bødker (1998). Although they find an increasing willingness to experiment with PD as a way of introducing new software, this does not refute the earlier observation by Clement and Van den Bresselaar (1993) who emphasize that “PD is still characterized by isolated projects with few signs that it leads to self-sustaining processes within work settings". Organisational inertia and resistance are seen to be the causes of this lack of long-term sustainability of PD practices in the organisations that have benefited from PD projects and "greater democratisation at all levels" would be needed to overcome this problem. Since democracy in voluntary settings is likely to be stronger than in employment workplaces, and, as discussed above, PD is likely to be accepted easier, *self-sustainability* of PD practices appears to have better prospects within non-profit voluntary settings.

As it will be shown later on, in the BEST case and most probably in other student organisation cases, self-sustainability of participatory design depends on the self-sustainability of software *development* activities (as distinct from software design) within the amateur work setting. Support for amateur software developers will be proposed here as yet another type of outcome for PD projects, besides outcomes like software systems (most projects), empowering workers with help on software use (Clement 1994), customising off-the-shelf software using PD techniques (McPhail et al. 1998).

Design for supporting software development was the initial focus of HCI (Schneiderman 1980 referred by Rosson and Carroll 1997). While the mainstream attention of the HCI community has been subsequently directed at more pressing issues related to non-programmers, IT design for the software developer, especially for the novice, remains an interesting domain. Designing easy-to-learn programming languages and environments are in the central focus of a separate field, Psychology of Programming (e.g. Hoc et al. 1990). Computer support for cooperation in large software development projects is still a provocative subject for HCI and related fields (e.g. Atwood 1995, Grinter 1997). Geographical distribution (like in the case of BEST) adds another set of problems to support for software development (Grinter et al. 1999). A growing interest exists for the ways software is developed in Open Source (e.g. Raymond 1999), although this interest is more channeled towards Open Source as a community (e.g. trying to explain volunteer contribution, Kollock 1999). HCI as a field has been less interested in the development tools used by geographically distributed volunteer settings, with the notable exception of Yamauchi et al. (2000).

4.1.3 Action for self-sustainability of software activities in BEST

In BEST, self-sustainability of an activity (such as international exchange programme coordination, training of members, software design, software development, etc) is known as “continuity”. While continuity of local practices (such as arranging a summer course) is preserved by personal contact of co-located members, continuity of work done at the international level is more difficult to achieve.

Since the emergence of the SPOC “committee” as an international group that takes long-term care of a certain area (exchange programme coordination), the idea of “committee” has been seen as an important tool for achieving “continuity” in that activity, by its new members learning hands-on from the older ones in e-mail contact and in periodic committee meetings (dedicated, or as part of statutory “general meetings” or smaller international meetings like “workshops”). In an attempt to increase continuity in software matters, the author proposed the creation of the “IT Committee” in 1997. As the continuity in software development was still problematic, the author started to see it as a research issue, and to propose designs for amateur software development tools in the end of 1999.

Chapter 3 has exemplified various ways in which BEST and other student organisations have shaped their software through voting by member group representatives, incremental additions and transformations requested by the members (“appetite comes by eating”) and changes of procedure that automatically implied changes in the software. To give more structure to these long-existing participatory practices, in 2000, a series of design workshops were initiated, which led to the institutionalisation of a “Feature Design Group” within the IT Committee, specialised in IT design, including many non-programmer members.

Establishing a software group is a form of progressing from a *spontaneous* activity in which volunteers from various locations make isolated software-development efforts, or isolated software design suggestions are made, to a *conscious* cultivation of software design and development competences, taking advantage of skills and perspectives from various European locations, in the same way as other competencies and activities (e.g. arranging student exchange) were developed and promoted by the association.

The attempts to achieve continuity (self-sustainability) in software design and software development activities within BEST and especially within its IT Committee will be the main subject of this chapter.

4.1.4 Structure of this chapter

First, Participatory Design in non-profit settings will be reviewed. Then follows a review of our conclusions from previous chapters that are considered to be relevant for the issue of self-sustainability in amateur community activities. The setting where the participatory interventions took place is then described. The *intervention in software design* attempted to set up a participatory design activity in the student community, and was evaluated reflectively with the members. The *intervention in software development* was directed at the self-sustainability of the amateur developer group within the association, the tools designed based on previous experiences and developer input are described. Before conclusions are drawn, a *generic approach to PD self-sustainability* is presented, by combining experiences from the two interventions.

4.2 Participatory design for Non-Profit and Volunteer Work

4.2.1 Differences from PD for employed work

While the basic principles of PD in volunteer settings are perceived to be the same as in any work setting (reciprocal learning between users and designers, hands-on learning and design) the accounts of PD in the non-profit sector have specific differences. We will review these differences by looking especially at the work of Trigg (2000) in the Global Fund for Women (GFW) and McPhail et al. (1998) at the CAVEAT organisation, aimed at reforming the Canadian judiciary system. It will also be pointed out whether the respective aspect is present in BEST. Before going on with the review it is important to note that they are not meant to be prescriptive, i.e. that there are many non-profit PD instances where few or none of the differences appear.

First, the *tensions between stakeholders* in the design process are likely *not expected to be pronounced* in the “third sector”. McPhail et al. report “a strong sense of shared purpose” among the setting members, making even the personal likes and dislikes to be less evident. In comparison, the ever-present conflict between management and employees is affecting most PD experiences reported. The “shared purpose” is very similar to a *challenge* in the sense developed in Chapters 2 and 3 (for example, fighting for the rights of victims of judiciary abuse, as in the case of McPhail et al) but, as we saw there, *challenge conflicts* do exist and they do affect design. However, their duration and intensity is not comparable with the ‘class struggle’ aspects of PD for employed work.

Setting up design workshops is a problem in employment-setting PD due e.g. to the necessity of convincing management of their usefulness, the need to arrange that the time of the involved workers is compensated for, etc. For similar reasons, *involving management in design* is also a problem in employment settings. Both issues are less evident in working with volunteers since the time of volunteers is more flexible, and material compensation for participating in ‘extra’ activities such as PD workshops is not needed. However, lack of time is reported by Bentson (1990): the volunteers are so busy with their work that they have little time and see little motivation to participate in design sessions (which is likely to happen in professional settings too). Trigg (2000) develops an entire strategy of ‘catching’ GFW members for simple design questions and for arranging more elaborate design sessions. At CAVEAT, organising a PD ‘future workshop’ lead to application of previous knowledge that members had from what they called the “ICA workshop”. In a similar manner, as it will be described in more detail, holding a PD session in BEST was organised over the “working group” ‘institution’ that BEST was practicing for a long time for all sorts of discussions in international meetings. In the GFW and CAVEAT accounts, non-profit management plays an important role in the design, and are open to participation. In BEST, several organisation leaders (members of the Board) ended up as long term members of the Feature Design Group after their Board mandate finished.

Design groups are more variable in non-profit settings. In the employment-based setting the design group might become a formal ‘institution’ due to the need to take workers away from their normal duties, so often a clear membership list exists. In the non-profit sector (at both CAVEAT and GFW, but possibly in employment-based settings too), members join the sessions or are caught between two tasks on a more ad-hoc basis. In BEST, members join working groups on a certain topic in a meeting, and can join a group on a completely different topic (i.e. not software design) in the next. Variability of groups can be seen as positive for getting more design perspectives, on the other hand, it appears negative for the acquisition of design skill, since members are focused on design for short periods.

Empowerment of workers with knowledge of technology, a classical employment-PD issue is less problematic at CAVEAT and GWF. In fact, both projects represented continuations of projects already started by members of the setting, for use by their colleagues.

In summary, many of the obstacles that need to be overcome by the PD practitioner in the employment-based settings tend not to be present in the “third sector”, at least those presented in the available studies. Reasons for this can be the absence of accountability for employed work, the absence of class struggle, the openness to learn software design and technology, etc. This does not imply that PD is a much easier thing to do in non-profits: the practitioner has to address other issues like the lack of time of the members, variability of the groups, as well as other issues suggested in the next section.

4.2.2 Other specifics of PD in non-profit settings

It is important to note that in many non-profit settings such as the three described in Chapter 3 (including BEST) and the CAVEAT and GFW settings *development is done from within*, by members of the association, in most cases *volunteers*. Trigg (himself a volunteer up to a moment) mentions that initial versions of the software were made by some consultants, but the organisation did not follow up with them, and wanted to make sure that at least one member “would always have an understanding of any new tool added to the database”. Indeed, many non-profits are not likely to be able to invest in external IT development resources over the long term. Although at GFW this has happened for a short time, development from within is preferred later on. As long as the software development needs are not too complex, IT-oriented members of the organisation are able to do the job. *Customisation* of existing software is often a way of proceeding in developing new features (both at CAVEAT and GFW), and is likely to require less effort and skill from the member-developers.

On the same token, in all non-profits considered, *many designer*s *are members, often volunteers.* Even when design becomes a very conscious and specialised activity (such as PD), a non-profit rarely has the possibility to employ design consultancy from outside. This suggests that the mission of a PD practitioner in such a setting is not only to make the organisation trust PD so next time when they need it, they can employ outside help (which, as argued here, they are not likely to), but to try to propose PD as a long-term, self-sustainable practice within the setting. Members being designers also constitute an advantage: there is more trust between users and designers, and there are smaller needs for translation between the user language and the designer language (like in e.g. Williams and Begg, 1993).

Design from within and development from within have a common cause that affects PD in other ways as well: the *lack of material resources* that often affects non-profits that ‘live from’ donations and sponsoring. In their CAVEAT account, McPhail et al. describe how “less than adequate” display equipment affected design decisions. While this is a direct effect of poor conditions for design, other effects such as the *technological heterogeneity* of equipment (usually donated, or, in student organisations ‘borrowed’ from universities) are likely to affect design as well (like e.g. at CAVEAT).

Another important factor affecting design, as suggested by McPhail et al. is that volunteers are (most frequently) not chosen to fill a position according to a minimum set of hiring conditions, as it happens in professional settings. As a result, people come from all sorts of educational backgrounds, professions and inclinations. According to McPhail et al., this creates a “microcosm of the computer user universe” among the setting members, from very experienced to “I’m not a computer person”. Unlike in professional settings, this issue of *heterogeneous IT skill* becomes “a central consideration in design”. This form of heterogeneity, as well as others, will be discussed later on.

An interesting common aspect of the CAVEAT and GFW experiences, which will also be encountered in BEST, is that the PD projects were re-design projects that combined old systems (usually done in a spontaneous fashion by IT-inclined members) into a common, more coherent one. This suggests an increasingly conscious approach that such non-profits take towards software design. Software and data reorganisations are also occasions for re-thinking the internals of the software.

4.3 Implications to self-sustainability of new activities as drawn from the field studies in Chapter 2 and 3

What BEST calls “the problem of continuity” is an immediately apparent problem with the sustainability of a long-term activity in the student organisation. As members leave the organisation, a competence is in danger of ‘dying out’ due to lack of ‘skilled workforce’. This danger is more pronounced in ‘non-core’, secondary activities (as different from the core activity of arranging student exchange), which are likely to involve fewer people.

For an activity to be sustainable, new members have to be attracted continuously to acquire the respective competence. According to results of Chapters 2 and 3, the *challenge* addressed in that activity should be apparent to them, and they should feel that they can address it. Challenge and contingency were found as important aspects of motivation in voluntary student work.

Challenge was seen to be exhaustible, more so in student organisation work than in the case of amateur radio. Introducing new challenges by proposing new activities such as software-related activities described here is then likely to be welcomed by the members who may ‘change careers’ towards the new activity as seen in Chapter 3.

In more specialized competencies like the software-related ones, *addressability* of challenge is also critical. After the new members join the international group pursuing the activity, *learning* how to do the work is of great importance for the activity to thrive. This has to take place over a short period, because members stay for a short time in the organisation, and in that time they have other obligations (e.g. studying), they can devote little time to amateur student work and to learning about it. As seen in the field studies, learning takes place mostly *hands-on*, from more experienced peers, often during *cycles of work repetition*, where a newer member learns from an older one who has performed the respective task in a previous cycle.

We also learned in the field studies that activities are influenced by their *professional* counterparts, and that influence is not always beneficial. Besides the professional competence representing the ‘state of the art’ in the field, some students see their amateur work in the same field as a personal development for doing later professional work in that field or e.g. presenting it as a plus when interviewing for a job. This is especially valid for software-related skills likely to be learned in the proposed activities.

As seen in the EME and SPOC examples, *pioneering* a new direction for the community is enjoyed by the amateurs, as a contribution that has a wide *audience* of beneficiaries. In that sense, in the light of the field study results, identifying the audiences of the new activities and making sure that learner amateurs are aware of their audience is important when proposing a new activity in the voluntary setting.

4.4 Guiding principles for intervention aimed at self-sustainability

The author has gradually developed some principles that have guided his intervention in the setting. These principles have not been consciously articulated from the beginning. For the convenience of exposition this chapter will present the intervention in terms of these principles and will focus less on how the principles were developed.

Similar to action research (e.g. Checkland 1981) the researcher activity is structured in *iterations* of action towards the goal (self- sustainability in this case). After each iteration, the situation of the setting is assessed in relation to the goal, lessons are learned, concepts about the setting, such as our perspective on amateur work developed in Chapters 2 and 3, are enriched, and the intervention is appropriated to be more efficient in reaching the goal.

In the particular instance of self-sustainability in the student setting, the case of a large number of members pursuing the new activity is a sign of good results. Another criterion is the diversity of member ‘ages’. If all members are in their last year of study or are about to leave the organisation for various other reasons, the prospects of continuity and self-sustainability are low, hence more new members need to be attracted and informed about the existing work.

In times of low membership numbers, the author had to fill in for the members and do parts of the work (software development, design), while at the same time trying to take action to attract more members to the activity introduced in the setting, as well as to try and change the routines and technologies of the group to achieve better sustainability over the long term.

In times of higher membership numbers, the author refrained from doing amateur work and sought to learn from the situation and report in accounts such as this one. At the late stages, the author has consciously retired from many sub-activities and stopped participating in meetings (in mid 2001) and stopped reading mailing lists dedicated to various sub-activities involved.

In both activities, evaluative reflections over longer periods were made together with the most active members and leaders, and ideas for action to improve the situation further were discussed and acted upon. A formal evaluation of the self-sustainability of software-related activities has been conducted at the final stages, by interviews in the case of software design and via a questionnaire in the activity of software development.

4.5 Setting: IT Committee

Unlike the organisations considered in other non-profit PD studies, BEST has ‘an IT department’, the “IT Committee” (ITC). At present the committee is headed by a “Chief Information Officer” (CIO), who is also one of the Vice-Presidents of the international board, mostly in charge of design, the relationship with users and cooperation with other committees (e.g. SPOC, see Chapter 3) and a “Chief Technology Officer” (CTO) in charge of software development, maintenance, data integrity, etc. This high level of formalisation, with personal responsibilities at the Vice-President level suggests the important role played by the committee in the organisation.

The 2002 edition of ITC’s regular summer meeting (held on the sea side in Patras, Greece with the help of the local BEST group there) was the largest summer committee meeting in terms of number of participants (17) in comparison to all other BEST committees in 2002, suggesting that ITC was at the time one of the most active committees. At the meeting, the members decided upon the following ITC definition, that they felt characterizes best what they are doing. The definition was announced to the ITC mailing list as follows:

```
And here is the DEFINITION of ITC, anno 2002:
   ----------------------------------
        ITC IS A GROUP OF FRIENDS
     PROVIDING RELIABLE IT SERVICES
   TO ENABLE BEST TO WORK EFFICIENTLY
   ----------------------------------
Hope you like it and find yourself in it! :-)
```

4.5.1 Applications designed, developed and maintained by ITC

To give an image of the work done by ITC and the size of the projects involved and to get familiar with the names of the projects, we will now review the main applications created by ITC. To provide for the large technological heterogeneity amongst locations, all systems are accessed by local users via the WWW.

- The exchange project support ("Johnny") guides BEST members through the 7 phases of each Vivaldi season. It was co-developed by the author in 1997 together with the designer and developer of the early 1996 version, as a last 'spontaneous' act of voluntary software development before ITC was formed. The author maintained Johnny as a volunteer from 1997 to spring 2002. Since Johnny supports the principal BEST programme, it is the most important BEST application. Johnny's database grows with approximately 1000 new users and 3000 new applications per year. ITC was initially created largely from a need to hand over this essential application to other members. An important result in terms of self-sustainability has been achieved when another ITC member was able to write a Johnny version using technologies designed together with the ITC developers. That latest Johnny version was launched in spring 2002.
- The "Private Area" (PA) started from some static web pages in 1995 and progressed to a number of Lotus Notes™ components in 1998. A new version of the PA was launched in late 2002. The PA contains:
    - A repository of official BEST documents ("the archive"), growing with approx 100 documents per year
    - Over 25 document repositories for international groups (e.g. committees, the board).

    - International group data management (including over 50 email lists, essential in BEST communication)
    - Support for applying to internal events (workshops, statutory meetings) handling yearly around 500 applications to 2 statutory meetings and around 10 smaller events

- A WWW-based "virtual jobfair" ("Minerva") where all students from the member universities can register their Curriculum Vitae (CV) to get in contact with companies and discuss future employment. Developing Minerva (the first application that was requested after ITC was established) has been a test for the viability of an IT Committee in BEST. Development started in Lotus Notes in late 1997, then switched to other technologies in late 1998. The application was finally launched in autumn 1999. A new version was developed starting with 2001 and was launched in mid 2002. Minerva contains over 4000 CVs at the moment.

- "Helpdesk" is a small application started in 1999 where BEST members can register problems with the software applications and problems with various procedural aspects in BEST activities such as Vivaldi. A group of "helpdesk members" from ITC and other committees (such as SPOC as Vivaldi stewards) solve and close the helpdesk issues.

- "Karamba" is a new application designed by the Feature Design group (created in part by the intervention described here) as a combination of Johnny, the Private Area and Minerva which would present the user an integrated, personalized view of all the subsystems. An initial version of Karamba (called the "Transitional System" or "TS" to emphasize transition from the present systems to much more sophisticated features) was launched during 2002. Helpdesk is presently being integrated in Karamba.

4.6 Design as challenge: participatory design as a new activity in the student community

4.6.1 The "Karamba" Project: PD as a new challenge. Challenge education

Considering what was learned in the field studies[14], it became natural to present the new software design activity as a new community *challenge*. Also, in the spirit of *cyclic* learning, by "re-inventing" and incrementally improving community aspects, it came natural to propose software design to members in the context of a project aimed at improving already existing 'spontaneous' design. The author proposed the "Karamba" project, as a large work of re-doing all BEST software applications in a new, integrated system. How these parts can be integrated, is of course, a problem of software design, providing a large space of idea *experimentation* for the prospective amateur software designers, suitable for a long-term challenge. Besides this expected *inexhaustibility*, the project also featured a wide *audience of beneficiaries*: when the design was going to be implemented, all organisation members working within the various activities supported by the Karamba subsystems were going to be benefit from the voluntary contribution of the future software designers.

As described in other PD accounts, it was anticipated that the learning of design skills by the members will take a lot of their initial energy in the project, including the induction of the belief that they can actually change the software design (see e.g. Clement and Van den Breselaar 1993, Carroll et al. 2000 for descriptions of such initial user attitudes). Given the tendency to 'not ask for features' described in Chapter 3, careful attention was paid to convincing members of their power to change design. The process was called "Karambization" and people who started to 'think design' were referred to as "Karambized". Among the first person "Karambized", one student worked closely with the author as part of his master thesis work. As a Board member in charge of IT, he helped "Karambizing" several Board members afterwards.

[14] As many rationales described in the chapter, this is a reflective account for the rationale of proposing the project. The rationale was not so conscious in the author's mind as it is described here.

A challenge may not be immediately apparent to members, and, according to this experience, software design is not. This makes us view “Karambization” as a form of *challenge education*, in which design’s contingencies, audience, and pioneering spirit are made apparent to the members. As it will be seen later on, ‘doing challenge education right’ is not an easy task in regard to the self-sustainability of the new activity.

As different from learning the very idea and possibility of software design, lower initial learning efforts were needed in regard to the method chosen for design. BEST had long used routinely a method that is very similar to the ‘future workshop’ PD method (e.g. Kensing and Madsen 1991), which offered the opportunity to present users with a familiar method, so as to reduce their ‘learning workload’ at the beginning. This method and its usual circumstances will be described in detail.

4.6.2 The BEST “working group” as PD ‘workshop’

The working group (WG) is the basic unit of BEST international work, learning and democracy. A WG typically works on improving the BEST international work and coordination in a certain project or a more general area. In addressing its topic, the WG typically follows a process similar to the critique-fantasy-implementation phases of the PD future workshop, by considering the current situation in the area, envisioning new directions, and considering their implementation. As emphasized by McPhail et al. (1998), methods of this sort can be found in many non-profit associations (the method is probably more unusual in the employment-based sector, due to having workers critiquing and proposing the existing working conditions).

4.6.2.1 International meetings

International BEST meetings are the usual venue for WGs. They are organised at the expense of one or more local BEST groups, and participants only need to provide for their travel expenses (if the budget permits, some travel expenses are covered by the BEST international account). Most participants in international meetings take part in at least one working group within a meeting. The WG activity spans a period of 2-4 days, with a total of 10-20 hours of work. A BEST “workshop” (small unofficial international meeting) includes from 2 to 5 working groups while a large statutory meeting (taking place every six months) can hold as many as 15 WGs. During the meeting, in between the WG sessions there are 1-3 “sharing sessions” where all WGs present their work to the rest of participants so they can give feedback on ongoing work, as well as other plenum discussions, visits to local sites, and, of course, parties at night.

Working in a dedicated meeting ensures that members who attend have reserved time for the design work, so problems of "busy members" unavailable for design, encountered and addressed by Trigg (2000) do not occur (yet it happened that experienced student designers could not attend international meetings due to school, family, work, financial or other reasons). Relatively large numbers of working hours over consecutive days provide for the possibility of focused work, which is a good asset in doing design (but that is alternated with long 'breaks' between meetings). The parties, on the other hand, lead to tiredness of group members, which becomes problematic for creativity. This seems to affect more design work than work on other topics (e.g. discussions of Vivaldi procedure). In one meeting the author was forced to introduce "sleeping sessions" after lunch, on and under the tables of the WG room, trying to balance for the parties at night. While Trigg was rewarding his users with chocolate, the BEST users were rewarded with badly needed extra sleep[15].

4.6.2.2 Group size and member experience

The number of WG participants can vary from very few (2-4) to the limits of 'productive groups' generally set by group management guidelines at around 12-15 members. Participants are generally a mix of experienced and inexperienced, resulting in the *hands-on-learning* where new members are exposed to a topic that is new for them, and have the opportunity to learn from older members. As PD is a process of mutual learning, this practice appeared suitable for the new software design activities, and perspectives for self-sustainability over the long term appeared to be good.

4.6.2.3 Topics, introductions, reports, proposals

In the 3-5 workshops in between two statutory meetings, a certain topic (for example "evaluation of Vivaldi events", "growth of BEST" or our case in

[15] As funny as they may seem, in retrospect, the sleeping sessions were useful for the project. Their humorous aspect was taken further by members of other WGs who came in to take photos of the unusual session, waking up the session participants with the noise of Velcro when opening their camera bags.

point, “Karamba”) can be discussed in as many working groups, by different people (but with some active and specialized members going to more or all of the workshops, taking part in the WG with the same topic, constituting in a kind of ‘topic experts’). This ensures that the association collects perspectives from many parts of Europe, contributing to a high acceptance of the discussion results and proposals. Typically, WGs in statutory meetings make proposals for voting, and, due to the variety of European perspectives considered, the WG proposals use to be voted with much bigger majorities than proposals not discussed in WGs, coming directly from e.g. local groups or international committees, emphasizing the democratic value of the WG.

Karamba WGs were not suitable for making voting proposals, which might have reduced the *audience* effect on the motivation of the members. The practice of getting a variety of European perspectives leads to the already-mentioned variability of PD session membership.

A WG is typically prepared by a ‘topic expert’, the Board, or a committee, by writing a “topic introduction” which typically includes references to reports of previous WGs on the topic. The first Karamba topic introduction, written by a Board member after discussions with the author, was calling on the members to “dare to imagine” a new BEST IT system, encompassing features of the all existing ones, with personalized features for each member. It also emphasized the need for careful consideration of these features before the upcoming implementation. The topic introduction thus provided a good vehicle for launching the new challenge.

4.6.2.4 Distribution of meeting participants to WGs

All topic introductions of international meetings are posted in the official WWW archive in advance of the meeting, and participants have the opportunity to read them (or at least the topic name) and pick their preferred WGs at the meeting, in a priority order. The Board and committees then distribute participants to the different WGs, trying to respect their preferences (lately making use of specialised software to keep track of participant preferences).

A new member can thus be distributed to a WG by preference or (if preference cannot be met) by chance. Experienced members, who have worked on a topic at previous international meetings and set that topic as their main preference will typically get it, to build on the accumulated competence, and to help new members learn about the topic. Along with members who are very interested, active and creative in their first WG, ‘active contributors’ of a topic are typically sought among the ‘returning members’, who participated in a WG on a topic, liked it, and are motivated to continue on the topic in a further WG, making the necessary financial and time sacrifices to join another international meeting. ‘Returning members’ are an important asset for a long-term creative activity like software design.

4.6.2.5 Working conditions

The WG venue and working conditions can vary a lot from one meeting to the other, depending on the facilities found by the local BEST group that arranges the meeting. From seminar rooms with whiteboards, overhead projectors, Internet connection and video projectors (which a professional setting would consider ‘normal’), via simple classrooms with a blackboard, through a corner of the plenary room with a flipchart, to a student hostel room with no flipchart; many possibilities exist. Sometimes the WG moves from room to room during the course of a meeting, or participants may decide to move to inspiring places such as the beach. The WG usually has access to a computer for typing their report, and laptops brought by members are customary in the past years. Access to Internet (of interest for a WWW-software-related WG topic) is more and more frequent, but it is generally not considered a requirement for the meeting organisers to provide. Smaller meetings like workshops, are typically organised close to universities, so Internet access is provided. Larger meetings like statutory ones are more expensive to arrange in cities and usually get organised in rural or mountainous areas, where Internet connection may not be available.

Participants make the most of whatever conditions are available to discuss their topic. For PD, low-tech conditions are likely to bring low-tech prototyping, typically based on the paper from the flipcharts, but laptops were often useful in trying out ideas in HTML. Working conditions are not usually communicated well in advance, affecting the preparation of the PD session.

4.6.3 The initial, intensive phase of PD practice

To compensate for the breaks between international meetings, a relatively large number of working groups (six) were arranged over a quite short period (six months, at and between two consecutive statutory meetings) in various parts of Europe, a variety which probably adds to the motivation of returning to international meetings, maybe on the same topic[16]. By allocating "WG time" for the topic (including e.g. food, lodging and other expenses for the WG members) the organisation allocated a large amount of resources to the Karamba topic (few topics, if any, have ever received six WGs in half a year).

One of the project meetings was exclusively dedicated to Karamba and included participation of the Board President and Secretary. 'Involving management' and 'getting resources from the organisation', two classic themes of PD practice, did not constitute major issues, at least during the intensive initial period of the project. The management of other (lower-level) international teams and committees was harder to involve, mostly due to problems of lack of time, similar to experiences of Bentson (1990). 'Catching' them in international meetings in a manner similar to Trigg's experience (2000) was a solution, but the ambition was to always have one member from each BEST international teams in the project, since the project was spanning all areas that needed IT support. This policy was followed later on, and several members slowly 'migrated' from their original team to Karamba and the IT Committee (for one example, a SPOC member became the ITC Helpdesk responsible, more such examples will be considered in detail later on).

To encourage WG members to return to the Karamba topic in future WGs, a mailing list was set up, and all Karamba WG members who wanted to were added to the list. Mailing lists are customary for BEST international teams like committees, and serve for carrying out work in between international meetings, preparing WGs on the team topic, etc. While WG and topic introduction announcement were frequent uses of the Karamba mailing list, little use could be made of it for actual design. This suggests problems for periods such as the next year, when the Karamba project was not 'spoiled' with so many working groups and resources.

During the first six meetings, 8 members returned to Karamba WGs with 2 members returning more than once. One member was working in NADA

[16] To give a flavour of this location variety: Veszprem (Hungary), Rome (Italy), Stockholm (Sweden), Gniew (Poland), Copenhangen (Denmark), Ljubljana (Slovenia). Many other locations were host to Karamba PD sessions and other forms of IT Committee work.

together with the author, acting as a ‘junior professional designer’. Several other members (especially 4 Board members and one old SPOC member) constantly encouraged the project and participated in discussions about its evolution and future. A nucleus of permanent members (who became *amateur designers*) was thus formed for the project. In two of the last 3 meetings, the author decided not to participate in Karamba working groups, letting the members do design by themselves, in the spirit of self-sustainability.

4.6.3.1 Working techniques and partial results

The system envisioned by the Karamba working groups is very much a portal-like interface inspired from WWW portals like e.g. My Yahoo®, where a member would see different “boxes” according to his/her different memberships in various international groups, his/her attendance to various events (“Vivaldi” international exchange events, statutory meetings, workshops, etc), including links to flight booking services, arrival details, etc. Typical tools offered to generic ‘community software’ on the WWW were envisioned, with the major difference that they were to include information extracted from other subsystems. For example a “calendar” would automatically show important dates such as deadlines from the Vivaldi procedure, the dates of planned internal meetings, etc (see Figure 10 middle).

A Karamba working group would typically work on whiteboards and flipcharts, sometimes deriving “animations” by turning flipcharts one after the other to show the evolutions of the interface in case of “clicks” (similar with cards in Hypercard) or by attaching small pieces of paper to flipcharts to show drop-down menus (see Figure 10 right).

After agreements in-principle of what the interface should present, more detailed design was done, called by members as “Detailed Interface Design” of a certain part of the system (“DID”). After a meeting, a working group member would take the paper mock-ups and translate them to HTML for between-meetings browsing by the Karamba group members and by the whole organisation.

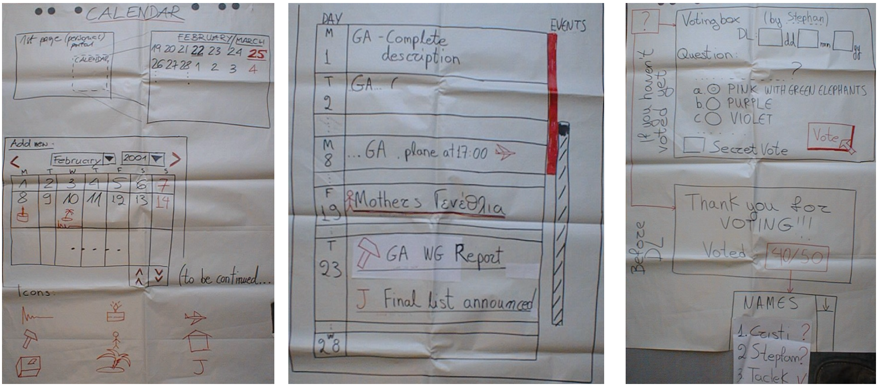

Figure 10 Paper mock-ups in the Karamba project made with flipcharts. Left: a “Detailed Interface Design” of calendar interaction and suggestions for icons to differentiate types of calendar entries. Middle: calendar detail containing both community-specific entries (“GA” stands for statutory meeting, “J” stands for a “Johnny” deadline), and personal entries (“Mother’s” followed by a Greek word is a personal entry denoting “Mother’s birthday”). Right: interaction detail for a voting system, containing drop-down menus made on paper. Flipcharts were folded for transportation before being photographed.

4.6.3.2 Setting up a permanent group for PD in BEST

After the close involvement of the Board in the PD activities, they came to the opinion that such activities should be taking place permanently in BEST, not just in the context of a project like Karamba. In the statutory meeting marking the end of the ‘intensive PD start-up period’, the formed Karamba project group were in majority present in the meeting (another large chunk of resources allocated to the project, since only 2-4 places are normally allocated in statutory meetings for each international team) and, from the initiative of the Board they were proposed (and approved by plenum vote) as a long-term, structural part of the IT Committee, called the “Feature Design Group” (FDG).

The IT Committee, which up to then only included developers, was thus re-structured to include a user-oriented section (FDG) and a technology oriented section (IT development, or ITD). For the first time, a person who was not inclined towards developing software, a feature designer, became the ITC coordinator and tehrefore the BEST Vice President for IT.

Setting up a permanent international BEST team is not just a formal act, it is also a commitment made by the association to allocate resources to that team in the future (travel money for members, working groups in meetings, etc).

While many PD projects can aspire to such an outcome (creation of a permanent group within the setting), a long-term group is a good prospect for self-sustainability but, as it will be seen, was not sufficient in this experience.

4.6.3.3 The decline of design activities during the implementation fever

Although the organisation formally welcomed the new activity and competence of software design, this is obviously not enough for the activity to thrive. After the initial enthusiasm came the hard work of going into design details. The next meeting (the “summer ITC meeting” of 2001) put together designers and developers in discussing the data structures of the new system, Karamba.

Due to problems in implementing Karamba, less and less resources were given to design, and an increasing amount of time and effort was given to implementation: only one more design meeting was held in 2001, working on the interface for “merging” accounts originating from the 3 systems (Johnny, Minerva and PA) that belong to a certain person (this is an interesting resemblance with the experiences reported by McPhail et al., 1998, and by Trigg, 2000, who also report issues of design for merging duplicates originating from previous systems). The “merger” design, reconsidered in the ITC summer meeting in 2002, is still not finished, showing a dramatic decrease of Feature Design activity during 2002.

The Karamba development has ‘overwhelmed’ the newly created IT group and its management, leading to the postponement of design activities. The current (end of 2002) situation creates the danger of the student organisation software design activity “dying out” due to the graduation of its members, though this is not yet the case, as many design-oriented members are still active. During late 2001 and most of 2002, many feature designers have been caught in the fever of Karamba Transitional Systems (TS) implementation, and helped in managing the ‘teething problems de rigueur’ when the TS subsystems were launched between spring and autumn 2002.

TS systems are mostly imitations of the old systems, so little of the Karamba design was actually implemented, which is not an incentive for designers’ motivation. Some designers fancied with development and yet others became full-fledged developers, in charge of major Karamba subsystems like Johnny TS or smaller subsystems like Helpdesk. Designers who were not involved in development helped in determining the features that were most urgent to add to the old system features (in general long-overdue additions), or helped in testing and evaluating the new TS systems. But many feature designers drastically reduced their contribution, and yet others left the group, getting involved in exciting projects such as the largest ever “Jamboree” (a training international meeting with free participation for over 300 members).

While the current image of software design may seem bleak, there is new hope on the horizon, brought by the fact that the TS systems are now all launched, and implementation of features thought for Karamba-proper (as different from the “transitional” system) during the design sessions can begin. However, even the most enthusiastic and competent feature designers will have to take a thorough look at the Karamba WG reports from the initial design period from over one year ago, as lots of things happened in their ITC, BEST, student and personal lives since then. Ideally, self-sustainable activities include regular work, so the work is fresh in the minds of the members, and new members come in regularly, and learn from the old ones.

4.6.4 Reflective evaluation

Although in the beginning it was thought that pioneering in addressing the new challenge, which seemed to have easily addressable components and seemed to be directed towards a wide audience, would be attractive enough for the members to create a long-term process, this was not sufficient for achieving self-sustainability of PD practices. To reflect on the experience and to learn for the future, the author conducted a series of open-ended interviews with 7 members of the Feature Design Group in the summer of 2002.

Before going on to review the major lessons learned (many of which will be illustrated by quotes from the members), it is important to note that the principal differences between PD in non-profit and for-profit settings, as discussed in the beginning of this chapter, were confirmed by the experience: less difficulty in setting up PD workshops, fewer problems in involving the management, fewer tensions between the stakeholders.

4.6.4.1 “Present systems are good enough”

> A few people asked why do we have to change (the Private Area) […]. Everyone else sees us as a salvation committee. You don’t find anything ever.

A number of BEST members, especially amongst those who were not involved in design, had an attitude that was discouraging improvement of existing systems. This attitude is related to the phenomenon of 'users not asking for features' encountered in Chapter 3, the rationale being that 'a poor organisation with volunteer developers can't afford to improve its software every day'. The CAVEAT experience of McPhail et al. suggests a similar attitude, that pre-intervention systems were "better than no system at all".

We can view this as a *professional management* (negative) influence of 'rationalizing costs' without taking notice that if an activity is discontinued for too long, it may die out, and that design improvements are not necessarily very costly in terms of development efforts. This view is strengthened by the fact that one of the proponents of the 'conservative' approach was a member of the Board installed at the statutory meeting where the FDG itself was canonized. As a sign of a change in his position, he was later on among the first people to congratulate ITC for the launch of TS systems.

It is important to reflect, at this point, on *management changes* in relation to PD. In many student organisations management is changed every year (as it is hard to neglect one's studies in favour of student organisation management for more than one year). The Karamba project was fortunate to benefit from favourable management in its first six months, who not only supported the project but also saw the benefits of permanently having a group concerned with software design and user needs. When a new management is installed, the PD project may have to 'justify its existence' all over again. Canonization as in the case of Karamba is a good way to address this risk: once the group is accepted as permanent, it becomes more difficult for management to discontinue it and its projects.

4.6.4.2 Heterogeneity of member experience in organisational matters

> (Following discussions between experienced members during design) was like watching tennis without even having heard of tennis.

> More experience in committee work is good for designing the archive. Jack has never seen a committee archive before. He was doing it because it was a task, things would have been different if he'd have more experienced as a committee member.

While McPhail et al. (1998) refer to the heterogeneity of IT skills within their PD project as a “microcosm of the computer user universe”, the BEST Working Group infrastructure, with the tradition of bringing together older and newer members, creates a heterogeneity of knowledge not only about IT matters, but about the organisation itself. It happened often that members participated in design of tools meant to support practices that they had no knowledge about, such as Jack and the archiving of documents above.

While in professional-settings PD experienced workers can be picked and enrolled in PD workshops, the continuous flow of members who come in contact with design within non-profit settings (not only in BEST working groups but also in organisations like CAVEAT and GWF) is likely to bring less experienced people in the design sessions. While this may seem like a hindrance for PD, it can actually constitute into yet another opportunity for learning about their own community, as it will be shown below.

4.6.4.3 Developers’ complex learning situation

> Developers were in touch with users for the first time. Even those who already work in companies, they come, reinstall Windows and go.
>
> I am sometimes too technical, it hinders the thoughts. I start to think of implementation too early, I learned that it’s useful to separate them.

Since development is done from within the organisation, amateur developers are faced with even more to learn than amateur designers. Besides learning about development, their participation in design requires them to learn both design (and its separation from development details) and the ‘ins and outs’ of the amateur work for which tools are designed.

As a case in point, during the implementation of Johnny TS it was found that developers who were working on it (relatively fresh BEST members, students in lower years, thus presenting good prospects for continuity) had no previous experience of organising or sending students to Vivaldi events, the activity supported by Johnny. As a consequence they had had no opportunity of learning hands-on the procedure that they were supposed to implement support for, hence they had limited knowledge about it. A designer and

SPOC member called this an “unfortunate surprise”. However, one of the developers tells us that

> I had to implement the (support for) Vivaldi procedure, so I learned it, now people in the (Local BEST Group) come to me with questions about (it) because they know I’ve been involved with it

In this situation, the design and development of support for an organisational procedure leads to learning that procedure (from handbooks and from asking other members), instead of its hands-on application. In turn, members applying it hands-on learn from the member who contributed in implementing its support. PD and development can thus lead to learning about the community, presenting yet another way for members to be exposed (hands-on) to its realities.

4.6.4.4 Amateur developer-amateur designer conflicts

> Developers might want to be the (interface design) inventors themselves.

The designer quoted above went on to suggest to give developers “unfinished designs” to leave them freedom in doing the last touch to design when implementing. In reply, the author suggested more involvement of developers in design (but at the same time to encourage them to ‘wear a different hat’, with less concern about implementation and more focus on the designing challenge).

Amateur developers are a sine qua non for amateur design. Their learning effort is, as emphasized, more intense. Due to their experience in development, they have surely thought (even if as a secondary priority) of interfaces, so they can be more experienced in software design than beginner-designers. Their resulting ‘power’ in design discussions recalls the lack of “level playing field” (gradient of resistance) found by Bowers and Pycock (1994) between users and developers. The developer ‘stress’ provoked by the urgency of launching new systems can make developers be even more conservative during design sessions.

4.6.4.5 The challenge and the contingencies that overshadowed it (hopefully temporarily)

```
The thing that astonished me was how big ideas we
   had and how far we wanted to get.
I don't think anyone (of the members) was
   involved in such a big project before.
From first it looked like an overblown importance
   of it all but sure got people's attention
   because of it.
```

The central effort in introducing the new activity in the setting (starting for the initial "Karambizations") is connected to the challenge proposed. In early stages of the project, members have embraced well the new challenge of software design.

However, in the face of short-term TS launching contingencies, the challenge of long-term Karamba design faded away. Hopefully it will come back to the members of the feature design group, but at the moment of the evaluation interviews, just after the 'storm' of TS bugs and bug scares, the feature design group was seen by one member as "decimated".

4.6.4.6 The challenging power of mock-ups. Challenging design

The relative delay in implementing the TS systems sparked a number of questions on whether or not design makes sense when designers cannot see at least an early stage (prototype) of the final product. None of the amateur designers interviewed confirmed this as being a problem (although some thought that it was a problem for *others*).

> It was tough to go into (detailed interface design) when there is nothing to try, to see working, just imagining […]. I am glad [that] (the technological infrastructure) wasn't ready yet then so we (had to put) a bit more thoughts into design

The quote above emphasizes that doing detailed interface design by mocking up on paper, by "just imagining" made users "put more thoughts" into the new activity. Ehn and Kyng (1991, pp. 172) emphasize that mock-ups provide a "hands-on experience", leading to user involvement in design. In the perspective developed here, mock-ups are *challenging* for the users and the hands-on experience is not just involving, it is providing them with contingencies that a prototype would not present, of having to imagine how the real system would look like. The hands-on experience leads not only to involvement, but also to *hands-on acquiring of design skill*.

In voluntary settings, where design is less likely to be done with professional designers, the accumulation of design skill is crucial for the sustainability of design practices. The remark above then suggests that preferring mock-ups to better developed prototypes is likely to lead to better learning about design and to better motivation of doing design.

"Keeping the users entertained" is a well-known rule of thumb for participatory design sessions. Reflecting on mock-ups inspires us to reason that putting efforts in *challenging the users* may be a more appropriate nuance of "entertainment". From that angle, the PD ideal of "mutual learning" can be understood as viewing and guiding the users as *amateur designers*, 'peers' of the professional PD practitioners. This suggests that PD can be approached with challenge in mind, that it should be *challenging design* for the user.

4.6.4.7 Questioning implementation as the ultimate result of addressing the design challenge. Decoupling design from implementation

> `The Karamba project takes more than a member's average lifetime (to reach a final release).`
>
> `I will stay in BEST until it's done!`
>
> `People (in the audience of the Karamba WG presentation) were interested. I think they liked the project and the ideas. Though I don't know how much they trusted it to reach the implementation. And from what we presented back then most of the things are not implemented yet.`
>
> `We were talking for so long and so loud (about new features designed). […] People probably stopped believing us […] But (after the TS launch) things are not static any more.`

It was not very clear for amateur designers whether their challenge was well addressed or not. If implementation is the final result, that does not depend on them. Members of their audience appeared (or were felt to be) more and more sceptical[17], which added to the confusion and affected their motivation. In retrospect, a major mistake in setting up the project was to link the design challenge with implementation. Designers could not do much about implementation, yet their challenge did not appear as addressed.

The experience suggests that, for the design activity to thrive within the community, it should be 'decoupled' to a certain extent from development, presented more as an 'art' in its own right. That way, the design process, while still communicating with the development process, is not so much dependent on it. As such, our results distance us from ideas of 'rapid application development' where the two processes are in close interdependence.

Some concrete steps that can be taken in this direction:

- A 'logically working mock-up' should be proposed as a goal to prospective members of the software design team.
- Collect 'textbook' examples of 'good' and 'bad' design, maybe taken from old or present BEST systems.
- Go beyond the traditional BEST working group towards more structured participatory design methods. We have seen the importance of the *professional counterpart* of amateur work, so this is likely to enhance members' motivation as the methods can be used in the professional life.
- If such methods are found unsuitable to the setting, try to contribute with new ones. Such methods would have a wide *audience of beneficiaries*.

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[17] It should be considered that many of the members had not seen any major improvement in the association software because such changes had not happened since the Minerva launch in 1999. Being sceptical about major features is then not unexpected.

4.7 Design for challenge: supporting amateur software developers

As many amateur settings such as non-profit organisations are not likely to be capable to sustain financially regular contacts with software development consultancies, support for the amateur software developer becomes important for the self-sustainability of software-related activities (including design) in such settings.

Once software applications in a voluntary setting become complex, it becomes increasingly difficult for newer developers to continue the work of older ones, as the size of the application that needs to be learned makes 're-implementation from scratch' a more attractive solution. As development of complex applications takes time, this form of 're-inventing the wheel' is likely to be extremely inefficient. Instead, having a permanent group of amateur developers who learn from each other about technologies and applications is a more attractive solution. While setting up such a group is not particularly difficult, choosing or designing the technologies ("shopping for a toolbox", in the words of Trigg, 2000) can become a complex problem.

The BEST group of amateur developers (called initially "ITC", later on, and throughout this section, "ITD", from "IT Development") tried a number of technological approaches along the years, and since 2001 have worked with their own toolbox, "Makumba", which will be described here.

Table 3 shows a summary of the ITD evolution, emphasizing the numbers of developers who contributed to a certain application *using* (as different from 'knowing how to use') a certain technology. Several observations:

- It is difficult to present a precise number of active developers throughout a year, so the numbers must be seen as approximations, with no statistical value. The concept of "returning" developer (similar to "returning" Karamba designer) was used to make estimations, i.e. a person experimenting with a technology in one meeting was not counted. Numbers are intended as indicators of growth and self-sustainability.
- Application names (Johnny, J, Minerva, M, Private Area, PA) are explained in section 4.5.1.

- JML represents an older technology where the author was involved (Bogdan and Sandor 1997), later obsolete by JSP™, used as part of Makumba.
- Development of the “Minerva” virtual job fair has been the major ‘test’ for the group since its creation. Minerva development was attempted using most of the technologies that ITD experimented with.
- As the only voluntary developer of a major application (Johnny), the author (although just maintaining the application for the past years) has been a liability for self-sustainability of the group until the application was replaced in April 2002. As the most senior developer who wanted to retire, the author has spent increasingly conscious design efforts to enable other developers to take over his responsibilities (such as Johnny). To follow such efforts, the numbers that include the author in the tables are marked with an asterisk. “1*” means ‘the author alone’, i.e. bad prospects for self-sustainability. To emphasize that, lone efforts of the author are shown in bold.
- Besides being constrained by the lack of self-sustainability to work on and maintain alone Johnny, the other lone efforts of the author were deliberate, and were not introducing long-term dependencies on the author’s expertise (i.e. were not contrary to self-sustainability):
    - developing the Makumba technology. Development self-sustainability refers to the applications, not to the technology, which is intended to be developed in open-source fashion, also with developers from outside BEST.
    - importing data from old applications to Makumba format, so amateur developers can make use of it in the new applications (“Transitional Systems” towards Karamba). Doing this alone is justified since knowledge of technologies used previously is not valuable in the long-term perspective of using Makumba
- low developer numbers using a certain technology is a sign of lack of self-sustainability in using that technology. After the group decided to renounce a certain technology, it is normal for its usage to decrease, however applications using these technologies remained, in

some cases for a long time. At some moments certain applications were left without active developers due to the fact that the technology they were based on was not known by any developer left in the group (e.g. Private Area -PA- developed in Lotus Notes, could not be developed starting from early 2001 and was eventually replaced in late 2002).

- the growing numbers of Makumba developers in 2001 and 2002 are an encouraging indicator in regard to self-sustainability
- the large variety of 'professional' technologies used by the group indicates growing opportunities for personal development for its members. Such development will be discussed in the next section.

4.7.1 Phases leading to design of Makumba

In 1996, BEST started to use the WWW for all of its European-wide applications. Server space was borrowed in university machines at first, then the association installed its own servers, at first obsolete desktop machines used for email routing, then higher quality desktops used as WWW and database servers, and finally a proper server machine. Internet connection is typically obtained in a local BEST group office, while ITD members administer the server remotely from their location in Europe.

Due to the technological heterogeneity (addressed by the WWW for BEST application users) developers work in a wide variety of conditions. These conditions can be different at home or at school, and they are very likely to vary when on the road, as many ITD members are, due to their membership in an international team, which involves joining a number of international meetings.

Year (developers)	**1997 (4)**	**1998 (5)**	**1999 (5)**	**2000 (6)**	**2001 (10)**	**2002 (12)**
Technology approach	Spontaneous /JML	Unique technology: Notes	'Open Source'	'Open Source'	Unique technology: Makumba	Unique technology: Makumba
Development sandbox	Local, not standardised	Local, Notes visual prog.	Local, not standardised	Local, not standardised	Local, "bundle"	Shared "Parade", supports ant, CVS and Makumba
'Professional' tools	Java (2)	Notes (3)	CVS (3), Java (3), SQL (3), Notes (1)	CVS (4), Java (2), SQL (2), Notes (1)	CVS (6), ant (3), Java (4), OQL (6), JSP (6)	CVS (12), ant (5), Bugzilla (25), Java (8), OQL (12), JSP (13)
Events	Apr: formation of the committee Nov: adopt Lotus Notes, start Minerva impl.	Problems with Notes Dec: re-start Minerva implem. in Java +SQL	Makumba: Mar: **idea** Jul: design Sept: **0.1** Nov: Minerva launch with 0.1	Apr: decide to adopt Makumba for all apps. Nov: start design of Karamba	Aug: **J, M and PA data imported to Makumba format** Oct: **Makumba 0.5** Nov: Karamba TS impl. Starts	Apr: Johnny TS launched Jun: Minerva TS launched Nov: PA TS launched Nov: helpdesk data imported to Makumba format
Java/JML	2*/Johnny	**1*/Johnny**	2*/Johnny	**1*/*Johnny***	**1*/*Johnny***	**1*/*Johnny*** -> Apr
Lotus Notes	2*/Minerva	3*/Minerva, PA	1/PA	1/PA	0/*PA*	0/*PA* ->Nov
Java + SQL		2*/Minerva	2*/Minerva -> Nov			
Makumba 0.1			2*/design 4*/Minerva	1/Minerva	1/*Minerva*	1/*Minerva* -> Jun
Makumba 0.5				1*+1/devel	2*/devel 4/JohnnyTS 1/MinervaTS 4/PA TS	2*+2/devel 12/Karamba TS 2/helpdesk TS
PHP				1/helpdesk	0/*helpdesk*	0/*helpdesk*

Table 3 Top: evolutions in ITC (efforts made by the author alone are indicated in bold, number of users of general-purpose tools is indicated). Bottom: Number of active/returning developers per technology and application. Application names in italics represent "*maintenance mode*", i.e. no active development. The author being part (or entirety) of the developer team is indicated with an asterisk (*). "devel" represents Makumba development (number of trainee developers is indicated separately after +)

4.7.1.1 Lotus Notes™

With its capabilities for replication between sites, large potential for tailorability, powerful templates, and WWW access, Lotus Notes seemed like an attractive solution at first. The problems that lead to the group switching to other approaches can be summarised as follows:

- Difficulty to grasp the Notes concepts in a short time. Notes programming concepts are not taught in universities. Getting to understand Notes programming alone (without hands-on assistance from peers) proved difficult.
- The multiple features offered by Notes, typically shown to the user-programmer in long lists. Few of these features were usable on the WWW (the BEST application domain) and few were necessary for the ITD applications.
- Notes visual programming made it difficult to discuss Notes programming issues at a distance, over email or chat.
- A fair amount of computing resources needed for a volunteer to develop. Impossibility to develop remotely (from e.g. a terminal that just became available in a university lab) without expensive remote access tools.
- As the WWW interface was the only interface available to BEST members, a greater control over the generated HTML was required by the ITD member-programmers.

While Minerva could not be developed with Notes to a sufficient level of quality, several applications (member database, document archives) remained in Notes up to the launch of Karamba TS.

4.7.1.2 'Open source'

Members decided to use a well-known programming language (Java™), which is taught in universities (and concepts of it can be familiar from other languages).

This was expected to:

- o allow members to get involved faster, without having to wait until they master a whole new set of concepts (i.e. the initial challenge should be easy to address)
- o when cooperating at a distance, be able to easily refer to locations in (plain text) source code where problems arise
- o develop on small machines, as available at home or university
- o allow the group to easily migrate from one database engine to another using SQL, avoiding the problems of data format that Notes introduced (since the Notes format is proprietary, it was difficult to take the data gathered and move it to another technology).

The group was keeping the Minerva code in an archive file (usually referred to as a 'tarball' in open source jargon). Other open source-specific tools like CVS were later adopted.

The problems encountered during this phase

- Fairly large complexity of the Java code, with many interdependencies between files, difficult for beginners to grasp. While a bit more remote assistance was possible than in the case of Notes visual programming, it was not enough to allow the new user-programmers to easily grasp the existing work.
- Set-up skills. Even if some members were close to understanding the source code that existed already, they had problems installing the 'tarball' and making it work. A typical setting for programming education includes the programming tools already set up. ITD members needed to learn to set up their work by themselves.
- Administration rights: some parts of the tarrball required administrator rights to function on desktop machines like those available in universities. Even if the installation skills were there, the amateur developer was 'blocked' from doing work

4.7.2 Tailoring and learning curves

Tailoring is the continuous appropriation of software while in use, to accommodate specifics in the use setting and their changes. One common aspect between amateur development and tailoring (see also Bogdan, 2001) is related to the concern for gradual, hands-on learning how to tailor, which is less evident in e.g. designing programming languages. Achieving “gentle slopes” in the tailor’s learning curve is important in tailorability (MacLean, Carter, Lövstrand, and Moran 1990). The “continuum of skills” that can be found among tailors is similar to the ‘skill heterogeneity’ from voluntary settings.

Considered from that point, the two experiences above exhibit steep learning curve problems:

- difficulty of learning the technology (Lotus Notes) due to unfamiliar concepts and technology having an abundance of features, from which amateurs had to select the ones needed.
- difficulty in learning the inner workings of existing code due to complex structure (in the case of Java, even when Java is known). Although programmers can design their code with this in mind, the language itself encourages complex relationships between modules, which are hard to grasp for newcomers.

According to observation, if a member cannot get involved from the start, they are very much likely to lose interest. As such, the importance of the initial ‘slopes’ of the technology learning curve is crucial.

Besides learning problems related to the ‘tailoring’ platform, problems in installing that platform were found. While Makumba (described below) does not do much for addressing set-up skill issues, efforts made in that direction will be described later on.

4.7.3 Design of Makumba

Makumba is a technology specialised in producing WWW views of data stored in databases. The amateur developers and designers can engage with Makumba at three levels, in order of complexity, known shortly as “MDD”, “JSP taglib” and “BL”.

4.7.3.1 MDD (Makumba Data Definition)

“Makumba Data Definition” is a simple language for describing data structures and links between them. The language supports a small number of types (`int, char, date, text`), and textbook relational database structures (one-to-many, one-to-one). Figure 11 shows the ‘data definition’ called `best.johnny.Season`, describing a Vivaldi season with name, reference (`ptr`) to a `best.internal.Student` for denoting the season coordinator, start date of the season, end date, etc. In supporting a small number of types and just elementary structures, Makumba design commits to a low level of application complexity, and to an easy initial learning.

To engage at this level, a user-programmer needs to have elementary notions of *data structures and entity-relationships*, which in practice proved to be very intuitive to understand even for users who are far from thinking of themselves as programmers.

Using the MDD information, Makumba can represent data in a multitude of database engines (‘host databaes’). The way Makumba maps between the MDD and the tables and fields of the database is transparent to the Makumba user. Makumba ‘protects’ the user[18] from learning database-specific aspects, which can vary considerably, such as:

- The types offered by the host database. In an effort to meet as many kinds of needs as possible, modern database engines offer a multitude of types, for various purposes (in a similar way with Notes’ abundance of features). By only offering 4 fundamental types, Makumba ‘hides’ this complexity and variety, ‘protecting’ the user-programmer from having to learn too much before being able to contribute. In other words, it is more important for BEST applications to exist and to be contributed to, than to be finely tuned with carefully chosen types used for each case of data storage.
- The variety of names that data types that are identical conceptually can get from one database engine to another. For example the Makumba type “`text`” maps to `LONG VARBINARY` in one database engine and `LONG VARCHAR FOR BIT DATA` in another

[18] By “Makumba user” we refer to the person reading a Makumba source code or programming with Makumba. In BEST many amateur *designers* (not developers) learned to e.g. understand MDD source code, and some of them went all the way to developing applications

Makumba also offers a way to copy data between the various database engines supported, making sure that the organisation using it will not 'get stuck' with a database vendor or another due to data format incompatibilities.

The questionnaire evaluation (n=12) confirmed that users have little problems reading MDDs and creating new ones (reading and modifying MDDs have equal averages 4.3 out of 5, starting MDDs from scratch average 3.6 out of 5). This suggests that MDD represents a desired 'gentle slope' in users' learning curve in getting contact with the technology.

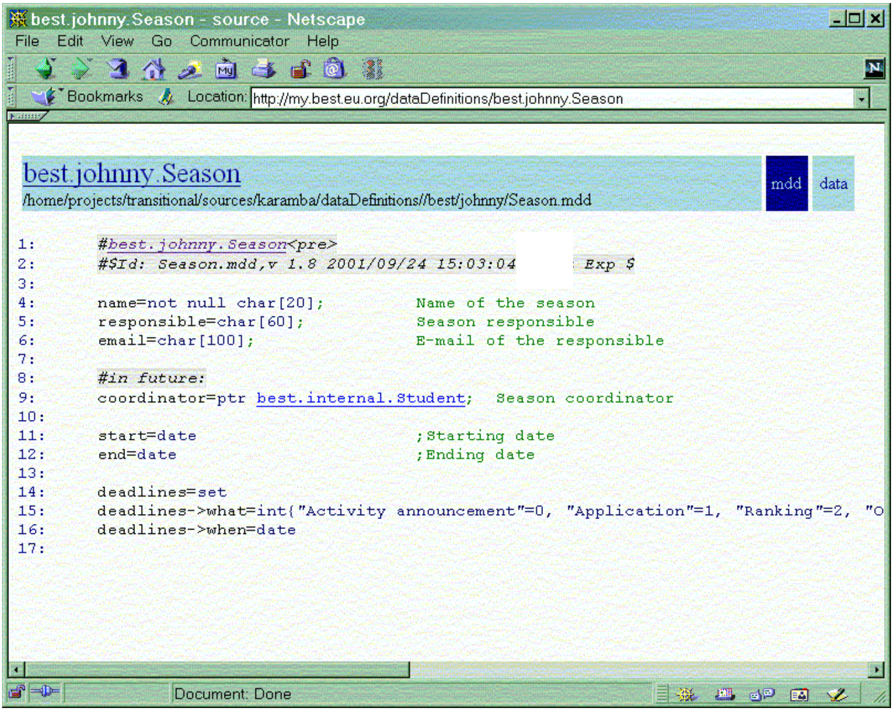

Figure 11: Makumba MDD source. Note the links to other connected MDD files.

4.7.3.2 JSP taglib

The "JSP[19] taglib" level offers a way of formatting in a HTML page data extracted from the database. In doing so, Makumba combines two languages

- HTML for formatting the data
- A form of SQL (called OQL[20]) for extracting data from the database using the fields and data types as declared in Makumba Data Definitions (MDDs)

Both languages were considered *familiar* to undergraduate students (see the results of formal evaluation below for judging this initial consideration), thus 'levelling' this 'second slope' in the learning curve. One further way to support hands-on learning by example (similar to the way HTML is learned by many Internet surfers by viewing the source of WWW pages) is a feature that shows the source of any Makumba JSP page by adding an "x" at the end of its URL. From there, the user can navigate to the involved MDDs, the MDDs related to them (e.g. see the link to `best.johnny.Season`, in Figure 12) etc.

The basic element used for data extraction is the `mak:list` tag (see Figure 12). The `mak:list` tag has SQL-like attributes such as `from`, `where`, etc. The `mak:value` tags inside a `mak:list` tag will determine the SQL projections (the SQL query part between SELECT and FROM). If a `mak:list` tag is embedded in another `mak:list` tag, they will be combined into one OQL query[21]. Unlike with many other data-driven WWW solutions, no other programming is needed for e.g. 'combining' results of embedded queries, connecting to the database, error handling, etc.

The large number of JSP files in real-world applications (608 in Karamba TS, see Table 4) might raise worries about the 'complex structure' created by file

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[19] The name comes from the Java Server Pages ™ technology, on top of which the Makumba tags such as <mak:list …> are implemented as "custom tags" in a "tag library" (taglib). Other implementations of Makumba tags are possible.

[20] OQL is a SQL extension for object-oriented databases. See the Object Database Management Group, www.odmg.org

[21] As a result, the number of queries sent to the database is impendent of the data size, and is mainly dependent on the number of mak:list tags. This is the essence of Makumba taglib performance

interdependency. This should not be the case, as JSP files only depend on the JSPs that they include (yet they do depend a lot on MDDs that they use). Plus, dependencies are easy to access via links in source viewers as the one in Figure 12.

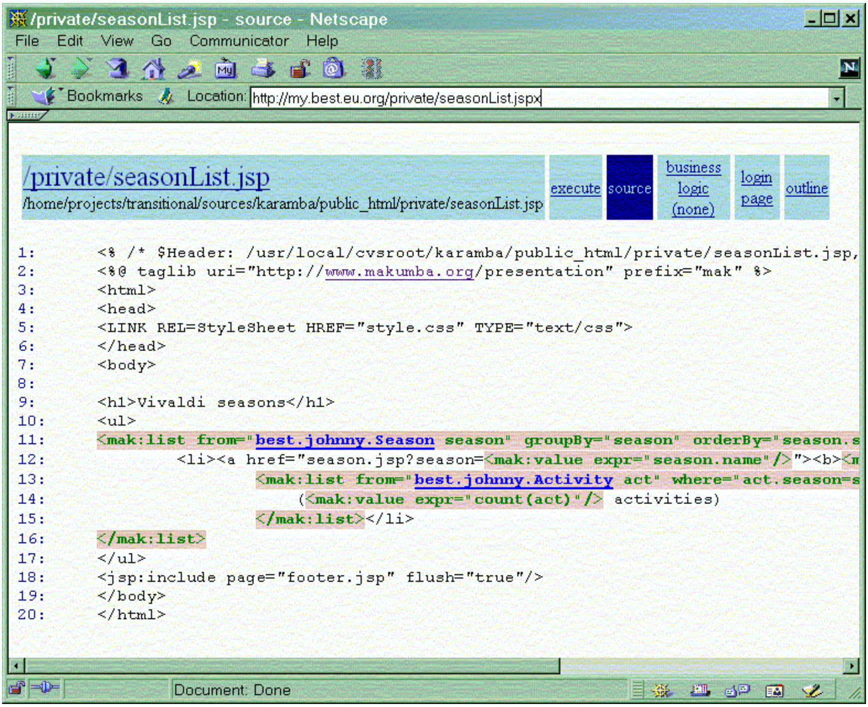

Figure 12: A Makumba JSP page. Note the links to other, logically related files (e.g. the “best.johnny.Season” MDD file). For the results of this program, see Figure 13

On questionnaire evaluation, users found the JSP taglib to be almost as easy as the MDD: easiness of reading JSP taglibs was rated in average 4.1 out of 5, modifying 4.2, starting from scratch 3.5. Easiness of passing from MDD to JSP taglib was rated in 4.0 in average.

A comment on a returned questionnaire reads:

> `MDD+JSP part is learnable in 4 hours (trainings have proved that)`

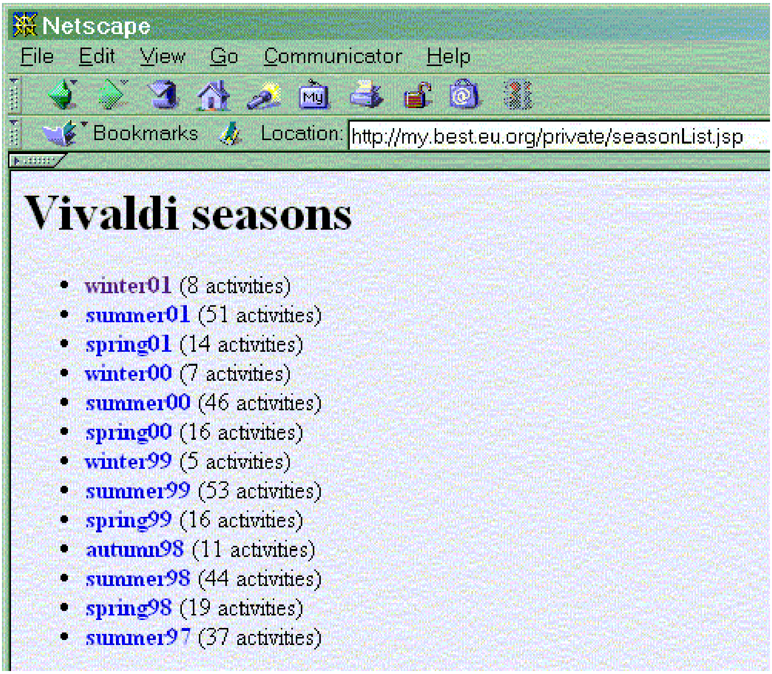

Figure 13: a WWW page generated with Makumba. Adding an x to the URL leads to a page that views the source code that produced this HTML, seen in Figure 12

With knowledge of manipulating MDDs and JSP tags, obtained via what the results suggest to be a smooth learning curve, a Makumba user can visualize the BEST data in a variety of ways, in pages viewed by a large *audience of beneficiaries*.

One of the initial ides of Makumba was connected to '*rapid application development*', e.g. generate HTML views automatically based on MDD data description so the user-programmer does not have to enter manually the name of every desired field[22]. Such automation was not yet implemented however, as the need for it did not yet arise. On the other hand, based on the exposed

[22] As the platform that was 'dropped' in favour of Makumba, Notes influenced the Makumba design. In many ways, an MDD is a Notes "form" translated to plain text, and the JSP taglib level is similar to the Notes "view", but without visual programming and using more familiar languages. Showing documents automatically based only on the "form" (MDD) without manual "view" additions at the JSP level, is a Notes similarity that was intended but did not yet prove useful.

rationale and its evaluation, '*rapid member involvement*' seems to be an appropriate description of Makumba, due to the low learning efforts that appear to be needed to get involved with its MDD and JSP taglib levels.

4.7.3.3 BL (Business Logic)[23]

While Makumba provides tools for adding, removing and editing data records, the rules such as "a student can only apply for 3 Vivaldi events in a season") need to be implemented in BEST-specific code, which Makumba discovers and runs. The Business Logic (BL) takes care of response to Makumba-generated HTML forms, as well as authorization for all pages. Makumba supports BL written in Java.

Besides Java knowledge, the Makumba strategy for "business logic discovery" (the way a Java BL file is associated to each JSP page) needs to be learned by user-programmers. Clicking on "business logic" at the top right of JSP source views (like e.g. Figure 12) will display the way Makumba looks for business logic for the respective page.

While all users (n=12) who filled in the evaluation form felt that they know both MDD and JSP taglib, a smaller number (n=8 for reading, n=6 for starting from scratch, n=7 for modifying existing BLs) filled answers for the BL evaluation. "Easiness" averages are 2.9 (just under "medium") for reading and modifying and 2.3 for "starting from scratch". Easiness of passing from working with JSP pages to working with BL was rated at 3.2 on the average by n=6 respondents.

The BL is the most specialized part of an application, and at the same time, the most important. Only advanced ITD members are likely to work with it. As shown in Table 4, the number of BL files in the large Karamba TS system is very small (73) in comparison to the number of JSP files in the application (608), suggesting that it is sensible to assume that a small nucleus of developers will be able to take care of them. BL represents a natural step for

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[23] In the language of 'Design Patterns' for object-oriented programming (OOP), the Makumba architecture can be described as an instance of the MVC (Model-View-Controller) paradigm. MDD represents the 'data model' structure, the 'BL' represents the data model rules (methods), the JSPs represent the 'view', with the 'controller' being a simple unit that reads HTML form parameters and invokes the needed BL method.

the personal development of user-programmers who do not find JSP challenging anymore.

	Makumba Data Definition (MDD)	JSP taglib	Business Logic (BL)
Skills needed	Data structures Data relations	SQL/OQL+ HTML, Optionally Java	Procedural Java + Makumba DB API
Source files	50	608	73
Interdependence	Very high	Low Very high dependence on MDD Low-medium dependence on BL	High Very high dependence on MDD
Jun 2001	8*	3*	
Nov 2001	10*	5	2*
May 2002	11	9	5
Nov 2002	15	12	8

Table 4 Top: skills needed and complexity involved for working at different Makumba architectural levels. Bottom: the number of active developers per Makumba architectural level (MDD, JSP taglib, BL) in the Karamba transitional system. Author participation is indicated with an asterisk (*).

4.7.4 Support for Makumba application development

A number of tools were developed along with Makumba to support development. Their evolution will be shortly described.

4.7.4.1 Sample data and the importer

One of the important ingredients in setting up the process of developing with Makumba was the sample data. Trigg (2000) emphasizes the need for sample data to be used by running prototypes. Another use for realistic sample data is of course for amateur developers learning to write applications. In general, ‘sandboxes’ (in the sense use by Trigg) can be useful not only for prototyping but also for development and developer training. Trigg notices that when the sandbox was transformed into the real application, the pace of implementing new features has decreased, to make sure that bugs are not introduced in the real application. As different from that approach, BEST sandboxes (including their sample data) were not closed down when the (sub)applications were launched.

To obtain realistic sample data, the group periodically produced partial results of the importer developed by the author to be run before each TS subsystem launch, for extracting data from the old applications. In retrospect, working on realistic data is important for developers. While their access to personal data is a potential source of abuse, the realistic content generated is important for their motivation. Once the effort of importing the data from the old applications has been made (by the author), a whole new world was open for the amateur developers.

	“Bundle” sandbox	**“Parade” sandbox**	**Importer**	**Makumba internals**
Skills needed	Ant XML scripting + Software installation /upgrade	OOP Java+ Java Servlets	Procedural Java+ Makumba DB API+ old Johnny internals	OOP Java+ JDBC+ Java servlets+ JSP taglib API
Source files	3	119	143	291
Interdependence	High dependence on latest versions of tools used	High	High	Very high
Jun 2001	**1***		2*	**1***
Nov 2001	2*		**1***	2*
May 2002	2*+1	2*	**1***	2
Nov 2002	2*+2	2*	2*	2*+2

Table 5 Top: skills needed and complexity involved for working on different tools supporting development. Bottom: the number of developers working on tools that support application development. Author participation is indicated with an asterisk (*). Novice participation indicated after “+”

4.7.4.2 On development sandboxes and set-up skills. Relation to self-sustainability

In reflecting on the ‘Open Source’ phase, we have seen that set-up skills are an important issue with amateur developers. Well-designed development sandboxes can come to respond to the problem. Two such designs will be described in what follows.

However, no sandbox design can ensure total avoidance of set-up-problems. While it is relatively easy to tutor a less experienced developer to solve a *programming* problem, tutoring in solving a *set-up* problem is difficult because the main method is trial and error, and it is often impossible for the tutor to make progress without trying him/herself. It is generally not possible to attempt the same trial twice, once by the tutor and once by the novice, so sometimes only the tutor gets to work hands-on. What the experienced member can do is try to explicate to the novice what are the *hypotheses* that he or she makes during problem solving, and what is their *rationale* (even if that will often be based on a series of guesses). To round up this short discussion, the experience suggests that programming self-sustainability is an easier problem than set-up self-sustainability.

As shown in Table 5 the indicators of self-sustainability (number of active developers, independence on the author's contribution as 'senior developer') in the case of tool supporting development (including Makumba itself) are much lower than in the application case (Table 4). As the tools are not likely to 'grow with the applications' (and indeed, some of them, such as the importer, are already phased out) this should not be a critical problem for software development self-sustainability, yet it is important to reflect on it and on what can be done to improve the situation.

4.7.4.3 The "bundle" sandbox

The "bundle" is an archive file that contains all tools needed for the developer to get started. It is maintained for Windows, Linux and in a generic Unix version. The bundle ensures that all developers have the same directory structure, which makes it easy for help to be provided in case of problems. The bundle does not contain any application installed, letting the developer to do the necessary operations for installing them, in order to practice installation operations. Such operations were initially suggested in HOW-TO files but at a later stage an effort was made to 'transparently-automate' (an explanation follows below) the operations described in the HOW-TOs.

Automation is focused on alleviating three main setup-skill problems by: (1) making sure that the files are in the right directory, (2) setting the correct environment variables and (3) taking care of third-party software updates and source directory structure changes. The tool used for automation is called Ant, a platform-independent variation of the Unix build tool "make". Scripts used for automation are platform independent, written in XML, yet another language that developers get a chance to practice with.

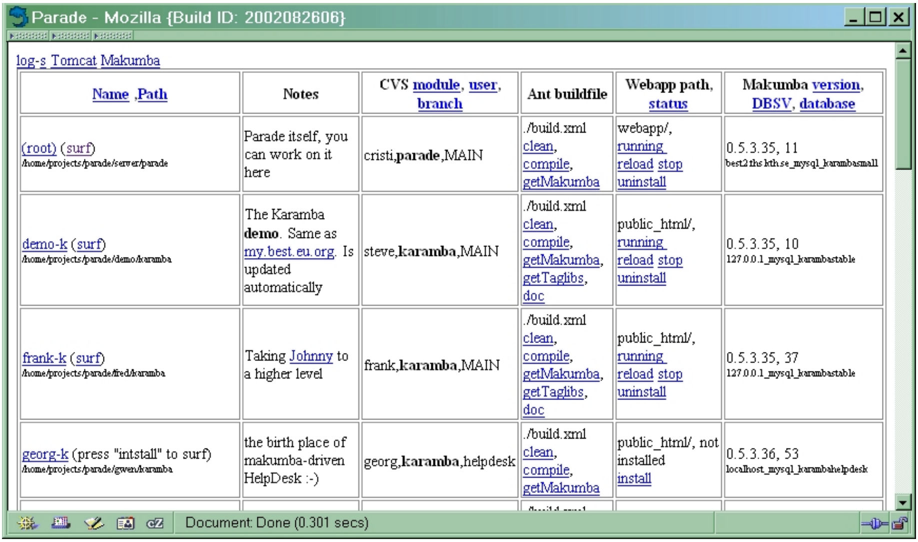
While these scripts look similar to familiar "setup wizards", they have a dimension related to hands-on learning and, related to that, *engagement* with the tool which was referred to as 'transparent automation'. A usual "setup wizard" would automate as much as possible, possibly ending up with one single automatic step. Instead, the user-programmer is involved in a dialog meant to ensure that he or she gets to be conscious of the phases involved in the set-up task, of the scripts involved, etc.

4.7.4.4 The "Parade" sandbox

Besides working as volunteers only part time, members work for short periods available to them from their other obligations. As such, using the bundle to set up their work every time they had time and access to a machine was still difficult.

Parade (Figure 14) is a collection of sandboxes designed by the initiative of the members. At a meeting where local installation was impossible, they developed a remote editor and a "file tracker". Several design ideas were circulated by the group and the author and the final Parade design emerged.

Parade is a web-based tool where amateur developers leave their work and find it back when they have time, at any place they may find a connected computer. All the necessary tools (ant, cvs, file tracking, etc) are installed and ready to be used. This has the downside of not training set-up-skills any more (thus leaving the group more vulnerable to set-up problems), however, many notions, such as the output of ant and cvs commands, are highly visible, and the intent is that they will be recognized if one has to work directly on command line.



Name ,Path	Notes	CVS module, user, branch	Ant buildfile	Webapp path, status	Makumba version, DBSV, database
(root) (surf) /home/projects/parade/server/parade	Parade itself, you can work on it here	cristi,**parade**,MAIN	./build.xml clean, compile, getMakumba	webapp/, running reload stop uninstall	0.5.3.35, 11 best2.ths.kth.se_mysql_karambasmall
demo-k (surf) /home/projects/parade/demo/karamba	The Karamba **demo**. Same as my.best.eu.org. Is updated automatically	steve,**karamba**,MAIN	./build.xml clean, compile, getMakumba, getTaglibs, doc	public_html/, running reload stop uninstall	0.5.3.35, 10 127.0.0.1_mysql_karambastable
frank-k (surf) /home/projects/parade/fred/karamba	Taking Johnny to a higher level	frank,**karamba**,MAIN	./build.xml clean, compile, getMakumba, getTaglibs, doc	public_html/, running reload stop uninstall	0.5.3.35, 37 127.0.0.1_mysql_karambastable
georg-k (press "intstall" to surf) /home/projects/parade/gwen/karamba	the birth place of makumba-driven HelpDesk :-)	georg,**karamba**,helpdesk	./build.xml clean, compile, getMakumba	public_html/, not installed install	0.5.3.36, 53 localhost_mysql_karambahelpdesk

Figure 14 The Parade welcome page. Each row is a working place. Each column represents a tool used by developers (CVS, Ant, Java web apps, Makumba), and the different operations and information provided by the tool are at the intersection. Developer names in the first and third columns have been altered for anonymity reasons.

Parade has become the tool of choice for developers. While few developers are using the bundle, the bundle scripts still need to be maintained (to be invoked by “ant” command within Parade). Typically, during ITC/ITD meetings, most Parade rows (see Figure 15 for an example) are populated by their owners, while the rest of the time different users connect at different times, but mostly in the evening. Even then, as (Nardi and Miller 1991) suggest, programming is a social activity. In case of problems, a member would typically look for fellow ITD members on the ICQ™ instant messaging network and asks questions. Lately an IRC channel is experimented with, and a Parade-specific channel is being considered (see below).

Although the rows are personal, working on somebody else’s row to test an idea, and especially looking there to find inspiration (learning by example), are the norm. No difference in access rights exists between the rows.

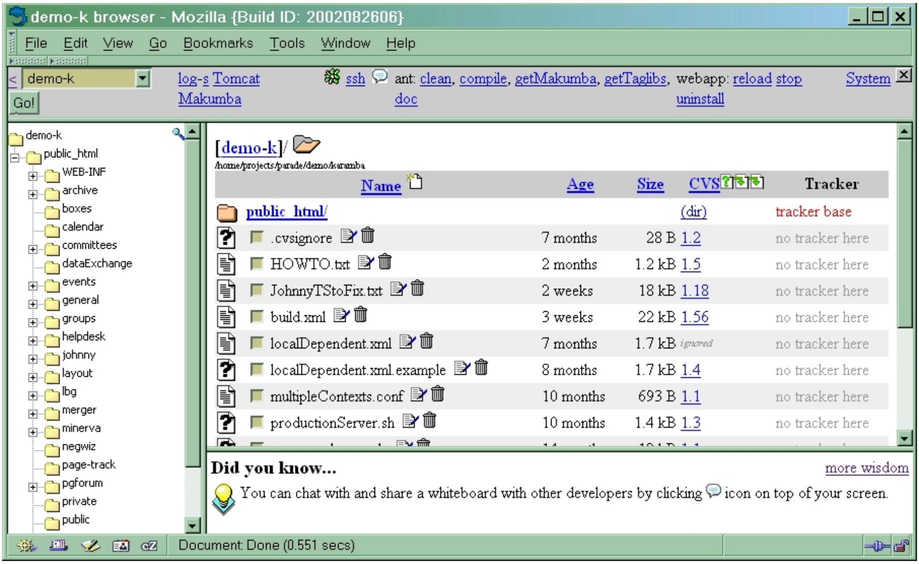


Figure 15 A Parade working place (row). Essentially a remote file browser and editor. As in the welcome page, tools are present on the columns and at the top of the page: CVS, Ant, Java web apps). New “tool drivers” can be added to Parade dynamically.

Bringing the work of members together at the same place has a number of advantages. The following ideas are currently under consideration:

- Developers could become aware of each other’s presence, and availability for ITD matters (unlike in ICQ where only ‘generic presence’ is revealed, but similar to the Ham radio case in which Hams are known to be available for radio matters when they are heard on the wave). A simple tickertape, or more advanced systems such as Elvin (Fitzpatrick et al. 1999) and Babble (Erickson et al. 2002) are being considered

- Developers could become aware of changes in other work places or changes made by others to their own row. Even at the moment, subtle cues such as log entries can be used to obtain awareness of other’s activity (see Bogdan and Sundblad 1998).

- In general, the idea of gathering of awareness information on the occasion of bringing together work contexts that have as “object of work” quasi-identical copies o.f the same object (e.g. a software application, a document, etc) can be considered for more abstract work on “awareness engines” (see Sandor, Bogdan, and Bowers 1997).

- Developers working on the same project could make use of tools to easily transfer a certain source file between their respective Parade rows

While most of these ideas are the object of possible future work, it is important to observe that an application like Parade (and indeed, a technology like Makumba) serves the community by essentially bein sensitive to the needs and learning patterns of the individual programmer (see also Bogdan and Cerratto Pargman, 2002). As Trigg (2000) also observes, supporting the individual member can become an efficient way of supporting the whole group. While famous cooperative systems like MUDs may inspire researchers and designers of IT in voluntary settings to concentrate their efforts on cooperative systems, the sheer support for the individual should not be forgotten.

4.8 Toward an approach to self-sustainability based on member personal development

`Karamba adds value to people, if we could just make them understand that!`

`Wanted to be a (training interest group) member, too much [information] technology in my life, but then I saw it’s not the same thing, also technology is different`

`The meeting in Stockholm was a big development… Maybe it was I who developed?`

Members quoted above all refer to personal development while working in ITC. Personal development is seen a possibility for people who do not yet know about software design (Karamba), personal development is considered as a criterion when a choice is made about deciding whether to join a training committee, or a software-related committee, and finally moments of personal development are evoked.

Most inspiring for the present discussion are the member opinions that mention implicitly or explicitly other activities than software design and software development as alternative challenges that could be taken.

How would people make the choice to join PD-related amateur activities? And, in the interest of self-sustainability, how would they decide to stay, and go on and do more difficult tasks? As it will be argued here, in making that choice, the possibilities of *further personal development* are considered. This is similar to the findings of Carroll et al. (1995) who also mention the evolution of their 'amateur' designers through phases like "informant", "analyst", "designer" and "coach", however, they do not relate member development to self-sustainability.

4.8.1 Member development paths

To take that perspective further, this section will present and comment on three IT Committee member evolutions. In commenting upon them, we will follow aspects of challenge diversity, learning and other forms of personal development.

Ray

Early 2001: 1st year Computer Science student, **joins ITC**.

Summer 2001: takes contact with Makumba MDD and JSP levels, starts learning Java (knew C++)

Autumn 2001: starts **implementing Johnny in Makumba** in hands-on sessions with the author, then in 2 international meetings in cooperation with other developers. In meetings he works mostly with Business Logic (BL, in Java) and other amateur developers help with JSP

Early 2002: being the only member who knows BL, sets up the structure of the Private Area (PA) BL, will be continued by other developers later

Spring 2002: elected "Chief Technical Officer" (CTO). Johnny TS is launched.

Spring-summer 2002: other members look (via Parade) at Ray doing a part of Johnny BL and get inspiration for doing the PA BL

Autumn 2002: starts developing on **Makumba internals**

As with many other members, Ray's remarkable progress (e.g. from not even knowing Java to starting to develop on a 300-file Java library) is due in large part to his personal talents and knowledge, as different from, or (hopefully) in addition to, the action of the author. He managed to make possible the first Johnny responsible change after four years. Since Johnny supports the most important programme of BEST (Vivaldi) and is the most computing-intensive application, handing Johnny over to a 2nd year student was an important achievement for ITC. One year after starting development on Johnny, Ray became the youngest Makumba trainee developer. Since Makumba is a complex library, mostly students from terminal years (2 persons at the moment), or graduated (2* persons, i.e. author included) use to look at its internals.

Ray followed a 'homogenous' development path; he was constantly interested in software development and made intense progress in that area, (in 'Legitimate Peripheral Participation' terms, advancing from the periphery to the core of the community of practice). He learned hands-on (especially BL) from the author and others learned BL hands-on and by example (on-line via Parade) from him later on.

While Ray is a good representative of a 'linear-homogenous' learning path, we will now look at other, more varied development paths.

Jane

- 1999: 2nd year student in "Environment and aquatic engineering", joins **Minerva management committee**
- 2000: **Local BEST group president**
- Autumn 2000: joins a **Karamba working group** (Roma)
- Early 2001: joins a Karamba meeting (Stockholm), works at **Makumba MDD level**
- Spring 2001: joins a Karamba working group (Copenhagen), works on **archive design**
- Spring 2001: elected "Chief information officer" **in charge of the new IT Committee** made of "development" and "Feature Design Group"
- Spring 2001-Spring 2002: participates in 5 IT-related meetings as CIO, as well as at 3 management-related meetings

Early 2002: Karamba implementation meeting, does **Makumba development at JSP level** with the help of developers
Autumn 2002: **Karamba (feature design group) responsible**

Jane did management work in Minerva, Local BEST group, ITC and feature design areas. She is a committed feature designer (starting from an urge to improve the Private area which she "hated" its old version, reason enough to join her first Karamba working group). Besides management and feature design, her third area of development is programming, though she is decided not to "jump over the wall" like other feature designers (such as Frank below) did.

Frank

1993-1998: studies Computer Engineering
1998-2000: graduate student in Processor Design. Has given high-quality feedback to ITC since 1999, especially in connection to the official WWW archive.
Spring 2000: elected **secretary of the international board**, in charge (among other things) of the official archive
Spring 2000-Spring 2001: as board member, gets to work closely with various international teams: **marketing** and **webmaster** teams
Early 2001: participates with other board members in a Karamba meeting. Interest especially in archives and **data structures (MDDs)**.
Spring 2001: international Board mandate ends
Summer 2001: Joins the IT Committee (ITC) summer meeting, sees himself as **ITC member** (feature design interest backed by strong IT background)
February 2002: Gets a job, which he describes as coordination of IT projects […] as bridge between users […] and the IT-developers
Spring 2002, general meeting: responds to a Makumba questionnaire, sees himself as a

Makumba developer. He describes his relevant experience as follows:

I knew concepts of relational db from my uni[versity] education (Computer Engineer) though I never toyed with one hands-on… so e.g. no experience setting up a new DB. Same for SQL. Knowledge of Java also from uni, was a good fundamental basis but was waning.

Spring-summer 2002: takes over from Ray as **main Johnny developer**. Due to his job, he does software development at night, after work

end 2002: still developing on Johnny. Adds the following line to the signature of many of his Johnny-related mails:

Johnny.BEST.eu.org - (de)serving 5000 happy users every year!

Frank has probably had the most 'colourful' evolution from among the setting members. Although a computer engineer, his training and exercise had little to do with the application domain of the BEST IT (web-based database applications). He evolved from 'power user' to 'main developer of a mission-critical application' via stages like 'European secretary' (with intensive activity in all European Board matters, in close cooperation with the President), 'marketing', 'web content author' and 'feature designer'. His mail signature shows the importance of audience for amateur work and suggests a reason for his last 'amateur work choice', software development, as well as reason for doing amateur work even after ceasing being a student.

From one perspective, as a graduate, Frank is a liability to self-sustainability (though he presently shows no sign of wanting to leave the team). However, a different perspective can regard Frank's enthusiastic continuation after graduation as a positive evaluation of the support for amateur software development. It is also important to note that his taking over of Johnny from Ray was the first hand-over of a BEST software application that did not involve complete re-writing. The takeover was done hands-on (Frank started improving Johnny by himself, and posted questions to Ray when need arose) over several weeks (around 8, but it is difficult to pinpoint the moment when Frank had taken over), and that encourages us to believe that some other member can take over from Frank in a similarly short time.

4.8.2 Aspects of personal development

As seen with Jane and Frank, members have a continuous interest in *diversifying their challenges*. Even if he is interested only in development, Ray is also taking diverse challenges that, although being related to a domain, are diverse: BL programming is mostly procedural Java, while Makumba programming needs much more object-oriented skill.

Personal development also has an aspect related to *professional* counterparts of the new challenges taken. If, while addressing a challenge, an amateur will get to use a tool that is used across the professional-amateur spectrum in the area, the sense of personal development is likely to be strengthened (professional tools are not the only alternative, understanding the whole spirit of a profession such as software design is also a case in point).

4.8.2.1 Challenge diversification and professional tools in ITD

To get inspiration in our quest to learn more about member personal development in relation to self-sustainability, we can examine the ITD work as it is at the moment. In approximate order of (technical) complexity, here are the tasks that an amateur can choose to take in the developer group

- MDD reading and altering in design discussions
- Testing and bug tracking (tools: Bugzilla)
- JSP (HTML +SQL) authoring (tools: JSP, Java, CVS)
- Java BL authoring (tools: Java, CVS, Ant)
- Ant script authoring (tools: Ant)
- Parade development (tools: Java, JSP, CVS, Ant)
- Bundle maintenance (tools: Ant, various generic tools included in the bundle)
- Makumba development (tools: Java, CVS, Ant)

This allows the members to follow a ‘smooth learning path’ like the ideal we encountered in amateur radio. The variety of difficulty levels can help to challenge amateur programmers of different levels of skill, thus the team is more likely to gain new members, and become more self-sustainable.

Examining Table 4 and Table 5 we see that, gradually, the researcher has shifted his participation down the above list, letting the amateurs take his place. This suggests a way in which liabilities for self-sustainability such as professionals who will retire anyway, can be gradually guided to tasks requiring more experience but are less frequent in the life of the amateur group.

Combining the generic “developer path” with the three specific learning paths, we notice that often challenge diversification takes place in between design and development. The design-development variety could be taken advantage of by a PD practitioner in such a setting.

4.8.3 Approach to self-sustainability

Based on the observations made at various points in this chapter, we can now suggest an approach to self-sustainability of PD practices in amateur settings.

- Divide the project work into a succession of challenges, of various difficulties and (if possible) natures. See the addressing of these challenges as steps in member development.
- Make sure that the low-difficulty challenges are low enough so members will be involved rapidly.
- Make sure that each challenge is self-standing and its outcome cannot be confused with the outcome of others.
- For each challenge, have a list of professional tools that can be used, and offer them to the users as they come in to do the job.
- If not enough members are attracted to a challenge, the researcher should do work him/herself.
- As easier challenges get ‘populated’, the researcher (and other liabilities to self-sustainability) should ‘retire’ from their addressing.
- As users achieve good skill in working for addressing a certain challenge, suggest them the further challenges ahead.
- High-skill ‘transitory’ operations (that are not likely to be repeated in the cyclic practice of the amateur group) should be preferred by the involved ‘professionals’

4.9 Conclusions

As technology costs decrease, amateur and voluntary settings take the issue of software design more and more consciously. Due to their inherent democracy, participatory design is a natural method for such settings, with important differences from professional settings, such as the likelihood of having more concord between participants in design, and larger design group variability. As lack of resources affects many such settings, the issue of design practices self-sustainability becomes of great importance. One danger to self-sustainability is the frequent changes in management in such settings, as they can bring changes in attitudes towards the PD process. Another problem is that PD workshop members are likely to have various degrees of knowledge, not only about computers but also about the community itself.

While it was easy to present the new PD activity as another challenge for the members, and as another direction in which they can develop, separating design from implementation in presenting the new challenge would have been a better approach. This exercise of *challenge education* shows that proposing a new challenge during interventions in amateur settings is a delicate matter. The experience also shows that, once the new PD activity has attracted enough amateur designers, special PD methods as *professional methods* should be introduced, to increase the possibility of *member development* through the new practice.

When software development is done from within the organisation, volunteer developers present the risk of having too much power in the design process. Also, self-sustainability of the software development activity becomes a sine-qua-non for the self-sustainability of the PD practices. In trying to address the need for development self-sustainability, an important consideration is that amateur developers are likely to present a continuum of skills, and the tools available should make them feel involved as early as possible. The skills that amateur student developers have for programming were found to be less problematic for self-sustainability than their skills for system set-up.

Various approaches have been tried out for involving amateur developers. They can be considered to correspond to different *professional models* of higher skill existent outside the amateur setting (Lotus Notes programmers, Open Source programmers). In the end, as none of these models fit, a setting-specific tool was devised, but a mix of professional tools was introduced in supporting it. This evolution shows that, when introducing a new practice in a setting (such as software development), the “user world” (cf. Muller 2001) is ‘a world in the making’. It is difficult for users (programmers in this case) and designers to determine which are the most appropriate tools in the absence of previous practice.

Personal member development was found to be a good guide for considering how to approach a PD setting in the spirit of self-sustainability. The recommendation is to view (and set up) the PD task as a continuum of challenges of different difficulties and natures. This continuum is similar to the ‘smooth learning path’ encountered in amateur radio, with its contribution to community endurance, which in the PD case corresponds to the self-sustainability of the PD subcommunity. As more and more challenges are addressed by members, professional skill resources given to the setting can be withdrawn from the respective areas.

Chapter 5
Discussion. The Amateur Community

Throughout the thesis, we have encountered amateur radio operators, amateur project arrangers, amateur graphic designers, amateur software designers, and amateur software developers. Amateurs of various kinds permeated the settings examined, and there are suggestive resemblances across their work, and its technological support. We will now examine these resemblances, and group them as a modest attempt to generalisation, in the hope to inform future research and relate to other perspectives. We will call our perspective the “Amateur Community”. This chapter will make some comparisons and indicate some relations with other community-related and CSCW-related perspectives. We will then use the perspective developed to answer the research questions posed in the Introduction.

It would be premature to theorize amateur communities from just two field studies and one participatory design experience. The generic features presented here are not normative or prescriptive, however, beginning to make a generalisation by tracing resemblances is considered useful for two reasons:

- By knowing the generic features of amateur communities, we can suggest an approach to IT design in such settings, and further consider these features on the field
- Present CSCW contributions in the area of communities (e.g. Mynatt et al. 1998) do not take a work perspective. Taking that perspective enables us to be more specific in design implications that regard a specific kind of community. That specificity may be of more value for other CSCW-related design and work

In what follows, we will review the resembling features of amateur communities. As we go along, we will compare to various theoretical perspectives made in related work. After that, conclusions will be drawn.

5.1 Amateur community features

Amateur communities are socio-technical contexts organized around amateur work, which, as field observations have shown, is inherently cooperative. This cooperative nature of amateur work can be viewed from several angles. As in other settings, ‘cooperative’ does not exclude individual work, but that work is, at some point, assembled within the community. Secondly, ‘cooperative’ denotes a shared challenge as the motivation for work. Third, the challenge is cooperatively (socially) constructed and shaped as has been seen, and as it will be reiterated below.

5.1.1 On joining, membership and structure

The perspective we are developing does not make any particular commitment regarding the number of members. One can think about Ham as an amateur community (sharing generic challenges), or about EME (sharing more specific challenges), or about SPOC (a smaller geographically distributed group pioneering new challenges).

More often than not, an amateur would become an ‘addresser’ of a challenge (i.e. an amateur in that ‘challenge field’) by simply encountering an already existing amateur community, rather than encountering the challenge in isolation from any community. However, for many kinds of amateur work, both possibilities are open. Communities such as Ham have a ‘canonical’ arrangement providing a well-known ‘entry point’ for welcoming new members, training and formally attesting them. Similarly, some Local BEST Groups organise “recruiting campaigns” where prospective members are presented with BEST event arrangement challenges.

No structural commitment is made within the perspective, except that of voluntary association (denoted by the term ‘community’), with various degrees of associational formality. An amateur community might have canonical laws at juridical level (e.g. amateur radio), might be formally registered as an organization (e.g. student organizations), or might be officially unregistered (e.g. Linux[24]). Internal canonical rules and procedures might be specified to various degrees of formality and juridical strength.

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[24] Studying Open Source communities as amateur communities deserves a separate thesis. For the purpose of the present thesis, we can easily notice the large *space of contingencies and experimentation* in developing, fixing bugs in and optimizing complex software, as well as the world-wide *audience* that generic open source projects such as libraries and operating systems have. Linus Torvalds, the Linux community leader, refers to the “intrinsic motivation” that a project should present to amateur developers (Kollock 1999, pp 231), which corresponds to what we call “challenge”. The economical tension coming from Linux competing products made by *professional counterparts* comes to add to Linux’s contingencies.

Furthermore, employees of industrial organisations may be members of communities of interest within the respective organisations. Even if such members are professionals, their voluntary work and association resembles with amateur communities.

5.1.2 Collective challenge, contingency spaces

Amateur communities grow and evolve around challenges that are found interesting by their members. Challenges are addressed collaboratively through debate of approaches, experimentation, discussion of achievements, combination of individual or subcommunity contributions, and other forms of cooperation. Challenge is thus *requisite* for amateur communities.

In this perspective, a challenge is strongly related to the contingencies that may occur while it is being addressed. In other words, amateurs like to *'live on the edge'* of their trade: Hams live on the edge of radio transmission (by experimenting to see whether they can achieve radio connections of a certain kind, in highly-contingent conditions), amateur student arrangers of international exchange projects live on the edge of managerial arrangement (by e.g. not knowing if they will find arrangement facilities, sponsoring and such), amateur graphical designers experiment with logo design that may or may not be liked by their 'customer' community, amateur developers experiment with algorithms and other technical contingencies, as well as having to deal with reactions from their community.

An amateur community or sub-community is likely to endure for longer if the contingencies that create its challenge are closer to an *inexhaustible* nature, such as the 'infinite spaces of possibilities for experimentation' encountered in amateur radio. On the contrary, if the challenge can be exhausted, the amateur community will have to define new, related challenges for amateur work to continue and the community to endure.

More than one challenge is likely to be addressed in an amateur community. Challenge diversity can be of various degrees of *heterogeneity*, for example EME and DX are both dependent on antennae, cables, high power and (sometimes in DX, almost always in EME) Morse (CW) transmission skill, although they depend on equipment and transmission skill in specifically different ways. At the same time, graphic design for a student organisation and amateur arrangement in the same organisation are of quite different nature, hence challenge heterogeneity is more pronounced in the student organisation context than in Ham. The different challenges define ‘localities’ (in the sociological sense) for *subcommunities* to be formed inside the larger community.

Pursuing a challenge in its own right (such as striving for the perfect algorithm implementation) is likely to create challenge conflicts (with e.g. striving for the perfect summer course). As the case in point illustrates, such conflicts are likely to be important in IT design, as balances to be achieved, problems to be solved, opportunities for inventive solutions, etc. As another illustrated case shows, graphic design and other forms of design need to take into account other challenges existent in the community, and the conflicts between them (for example the conflict between local and global challenges is important in IT design).

Challenge must also be *actionable* for the community to thrive. Not every challenge can be addressed; there is a fine balance between the difficulties created by the contingencies in addressing the challenge, and the skills of the amateur. ‘Living on the edge’ is thus seen through the existing skill: an experienced amateur programmer (e.g. a Linux contributor) will not see as ‘the edge’ the kinds of contingencies encountered by programming in a student organisation. This is unlike an undergraduate student who may be just learning to program. Endurance of amateur communities also depends on the extent to which new members can address the ‘lower entry’ challenges posed as well as the extent to which they can learn and acquire skill to address more difficult challenges. Csickszentmihalyi (1990) emphasized this challenge-skill balance, yet, our perspective adds emphasis on social aspects of challenge, as we will illustrate later.

5.1.2.1 Challenge, contingency and “situated action”

Many CSCW ethnographies use the word ‘contingency’ to describe unexpected situations faced by workers or users of cooperative systems (Bowers et al. 1995) and the skill involved in addressing these unplanned, non-canonical (Brown and Duguid 1991) aspects of work, and studies like Suchman and Wynn (1984) on office work conclude that most of that work is actually made by negotiating unplanned situations. In her seminal text on situated action, Suchman (1987) considers in detail the case of a copier designed to assist its users and the way in which the ‘plan’ inscribed in the copier software fails to include all the situations faced by the copier users. This results in various contingencies that the users have to address.

It is interesting, at this point, to reflect on what a hypothetical amateur-of-the-copy-machine would do in this situation, in the light of what we learned from e.g. the amateurs-of-the-radio-wave. A highly situated, improvisational manipulation of the copy machine needed to accomplish a certain ‘unplanned’ task would be in fact enjoyed by our hypothetical amateur. He or she would probably try to gain a better understanding (e.g. reverse-engineer the copy machine’s ‘plan’ by experimentation) of the ‘cultivated medium’ (the copier). Upon success, he or she would tell to peers a story of how the contingencies were addressed (cf. Orr 1996). As noted earlier, the act of copying as such is not the only thing of importance (it could be associated to small-talk, as opposed to serious traffic on an amateur radio frequency), but the sequence of contingency negotiations and the story are important. As such, the amateur negotiates contingencies and enjoys the situatedness of the activity for a ‘story to tell’.

Pleasurable situatedness is then a basic feature of amateur work. That is not to say that all amateur work only consists of pleasurable situations, nor is it to say that waged work (e.g. office work) cannot offer such situatedness or pleasures. Indeed, it would not be surprising if one would find that most office workers actually enjoy the unplanned parts of their work, as these involve most of their skill.

5.1.2.2 Amateur work and contingency Vs planning and accountability

Yamauchi et al. (2000) found that in open source software development projects, community members prefer to address items from the project to-do list without previously announcing (to the project mailing list) the intention of addressing that to-do item. Instead, the announcement is made only after the to-do task has been successfully completed. The explanation offered by Yamauchi et al. is that, in case the to-do-item-addressing fails, the addresser’s prestige inside the community will not be affected.

A number of other explanations can be offered: resource sparing (other members don’t need to waste time waiting for a solution which might never come), ‘peer review’ of rival solutions to the same problem, etc. A further explanation, suggested by accounts of study informants in both the amateur radio and student organisation studies. Remarking on the software he has done for amateur radio, a professional programmer who is also a Ham says

> What I do for radio is done with pleasure and offered with pleasure, what I do at work is sold.

The informant refers to the result of work (software) being “offered” in the sense that it has already been “done” at the time it is given away to the community. In contrast, “selling” the work takes place on the basis of a pre-existing contract and planning. Doing something “with pleasure” has a connotation of doing something that one was not asked to do, something which was not planned and hence is *not accountable* to other parties of an organisation (cf. Suchman 1994). This is not only the case in organisations, but in the amateur community itself. Members of the studied settings often expressed that, from the moment they committed to do something, the pleasure of working to achieve it ‘reduced’ by the promise they made.

On the same note, if an amateur has to choose between working on a task committed for (within the community or in other contexts) and a contingency (that just ‘comes up’, unplanned), to be negotiated, the latter has quite some chance to be preferred over the former. As a case in point, exam periods are not periods of lower amateur programming activity for some amateur student programmers. “Studying” is often referred to as “what I should have done instead” when a programming achievement is reported to the amateur group.

In the case of accountability within the amateur community, there are other aspects that counterbalance the preference for non-accountability. One of them is personal prestige in the community, which would be affected if a promise were not kept. This is even more pronounced in the case of student organisation work, where a strong professional-managerial influence exists, and planning and accountability specific to that profession are given more emphasis. Prestige of a group (rather than individual) is even more important. ‘Saving the face’ of one’s sub-community (e.g. a local group of a student organisation) by doing something that the group has committed to, is also motivated by that group being an ‘audience’ to its member’s work (see discussion on audience below).

These reflections on the preference for non-acountability may be of interest for design of cooperative software for amateurs. Workflow systems are viewed by Suchman (1994) as ‘technologies of accountability’ in the accountant’s sense of ‘debts still outstanding’. Such technologies should then be designed with care for this preference for individual ‘freedom from accountability’.

As it will be reminded in the next section, economic models such the one used by Kollock and Smith (1996) promote exactly the opposite: accountability of voluntary contributions. Member accounts suggest once again that such models do not fit in amateur communities.

5.1.2.3 Audience and beneficiaries of challenge addressing

The audience of a member’s report about a challenge addressing (often a story) is important as part of amateur’s motivation. The audience could just admire the new achievement, or could practically benefit from it in various ways.

An achievement is even more important if it has beneficiaries beyond the scope of the amateur community, in the ‘public’ of the community. The *public* of the amateur community is then the part of the audience that is not interested in the details of challenge addressing (strings of negotiated contingencies), but in the result as a ‘black box’, for example users of a radio wave who receive broadcast radio, students who participate in an exchange project, users of open-source software, etc.

Specific audiences can create opportunities for interesting challenges. For example, general-purpose organization-wide software such as an email archive system is likely to be bought (as opposed to being built in-house) by a company, hence that domain is not likely to offer the opportunity to do such software. This is not the case in a student organisation, where scarce resources can impede a commercial acquisition and maintenance. Such general-purpose challenges taken in amateur contexts provide a much larger ‘virtual audience’: by fulfilling a general purpose task (e.g. a WWW archive), the software has a potential audience that makes it even more motivating to develop.

In relation to challenge-addressing audience, we can also reflect on the frequent occurrence of the question “why do people make voluntary contributions” (Kollock, 1999, Kollock and Smith, 1996) by answering to questions asked in public forums such as the Usenet even in situations where they could charge consultancy money for their answer. From the Amateur Community perspective, it is not necessary to resort to mathematical explanations based on iterative versions of Prisoner’s Dilemma (Axelrod

1984) and terms such as "lurkers" and "suckers" (see also Nonnecke and Preece 2000 for a criticism of understandings of lurking as free-riding). The motivation for contribution is related to the fact that a contingency of the sort indicated by the question has been negotiated in the past, and this achievement can be reported to a wide audience. Without the question, the contribution is unlikely to be made; indeed, there are many contingencies that one has addressed within the amateur field. The question sparks the remembering of an incident of challenge addressing, and subsequently the contribution. From such a perspective it is not unbelievable that the Usenet works (cf. Kollock and Smith 1996).

The same rationale can be used to interpret the account of the informant to a study by Ackerman and Palen (1996) of a chat-like help system within a university. The informant says: "I answer partially to be helpful, partially to show off". From the amateur community perspective, the informant "shows off" his skill in negotiating a contingency, to a university-wide audience.

5.1.2.4 Reading challenge back in other community accounts

Besides remarks on motivation for voluntary contribution, challenge can be read back into numerous other accounts of community life. "Collective action" referred in Smith and Kollock (1999) provides an entire class of collective addressing of challenge. Similar examples can be found in Schuler (1996) describing projects of 'wiring up' schools to the Internet in one day.

In reading the entertaining gender-deception accounts from the CMC community literature (e.g. van Gelder 1991, which also includes deception on disability), one cannot help notice how challenging it is for one to deceive an audience about their gender for a long time, in intimate online relationships. Ethnomethodologists explain that simulating an everyday ordinary-ness that one does not know first-hand (such as that of a person of the opposite sex) is extremely difficult, and lots of contingencies would need to be negotiated as time goes on (Garfinkel, 1967). In fact, professional actors were hired to do so over the French Minitel (Rheingold 1993) and many professional operators are doing it in sex-on-the-phone workplaces (cf. Stone 1991). In the perspective developed here, media such as audio and plain text (i.e. lack of visual information) afford the addressing of such deception-related challenges.

"Mudding", the act of playing a Mud game (e.g. Muramatsu and Ackerman 1998, Pargman 2000) gives the opportunity of another reflection that one can make on long-time community activity (though, as gender deception above, not necessarily regarded as work). Indeed, designing a good Mud game and shaping it over a long term is an act of design for cooperative challenge and combination of individual skill. A game is inherently a setting in which one has to address a challenge with skill. IT design for amateurs could reflect on that further.

5.1.2.5 Complements and alternatives to challenge as amateur work motivation

In situating challenge as the main motivation for amateur work, one should not forget other motivations. The opportunity of a rich social life in a strongly connected community is much appreciated by many of the encountered members. 'Belonging' to a prestigious community is not insignificant as a motivation for joining and working.

Especially in student organisations, it is well-known that 'extracurricular activities' such as student organisation work are seen as a plus when the student applies for a job. Serving in high-responsibility formal positions within the community (e.g. "secretary of the international board") is even more valuable for such purposes. Members talk of students who joined the organisation just to get involved in a project that involved European Union participation so as to get in contact with politicians at that level and subsequently get active in European-level politics.

However, even if such 'not-only-challenged' or 'non-challenged' members exist, the 'gossip' illustrated in the European politics case above is illustrative to the fact that such cases are 'tolerated' by the community (for reasons of e.g. not having somebody else interested in the particular EU project) without being especially respected. The most appreciated members, according to this perspective, are still those who are genuinely interested in addressing the community challenges.

Still, sometimes a perceived personal interest can actually correspond to a collective challenge. The 'politically-interested' member above can also be seen as pioneering (see below) a new kind of challenge (dealing with European projects and politicians), which was not seen as interesting by the most members of the student organisation, who were interested in event arrangement as main challenge. In a heterogeneous-challenge environment like most amateur communities are, it is not uncommon for members to stigmatise each other's preferred challenges, like in the illustrated 'member talk' about the 'politician-to-be'. For example an EME radio operator browsing a DX frequency range referred to the SW traffic going on there as "just gossip".

5.1.3 Pioneering of new challenges. Challenge research

In the context of the extent to which a challenge is actionable, an important role is played by *proof-of-concept* work done by more advanced (groups of) community members or even by non-members. Wide audiences of members can attempt to build on that kind of work, or simply attempt similar experiments (e.g. EME in Ham radio). The proof-of-concept work is not necessarily done in the community, but motivation for such seminal work is likely to be high, as exemplified by the SPOC case in the student organisation field studies.

Pioneering new challenges and refining the existing ones are perpetual amateur preoccupations. Challenge is not just a coincidental preference of the members, it is changed by members continuously according to what they consider to be 'further challenging' on the base of existing challenge-addressing achievements. Challenge is thus *socially constructed*, in a *research* fashion (which makes this perspective differ from Csickszentmihalyi's, 1990). In the 'living-on-the-edge' metaphor, amateurs do not only live on the edge, they also continually *push the edge* further. Brown and Duguid (2000) describe "story vetting", a form of 'story review' by practitioners in a geographically-distributed organisation who 'rate' stories in their domain of expertise (e.g. copier repair) according to their usefulness for the advancement of that domain. As a generalization of Orr's (1996) findings, story vetting is illustrative for the peer-reviewed-research aspects of non-canonical work.

Having noted the preference of amateurs for non-planned, non-canonical work, we could see research to find new challenges or novel aspects of a challenge as a continuous quest for *non-canonicity of the amateur practice*. Indeed, the moment an amateur practice gets stabilized and routine, it will exhibit aspects of regularity that would make it be unlike 'living on the edge', unlike amateur work as such. Hence such 'stable state' (cf. Schön 1971), or challenge exhaustion, is always to be avoided.

A specific kind of pioneering is *hybridisation*, which results when two challenge-heterogeneous amateur groups cooperate. One such example occurred in the context of SPOC challenge exhaustion mentioned in Chapter 3. A challenge that appeared just as SPOC needed new challenges most was the redesign of the software that supported the international exchange programme coordinated by SPOC. Their challenge combined with the more technical quest of the IT group within the organisation, resulting in new interesting situations to address, and new skills to learn. As shown in Chapter 4, this later led to specific socio-technical co-evolutions in which members learned a community procedure while supporting it with software.

In the context of challenge shaping, it is important to note the importance of *professional influences* from the corresponding professional trade. As seen in the student organisation example, professional influences (in the area of graphic design in that case) may not be suitable in the amateur context (e.g. in regard to non-commercial specifics) hence the influences need to be regarded with caution in design situations. On the other hand, learning about professional tools and practices can be an important incentive for members to participate in newly created challenges such as software design and development, as part of PD endeavours (see Chapter 4).

5.1.4 Amateur learning and “Legitimate peripheral participation”

In a context where the balance of challenge and skill is of central importance (challenge addressability), one needs to give equal attention to learning of contingency-negotiation skill in particular and Amateur Community context in general. Existence of low-entry levels of contingency for newcomers, as well as the possibility to follow a smooth learning trajectory to more difficult challenges are of central importance for the ‘reproduction’ and, ultimately, endurance of amateur communities (see Chapter 4 for an example in the software design subcommunity). ‘Smoothness’ is important because, if one has a lot to learn before seeing successful results in addressing a greater challenge (or an initial challenge, for newcomers), one is more likely to ‘drop out’ in the process.

The field observations suggest that there is a wide preference for non-canonical learning, which takes place by observing the practice of more experienced members: listening in amateur radio, repeating last year’s procedure in which one has participated in the student organisation context.

Hands-on learning has been theorized by Lave and Wenger (1991) as "legitimate peripheral participation".

Reification (cf. Wenger 1998) of practice to canonical forms (rules and regulations) and formal teaching of the canonical descriptions of practice also exist. Subcommunities that form around a new practice (a new challenge) can be 'reified' into canonical groups of the organisation (as in e.g. making SPOC be an official group and reifying the notion of international committee in the process).

Furthermore, operation directly at the canonical level (changing rules without reification from practice) was also found, at least in student organisations. This can be seen as a form of large-audience challenge, in that coming up with better rules is likely to benefit a lot of members, but the contingencies created by their representatives' objections to the new rules must be negotiated in the process.

Another aspect of learning in relation to challenge is that not only skills are learned, but challenge itself is learned. The new challenges to be addressed by a member through his or her learning trajectory are not necessarily immediately-apparent to the member as challenges, their contingent nature becomes evident to the member through participation and observation of other members. Such 'challenge learning' can take place explicitly as well. One needs 'training skill' to present a certain activity domain in such a way that a challenge will be seen by members who were previously not aware that its addressing can benefit the amateur community. Such 'challenge education' is important in IT design for self-sustainability, which often has to introduce new, design-related or technology-related long-term practices in the community (see Chapter 4). In order for such practices to endure, new challenges often need to be 'uncovered' for the members during the act of design.

While useful for thinking of how learning takes place in amateur settings, the theoretical model of "legitimate peripheral participation" for "situated learning" (Lave and Wenger 1991) in "communities of practice" (Wenger 1998) does not entirely capture learning as it was seen on the field. The frequent operations at the canonical level and their dissemination are a case in point. Also, in their model, Lave and Wenger suggest that the main motivation for membership and practice is the progress of "identity" from "peripheral" to "full participant". In the amateur community perspective, such a motivation only comes second to the addressing of collective challenge for the benefit of the community. In other words, our amateurs seem to be more community-conscious and audience-conscious than the members of the five settings from which Lave and Wenger have extracted their model.

To sum up, learning is an important aspect to take into account when doing IT design for amateur communities, due to its relation to acquiring of skill needed to address challenge. Peripheral participation has been found to be an important vehicle for hands-on learning of skill and challenge, but more formal learning (for example in initial training, or in promoting new challenges) should not be neglected. In short-term-membership amateur communities repetition and wheel-reinvention (taking place when a certain discussion or action is repeated regularly) are remarkable vehicles for learning and challenge refinement, and thus for community endurance.

5.2 Conclusions

We will now conclude the thesis by revisiting our research questions. While details that help answering the questions have been given throughout the thesis, a brief summary of the main outcomes will be shortly presented here.

5.2.1.1 What are the aspects of amateur work that relate to technology and community endurance?

Communities based on amateur work were found to *endure* due to such work being motivated by inexhaustible, yet addressable challenges, as well as by wide audiences of beneficiaries. Such challenges are transformed by pioneering and professional influence and are continuously reviewed within a research-like process.

As part of endurance, member *learning* how to address the challenges and learning (as well as ‘teaching’) about new challenges themselves is of primary importance. Gradual member development through hands-on learning was seen as the preferred way, in a similar manner with the “Community of Practice” perspective. However more formal learning should not be neglected. Practice repetition and ‘wheel reinvention’ were also useful in short-term membership amateur settings.

In amateur radio, the main challenges of a certain kind of amateur work were found to be reflected in the *technologies* developed for its support.

Technologies supporting amateur work assist members in addressing their challenges while preserving the contingencies cultivated by the community. The heterogeneity of challenge encountered in student communities found challenge as an important factor in the *technology shaping* by the community.

5.2.1.2 How can amateur work be supported with design of information technologies?

Design of information technologies for amateur work should be grounded in a thorough understanding of challenges cultivated within the amateur setting and the eventual conflicts between them, which should be carefully balanced during design. According to the Amateur Community perspective, a designer of IT for an amateur community should first and foremost identify the core challenges of that community, their patterns of action-ability, pioneering, audiences of beneficiaries, professional counterparts, research.

As seen when examining Ham artefact design, the contingencies valued by the community members should be carefully preserved in design. While many instances of design for professional work may want to eliminate contingencies and to commit to 'plans' such as e.g. workflows, IT design for amateurs should have a slightly different agenda, valuing the situatedness that is pleasurable to users.

Due to its sensitivity to voluntary member opinion and free choice in use, Participatory Design is intrinsically suited for IT design in amateur communities. It is recommended that design itself is presented as a challenge to members, through a new-challenge-education approach, in ways that would make apparent the personal development that members can draw from participating in design sessions and learning IT design skills.

Chapter 3 has emphasized challenge conflict in heterogeneous challenge environments, and their role in shaping the software. Conflicts such as 'global-local' or 'member-developer' need to be identified and carefully balanced during design.

Amateurs are in a continuous learning process, and learning takes place mostly hands-on. Hands-on work with the designed software is thus a good opportunity for learning, as exemplified in Chapter 3. Other ways of supporting learning should be sought (e.g. learning by example, see the tools for amateur developers in Chapter 4).

5.2.1.3 How can the practices of designing and implementing information technologies be made self-sustainable in an amateur setting?

Once design is established as a new challenge-ful activity, maintaining it as such is not an easy task. The experience with designing in the student organisation has revealed problems with clearly setting the challenge of design in relation to the challenge of implementation, frequent changes of management of the organisation, interruption of design activities due to intense implementation efforts, etc.

The proposed way of seeking self-sustainability of software-related practices within amateur communities is to create a graceful development path for the amateur designers and developers, and to gradually withdraw professionals from different stages as sufficient numbers of setting members arrive at the respective learning stages.

Due to lack of resources in many amateur settings, design and development are likely to be done from within, and especially in such cases, self-sustainability of software implementation is an important goal. Chapter 4 described technologies designed to support amateur development of data-driven WWW applications, with promising early results in regard to self-sustainability.

5.2.1.4 How can the study of amateur work and technology contribute to CSCW community understandings and research programs? How can the CSCW 'community' research agenda be improved?

In CSCW terms, amateur work represents a specific form of situated action, which we named 'pleasurable situatedness'. Other specifics of amateur work in comparison with employed cooperative work have been emphasized, such as the preference for less formal accountability.

The Amateur Community perspective has been proposed as a contribution to CSCW understandings of community. As improvement to the CSCW research agenda on 'community' a more work-oriented perspective (like in the amateur work perspective, or alternatives) is being recommended. Economy-based understandings of voluntary cooperation in communities (as in Smith and Kollock 1996) were found not to be suitable within amateur communities.

Features of amateur work resembled across the settings studied and appeared different *in a CSCW sense* in fundamental ways from other kinds of work studied, starting from the very aspects of their situatedness as perceived by members. This makes a strong case for *Computer Support for Amateur Work ('CSAW')* as a work-oriented agenda for CSCW in communities. The word 'cooperative' is not present in the 'CSAW' title, as we know that challenge-motivated voluntary work in amateur communities is fundamentally cooperative.

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