

Users as *cultural mediators* in interactive system design

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ABSTRACT

The paper discusses the role of users in interactive system design and in particular their involvement as “cultural mediators” to facilitate communication, sharing and collaboration between final users and designers. Whilst the benefits of user-centred and participatory design are widely accepted as a general framework for interactive system design, the practice often fails in involving the users as equal partners in the design process. In the paper, we examine the case of complex systems design and in particular Air Traffic Management. The domain is interesting because even if it traditionally recognises the fundamental role of the human factor in system design, however user participation in the design process is too often reduced to an acceptance test of the future system. Despite of this practice, the paper reports cases of different kinds of user involvement in system design. In particular, it discusses the role of *in-house experts*, *testers* and *cultural mediators* showing through the presentation of case studies the importance of not only involving users but also of purposely diversifying their role in relation to the different phases and objectives of the design process.

Keywords

Air Traffic Control, Participatory Design, User Centred Design.

CULTURAL AND INTERCULTURAL ENCOUNTERS

Multidisciplinary design of interactive systems often entails cultural and intercultural encounters. The definition of new concepts and the way to turn them in successful systems is not always collaborative nor nearly as “user-centred” as the organization doing the design claims. The integration of different disciplines in early user research and in the synthesis of the findings and their application to design activities is not obvious or granted. In particular the domain knowledge of users involved in the design of a future system is often the weak ring of the process in the meeting of different cultures and visions about future systems. Successful intercultural communication in system design is often difficult to achieve, as it involves a great number of factors like expectations, previous knowledge,

capability of envisioning, practices, conflicting objectives, use of time and resources. For these reasons, the harmonisation in multidisciplinary design teams is a delicate task. Admittedly, the mediation between different cultures requires the communication and sharing of ideas and information from one cultural context to the other, and the development of *ad hoc* methodologies to help the different actors understanding each others and working together. The construction of a common vision is a collaborative endeavour of customer, users, designers and manufacturer. Typically, contradictory or disputed requirements evolve during the design process, which stem from the different views of the stakeholders. Mismatches and misunderstandings should be solved avoiding to push them back because of conventional role playing in taking decision. In particular, users are underprivileged in the process of concept design and requirements development, since they are not always sufficiently prepared for active participation. Nevertheless, it is exactly the user's professional expertise in coping with daily work problems which is indispensable for creating some innovative applications. In order to minimise this inconvenience, it is extremely important to define different roles users can play and to develop *ad hoc* methodologies for user participation.

From the analysis of recent projects in the field of Air Traffic Management (ATM), we discovered different modalities and motives to involve users in the design process. We experienced that in order to avoid user participation to become a flop, users need to be prepared for playing their role effectively, for contributing their domain knowledge to the project, for defining concepts, for evaluating and comparing solution proposals and identifying usage problems. From the analysis of case studies we realised that it is advisable to define different roles for users and be able, as designers, to provide an appropriate context for user collaboration. Indeed when the design process does not envisage the user as equal partner in the design process, one can observe that user participation is reduced to an acceptance test of the final system. Such a test is an obsolete means, since it just provides a final snapshot evaluation of a system, the development of which could not be really influenced by

users. On the contrary, the user participation should be regarded as a process of incremental optimisation of quality of the final system that results in a reasonably satisfactory solution.

In light of this consideration, the paper will firstly discuss the impact of successful and well consolidated approaches to user involvement like Participatory Design (PD) in the current practices of the ATM system design. In particular Bannon's analysis of the transition from Human Factors to Human Actors (Bannon 1991) will be taken as point of reference. The second part of the paper will present the different roles of end users in ATM projects. Roles will be defined in relation to the system design phases and the forms of their involvement.

PARTICIPATORY DESIGN

In order to briefly present the key characteristics of PD, the present section will certainly oversimplify the variety of projects and systems being designed in the ATM field. In fact only general features will be discussed, and in addition only those encountered in the experience of the authors. However, they will testify a different cultural approach to the general principles of PD and to the involvement of end users in ATM.

The origins of PD are deeply intertwined with trade unions efforts to bring democracy into the work domains. During the Seventies the Scandinavian Approach led by Ehn and Kyng among the others was the first that clearly recognized workers' democratic participation in the organisational change process as a multi faceted issue (Ehn & Kyng 1987; Ehn, 1988). The possibility to voice one's own opinion in the management decision-making process is certainly one relevant means to bring the workers in a more active stance, but often it does not suffice. Given the pace of technological innovation one legitimate objective may also be to ensure that the introduction of new technological devices do not spoil workers' knowledge and acquired skills. An awkward technological innovation is then likely to de-qualify workers from professionals/craftsmen to machine-assistants, by routinising and disrupting those workers' tasks that requires professional skills (Latour, 1991). The Scandinavian Approach tried to overcome this drawback by ensuring that workers' core competencies and professional knowledge could play a major role in the technology design process. A design process where workers are given effective means to participate can more easily address real operational needs, rather than being driven by technological possibilities, and most of all it can exploit existing operational knowledge to support designers' decisions and to solve design problems.

Even if these principles were readily accepted by the HCI community, a certain degree of inertia appeared. At the beginning at the Nineties Bannon (Bannon, 1991) could well highlight the differences between PD principles and current practices. Bannon claimed that end-users were still considered as Human Factors rather

than Human Actors, that is emphasis was still on humans as "a passive element in a human-machine system", and not "as an autonomous agent that has the capacity to regulate and coordinate his or her behaviour". More than ten years later, these claims still represent an open issue in ATM, as the transition from Human Factors to Human Actors has not been a linear or completed process.

The Transition to Human Actors in ATM

The need to consider end-users' knowledge and competencies was widely recognised in the civil aviation community and in the ATM domain only by the beginning of the Nineties, when the introduction of new digital technologies and of advanced computational capabilities (e.g., the appearance of the "glass cockpit" in commercial aircraft) encountered unexpected operators' resistance. In some cases technological innovations were even found to be part of contributory causes in aircraft incidents (e.g., three Airbus 320 crashes between 1988 and 1993 due to mismatches between pilots' mental models and aircraft automated flight system).

From Product to Process

In ATM design process, end-users involvement is usually extensive as far as number of users and of times are concerned, but still limited to roles of marginal or occasional participation. The ATM domain took into account Bannon's recommendation to shift attention *from product to process*: "attention needs to be paid to the *process* of design, to working with users in all stages of design, to see the iterative nature of design" (Bannon, 1991), but that did not imply a corresponding shift of roles. Controllers are nowadays involved many times during a project, but they are still mostly required to evaluate a system, rather than contributing actively to the design process. For instance, they are often interviewed or observed as sources of operational knowledge in the first phases of the design process. Or they take part in large testing sessions, that are organised in the latest phases when the system has been fully developed. In other words, they are still considered as part of the system under study, and they are mainly requested to test and evaluate it. An increased participation in terms of users and occasions did not bring to a qualitatively different contribution, that certainly requires other means/roles of users participation.

From Analysis to Design

In the first phases of an ideal PD process designers and end-users should be focused on acquiring a shared understanding of the design objectives and on developing a common language and common representations (Kyng, 1995). A more problem-oriented point of view is taken in ATM, as the designer usually analyses the work setting (controllers are included as part of the system), identifies the problem and sets the requirement/solution for that. No common tools, language or shared representations are usually developed to ensure effective users participations at

later stages. This practice may be even due to the fact that designers possess sometimes a background as former operational controllers. In that case the designer's operational experience may be deemed as adequate to effectively inform a design process framed in terms of identifying a problem and finding the appropriate solution. PD turns out to be a process where knowledge and competencies of two different communities are integrated only in the experience of one or few designers, that act simultaneously as designer and as end-user.

This may affect negatively the evaluation phase too, when users try to assess a system that was built following criteria that are abstract from the daily work practice. If a shared understanding is established in the early phases of the system design cycle, it will then be possible to ask users to evaluate the system at the light of their actual work needs and core competencies. Users will be able to disregard more mundane aspects of the system that are maybe related to some local implementation constraints. This especially concerns the large testing sessions usually exploited in the latest phases, where users interact with very complex interactive systems, that are obviously far from the reliable and smoothly working operational systems. In case no shared understanding has been achieved, the paradoxical result is that the new system is evaluated by work expert, that unfortunately are not given the proper conditions to exploit their expertise for the assessment. Hence they happen to give the same feedback as ordinary naïve users and to provide a large amount of comments on nearly any aspect of the experimental setting, failing to address the core design issues and the real support the system gives to the controllers' activity.

USERS AS PARTNERS IN THE DESIGN PROCESS

By reviewing the literature on user participation in the design process we have come to discover different roles for users participating in the technology design process. For example, Druin (1998) defined four roles that children can play in the technology design process: user, tester, informant or design partner. Summarising, Druin considers USERS children who contribute to the research and development process by using technology, while adults observe and videotape with the aim to test concepts and understand the learning process. TESTERS are children who use prototypes of emerging technologies. The goal of this type of research is to shape new technologies before these commercial products or research projects are released. INFORMANTS contribute at various stages of the design process mainly being asked for their feedback when researchers feel that children could provide needed information. DESIGN PARTNERS are equal stakeholders in the design of new technologies. While children do not have the same specialized expertise that adults have, they have equal opportunity to contribute in any way they can to the design process.

By reflecting on our own experiences in ATM, we have come to discover somehow similar but also very different roles for user participation in the ATM design process. In particular we observed three roles for users participating in the ATM design process: *in-house users*, *testers* and *cultural mediator users*.

The IN-HOUSE USERS are part of the design team, with the role to provide constant support as operational experts. They can work for the team part-time or full-time, but on both cases they follow all the project phases from the very beginning. Hence they usually reach full awareness of the design process.

The TESTERS are not part of the team, as they are only convened to participate in certain design activities. They typically represent the final users of the system. They are external to the design team as they belong to a different professional community, but also because their involvement is "occasional", that is limited and discontinuous. In general, they participate only in a few of the system design activities; in many cases they take part in only one of them. Their effective contribution requires an *ad hoc* training, focused on the objectives of the specific design step. Consequently, their view of the project is partial and limited exclusively to those aspects of concepts/tools which are deemed necessary for their occasional involvement.

Both *in-house users* and *testers* represent traditional roles of the users in the design process. These roles act as informants and testers. Their involvement is supervised by the design team with the aim to get information needed to feed the design process. They can be consider "subjects" of the study and part of the system to design and evaluate. A different and less traditional role is played by the *mediator users*.

The MEDIATOR USERS are a "hybrid" category of users that mediate the relationship between the design team and the *tester users*. Being asked to hold both the *tester* and the design team viewpoints, the *mediators*' task consists in interpreting the behaviour of the *testers* according to the objectives and the perspective of the designers. Hence, they cannot be considered subjects of the study, since they are actors fully involved in the design activity. To achieve their goals, the *mediators* are given a two-fold training which concerns not only the ATM operational practice (i.e., how *testers* should deal with new operational concepts, working methods and the system) but also the evaluation objectives and techniques utilised by the design team. In many cases, they are also provided with specific supporting tools, such as checklists and monitoring grids to support their work.

Figure 1 illustrates an example of involvement of *in-house users*, *testers* and *mediator users* in the various phases of the project. The different tonalities of grey in the bars show that the same role can be played by different users, each of them with dedicated objectives and tasks.

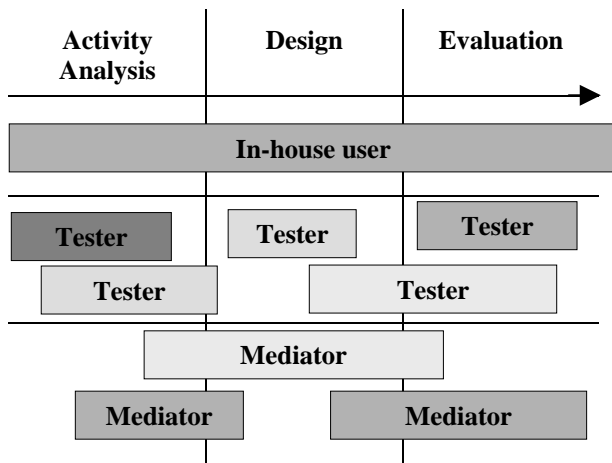


Fig. 1. Users involvement in the various phases of the project.

A more detailed description of these roles and guidelines for their involvement in the design process is contained in the sections below.

In-house Users

In-house users are essential to the successful outcome of the project, because they ensure a constant participation of final users in the design team, as required by the PD. However, it is noteworthy that it is not sufficient to include an air traffic controller or a pilot in the design team to be sure that a PD process is correctly applied. For a fruitful participation of *in-house users* we suggest to adopt the following principles:

- To select users who are really representative of the final users. A quite common problem in the ATM research occurs when a potential user outside the final users community is selected as operational expert to support the design team. This is the case – for example – of a controller used to work in an Air Traffic Control Centre (ACC) different from the one in which the new concept/system will be tested and eventually introduced. Due to variability of ATM services in different countries, the involvement of an external user (external to the culture and local habits) might introduce in the concept/system design process elements that are not fully adequate and acceptable to the end users community.
- To involve *in-house users* as informants of the process to avoid the well known problem of the designer-users who may define the system according to personal preferences or a limited knowledge of technology and alternative interaction paradigms.
- In the evaluation phase, to distinguish the *in-house users* from the *testers* in order to avoid that the former be directly involved in the evaluation. This problem is quite common when the *in-house users* are asked to manage the *tester* training, since they tend to focus only on those aspects they consider as the most significant from an operational point of view and to anticipate the results they expect from the evaluation session.

Testers

Testers are one of the key resources to achieve the objectives of the system design process, and to assess whether they have been pursued effectively. Their role changes according to the design phase. For instance, in the early phases of the project where new operational concepts need to be defined, *testers* can be observed and interviewed. They can also be invited to attend a workshop to debate the fitness-for-purpose of a new operational concept and to test some low fidelity prototypes. One mandatory guideline for this part of the process is to maximise the variety of information provided by the *testers*. The aim is to avoid defining a too specific operational concept, that can only address some very specific local problems or personal peculiarities. Variety can be maximised by exploiting common practices and methodologies of social research paradigms: either a large number of controllers is involved to achieve comprehensive sampling, or very experienced controllers (e.g., trainers) are selected, or a limited pool of controllers with very different operational experiences (i.e., age, position, rating, ACC of origin...) is gathered. At the end of this phase the designer should also have acquired a good understanding of the ATM activities addressed by the new concepts.

In the intermediate phases, the process focus shifts to the evaluation of the concepts and to the preparation of the evaluation exercises. *Testers* can be invited to assess the appropriateness of traffic samples, procedures or prototypes. They can take part in the acceptance tests and exercises performed during Real Time Simulations (RTS), shadow mode trials or flight trials, etc (Marti & Scrivani, 2003). *Testers* are then required to act as part of the system and to assess its suitability. One recommendation for this phase is to ensure that a basic shared understanding of the project objectives is developed. This represents a key requirement for two main reasons:

- the concept will be implemented in a system that is far from being perfect. Controllers can then focus their attention on minor interaction problems, outside of the project objectives, and they may fail to provide feedback on the concept/tool under study. An effective assessment requires the *tester* to act as if the system is working perfectly and focus only on the relevant features of the new concept/tool. This can only be achieved by developing and ensuring mutual understanding between *testers* and designers.
- the system under analysis will in most of the cases require a throughout training to be effectively used. In a large part of design processes such an extensive training cannot be provided. Pushing the argument to its limit, controllers are then requested to assess a professional system at the light of their professional competences, but in conditions closer to a one-shoot learning system (that is with very limited training). Again a proper understanding of the project aims may help mitigate this

organisational constraint, and complement the specific training on the concept/tool.

At the end of the process, *testers* can be consulted to verify whether the results achieved are complete and correct. Another objective is to establish an active channel of communication between designers and users, and to maintain *testers* in contact with the project.

Mediators

The *mediator* users, play the role to support the design team in understanding the end-users behaviour and to support the *testers* in eliciting their own knowledge.

Mediators must not be confused with the so-called Subject Matter Experts (SME) Observers. The SME Observers are operational controllers, usually involved in the analysis of the performance of the *testers* during or after the test. Their task is mainly the identification of *testers*' errors during the simulation and the reporting of those errors to the design team. Therefore their role is quite far away from that defined above for the *mediators*. The SME Observers are not involved as *cultural mediators* between designers and *testers*, but merely in the role of *Expert Testers*. They have to judge the performance of their colleagues from their own experience.

On the other hand, a *mediator* is neither the simple executor of a task allocated by a designer, nor an informant of the process.

Mediators are actors of the design cycle involved in bridging the roles of designers and *testers* favouring a common view and understanding.

In order to perform this activity, *mediators* should be involved as equal partners in the process, sharing objectives and tools in each design phases with the designers and the *testers*.

In what follows we exemplify the role of *mediator* providing evidence from recent projects in the ATM field. The projects are regarded as case studies to illustrate this role in the different phases of the design process.

Mediators in the Activity Analysis

During the *Activity Analysis*, once *mediators* are introduced to the aims and objectives of the analysis, they should support the designer in field observations, in preparation of material for gathering data and in the collection of data as well. They can support the observation guiding the analyst perspective on the most relevant issues, as well as acting as "translators" of the specific professional instances of the work setting in the designer language and vice-versa.

A practical example of the *mediators* role during the *Activity Analysis* is reported hereafter. The project from which it is extracted aimed at assessing the acceptability of a new tool for arrival sequencing (Arrival Manager – AMAN). Thus a session of field observation was planned to collect baseline data on current controllers' working methods, practises and performances. The term of comparison was a following RTS, in which a group

of controllers was trained to manage in simulation traffic with the AMAN support. Due to the complexity of the sequencing tasks, an air traffic controller from the same ACC was involved as *mediator* to support the designers in the field observation, with evident benefits in the quality of data collected. A three-step process was followed:

- As first step the appointed *mediator* was both trained on AMAN concept, behaviour and usage and on the designers' aims and objectives;
- Secondly a workshop was organised to discuss the potential impact of AMAN introduction in that operational environment, in terms of traffic management and working processes;
- Finally the field observation was conducted, starting with a focus on the working processes identified during the workshop and then enlarging to other working processes not previously analysed, but deemed to be likely affected, whether directly or indirectly, by AMAN introduction. Scenarios were also collected during the field observation.

As result of this field observation the *mediator* proved to be essential for the collection of baseline data, as the outcomes were much richer than those collected without his support. Working on their own, designers could have noticed relevant events (e.g., problematic aircraft requiring to be first in the landing sequence or not to be delayed) and understand the way they were managed. But those critical events correspond to fragments of the ATM activity. *Mediator* contribution and added value was to turn fragments into details of a wider picture, highlighting their relationship to traffic history and overall structure.

Mediators in the Design Phase

During the *Design* phase, *mediators* can actively participate in the design mainly by integrating their operational expertise with proposed design solutions. They can effectively perform this activity if the designers develop representations and appropriate tools to support their work. In other words, users can act as *mediators* only if they share with the designers objectives, concepts and tools.. For instance, scenarios can be used for this purpose, as their narrative form can be easily manipulated, externalised and communicated by the users. Scenarios enable non-designer users to define and communicate their design ideas. A practical example of scenario used with this purpose is related to a project - named Care-Uncertainty - that addressed the presentation of uncertainty to controllers (Nicholls *et al.*, 2003). Three tools based on aircraft trajectory prediction were selected as case studies (MTCD - Medium Term Conflict Detection, CORA - Conflict Resolution Advisory, TLS – Tactical Load Smoother), with the aim of studying whether and how information about uncertainty could be presented to controllers. More in detail, controllers were involved to co-design the roles and the communication flows in the TLS.

TLS is one of the tools intended to support a new controller role (named Multi-Sector Planner), whose function is to survey traffic over a number of sectors, identify conditions which could lead to excessively complex situations for the sector controllers, and intervene where necessary. The TLS supports the MSP by providing graphical displays of the predicted complexity across the area, at times of up to 30-90 minutes ahead (Schaefer *et al.*, 2000; Meckiff *et al.*, 1998).

Whilst the algorithm part of the TLS tool was partially developed, the roles of the actors and interface to the system were not specified. Thus the designer team developed a scenario of use by involving controllers and by asking them to narrate past experiences where visualisation of uncertainty could have been beneficial. Those *war-stories* were first used to identify which controllers' competencies and working practices should be convened in the new MSP role. Then a TLS scenario was built to outline the first basic interactions between the MSP and the TLS.

Starting from the TLS scenario, the design team could refine their understanding of the interactions with the TLS and of the complementary tools/information required to work as MSP. The TLS scenario was then animated (see Fig. 2), in order to externalise and share a more detailed understanding of the role.

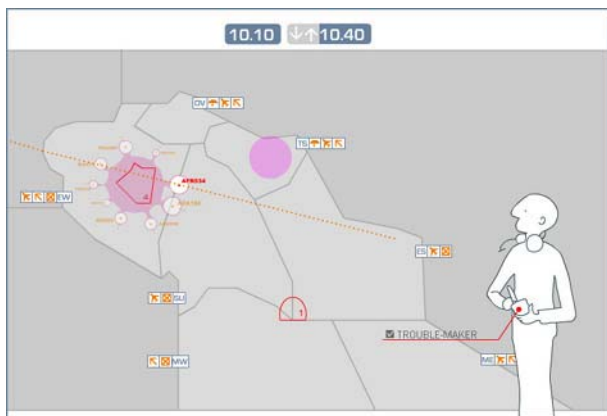


Fig. 2. A still frame of the TLS animated scenario.

While reviewing the animated scenario, controllers could add further comments, thus working on the scenario as the primary object/tool of design. The most relevant finding addressed the revision of the communication model, which entailed a different definition of the role of MSP (Fig. 3).

In comparison to designers, *mediators* could more easily build a realistic and meaningful scenario of use and help refining the MSP-TLS interactions. At a later stage, not only they validated and corrected the scenario, but defined in detail the MSP role and communication flows. The designer understanding was effectively complemented, and the project scope was brought beyond the initial technical-oriented point of view. This case study highlights that the participation of *mediators* in a design cycle can produce important

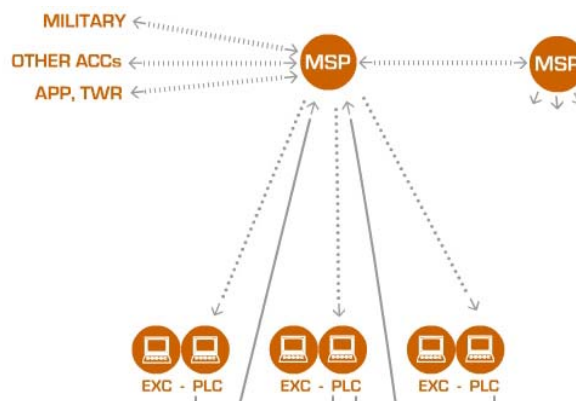


Fig. 3. The MSP role as defined with controllers.

results. When *mediators* are involved iteratively in different phases, new concepts can be developed gradually. In the same way the problems which might be associated with them can also be tackled step by step. Their involvement allows a scaffolding process to be constructed by the progressive introduction of data from the test into the designers-*testers* dialogue.

Mediators in the Evaluation Phase

In our experience, during the *Evaluation* phase the *mediators* are requested to monitor *testers*' activities and record observations using grids and guidelines prepared by the designers. Such tools incorporate human factors knowledge and experience and guide the observation allowing externalisation of the end-users knowledge. The aim of the *mediators*' observations is to collect insights about strategies, performance, frustration, difficulties, etc., of controllers interacting with new systems. In fact *mediators* are not directly involved in the execution of the test and can evaluate the performance of their colleagues from an external point of view, but with an equally expert view.

Furthermore, after the test *mediators* may be involved in preparing the debriefing that follows the exercises. During this session they provide designers with observed data and support them in structuring the debriefing. During the debriefing with the *testers*, data provided by the *mediators* are often used as a basis for discussion. During this session, *mediators* are requested to facilitate the moderators by introducing topics for discussion, by reporting their observations and by focussing discussions on the relevant interaction emerged during the exercise.

Mediators should be interviewed on the findings of the test not only during debriefing after the exercises, but also in the *post-hoc* analysis made by the *testers*. In fact they share with their *tester*-colleagues the same knowledge of domain and evaluation aims, but at the same time they are not biased by their own performance during the test.

For instance here it is an example of the observations noted down by a *mediator* during a Real Time Simulation exercise.

	TIME	DESCRIPTION
1	15:22	The EXC cleared a/c to descend too early (because he remembered the traffic sample and was solving potential conflicts before they occurred).
2	15:29	Potential conflict between AZA055 and AMM692C was recovered by the EXC giving an heading to the AZA055. Detected in time, good solution.
3	15:45	Labels confusing the controller.
4	15:49	The EXC gave a heading to an a/c to permit another aircraft descent. However, normally the a/c that has to descend should be given the heading to clear it from the traffic below before descending. It is not clear why the EXC did this.
5	15:50	To avoid a potential conflict (BER6444, BAL877A) the EXC cleared the BER6444 to a lower level. But he didn't realise that BAL877A was an inbound traffic that had to descend in any case, while BER6444 did not have to descend. So it would have been better to solve the conflict vice versa.
6	16:00	The EXC did the almost same as 15:49; heading to AMM484C and also BAL537A, to permit a descent. The reason he did this was because he wanted to maintain the first a/c ahead. Both a/c descending to land at the same airport.
7	16:13	The EXC seems tired. This is general impression that during the exercises most controllers seem to get tired after 40-50 minutes and start making unnecessary mistakes.

The *mediator* has the knowledge and the role to highlight aspects of the *tester* performance that would be difficultly detected by means of designer observation or *testers* self reporting, namely:

- To highlight good strategies' solutions (2)
- To note aspects that seems to cause unnecessary workload and/or frustration (3; 7).
- To highlight actions, events or states of the airspace that seemed notable to the *mediator* because it seems strange to him; because he could not understand (4); because he wouldn't have done it that way (5); because it represents a deviation from what could be expected in that situation (1).

The added value of this role *mediators* during the design phase is that all these issues may emerge in real-time during the observation. That means to have the opportunity to interview the *testers* just after the test about their performance. The presence of the *mediator* during the debriefing allows to build a constructive dialogue in the language of the *tester*. *Testers* and *mediators* comments, clarifications, explanations on the

performed test constitute a very rich corpus of data fundamental for understanding of the quality of solution and for re-design. The involvement of *mediators* in the *evaluation* phase allows the emergence of issues that in more traditional way would be difficult to capture.

They can guarantee the externalization of knowledge and the progressive building of a shared field of discussion: this is a cooperative work process between designers, *testers* and *mediators*.

Moreover their involvement allows important issues to be considered, such as:

- Overcoming bias in the approach of the design team to the observation, i.e. looking for confirmation of the hypothesis stated rather than searching for counter-examples;
- Facing difficulties that the design team might meet in understanding the link between different activities and the undergoing strategies;
- Sustaining the mutual learning and comprehension between users and designers.

In order to benefit from the participation of *mediators*, it is suggested to:

- select expert users capable of understanding *tester* behaviour and capable of explaining strategies, i.e. users with the same background knowledge, with shared experiences, with high motivation;
- explain clearly to the *mediators* their own roles and the type of results expected. It is most important that *mediators* do not misunderstand their role or their contribution to the research. It must be clear that they are not involved in an assessment of the quality of the work of their *tester*-colleagues
- organise a joint training course for the *mediators* and *testers* in order to ensure the same knowledge on the concept/system to be investigated
- provide regular, even though occasional participation of the *mediators* in the experimental team work.

CONCLUSIONS

Today, an array of methodologies has been developed to observe, understand and more, in general, involve users of technology in the design process. However, the observation and participation methodologies do not always take into account the difficulty in managing "cultural encounters" due to the many variables at stake in the design process and the different roles that the users may assume. This paper offers a reflection about the most relevant roles the users can play in the design and evaluation of ATM systems. In particular the role of *cultural mediator* is advised in sustaining negotiation and learning processes between the members of the design team and *tester* users.

What we presented is an on-going work that continues in developing and refining research methodologies and tools that are inclusive of different categories of users. Our aim is to understand how to bring the designer knowledge from the "real world" of the final users into

the "design world" of technology development. To achieve the goal, we believe that a more adequate definition of user roles and methodologies for their involvement is necessary. The definition of *cultural mediators* may be a step ahead in the achievement of a more fruitful and natural intervention of users in the design process.

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