

Design and evaluation: complementary viewpoints in ergonomists' practice

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Abstract

In practicing ergonomics within design projects for new telecommunication tools and services at France Télécom's R&D division, the authors wanted to share their experience during which they felt it was essential to be able to take part both in design and assessment. Users' firm knowledge is beneficial for design, whereas a good knowledge of how a project evolves facilitates the integration of evaluation results within this process.

Key words: ergonomics, evaluation methodology, design, user testing, usability, sharing experience, telecommunication products and services.

1. Introduction

A project's interest in using ergonomic tools and methods throughout the design cycle has increased many times and the aim of this article is not to demonstrate this, or at least, not directly.

The authors prefer to share their experience during which they felt it was essential to be able to take part both in design and assessment. This complementarity tends to promote the achievement of the main objective of ergonomics: the adaptation of tools and services to users' needs.

On one hand, evaluations carried out with users provide ergonomics with reference situations that will provide support for future designs. They will also allow design choices to be validated by restituting them to the context of the user's activity. Finally, the experience acquired during evaluation means that, during the design phase, the evaluation phases to come could be predicted.

On the other hand, the design activity and its constraints mean that evaluations results can be relativized and data collected can be integrated more efficiently during evaluation in the project process.

This article recalls several theoretic bases for ergonomic initiatives. Concrete examples from the authors' ergonomic practice in the field of telecommunications then serve as the basis for discussion to increase the value of the combined design and evaluation activities.

2. Reminder of the principles of user-centered design

Here, we would like to remind the reader of the role of ergonomics in the design of services and products.

Ergonomics' mission consists globally in ensuring the utility and usability of tools and services made available to users (ISO 9241-11, 1998). To achieve this, the ergonomist uses various fields of knowledge: psychology, physiology, ergonomic norms, style guides, etc.

However, recognizing human components and common, predefined rules is not enough for developing activity-centered ergonomics. For the ergonomist, defining a product, tool or an organization, means, above all, designing situations in which individuals develop an activity. He/she, therefore, uses various methods that enable him/her, throughout the design cycle, to gather every piece of data on users, tasks and contexts of use.

Norm ISO 13407 (1999) clearly defines the various stages of a design cycle centered on the users of interactive materials and software:

- Initially, the objective is to "understand and specify the context of use" and to "specify the requirements linked to the user and the organization". To collect this data, the ergonomist uses the following methods: real-situation observation, the personal interview, verbalizations out loud during the activity or a posteriori, methods of creativity, etc. (ISO/TR 16982, 2001; Bisseret, Sébillotte and Falzon, 1999).
- Secondly, the ergonomist proposes "design solutions" relating to superficial aspects (character size, information density ...), but especially the structure of the dialogue. To do this, he/she uses his/her prior theoretic knowledge, the data collected during the initial phase and also integrates all constraints inherent to the project.
- Finally, these solutions are evaluated iteratively until a result is obtained that is deemed to be satisfactory to users.

The evaluation methods of interactive systems are many and varied (Falzon, 2004; Valentin, Vallery and Luconsang, 1993). In global terms, we can distinguish two main categories of methodology (Senach, 1993): those requiring the participation of users, and those applying to the characteristics of the interface. In the first category, we can include user tests, questionnaires and interviews. The second category includes, amongst other things, inspection methods (Bastien and Scapin, 1993) and recourse to experts.

The following paragraph presents concrete examples of our ergonomic practice in design and our experience of user tests.

3. Focus on part of our ergonomic practice

Here, we would like to share our professional experience in France Télécom's R&D division by focusing on two types of intervention: i.e. the contribution to the interface specification phases and the performance of user tests.

The aim is not an exhaustive presentation of our ergonomic practice, but rather to home in on these two essential axes of our activity. It is no longer a matter of coming up with a state of the art presentation summarizing all the contributions of the sixty ergonomists currently working within the R&D division.

Our activity in the design phase mainly consists in offering solutions for the production of telecommunication products and services for use by the public at large. We base our work essentially on a set of data and constraints that have come, for example, from marketing, the technical sector, creativity groups or even scenarios of use written by the project team. We also use ergonomic design criteria, norms, style guides and charts. In concrete terms, the options envisaged at the design phase come from close collaboration between the various players in the project. Here are a few examples of our contributions:

- *The definition of the Web interface for a virtual office for small-user professionals working from home, as well as its use by a personnel assistant. The aim was not to overload this assistant by presenting only the most relevant information.*
- *The definition of interactive voice services using voice recognition: e.g. automatic information services, France Telecom's voice agency, the vocal repertoire to make*

a contact using the voice or even voice welcome messages to steer clients towards tele-advisors. For each service, the ergonomist specifies the logic and the key stages in the vocal dialogue.

- *The specification of screens for a television service on mobile telephones with the opportunity to access contextual information immediately. The size of the TV image was a determinant factor and a huge constraint on the construction of any interface that allowed navigation between the screens.*

Our evaluation activity mainly consists in performing "user tests": these are tests carried out in a laboratory where a dozen users in the marketing target are invited to use mock-ups, prototypes or even products already on the market, on the basis of scenarios of use representative of actual tasks. Following user interactions with the tested service, an interview allows us to gather subjective data relating to attitudes, opinions and user satisfaction.

Most of the time, the targeted objective is to evaluate the usability of the service or the tested product, by highlighting the strengths and weaknesses, and by offering ways of improvement. The user tests that we carry out can also be tailored towards comparing design solutions or even testing a new concept. Here are a few examples of our contributions:

- *User tests of an Internet service allowing the management of telecommunication services. The main objectives were to determine whether the users understood the perimeters for using the service, if they grasped the main actions and if the terminology was suitable.*
- *Comparative user tests on three mobile terminals. This enabled us to highlight the strengths and weaknesses of various physical (screen, keys...) and graphic interfaces (tree-structure, navigation, presentation of information, feedback ...) of competitor constructors. The aim was to propose recommendations applicable to constructors in order to improve the usability of future mobile terminals proposed by Orange, the mobile operator of France Télécom.*

Having presented a few concrete examples of our ergonomic practice, we will now try to show the benefits of a practice combining the design and evaluation activities.

4. Complementarity of design and evaluation activities in our practice

In the two chapters below, it is taken for granted that we are in a context, where an ergonomist who designs is not the same as one who evaluates.

4.1 Benefits of design

From the evaluating ergonomist's viewpoint, what benefits can be derived from also having a design activity?

The design activity may be compared with problem solving. A set of data and constraints are given at the start and a solution has to be constructed. This is constructed en route since we do not a priori know the exact final state to be expected. The solution is constructed within the project team, i.e. by taking into account the various points of view and by progressive integration through refining of the data from the problem. Also, when a mock-up is to be tested, with the aim of gathering users' opinions during design, this may seem odd, since some aspects seem undeveloped whilst others are over-developed.

The "evaluator" ergonomist, who also has a design activity knows how the project will progress. During the test process, whilst still retaining his/her role as an evaluator, he may

also adapt to this context, especially in terms of understanding demand and comprehension of the team's "state of mind" during "design work".

Before going further in the design of an Internet portal, a project team wants to carry out a user test to ensure that the organization of information and the main procedures are tailored to the characteristics of the targeted activity. However, the interface is not fully developed: there is no online help or "help" messages and some passages have no title. The situation is not ideal for a user test: some procedures cannot end, thus limiting the situation's realism and participants will make comments like "bugs" since we already know all the shortcomings in the interface in question, etc. Nevertheless, the ergonomist, rather than considering this as a disadvantage will try to integrate into his analysis of the demand the project context and will construct its specifications from these elements.

If the evaluator ergonomist has not been a player in the history of the design, he may not understand the choices used. The danger for him is, for example, that he could waste his time evaluation a poorly processed function that will never be improved for technical reasons.

From his design experience, the ergonomist carrying out an evaluation also has a good knowledge of the way in which his recommendations may be integrated into design. In some cases, they may have a significant impact on the stages after design. In other cases, even if their importance is unquestioned, these recommendations will be relativized vis-à-vis other data from the problem such as quantitative studies, focus groups, marketing demands, technical constraints and the design team's creativity.

During the user test of a communicating object, the selected design does not evoke the world of telecommunications for users. The project team then decides to modify this design.

Conversely, in another project, the problems encountered during the user test relating to the keys of a videophone terminal are not taken into account, because the project team does not control on this terminal for which it can only request software modifications.

4.2 Benefits of evaluation

If we now put ourselves in the shoes of a design ergonomist: what benefits can he derive from also having an evaluation brief?

Carrying out user tests involves confronting the variability of users, tasks to be completed and contexts of use. Reality for users is very often a lot more complex and varied than any representation that can be constructed in a laboratory. In the definition phase of design solutions, the ergonomist will be able to tap into his experience.

Carrying out several sets of user tests on several mobile terminals meant that we could show that access to special characters often posed problems, although they were indispensable for clients who were frequent users of SMS, MMS, e-mail and chat. Some characters were dispersed across different keys and short or long presses were sometimes necessary. Users faced particular problems when they changed terminals. A design project for another mobile meant that we could use these test results and offer easy access to special characters from a single key on the keyboard. Those keys most often used in French were placed at the start so that they could be accessed more quickly.

Thus for certain project owners or project managers, the evaluation can, therefore, be the means of obtaining know-how that can lead them in a different direction or towards

reinvestment in another design phase. Carrying out a test can also mean reorienting the marketing target.

Moreover, the ergonomist may also propose that a user test be carried out, when he believes that the current design process is on the wrong track and that it is necessary to bring in the user to convince the other project protagonists.

Carrying out user tests also means that we can have a firm idea of the importance of an ergonomic approach centered on the user's activity, since one of the test's interests is to relocate the design object within the context of the user's activity. Knowledge of the activity is fundamental, since it is this that really determines the use of the tool by the user. It seems to us that, in the design phase, the ergonomist may exploit this activity "culture", whilst always taking care to relocate his proposals within the framework of the targeted activity.

When editing use instructions, the ergonomist may exploit observations made during tests: e.g. during a test for the installation of a videophone, it was observed that most of the users did not read the use instructions. They started by switching on all the elements available to them and only consulted the manual when they could not make any more progress or when the result obtained did not work.

Therefore, carrying out evaluations reminds us that when we define design solutions, we are only coming up with hypotheses that must be tested by users.

During the design of a complete tree-structure for a mobile, some terms had been preferred to describe the basic functions available. These terms had been selected using the results of the previous user tests. A new test carried out using a card selection method meant that we could refine the chosen terms even more, so that they were understood by the greatest number of users in the public at large (e.g.: the term "Accessories" is understood, because the contents of this heading remain fluid. Users preferred to dissociate the terms below into two distinct groups: calculator / converter / memos / diary; Clock / alarm / ring tones / vibrator).

Carrying out user tests also requires the definition of the criteria of use of the interface to be tested in terms of efficacy, efficiency and user satisfaction (ISO 9241-11, 1998). This practice may help the design ergonomist to integrate the definition of these criteria as early as possible into the project process.

In simple terms, these evaluations allow us to observe and to come into direct contact with "real" users and, therefore, to construct the least abstract representation possible.

During a test on an interactive vocal service, a user declares that he prefers to search for information by speaking to a machine rather than a human. This is a typical example running counter to the user model that the designers had been able to construct (Norman, 1988).

The experience acquired from these evaluations will also enrich this view of the ergonomist in relation to the final users, who will also continue to evolve. He/she acquires a set of data that will provide him with details and reference situations for design:

- The usages and contexts of use
- The user/system interaction relating to all the interface components (tree-structure, navigation, terminology...).
- Mental representations for use in the installation of tools, their use, problem solving and discovering new functions, ...

Finally, for the design ergonomist, carrying out evaluations also means having the reflexes to tackle his/her work from design to evaluation without expecting the solution to come to a definite conclusion. The results of the evaluation may also be better accepted and better integrated into the design process.

5. Conclusion

At the start of our ergonomics practice in telecommunications, our activity was clearly centered on a profile dedicated to carrying out user tests or truly and exclusively integrated into the heart of design teams.

The professional development of each author has allowed him or her to achieve a better distribution of their interventions throughout the design cycle and it is this positive experience that they wanted to demonstrate in this article.

All these interventions are complementary and indispensable when constructing concrete experience for the benefit of users and the telecommunications products/services that they use.

We have chosen to base this article on the complementarity of design activities and user tests, because these are the two characteristic activities of our day-to-day life.

We know (and the literature of ergonomics is there to remind us) that these interventions are not enough to provide a good knowledge of Man and his activities. Our experience, related here, is of interest because it reinforces in us the notion that we must vary our approaches in order to be a little closer to the variety of user situations and activities. Although the user test is a good qualitative tool, it still remains within the "laboratory". To get anywhere near real life, we must be able to diversify user approaches by means, amongst others, of an analysis of their activity in situ and by developing the use of more sophisticated tools to trace the real activity of users. We can quote the use of probes integrated into mobile phones and the recording of calls between users and interactive voice servers within the context of an experimentation contract with a certain number of clients. These approaches, of course, complement other qualitative methods that we use, such as multi-expert meetings, user round tables, the qualitative analysis of usages that are necessary throughout the entire design cycle for services.

Experience in using a more global approach to the project process as a whole centered on the user seems to us to be a constructive step that enables us to paint a better picture of ergonomics for the various players in the company. In effect, ergonomics does not limit itself to "improving the surface of IT productions"; it can also have "real power in proposals during the initial design phases" (De Montmollin, 1997, p.178).

In addition, the company ergonomist is not content with intervening in projects on an incoherent, ad hoc, basis. He capitalizes on experiences and knowledge about users and their activities, in order to re-inject them into new projects at every design stage. The development of new, so-called convergent services, simultaneously combining services in the landline, mobile and Internet sector, presupposes a minimum user feedback from each sector to be efficient in design. Interventions accumulated throughout different projects over the years are, therefore, indispensable.

Moreover, although we sometimes feel that design is often seen as more interesting, this article aims to highlight the contribution of evaluation relocated in a global ergonomic activity. Devoting an average of six weeks to carrying out user tests is not a waste of time in

terms of design, because it brings us closer to "the user's experience." "Evaluating is anticipating" (EDF, 1999, p.59).

Finally, our experience has led us to debate a generally accepted principle within our practice, which states that it is preferable that the "design" ergonomist is not also an "evaluator" ergonomist. Even though this view point merits a separate debate, we can already suggest that several solutions can be envisaged: at the design stage, the ergonomist should offer short, less formal evaluations (e.g. screen designs on paper, reduced panel, no recording, etc.) to give him food for thought; it would also benefit the project to integrate the evaluator ergonomist as early as possible in the team to ensure a better match between the test and project needs; finally, a user test carried out by another ergonomist is also enriching, because this ergonomist can bring another point of view to the current design process.

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