Applying Scenarios in the context of Specific User Design: Surgeon as an Expert User, and Design for Handicapped Children.

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Abstract
In the context of specific user (surgery or handicap domain), the list of requirements is especially difficult to establish. We propose to reflect on the design methodology and especially on the Scenario & Emulation application. The aim is to make emerge needs in users who have specific relation to the final product. In this paper, we illustrate the research with two projects: the DESTIN Project (know-how and experience of the surgeons) and the AE2M Project (handicapped children). User, usage and products are the parameters we chose to define and to categorize with the objective to optimise the design process.

Keywords:
Emulation & Scenario, User Centred Design, Design Methodology, Handicapped children, Design in Surgery, Specific User.

1 INTRODUCTION

In the design process, the early stage of the conceptual design consists of preparing a requirement list according to the user needs. In most cases, only one discussion is sufficient to acquire enough understanding of the problem. In specific contexts, designers as a team need to change this classic methodology process and to adapt their approach to the specific user.

In this article, we study two cases (AE2M and DESTIN projects) where we can suggest reflections on the design methodology. These two specific design projects follow the user centred design, participatory design and scenario based design methodologies, but the user capacities and capabilities are completely different.

The aim of this article is to work on generalisation of a proposed methodology concerning two situations where the position of the user is essential in the design process. The aim of the AE2M project (Ergonomic Adaptation of Musical Materials) is to enable handicapped children play musical instruments. In this case, the user has to play the music, but specific system has to be designed for that. Three proficiencies have been notified not only as a necessity, but also as interactive tasks for the design of adapted systems for handicapped children (engineers, musicians and paramedical specialists).

The DESTIN project (DEsign for Surgical-Technological INnovation) concerns the design of innovative surgical instruments that are used by the surgeons during Minimally Invasive Surgery (MIS) and interventions. In this case, the place of the expert user is essential to guide the design team through an optimal instrument. The know-how and the knowledge of the user must be efficiency taking into account during the design process.

To be able to better understanding these two specific design situations and to work on a design methodology, we based our comparison on the three main parameters: user, usage and product. The definitions of these parameters will be completely described in details in the article and the comparison will provide some ways to propose better adaptation of the design process in each situation.

In spite of well-identified differences between these two projects, the article shows that the design process, that integrates specific user, can use the scenario based approach. Our proposition concerns the applications of scenarios (emulation) in these design cases and the organisation for applying them efficiently considering the expressive capacities of the final user of the developing product

These reflections and some applications will be experimented during courses in the University of Grenoble with the engineering students, we experiment the SBD methodology to design user adapted products in these two projects. Even if the projects are completely different, we observe some similarities and can give some interesting information on the product.

2 TOWARDS THE USER CENTRED DESIGN METHODOLOGY

The purpose of the research behind this article is to propose an adapted design methodology and to find the place of specific user in design process, particularly when he has a specific position (as an expert or a handicapped person for example) and when the design is highly dealing with his expertise.
In this case, i.e. when the user is not only the client of a product but also the final specific user, the design process has to be adapted to the situation.

The great importance of human aspects in industrial environments have changed the viewpoints of designers and developed Human-Centered design approaches. One of the fundamentals of this approach is to consider human factors at all stages of the design process. The

integration of human factors in design process phases requires the effective use of the appropriate human models. In [1], the authors present definitions of human models and their classification in industrial applications with emphasis on industrial design processes. The authors also focus on the application of the human models in a human centred industrial system approach.

In the domain of advanced manufacturing system for example, researchers explain that human Impacts can significantly impair system performance and the future capability of the company to react to market requirements [2]. As it is discussed, these authors propose the development of an alternative 'human-centred' approach: technical and human aspects of advanced systems can be considered in parallel from the start of the design process.

Advanced production technology is not only characterized by higher automation of production flow and control, but more and more measured at the level of the ergonomics of man-machine interaction. Although much effort has been devoted to user friendly design and improved interface techniques, today's systems do not take into account their individual user's problems and tasks [3]. One possible answer to this problem is the design of 'cooperative', adaptable or adaptive user interfaces. The idea proposed is to adapt interface behaviour (presentation and dialog control) on account of individual user differences or user problems, by reasoning about user intensions in situational work contexts.

Several comprehensive user related design methodologies have been published in the last decade, like User Centred Design (UCD) and Participatory Design (PD), but while they all focus on users, they disagree on the definition of user, what relation exists between user and product, what activities should take place during the user needs analysis, and how these finding should be observed, presented, documented and communicated. All these aspects assume that the user's knowledge, capabilities, limitation and needs have to be taken into account. Moreover, there is the actual use situation and environment that has a great effect when the degree of expertise of user increases.

In PD, the users are involved in development of the products; in essence they are co-designers. A great number of projects are currently made around Software, Web and Human-Machine Interface development [4].

The main advantage of the UCD approach is that a deeper understanding of the psychological, organizational, social and ergonomic factors that affect the use of computer technology emerges from the involvement of the users at every stage of the design and evaluation of the product [5]. The involvement of users assures that the product will be suitable for its intended purpose in the environment in which it will be used. This approach leads to the development of products that are more effective, efficient, and safe.

UCD as a design approach was introduced first time in the format of the standard ISO 13407: Human-Centred Design Processes for Interactive Systems [6]. The idea of developing usable products and services always pushed the design approaches toward placing the user in the design process. There exist many literatures on UCD, called also Human-centred design and usability design with the same basic principles for develop products and services that will meet the needs and expectations of the end users by user involvement such as iterative design and multidisciplinary teamwork [7] [8] [9] [10]. The main issue is how to involve and integrate the user in the design process.
The general reference model of UCD principles and process is the model presented by ISO 13407. It identifies five UCD activities, one main for laying out the design process and the four rest of which deal with the substance [11].

As mentioned as the main issue, the details in integrating the user in design process are very interesting in research point of view. Some researchers have proposed a novel process model of UCD, contrasted it with existing models, and reported their experience of using the model; see Jokela in [12]. The original aim of these kinds of researches is to learn how to improve the performance of UCD processes of product or system development trough the amelioration of user interaction with the process.

The main idea of Jokela's new UCD process model is to intercommunicate the user with the usability in cycling process, as shown in the schema (figure 1).

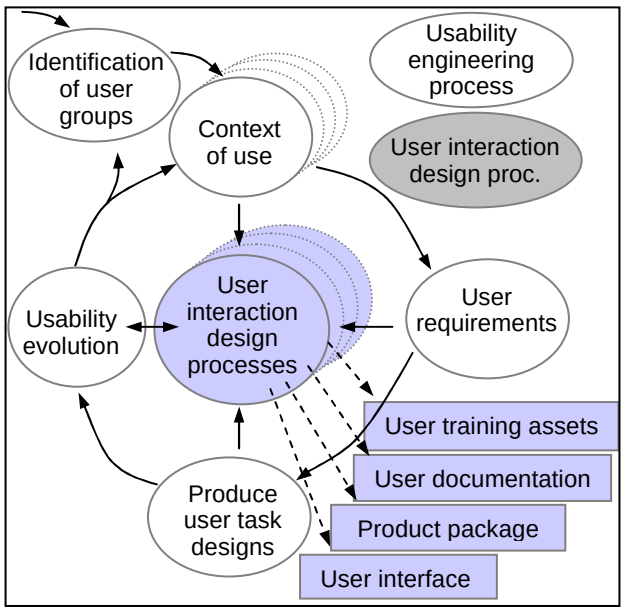

Figure 1: Jokela's UCD Process Model

"User inter- action" as he defined, aims to produce the interaction between user and design process who leads to four outcomes: user training assets, user documentation, product package and user interface. On the other hand, this model supposed to be an effective tool for training in the essentials of UCD. Some feedbacks indicate that getting needs piled up is more practical than focusing on methods.

The other important issue in UCD is how identifying and selecting relevant users in the development work. In practice it is commonly possible to involve only a limited number of users, and therefore it is very important how to select the "representative users" to centre the design on their requirements and expectations. There are several studies in different themes such as [13] [14] [15], trying to avoid misunderstanding the representative needs.

Nowadays, the UCD and PD methodologies are experimented in many different studies and domain. Their applications on the design process with the concrete integration of the user need more understanding of the Scenario Based Design (SBD) Methodology.

3 SCENARIO BASED DESIGN APPROACH FOR CONCRETE APPLICATION OF DESIGN FOR SPECIFIC USERS

As a more global methodology, the PD workshop is one in which developers, designers, business representatives and users work together to design a solution [16]. PD workshops are most effective early in the design process, when ideas can be less constrained by existing code or other infrastructure.

The methodologies presented above show lots of researches that are interested in working with a specific placement of the users in the design process. It is in the beginning of the design process that the list of requirements is essential for the design team.

Nowadays, in specific domains, i.e. when the final user has its proper know-how and experience, the communication with the design team is too difficult and terms often used by users and employed to explain their needs don't allow an instantaneous understanding by the designers. Moreover, when the aim of the designer is to work on radical innovations, they need a more precise approach for the user observation and work analysis.

In this article, we will present two different real situations that need specific organisation between final users and designers in the context of innovative product design. To be able for the designers to better understand the user requirements, we proposed to integer the concept of scenarios to the methodology thanks to the Emulation. In our case, emulation consists on the exact reproduction of the activity applied on one system but using a different system.

Many papers deal with the advantages of the Scenario-Based Design (SBD) and with the way of creating scenarios [17] [18] [19]. In SBD, descriptions of situations become more than just orienting examples and background data, they become first-class design objects.

To write a scenario, it is necessary to describe in a simple language the interaction which needs installation. It is important to put of references to technology, except when technology represents a constraint of design which must be represented [18]. It is thus always necessary to have the scenario read again by a user to be sure that it is representative of the real world in which he evolves.

In [20] and [21], we have identifying the scenario as a manner to better communicate the requirements of the users to the designers. SBD methodology is defining by a person who makes things in a certain context. Using scenarios during design ensure that all participants understand and agree to the design parameters, and to specify exactly what interactions the system must support. In this study, the first step was to identify the needs and the goals of the surgeon. Due to observations in its real environment and discussions with users, the conclusion was the design of "new surgical instruments adapted to the requirement of MIS associated with a new operative procedure adapted to these instruments".

This case study shows that it is necessary to place the user in an environment as real as possible for an efficiency experiment. This confrontation is the identified link between the user and the designing prototype. It is realised thanks to the scenario, which allows an efficiency requirements expression from the user.

In the two following sections, we present two original projects which can illustrate the theory developed above. The first one called AE2M project (Ergonomic Adaptation of Musical Materials) concerns specific users as they are handicapped children. The aim of this project is the design and manufacture of electromechanical systems for users to play normal musical instruments. In the second example (DESTIN Project for DEsign for Surgical-Technological INnovation), the goal is to design innovative surgical instrument for a new type of Minimally Invasive Surgery intervention.

4 AE2M PROJECT

4.1 Presentation

In one of the specific institutes for handicapped children in Grenoble, France, a music teacher observes that some children have a significant respond to music, and even they are motivated to play. According to their low physical capacities, these children can not use the proper instruments. This context inspired the idea of the AE2M project (http://projetae2m.free.fr/) in which the goal was to develop, some solutions for the handicapped children, by engineering students [22].

The final aim of this project is to provide a similar condition for handicapped children for music play, as the normal ones use musical instruments. The ambition is to create an orchestral musical practice for both normal and handicapped children.

This multidisciplinary project (musical, ergonomics, social and technical aspects) tries to place engineering students in the context of reality, learns them to deal with numerous important specifications and different constrains around the special users of the product in design and manufacturing process.

Authors propose an interactions representation around the AE2M project. The figure 2 shows the "competencies triangle" with the three main applications specialities: Engineers, Musicians and Paramedical specialists. These three competencies have been notified not only as a necessity, but also as interactive tasks for the design of adapted systems for handicapped children.

For a better comprehension of this competencies triangle, it is necessary to develop the roles and the work of these specialities in the project. The design engineers are represented by the engineering students. Depending on the project, this team can be composed from 2 to 6 students in the AE2M project:

- They have to discuss with the paramedical specialists who spend all their times with the handicapped children. They know all the physical capacities of these children.
- They should be familiar with the properties of the musical instrument the children would try to play. So they consult the music specialists of the project, in order to acquire enough knowledge about the good position of the body, the playing mechanism such as the velocity and the position of the contact for instance for the percussion instrument.

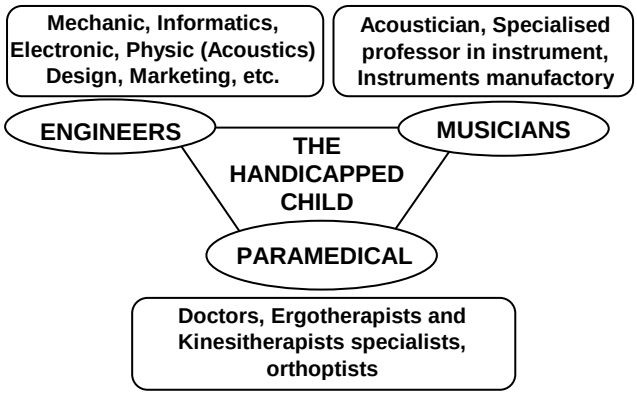

Figure 2: Competencies triangle of the AE2M Project: competencies around the final user

All these specific requirements gained from the paramedical and the music specialists should be taken into account for the design of an adapted product. The mechanical engineering students' team has the aim to compile these numerous data and to propose and discuss around proposed data user requirements.

4.2 Application and methods

This study aims to focus on the design and the manufacturing process in the mechanical engineering field, and in the same time, opens the students' mind to the other considerations of the final user such as handicaps, and deals with social and human relations and realities.

After three years works of this AE2M Project, some prototypes have been manufactured in the Grenoble Institute of Technology. Currently, the main musical field is the percussion instruments. Three mechanical and electromechanical systems are used by handicapped children in the Motrice Educational Institute with the help of the pedagogic teachers.

For example, during the last four months' study, some experiments in usage situation have been done and two successive prototypes tested. Then, the students' team proposed a final system. During this study, the emotional comportment of the children playing the music with prototypes guided some mechanical design decisions. Despites of the important handicaps of the children, students learn that users are able to give essential requirements thanks to their expressive comportment

In this situation, scenarios are written to prepare the emulation with the children in usage situation:

- What kind of data to recover, how and why instrumented the child and the prototype?
- To list and prepare facilities for filming, recording and taking pictures to anticipate the future analysis,
- To prepare questionnaire to submit to the child, but also to the other users of the prototype (musical teacher, paramedical specialists; etc.),
- To take care of the children authorisations obtained.

The added activity (Scenario & Emulation) imposed to the students shows them the necessity to adapt their step to the context of design. The aim is to make emerge needs in users who have specific relation to the final product.

Using the same design methodology of playing the scenario, two others systems are in development this year. One system allows a child to play a wind musical instrument and the aim of another one is to help children to support the weight of their superior members to play the music.

In the University of Grenoble, the AE2M projects are examples of multidisciplinary studies that can contribute to the complete formation of the engineering students. Actually, electrical and mechanical engineering students from two different engineering schools are collaborating with paramedical and musical specialists around the handicapped children.

We have clearly identified the necessity to organise this difficult work around the final specific user. Not only the children requirement and physical capacities but also the other technical requirements (musical and paramedical) have to be taken into account by the engineering team. Currently, the best mean of success in design is to confront the successive prototypes as soon as possible in the design process. With engineering students, teachers propose to the final user to evaluate successively the prototypes manufactured. A lot of different informatics means are employed to get information and to analyse the effective use.

5 DESTIN PROJECT

5.1 Presentation

The DESTIN Project consists of reflection about complexity of medical instruments design in the Minimally Invasive Surgery (MIS) and some about the Scenario Based Design (SBD) which constitute another proposition for the better integration of the user in the Design Process [20].

Currently, the consequences are very handicapping after hard classical surgical interventions. Scientific progress of the last decades makes more and more possible to satisfy the needs for the surgeons in terms of surgical materials and more precisely of surgical tools. MIS has the main objectives to make the post-operative constraints less painful for the patient, mainly by modifying the operative process with the aim of introducing miniaturized or modified tools inside the human body.

In this study, we try to propose an innovative process design method with a better integration of the user which allows the designer to design surgical tools more adapted to surgical procedure and more supporting for the surgeon's ideas. This proposition consists in a new idea on the integration of the Scenario Based Design Methodology and the confrontation of:

- Evolution of the surgical tool prototypes,
- Modification of surgical procedure.

This situation will be able to decrease the differences between the surgeons' needs and the designed tools and their usage. The proposal is to develop the application a Co-Evolutive Design Process methodology, with the explanation of prototype and surgical procedure evolutions (figure 3).

In this specific surgical application studied, a particular lumbar fracture is caused by 50% of the serious sport accidents (falls of motorbike, ski, and parapet, etc.). Currently, the "classical" lumbar arthrodesis operation (placed an implant on the L1 vertebra) is carried out by tools introduced against the patient's back through a 25cm large incision. It is a heavy surgical operation consisting in reforming the vertebra fractured, while having beforehand repositioned the adjacent vertebrae with their origin positions. The post operative consequences are very handicapping for the patient.

Following this observation, the surgeon has explained his need concerning the use of minimally invasive surgical tools.

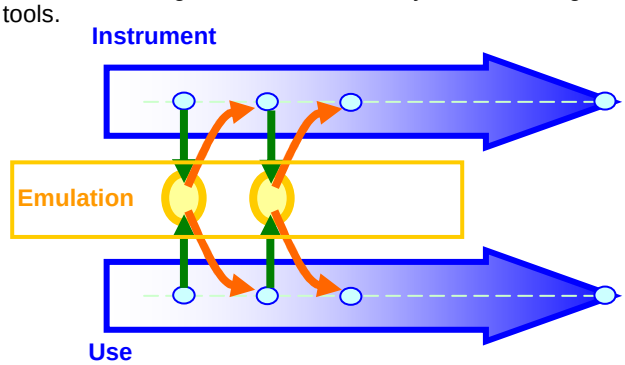

Figure 3: Co-evolutive Design Methodology proposal in the surgical domain

The complexity of designing medical instruments in proved. A proposition to design medical systems as closer as possible to the idea and needs of the users is to design with them.

The proposal is to integer as soon as possible the surgeon in the design process. The proposed model shows the co-evolution of the instrument and the use.

The idea is to confront the instrument developed by the engineers with the use idea of the physician. Thus, the successive prototypes can evolve in the same time than the surgical procedure. In this case of product innovation, the first surgeon's idea of use is in its mind and comes from his know-how and his experience. Successively, the use and the instrument will converge to a final and efficiency solution.

The procedure between one positions to another pass through another stage called emulation.

5.2 Application and methods

In an emulation, the surgeon and the designer participate by making arguments, but they use different means of communication and different knowledge references. The surgeon communicates almost exclusively with words of his vocabulary while the designer uses his own words, and they have limited capacity of technical expression.

In the experiment, the surgeon was asked to explain the operation and to give his comments in real time. We decided to capture and observe the emulation to validate the concept of emulation and to better understand the surgeon-instrument and surgeon-prototype interactions.

One object of this study is to develop an analysis model for detailing surgical procedure, in order to have a focused vision on prototype validation. This model aims also to provide some helps in requirement analysis for the designer in conceptual design [23].

We used a scenario-based approach to be certain about the observation recordings. The scenario was used to clarify what the usage situation was supposed to be, and how the emulation observation could represent the feed for design modifications.

We define the scenario as a written document in which characteristics of confrontation between instrument and usage are explained. These characteristics can be divided to four main categories:

1. Surgical procedure

A Scenario is supposed to explain the objectives of the operation, operative tasks of surgeon, and required tools for surgery. If the operation is realized by a team, their role (ex. Nurse, technician) and tasks should be mentioned

2. Instrument prototype functions

In this part, scenario describes the functions of the actual prototype and the elaboration of the principle solutions. Functions are determined by requirements, so in each emulation due to the understanding of requirements, different functions are proposed

3. Usage situation

The instrument is going to be used by a surgeon in an operative situation. This situation can be characterized by environmental factors of where the usage is taking place, including the patient. It is possible, and very common, that the usage situation does not happen on the patient but on a box, mannequin, or cadaver. Some general information about the emulation like characteristics of the mannequin, the external equipment, and the general environment should be prepared

4. Observation

How the surgeon and emulation should be observed is important to be prepared before. In normal experience, there is a general camera for filming the whole scene. The technique of filming is somehow informal and dependent on project, and is a subject of discussion [24].

In this design case, we can consider the surgeon as an expert [25]. This study was made to determine whether level of expertises of user affect the design process in a development of new surgical instrument. From the results, the following conclusion can be drawn:

- The classification of users can involve their level of expertise when priority of exigencies takes into account in order to modification of prototype of the instrument, and operational procedure.
- Emulation seems to be essential for observing expert user's needs for the reason that expert user is like an artist and he uses to manipulate the artefact in his hands and in real situation.
- While an expert activity is dependent on actor's authority and decision making, data interpretation should be verified with more than one expert in each profile of the classification.

As we have shown in this study, it is essential to use the scenario based design methodology to adapt the future product to the expert user requirements. We have proposed a co-evolutive instrument-surgical Methodology where the essential step called "emulation" is realized thanks to a scenario that consists in four main categories. Effective emulations coupled with adapted instrumented observations and analysis must largely contribute to a final product completely in phase with the use of the expert user.

To complete this study in the medical domain, this is an other example of design organisation [26]. In the fuzzy front end, designs with medical information asks special attention to the communication between designer and specialist, otherwise there could be lost opportunities for an optimized product design. The knowledge must be brought directly on the level of understanding and sharing the medical and technical information. The shared information should be known to all the involved parties for a successful project with an optimized product design or working prototype as result. Projects with medical science as starting point require a new design approach to develop a design concept or a prototype. The new approach is doing of observation research in the orientation phase of the process by following a medical treatment and the medical steps forward which the medical researcher wanted to reach with the project. But the acceptance of design progress belongs also to this new approach. Shortly, communication and understanding the design progress by all involved parties motivate to come to a new product design or prototype.

6 TOWARDS A MORE ADAPTED METHODOLOGY

6.1 SBD in the AE2M and DESTIN Projects

In SBD, descriptions of situations become more than just orienting examples and background data, they become first-class design objects. Scenario-based design takes literally the adage that a tool is what people can do with it — the consequences it has for them and for their activities that use it.

In SBD, scenarios of established work practice are constructed. Each scenario depicts actors, goals, supporting tools and other artefacts, and a sequence of thoughts, actions, and events, through which goals are achieved, transformed, obstructed, and/or abandoned. The scenarios are iteratively analyzed, revised, and refined.

In the two projects presented above, some scenarios have been experimented with user in real situations: in the Motrice Educational Institute, children have tested the designed systems with the musical teacher (AE2M Project, figure 4). In the DESTIN project, the surgical instrument is used on phantom and cadaver during emulation in the operating room (figure 5).

The objectives of these two projects are concrete and the manufactured systems satisfy the requirement of the user. The main difficulty is to integer the requirements of all the actors who are working around the user. The Scenario Based Design Methodology is the used in all the cases and some systems are currently used in real situations by the users.

Figure 4: A handicapped child is testing one mechanical system prototype with a teacher and an engineering student

Figure 5: The surgeon and its assistant using the prototype of surgical tool on cadaver in the operating room

6.2 Proposal of an adapted classification

During the design process, we have identified three factors that can influent the organisation of the scenario and the practical application: the user, the product and the usage.

Firstly, the user can be identified in the working context with his know-how and experience. For example an expert surgeon mustn't be considered as the same manner than a beginner and the scenario will be prepared differently. The expression mean of the user have to be analysed a priori by the designer and the observation of the emulation must be adapted to the situation. The user mustn't be disturbed by the camera and the other observers.

It is also important to identify the user in the usage context. The user in a team or using the product alone doesn't react in the same way and more interactions with the team members change the user behaviour.

The usage of the product depends essentially of the working environment and of the user itself. In the beginning, it is defined by the user from its own experience and needs. Throughout the design process, the usage often evolves and it is essential to confront different users with the prototype. Depending of the type of user, it is finally possible to propose a common prototype for multiple users (usable with each usage) or one generic but adaptable prototype for one type of use.

The product must answer to the list of requirements. User must practice all the tasks the product or system is designed for. If something doesn't work well (point of view of the user), the first reaction of the user will be directed towards the product without calling into question its own usage.

These three definitions allow us to propose the table 1 as follows. This table represents the classification of the two presented projects in regards to the user, product and usage definitions.

	DESTIN Project	**AE2M Project**
User	with a team	alone
Product	generic & adaptable	generic & adaptable
Usage	personalised	unique

Table 1: Representation of the user, product and usage for the AE2M and DESTIN Projects

The user

In the DESTIN Project, the surgeon is always working with the complete medical team (anaesthetist, instrumentals' person, young surgeon, etc.). It often happens that the surgical operation held with the participation of two surgeons at the same time and with multiple others surgical instruments; this must be taken into account. Moreover, it is not possible for them to prepare the instrument before using it on the patient. Thus, the preparation of this kind of emulation needs more organisation and anticipation than for a "simple" user. All the team members have to give their opinion on the product in their own level and expertise.

Even if the handicapped child needs assistance to install and arrange the system, he uses it alone with its own physical capacities. So the musical teacher and the child are using successively the system and it has to be design in these conditions. One time the system is installed for the child, he must be able to use it alone for approximately one hour without intervention of anybody. Indeed, the musical teacher has to coordinate a lot of children in the same time.

The product

The product, as a surgical instrument for the surgeon or an electromechanical system for the handicapped child, is what the user is waiting for. In the surgical domain, even if it is advised to test the product with many users, at the end there will be a single specimen of surgical tool. In the AE2M Project, each child has his own handicap, but it is better that the system will be used by many children.

The usage

We can define the usage as the manner the user uses the product in situation. Each surgeon manipulates the surgical instrument in function of its experience and know-how. We observe that the same product in situation is used differently.

In situation, the product must be adapted to the handicap of the child. But even if each user is single, the product and the usage are unique. It means that the relation

between the product and the instrument is always the same. Indeed, the objective of the project is that all the handicapped children will be able to play effectively the music as easily as valid ones.

7 INFLUENCE OF THE THREE FACTORS ON THE DEVELOPED PROJECTS

Here we propose that there are interconnections between the three parameters: user, usage and product (figure 6). The product must be personalised to the user and we are convinced that it has to be design not only for him but with him. This figure represents also the usage that is imposed by the user. In fact, all the users will finally use the same generic product (definition of a frontier) with their own usage and with the same final result. This is represented by the third arrow.

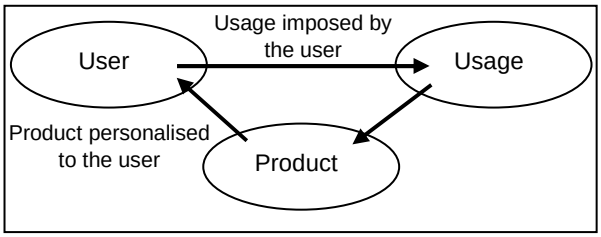

Figure 6: Relation between user, product and usage

During the design, designers always have to think about the place of this frontier: the designed product must answer the requirements of the specific user but it has to be as generic as possible. It means that the frontier of the product has to be as large as possible compared to the use and the usage ones.

In the two cases studied, the product must be as generic as possible but adaptable. We will explain the main differences below.

In the study made with the surgeons, the experience and the know-how of the user allow to represent this schema as shown in figure 7.

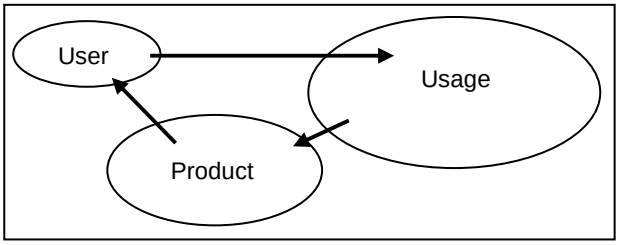

Figure 7: Representation of the scheme for the DESTIN Project

The product is the link between the user and the patient. In the medical field, each physician defends his own practice. The consequence is the adapted usage of the surgeon to the product developed. With the same product, and because of the history of the physician, the result of the surgical operation will be exactly the same with a completely different usage.

The ergonomic factor is essential in this design case with surgeons and this is the main link with the user. On the other hand, this aspect has a great influence on the usage. That is the reason why the usage mainly influences the design process in this case.

In final situation of use, all the expert users will be able to realise the surgical interventions with the team, using generic and adapted instrument, with a personalised usage.

The representation of the influences of the use, the product and the usage, concerning the design of systems that allow the handicapped children to play the music can be represented as shown in figure 8.

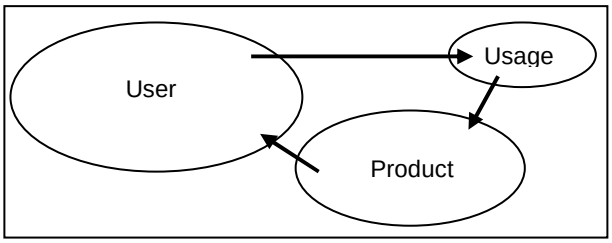

Figure 8: Representation of the scheme in the AE2M Project

In this case, the physical capacities of the children are limited but lots of knowledge must be taken into account to satisfy them. The designers mainly have to take into account the remarks coming from the experiences of the medical specialists who are daily working with the user. The most important thing in this context is the limited capacities of the user to express his satisfactions and dissatisfactions during the applied scenarios.

Once this important quantity of information recovered and analysed, the usage become simple. All the products manufactured during this project correspond to this schema. A lot of time is consumed with the user before beginning the design with the musical teacher.

In final situation of use, all the handicapped users will be able to play alone the musical generic and adapted instrument, with their own usage.

8 CONCLUSION AND PERSPECTIVES

Our main contribution to the design methodology consists of the proposition and classification of three parameters: the user, the product and the usage. We illustrate their inter-relations with the examples of the DESTIN and the AE2M projects. These projects are chosen because they strongly imply two different types of user for concrete product design objectives.

We show firstly that a lot of researchers are working and developing the UCD and PD methodologies. The applications of these methodologies allow the designer to focus on the user and its practices of work. The Scenario and the Emulation are proposed to observe the user in situation and then to analyse the usage in real environment. It is important to remind the comment that “the scenario is as a manner to better communicate the requirements of the users to the designers”. Using scenarios and emulation several times during design ensure that all participants (not only the users but also the other persons who are interacting with the product) understand and agree to the design parameters, and to specify exactly what interactions the system must support.

The two projects presented are completely dependent on the SBD methodology. The users, as they are considered as specific users, are put in situation during emulation. These concrete projects allow us to currently propose 3 patents: two surgical instruments have been tested with two different surgeons and one electromechanical system allows disabled children to play percussion instruments with the help of a contactor.

The objectives of the proposed classifications of the user, the product and the usage and their interactions must allow the designer to better organise the preparation and the application of the methodology. The integration of Scenarios and Emulations are essential in the design process for the evolution of the product in these cases. In

the future design projects, we will try to better pre-analyse the usage situation of the product with the objective to adapt Scenario & Emulation to this context.

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