A Blended Approach to Interaction Design: from Emotion to Atmosphere

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Abstract. The past years have seen the deep changes in development strategies of interaction systems in which human feelings have been played an important role during the design process. This paper presents a new interaction design model for designing systems to convey feelings and moods reflecting the mental model of its visitors in supporting their interaction activities. This model recognizes the interdisciplinary and intercultural contribution of each stakeholder involved in the design process. Combining different experiences and skills, the stakeholders embed in the final environment positive emotions according to the domain context in which the project is grounded. In the paper this design process is called atmosphere design and its validity was tested in a case study.

Keywords: Tools for design, modeling, evaluation, affective HCI, emotion, motivational aspects, evaluation methods, usability evaluation, user experience based approaches.

1 Introduction

User interfaces can be seen as virtual spaces in which users can live satisfactory experiences and in which creative insight is fostered. To address these challenges, design projects should be carried out collaboratively by interdisciplinary teams, since more knowledge that the one possessed by any individual is needed.

This research joins knowledge emerging in hard sciences (Human-Computer Interaction (HCI), computer science, software engineering, ergonomics, cybernetics and neuroscience) and humanities (semiotics, philosophy, cognitive science, psychology and psycho-analysis), in

order to raise awareness of the different expertise that can be found in different design teams. These teams have to collaborate during all the interaction design phases in order to develop what in architectural design is defined as atmosphere: a space should be able to convey specific feelings and moods, most of which are related to the affordances it offers. In this way, the space better reflects the mental model of its visitors in supporting the achievement of specific goals.

This paper presents a blended approach to interaction design based on different theories and methods, which enables the communication among the various stakeholders to better define the atmosphere of virtual spaces under design in order to foster satisfactory user experiences.

The paper describes a new design model dedicated to encourage the creative process and the awareness of atmosphere concept. In order to test the model, two groups of designers have been involved in the design of two Websites, one of which was based on the blended approach. The two Websites have been evaluated using both heuristic and semiotic engineering methods. The results obtained by all the evaluations confirmed the validity of the blended approach.

The paper is organized as follows. Section 2 presents a state of the art of interaction design techniques and describes the atmosphere concept in this context. Section 3 introduces the a new model of interaction design and Section 4 presents the case study developed to test its validity. Finally, conclusions and future works close the paper.

2 Interaction Design Techniques: from emotion to atmosphere

Nowadays, a successful interactive application must be the result of a cooperative work among different actors forming an interdisciplinary design team. In a collaborative design team, stakeholders have skills and experience in different fields such as hard sciences (HCI, computer science, software engineering, ergonomics, cybernetics and neuroscience) or humanities (semiotics, philosophy, cognitive science, psychology and psycho-analysis), and each stakeholder owns specific knowledge that is crucial to the design. This situation, defined as symmetry of ignorance (Fischer, 2000; Rittel, 1984), requires that each stakeholder's knowledge is shared and integrated with other stakeholders' knowledge. Moreover, it is important to remark that users

are the real “owners” of the problems in their domain and that software engineers and designers are “owners” of the technology and methodologies and their active cooperation is necessary to design and develop software artifacts which are usable and accepted by users communities (Bødker et al., 1988).

For this reason, an application’s interaction style has to reflect users’ culture, skill, and physical abilities rather than those of its designers otherwise users are forced to adopt interaction styles alien to their culture that affect the performance of their activities (Majhew, 1992).

The design approach supporting the collaboration among hard science experts, humanities experts and users falls in the category known as Participatory Design. In (Schuler and Namioka, 1993) a Participatory Design process is described as a human activity, involving communication and creative thought amongst groups of different stakeholders (Gennari and Reddy, 2000) and in which the people destined to use the system play a critical role in designing it.

Solutions to design usable and successful interactive systems have to explicitly recognize the existence of different cultures and of the communication gap between users and system designers and developers and have to suggest the human-system interaction style that must be adapted to the end users’ culture and capabilities.

The American designer Bill Verplank (2003; 2001) says that a system able to conform to user expectations has to comply with a model of interaction design that is essentially based on three concepts: do, feel and know and that together represent the fundamentals of each interaction style.

According to Verplank’s thought, to design any product means to reply three questions:

1. How do you do? (How does the user use it?)
2. How do you feel? (How does the user perceive it? How does the environment involve the user? Which feedback does the environment offer in order to understand how to do?)
3. How do you know? (How does the user know the modality of use of the environment? Which knowledge and rules does the user learn from her/his experience?)

The feature “Feel” allows to understand “how much of itself” explains the system, how it does it, and then how much is the benefit the user has from an emotional point of view.

The feature “Do” allows to understand which modality of use the system communicates to the user, and if so, if it does it in an efficient and understandable way .

The feature “Know” allows to understand if the system is able to communicate its “knowability” in a clear way, that is if it is able to transmit the proper logic of use to both novice users and to advanced users who require advanced interactions to support the detection of personalized strategies of use.

These design features are addressed to emphasize what Norman claims in (Norman, 1986): emotion plays a significant role in attracting the user and an attractive thing makes a person more relaxed and a relaxed person is better at problem solving than a tense one.

Norman re-arranges the design process according to the three levels of brain functioning: visceral, behavioral, and reflective. Designing for the visceral level means taking in consideration the part of the interface instinctively perceived by the user (e.g. affordance, look and feel) according to which s/he reacts and makes judgements based on primal level biological responses.

At the next level of processing, that is the behavioural layer, the pleasure of using a product is involved – the usability, functionality, efficiency, or ergonomic comfort of a design. Finally the reflective aspect of the design is associated with long-term response which involves the level of satisfaction associated with an object according to the user’s culture and experience. Pride of ownership and brand recognition are key elements of design for fostering to the reflective levels of thought.

Starting from and blending the Verplank and Norman’s studies, our proposal extends the concept of emotional design taking in consideration the interaction process at the base of the user activities. Our model focuses on the study of how the user is emotionally involved through the exchange of information with the system and how the elements on the interface are able to trigger these emotions.

According to this perspective, in our opinion, the design process has to be addressed to define an interactive environment embedding an atmosphere able to communicate “semiotic emotions”, that is, emotions triggered in the user during the interaction with the elements of the system and interpreted according to her/his culture, interests, and context of use. Moreover, the process of finding new interaction

strategies by inferring, from a semiotic point of view, allows to recover emotions by previous interaction experiences.

2.1 The Atmosphere Design

Designing for atmosphere means to design taking in consideration the characteristics of what we might call "semiotic emotions", which are the user's emotions triggered by the interactive elements of the system (e.g. shape, colors, dimensions, spatial distributions, navigation strategies, sounds) perceived and interpreted by the user during the interaction activity. Through the inferential process, the user interaction activities are able to trigger positive emotions according to previous experiences, communicating a pleasurable atmosphere to the user.

This design strategy supports the collaboration among hard science experts, humanities experts and users that, in a participatory way, operate for designing a system able to offer satisfactory experiences. A satisfactory experience is an experience able to trigger a set of positive emotions during the interaction activity. Emotions are felt by the user as a pleasant atmosphere according to three different levels of perception and comprehension:

- Reactive
- Interactive
- Cognitive

These three levels of the atmosphere are conceived blending the characteristics of the interactive design process as defined in the Verplank and Norman's researches.

The reactive level of the atmosphere design process is the instinctive phase of the user's perception and is not only related to what Norman calls visceral perception, that is, the attractiveness and pleasantness of the interface, but also to what Verplank calls "feel" feature, that is how much the elements of the interface are able to communicate to the user about themselves or how much cognitive effort the user has to do for interpreting them.

From a semiotic point of view, the reactive level studies the senses employed for interacting with the elements on the interface which affect the type of experience performed by the user. The characteristics of the environment define the messages communicated to the user

through the elements of the interface because they fix the modality of presentation and transfer and the tools for interacting with them.

Therefore the elements of the interface are the media using which the user perceives the environment. Starting from the McLuhan's studies (McLuhan, 1964), it is possible to claim that these media can be cool or hot according to the amount of information that they are able to communicate using the human perceptive system.

A medium is hot if the user does not need to exert much effort to determine its meaning. Instead, a medium is cool if it requires more effort to determine its meaning, that is its presentation in the interface requires a high degree of effort to fill in details, in order to understand what the medium intends to communicate.

The cool and hot media determine the degrees of participation on the part of a user who chooses to consume them according to the cognitive load needed to understand their meaning.

The next level of our atmosphere concept concerns the interactive aspect, that is the behavioral patterns that the environment communicates for interacting with the elements. These behaviors models are defined according to usability, functionality, efficiency, or ergonomic comfort of a design (the Norman's behavioral level) but also according to the interaction patterns that the system is able to communicate (the Verplank's "do" feature).

From a semiotic point of view, the elements of the interface are able to communicate their modality of interaction in a symbolic or analogic perspective. With a symbolic medium, the user deals with a sequence of operations that becomes a process, in that the interaction is discrete inasmuch as it allows only a set of possible status in which the user can set the medium (i.e. a button can be set in "on" or "off" status).

Instead, with an analogic medium, such sequence becomes a gesture allowing a continuous control both in space and time of the interaction (i.e. a handle can be put in a set of continuous statuses).

Finally, the highest level of the atmosphere design process is characterized by a perception of the system based on reasoning and reflection. At this level, the semiotic communication happens along two directions defined according to a conscious consideration of what we are expecting from the users for whom we are designing.

The easiest interaction strategy requires a knowability of the environment communicated only one step at a time (what Verplank calls path knowledge).

In this case, our assumption is that the user according to her/his mental model is expecting step-by-step instructions. This step-by-step knowledge communication process is characterized by elements of the interface enabling secure operations through few and simple steps.

Another assumption is that the user is expecting to choose a proper navigation strategy according to a knowledge that s/he is able to mine from the environment itself. This assumption is based on the fact that, when using an interactive system, a significant portion of the information conveyed by the system is 'implicit information' (Costabile et al., 2006), i.e. is embedded in the actual shape of the elements displayed and in the visual organization of the overall screen image. Such information can only be understood by users who possess tacit domain knowledge as happens with sequences of images that illustrate sequences of actions to be performed. The knowability (called map knowledge) is organized by elements of the interface enabling a polyhedral use of the system and that open a set of alternative possibilities and interaction strategies.

Moreover, at the cognitive level the atmosphere is communicated not only according to different knowability strategies but also according to the level of satisfaction associated to the elements of the interface that the user perceives in relation to her/his culture and experience (what Norman calls reflective design). The user can be happy to use an environment due the reliability it transmits or the brand it communicates, features that depend on the experience and culture of the user.

3 A New Model of interaction Design

A successful interaction design process is the result of the collaboration of different communities of stakeholders. At least three different communities could be identified as fundamental in a collaborative interaction design process: experts in hard science, experts in humanities, and end users.

Moreover, this process has to result in the design of a system in which the users can be emotionally involved through the exchange of information with the virtual environment itself. From this point of view, the atmosphere concept plays a primary role in involving the user during her/his interaction activities.

The new model of interaction design that we propose in this paper stems from the blending of different creative design techniques, in which the cooperation of different stakeholders contributes to define a creative product that embeds a pleasant atmosphere supporting successful interactions (***).

The model is composed by seven main phases:

1. Comparison analysis phase: during this phase the stakeholders carry out a set of comparative analysis of competing products. The aim of this phase is to make the stakeholders more familiar with atmospheres already adopted in previous design projects. Each competing product has to be analyzed in order to highlight its strong points, its weak points and should be described both from a user and from an expert point of view. This means that each stakeholder should first test the product identifying her/himself in a targeted user profile and then test it again using her/his knowledge in her/his domain of expertise. Finally, each stakeholder is asked to balance her/his personal results and to explain them to the others.
2. Atmosphere definition phase: during this phase a psychological session is carried out. Experts in cognitive science, art, and psycho-analysis, through the use of images, sounds and videos, involve other stakeholders in activities with the aim to understand the basic features of the atmosphere triggering positive emotions in the domain context in which the project is grounded.
3. Creative ideas definition phase: this phase is addressed to define a set of creative ideas useful to design the system that has to be developed. These ideas are devised blending two creative strategies: Dix's bad ideas (Dix et al., 2006) and Munari's creative constants (Munari, 1977). This phase is described more in details further in this section.
4. Brainstorming phase: during this phase the stakeholders transform the creative ideas in creative possible solutions according to the specs of the system to be developed. In this phase, the collaboration of technical and non-technical stakeholders is very important in order to design a working solution according to the atmosphere features detected in the previous phases.
5. Incubation phase: between the design and the development of the system, a period of two weeks is granted to the stakeholders. In

this period of time they are invited to reflect on the work done so far and to think on its further development.

6. Development phase: in this phase the more technical experts (designers, software engineering, HCI experts) are involved in the development of a set of prototypes, each one evolving the previous one, in a cycle that leads to the release of a candidate final system.
7. Evaluation phase: this phase is reported at last but it is actually a phase that involves the stakeholders during the whole life cycle of the product. The evaluation is in fact performed on all the mockups that results as output of phases 2,3,4 and 6.

3.1 Creative ideas definition

As explained above, seven distinct phases constitute the new model of interaction design proposed in this paper. The third of these phases is aimed at defining a set of creative ideas to be used to design and then develop the required system.
The model by which these ideas are formulated is defined by the blend of two creative strategies: Dix's bad ideas and Munari's creativity constants.

Dix's bad ideas. This technique starts from the basic assumption that in order to learn how to apply new rules they should be first broken (Dix et al., 2006). In fact, to apply bad ideas helps at immediately understand which functional needs are strongly required. Following Alan Dix's bad ideas technique, the stakeholders are first required to propose some ideas that are considered bad in that they produce negative effects if adopted in an interaction design process. These ideas are devised starting from experiences gained during the previous phase. Combining comparative analysis of competing products and the basic features of the atmosphere characterizing the domain context in which the project is grounded, the stakeholders identify bad design solutions.
Then the stakeholders are asked to list all the cons of the use of these ideas but also to identify some pro that could emerge during a collaborative discussion. This stage of "the creative ideas definition" phase leads to the specification of some ideas that have to be used in the stage that follows.

Munari's creativity constants. Bruno Munari identified some of the constants that characterized the creative design processes (Munari, 1977). These constants are the basic operations made by the human brain and that are managed using memory.

These constants are:

- Reverse of a situation by using the opposites and the complements.
- Multiplication of the elements in a set.
- Creation of new relations between elements in a set.
- Change of colors, context, materials, function, dimension, etc.
- Merge of more things in a unique one.

At this stage in the creative ideas definition phase, the stakeholders are invited to apply the Munari constants to the bad ideas formulated at the previous stage.

The phase 3 is the core of our interaction design model because, at this stage, each stakeholder is involved in defining creative ideas according to her/his skills, background, and culure. Moreover defining creative ideas, the stakeholders find new solutions for embedding in the environment a positive atmosphere able to support the user in her/his interaction activities. Therefore, the proposed design model has not the aim to design a full usable system but a satisfactory and pleasant environment according to the user's expectation and wishes.

4 A Case Study

The case study performed to test the new model of interaction design proposed in the previous section was developed in two phases: the first dedicated to design and development of Websites and the second to their evaluation.

4.1 Design and Development

In the design and development phase, students of the course of "Web Technologies" at Università degli Studi di Pordenone have been involved.

Two groups of students, each formed by 5 persons, have been asked to develop a Website having as common theme "tourism and

sustainable travel". The both groups had the same expertise and they did not interact with each other for the whole duration of the study.

One of the two groups (Group 1 from here on) was asked to design and develop the Website following a functional approach to interaction design, while the other group (Group 2) was asked to apply the interaction design model proposed in Section 3. Therefore, the organization of the two groups and of the work performed by them was deeply different and the Websites they developed were affected by the applied approaches. In what follows the work of the two groups is described.

Group 1 (Functional Approach to Interaction Design). This group was formed by five students. The result of their collaborative design work is illustrated in Fig. 1.

The group followed a waterfall design model focusing on four main activities: requirements specification, design, development, and debugging.

As to the requirements specification, a quite large degree of freedom was given to the students. In fact, the students were able to autonomously decide the target of their Website. As to design and development, students decided which metaphors, interaction styles, and graphics had to be used. The debugging activity was performed by some of the students in order to check all the functionalities before the release of the Website.

Apart from debugging, no validation activity has been performed by the students at this stage of the case study because it has been postponed to a successively step. During the whole process only the five students have been involved and no end users have been consulted.

Fig. 1. The Website realized by the group of students that applied the functional approach to interaction design.

Group 2 (New Model of Interaction Design). Like Group 1, also this group was formed by five students. Fig. 2 illustrates the result of their work.

Fig. 2. The Website realized by the group of students that applied the new model of interaction design.

Since the students do not have a specific domain expertise at this stage of their career, they were asked to play a role during the design project. They could choose among three different roles: software engineer, HCI expert, end user.Once the group was formed, the new interaction design model has been applied and all its seven phases were handled in succession.

According to what the model described in Section 3, several evaluation steps have been performed at the different stages of the design process. However, for sake of space in this paper only the final evaluation session performed by the students at Università degli Studi di Milano is presented and discussed in what follows.

4.2 Evaluation

This section presents and discusses the results of different evaluations performed on the two Websites described in the previous section. In this phase, students of the courses "Basics of Digital Communication" and "Advanced Human-Computer Interaction" at Università degli Studi di Milano have been involved. The evaluation of the two Websites has been performed using different evaluation methods. The various methods that have been applied aimed at i) investigating about the usability problems that may be encountered in using the Websites, and ii) at checking the metacommunication between the designers of the Websites and their users. In what follows, the two steps of evaluation are described.

Step 1. In this step 18 students were involved in the evaluation of the two Websites designed and developed in the previous phase of the study. The first evaluation method applied was heuristic evaluation and the principles adopted were the Nielsen's ten usability heuristics (Nielsen, 1994): 1) Visibility of system status, 2) Match between system and the real world, 3) User control and freedom, 4) Consistency and standards, 5) Error prevention, 6) Recognition rather than recall, 7) Flexibility and efficiency of use, 8) Aesthetic and minimalist design, 9) Help users recognize, diagnose, and recover from errors, and 10) Help and documentation.

The 10 Nielsen's heuristics may be grouped on the basis of the class of problems they belong to: perception, cognition, and errors management.

The first three heuristics (Visibility of system status, Match between system and the real world, and User control and freedom) belong to the perception class. The next four heuristics (Consistency and standards, Error prevention, Recognition rather than recall, and Flexibility and efficiency of use) belong to the cognition class. Finally the last three heuristics (Aesthetic and minimalist design, Help users recognize, diagnose, and recover from errors, and Help and documentation) belong to the errors management class.
The results of grouping the usability problems previously detected into these categories are presented in Fig. 3.

The results obtained at this step of evaluation highlight how the Website realized by Group 2 presents less usability problems than the one created by Group 1.

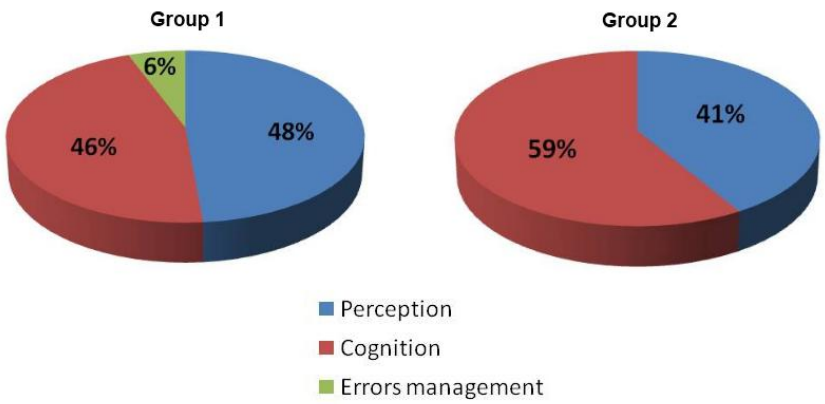

Fig. 3. The detected usability problems divided into Perception, Cognition, and Errors management categories.

The usability problems detected through a heuristic evaluation can be also classified on the basis of the area of intervention required to fix them: graphics, architecture, and programming. According to this classification, the problems detected are divided into three groups and the results are illustrated in Fig. 4.

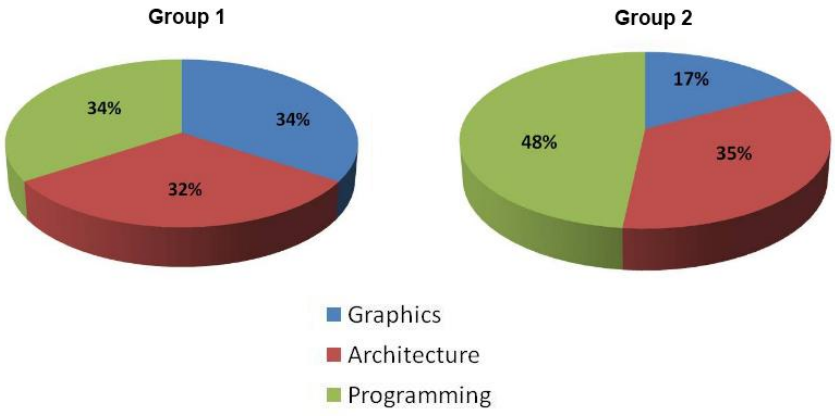

Fig. 4. The detected usability problems divided into Graphics, Architecture, and Programming categories.

In spite of the fact that for Group 2's Website presents more problems related to programming, the final comments of the evaluators pointed out that in general the interaction with this Website is more pleasant than the one offered by the Group 1's Website.

Step 2. Results from some studies published in (Thompson and Kemp, 2009) and (Gomes da Silva and Dix, 2007) have highlighted how conventional usability evaluation methods like heuristic evaluation (Nielsen and Mack, 1994), and even exploratory methods like the cognitive walkthrough (Cathleen et al., 1994), do not reflect the opinions of the users. For example, in (Gomes da Silva and Dix, 2007) the authors found that YouTube failed when tested using heuristic evaluation although it is one of the most popular Web applications. Moreover, the work in (Greenberg and Buxton, 2008) presents a thesis according to which, in some cases, focusing on the usability can be harmful. This is because usability methods tend to put the lens on the usability bugs and not on the whole usefulness of an application. Innovative ideas could be discouraged by negative results and give up on plans that might otherwise bear good fruits.

For this reason, the second step of evaluation was performed applying two methods of semiotic engineering evaluation (de Souza et al., 2006): the semiotic inspection method (SIM) and the communicability evaluation method (CEM). The two methods, going beyond the limit of the cognitive engineering methods. They have not

been used to evaluate the usability bugs of the systems but, to evaluate the efficacy of the metacommunication between the users of the Websites and their designers. An efficacy metacommunication is a good comparison parameter for evaluating how the conceptual model defined by designers fits the mental model of the users. The two methods have been defined in (Prates et al., 2000) as applications of semiotic engineering theory to support professional HCI activities. SIM method explores the emission of the metacommunication, trying to reconstruct the messages sent by the designer to the targeted users. CEM method explores the reception of the metacommunication, trying to identify through users' observation the empirical evidence of the effects that the designer's messages have on the users' interaction.

SIM analyses have been performed by three students in an individual way and after that, during a debriefing, the results of the three analyses have been compared and the final results were resumed.

SIM analysis on Group 1's Website highlighted that the colors choice affected negatively the readability of the information. Moreover, the company logo appears to many times in the same pages and it distracts the users' activity on the Website. Important information, like for example the special offers, are not enough evident and this compromises the achievement of the goal. The main goal of the Website is to choose a holiday offer and to proceed to booking it. However, the Website does not offer directly this functionality: the user is asked to write an e-mail to the travel agency in order to manage the booking through the direct communication with a travel agent.

The results of the SIM analysis on Group 2's Website are better in that this Website appears more welcoming than the other one. The colors chosen are pleasant and the pictures capture the user attention. The goal of the Website and its main functionalities are well working but also in this case the booking functionality is not fully available: the Website refers to another travel agency to manage the reservation of the holiday offers.

The comparison between the two analyses' results points out that the Website developed applying the new model of interaction design (Group 2) presents a better organized communication. The user is in fact better supported in the search of basic and advanced information about the destination s/he is interested in.

As to the CEM analyses, a group of six users have been involved in the test. Two evaluators have been involved as observers and were in

charge of videorecording the tests and of taking note of the communication breakdowns detected. After the user test, the evaluators performed what is called the tagging of the identified communication breakdowns. At each breakdown, one or more of the 13 semiotic tags defined in (de Souza et al., 2009) were assigned: 1) I give up, 2) Looks fine to me, 3) Thanks, but no, thanks, 4) I can do otherwise, 5) Where is it?, 6) What happened?, 7) What now?, 8) Where am I?, 9) Oops!, 10) I can't do it this way, 11) What is this?, 12) Help!, and 13) Why doesn't it?.

These tags represent utterances that characterize communicative breakdowns between the user and the designer's deputy, that is the Website under evaluation.

The frequency of presentation of the tags for the Group 1's Website are illustrated in Fig. 5, while the ones for the Group 2's Website are depicted in Fig. 6.

TAG	FREQUENCY	TAG	FREQUENCY
I give up	11	Where am I?	1
Looks fine to me	2	Oops!	1
Thanks, but no, thanks	1	I can't do it this way	3
I can do otherwise	0	What is this?	4
Where is it?	4	Help!	5
What happened?	5	Why doesn't it?	4
What now?	3		

Fig. 5. The tags frequency for the Website designed and developed by Group 1.

TAG	FREQUENCY	TAG	FREQUENCY
I give up	2	Where am I?	1
Looks fine to me	0	Oops!	0
Thanks, but no, thanks	2	I can't do it this way	1
I can do otherwise	0	What is this?	3
Where is it?	2	Help!	7
What happened?	2	Why doesn't it?	0
What now?	2		

Fig. 6. The tags frequency for the Website designed and developed by Group 2.

In the case of the Website designed and developed using the functional approach to interaction design (Group 1), the number of help requests is higher than the one detected for the other Website (designed and developed by Group 2). Moreover, this Website presents a higher number of breakdowns tagged as "I give up" or "What happened?", and this points out the fact that the user appears to be disoriented.

The patterns of presentation of the tags for the two Websites are presented in Fig. 7 and Fig. 8.

PATTERN	FREQUENCY
Why doesn't it? I give up.	2
Thanks, but no, thanks. I give up.	1
What happened? I give up.	2
Looks fine to me. I give up.	2
What now? I give up.	2
What happened? I can't do it this way.	1
I can't do it this way. I give up.	1

Fig. 7. The pattern of presentation of the tags for the Group 1's Website.

PATTERN	FREQUENCY
Thanks, but no, thanks. I give up.	2
What happened? What now?	2

Fig. 8. The pattern of presentation of the tags for the Group 2's Website.

Group 1's Website presents many patterns that indicate severe problems in the metacommunication between designer and users. These patterns are mainly linked to some functionalities of the Website, like the reservation. The patterns detected for the Group 2's Website point out a less clarity and usability that lead to problems in the orientation.

Final considerations on the evaluations. A comparison of the results obtained by the two steps of evaluation performed on the Websites is schematized in Fig. 9.

The Website designed and developed by Group 2, that was realized by applying the new model of interaction design, seems to be better than the one realized by using the functional interaction design approach. In fact, better results were obtained in all the three evaluations made: heuristic, SIM and CEM.

WEBSITES	HEURISTIC	SIM	CEM
Group 1	more usability problems	worse organized	less appreciated
Group 2	less usability problems	better organized	more appreciated

Fig. 9. A comparison of the results obtained by the different evaluations (heuristic, SIM, and CEM) made on the two Websites.

5 Conclusions and Future Works

Today, designing systems in which to live satisfactory experiences and in which ceative insight is fostered is a very appealing challenge. In this paper an innovative interaction design model is presented. The idea at the base of this model is aimed to involve experts in hard science, in humanities, and the final users during the whole design process in order to foster satisfactory user experiences. To ensure satisfactory experiences, the environment has to be able to convey specific feelings and moods, most of which are related to the affordances it offers. The proposed design approach is based on the definition of basic features of the atmosphere enabling and triggering positive emotions in the domain context in which the project is grounded.

In order to test the validity of the design model, two groups of students have been involved in the design of two Websites.

The first Website was designed using functional aproach to interaction design, instead the second one was based on the blended approach presented in the paper.

According to two usability analyses carried out on the final Websites, the application designed using the blended method is more satisfactory than the one designed using functional approach, that is its space of interaction better reflects the mental model of its visitors in supporting the achievement of specific goals.

Current studies are addressed to redefine a semiotic method of analysis (CEM) in order to better evaluate the feelings and moods of the environment from an “atmosphere design” point of view. The idea is to find a method for understanding if the designer has been able to communicate to the user the atmosphere s/he designed. Therefore, the goal of this improved semiotic method of analysis is to evaluate if the message sent by the designer is correctly perceived by the user and at the same time, if the triggered emotions have been felt by the user according to the interaction purposes of the designer.

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References

1. Fischer, G.: Social Creativity, Symmetry of Ignorance and Meta-design. Knowledge-Based Systems Journal 13(7-8), 527--37 (2000)
2. Rittel, H.: Second-Generation Design Methods. In: Cross, N. (ed.) Developments in Design Methodology, pp. 317--327. John Wiley & Sons Ltd, Chichester (1984)
3. Bødker, S., Ehn, P., Knudsen, J., Kyng, M., Madsen, K.: Computer support for cooperative design. In: Proc. of CSCW '88, pp. 377--394. ACM Press, New York (1988)
4. Majhew, D. J.: Principles and Guideline in Software User Interface Design. Prentice Hall, Englewood Cliffs (1992)
5. Schuler, D., Namioka, A. (Eds.): Participatory Design: Principles and Practices. L. Erlbaum Associates Inc., Hillsdale (1993)
6. Gennari, J. H., Reddy M.: Participatory Design and an Eligibility Screening Tool. In: Overhage, J. M. (ed.) Proc. of the AMIA Annual Fall Symposium, pp. 290--294. Hanley & Belfus Inc., Philadelphia (2000)
7. Verplank, B.: Interaction Design Sketchbook by Bill Verplank. Stanford University (2003)
8. Verplank B., Sapp C., Mathews M.: A Course on Controllers, Center for Computer Research in Music and Acoustics. Stanford University (2001)
9. Norman, D.: User centred system design, Lawrence Elbaum Associates Publishers, London (1986)
10. McLuhan, M.: Understanding Media: The Extensions of Man. McGraw Hill, NY (1964)
11. Costabile, M. F., Fogli, D., Mussio, P., Piccinno, A.: End-User Development: the Software Shaping Workshop Approach. In: H. Lieberman, F. Paternò, V. Wulf (eds.) End-User Development, pp. 183--205. Springer, Dordrecht (2006)
12. ***
13. Dix, A., Ormerod, T., Twidale, M., Sas, C., Gomes da Silva, P., McKnight, L.: Why bad ideas are a good idea. In: Proceedings of HCIEd 2006 (2006)

14. Munari, B.: Fantasia. Laterza, Bari (1977)
15. Nielsen, J.: Heuristic evaluation. In: Nielsen, J., Mack, R.L. (eds.) Usability Inspection Methods. pp. 25--64. John Wiley & Sons, New York (1994)
16. Thompson, A., Kemp, E.: Web 2.0: extending the framework for heuristic evaluation. In: Proc. of CHINZ '09, pp. 29--36. ACM Press, New York (2009)
17. Gomes da Silva, P., Dix, A.: Usability - not as we know it! In: Proc. of HCI (2007)
18. Nielsen, J., Mack, R.L.: Usability inspection methods. John Wiley & Sons, New York (1994)
19. Cathleen, W., John, R., Clayton, L., Peter, P.: The cognitive walkthrough method: a practitioner's guide. In: Usability inspection methods, pp. 105--140. John Wiley & Sons Inc. (1994)
20. Greenberg, S., Buxton, W.: Usability evaluation considered harmful (some of the time). In: Proc. of CHI, pp. 111--120 (2008)
21. Prates, R. O., de Souza, C. S., Barbosa, S. D. J.: A method for evaluating the communicability of user interfaces. ACM Interactions, 7(1), 31--38 (2000)
22. de Souza, C. S., Leitão, C. F., Prates, R. O., da Silva, E. J.: The semiotic inspection method. In: Proc. of the 7th Brazilian Symposium of Human Factors on Computer Systems, pp. 148--157. SBC, Porto Alegre (2006)
23. de Souza, C. S., Leitão, C. F.: Semiotic Engineering Methods for Scientific Research in HCI. Morgan and Claypool Publishers, San Rafael (2009)