

# Addressing User-Centeredness : Communicating Meaningfully through Design

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**Abstract.** This paper proposes a model for human-computer interface design, which is focused on a user-centered approach. The paper studies the complexity inherent in the design process when the aim is to consider all team members of a project as contributors to a human-centered approach. Designers know that they are dealing with "messy" situations; they understand the uniqueness of each project, the continuous change of user needs, and the rapid development of information technology. They also see the challenges, to creating shared understanding regarding user-centeredness when working with other disciplines at the conceptual level. In this context, how can designers create the conditions for diverse contributing collaborators to go beyond their individual knowledge and enrich their reflections in order to efficiently collaborate within a human-centered approach ? This study proposes that in looking to increase the efficiency of interfaces, all stakeholders should consider the user in every phase of the design process especially when they deal with complex and multi-disciplinary situations. Conducting a project-grounded approach led to introducing a new theoretical model of design. The model, which is based on joint reflective practice and an interdisciplinary attitude supports and frames a collaborative human-computer interface design process.

## 1. Introduction

The ongoing development and increasing complexity of computer interfaces such as the Internet, or using a software program, impact not only our professional work, but also our social and economic interactions. While these computer interfaces constantly transform the way we work individually or collaboratively, each one of us can recall occasional dissatisfaction with them [22]. The focus of

this paper is on the complexity of the design process of the human-computer interface (HCI). HCI continually generates new opportunities and problems which design has to deal with [19]. This paper discusses the problematic of the research, its' methodological approach and the proposed model. It also considers the challenges of designing computer-assisted architectural interfaces to be a type of HCI design.

A significant amount of study about user-centered approach and usability has been undertaken, and it is now well established that collaboration of a multidisciplinary team is crucial to develop user-centered interfaces [1, 4, 10, 19, 22]. "Without primary consideration for the people using the artifacts we design, and the context for their use, – in short, the entire experience of use – we relegate design to a marginal and self-serving activity" [1]. It is also well accepted that a disciplinary attitude alone can rarely succeed to solve these complex and ill-defined problems [4, 10, 16, 22]. HCI design problems are complex and cannot be decomposed into independent sub-problems; analysis of the problem and elaboration of the solution are not two consecutive stages, rather they progress in parallel [27].

### **1.1. Communication difficulties**

Although it is a common practice to bring together a multidisciplinary team, in a virtual or face-to-face setting, problems typically arise because team members do not share a common language of communication and common vision, do not hold a holistic perspective of the project, and do not have a similar understanding of the needs and motivations of the user [4, 22]. In addition they each have their own operating procedures and ways in which they make representations of their ideas [15]. Also, they don't bring their knowledge to the team at the right time [28]. All these problems make it difficult for them to consider the end user.

Generally speaking, it is accepted that unsuccessful design is a direct result of an inadequate approach at the conceptual level, and in many cases, the inadequate approach is caused by miscommunication and a lack of understanding among team members [3, 15]. The communication within a multidisciplinary team motivated us to address today's conventional approaches to collaboration and ask the central question of this paper : as a designer, how can we create the conditions for diverse contributing experts to go beyond their individual knowledge and enrich their reflections in order to efficiently collaborate ?

We believe that some of HCI design activities (such as exploring the context, framing of problems, sketching) have the capacity to be used as a method for modifying the dynamic of collaboration and creating conditions leading the multidisciplinary teams to user-centered interface solutions. In this regard there is a need to address the intertwined multidisciplinary situations where social, technological, political, or organizational problems are closely linked to design.

## 1.2. User-centered design and its shortcomings

Until recently, HCI had been developed for the most part with a technology-centered approach [10, 17]. Emergence of interaction design brought together the interests of many disciplines including business, technology and engineering, ergonomics and cognitive psychology, design, media and culture. These interests contributed to the move away from technology-centered design and to the shift of focus on the human being [2] for which new methods and tools are needed to facilitate the unavoidable disciplinary collaboration.

Two situations are common regarding HCI design. In a conventional approach, it is mainly the responsibility of the designer to gain a comprehensive understanding of users. The designer uses diverse methods such as ethnography, observation, and contextual study to grasp the user experience [10, 26], and subsequently uses this understanding for decision-making. In a collaborative approach, users as well as other contributors are invited to take part in the project, share their ideas and experiences with the design team. In this approach, "designers are partners with the problem owners" [8]. Users' knowledge helps the design team look at the project in a different way, generate ideas and create new concepts. In both these approaches, team members need to communicate. However, as Preece et al. [22] states : "The more people there are with different backgrounds in a design team, the more difficult it can be to communicate and progress forward the designs being generated". The reason seems to be that the lack of a common language among team members creates confusion and becomes the source of disinterest and dissatisfaction regarding the exchange of ideas. As a result of these communication challenges, interaction design needs to deal with interactions and negotiations among people in addition to interactions between people and interfaces.

Searching for effective ways of communication between disciplines has been a question for researchers trying to find a new language that goes beyond the boundaries of individual disciplines. As a team, efficient communication and the sharing of knowledge between disciplines marks a move toward interdisciplinarity. According to Morin [21], the interdisciplinary approach supports dialogue and the exchange of knowledge, analysis, and methods between two or more disciplines. It also implies interaction and a mutual enrichment between specialists. This idea has been gaining acceptance by many researchers in HCI design. Boyarski [1] talks about an "interdisciplinary attitude" by which he means "integrating approaches from other disciplines, allowing "multiple sighting" on a problem".

## 2. Studying HCI design

In order to answer the question of the research we used a mixed methodology [5]. In the first part, a project-grounded research (research through design) was used on three successive case studies with increasing degrees of intervention and control by the researcher. Project-grounded research [11, 12, 13] is about developing knowledge and theory related to design activity by going through an authentic design project. This means that the theory is situated in the project and its implication on practice is directly observable. This method conciliates theory and practice [13, 14]. In other words, conducting research and constructing knowledge become part of the design project. This research approach offers advantages for HCI design [29] and can deal with ill-defined (wicked) problems [23], contrary to techniques of science and engineering, which deal with tame problems. It can also help tackle the complexity of problems where the designer needs to use opportunities related to different design situations in order to integrate information, knowledge and competencies from several domains [27].

The case studies focused on the early stages of HCI design process and the dynamic of decision-making related to design of three website projects. As designer/researcher, we simultaneously designed and examined each case, and gathered data with the objective of understanding what really happens during collaboration within the assigned team. The analysis and the interpretation of the data led us develop a theoretical model.

In part two of this research, the model was presented to three design experts individually for validation purposes [9, 18]. The model and the validation process and its results are discussed later in this paper.

### 2.1. Part one - three successive case studies

**A-** The focus of the first case study was for the designer/researcher to observe her role and interaction with others during a conventional HCI design process while conducting a professional project. Although conventional HCI design process contains usually four main phases : project definition & analysis (i.e. exploration and analysis of the users' needs, the context of use, the available technologies), conceptualization, construction, and maintenance, this study's focus was on the two first phases. We examined how the designer collaborates with each involved discipline separately, collects all information, and brings solutions through an iterative and cyclical design process. The main conclusions of this study are :

- Information is not fully given to the designer when it is needed.
- Stakeholders focus on their disciplinary domains; they don't seek a holistic view of the project.
- There is a lack of common language.

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- The project solution is crystallized through many back and forth conversations between the designer and other stakeholders.

**B-** For the second case, the focus shifted to collaborative interactions. A framework was created to study the conditions that could support collaboration between project team members enabling them to have more constructive dialogue and exchanges of information, and to consider the user in all steps of their work. A voluntary group (including three designers, a manager, two web programmers, a journalist and a photographer) teamed up for this project. As a guiding principle, the designer/researcher facilitated the integration of the two first phases of design process in order to define the project's goal and frame the problems, establish the information architecture, and create the guidelines of visual design. During multiple collaborative sessions, HCI design activities were used as a method to foster consensus building and the adoption of a common language to develop mutual goals. The observations of this study showed that collaboration helped to :

- Generate a holistic vision and demonstrate the project's complexity when the focus is on users need and wants.
- Facilitate communications and constructive exchanges between disciplines.

Limitations identified in these two cases led to the design of an intervention that was implemented in the third case.

**C-** Case three was related to the redesign of a complex website. The intervention comprised an intensive workshop at the start of the project whereby all stakeholders (project owner, content experts, administrators, web programmers, users, office managers, designer) engaged in the design process with an interdisciplinary attitude which led to joint-reflective practice toward achieving the new goals of the project. The disciplinary collaboration was converted into a new knowledge generation, useful for the purpose of the project. The availability of the stakeholders for a set period of time and their willingness to participate in the process through subsequent activities were the needed conditions for this intervention.

As the stakeholders became more familiar with the HCI design process, new questions emerged and modified the viewpoints of the team. The team's interest in theory and its implications in practice grew. Discussions regarding the concerns of each discipline helped everyone share information, develop a common understanding, and modify their attitude toward collaboration [28]. Figure 1 shows the phases of the project and the place of the intensive and iterative work session in the phase 1. During this phase, stakeholders redefined the project through consensus building. Their joint reflection on diverse aspects of project crystallized the design solution. Phase 2 relates to production and Phase 3 to implementation.

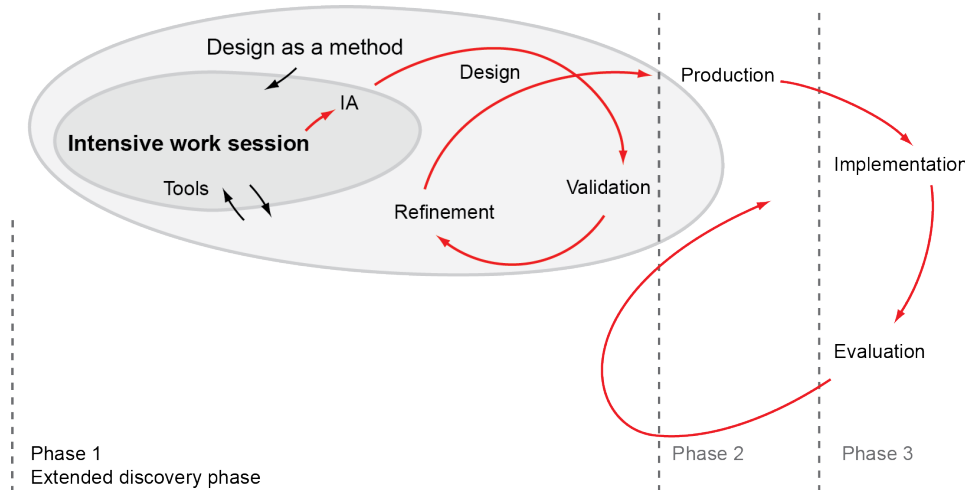


Fig. 1. Integrated design process for HCI.

The conclusions drawn from this case study confirmed that efficient collaboration between stakeholders is a key condition for leading a team to set the underlying principles of a user oriented and sustainable HCI design. Openness, sharing, trust, engagement and reflective practice characterize this collaboration. The principles of the intensive workshop are explained later in the paper.

Data generated from these three case studies informed the development of a theoretical model that represents steps of optimal collaborative HCI design process focusing on user-centeredness.

## 2.2. The theoretical design model

The model supports and structures collaborative design activities of a multidisciplinary team with regards to designing user-centered interfaces. It is inevitably organized around a line that we call "User axis". The function of this axis is to align communications, conversations, and individual or collective efforts of the team with the user. We use the term "user axis" rather than "user-centered" to depict the idea of evolution and continuity regarding usability principles. Also, as the axis is a continuum, there is no target point; rather there is a direction to follow. Design process revolves around the user axis.

The model is based on constructivism epistemology [16]. It is considered a tool that supports a project team during a HCI design process, when the goal is to achieve user-oriented results. The elements of the model are the following :

- Embracement of a "interdisciplinary attitude" by all project team members.
- Introduction of a "joint reflective practice".

- Establishment of new phase called "extended discovery phase" at the beginning of the design process in which all team members participate actively in order to build consensus on the project goals and users' needs/wants.

### 2.2.1. *The interdisciplinary attitude*

Each participating discipline in a HCI design project brings its visions, priorities, and motivations. However they need to make a significant move and align their interests rapidly with the user axis to achieve a common goal for the project. By embracing an interdisciplinary attitude the move becomes possible.

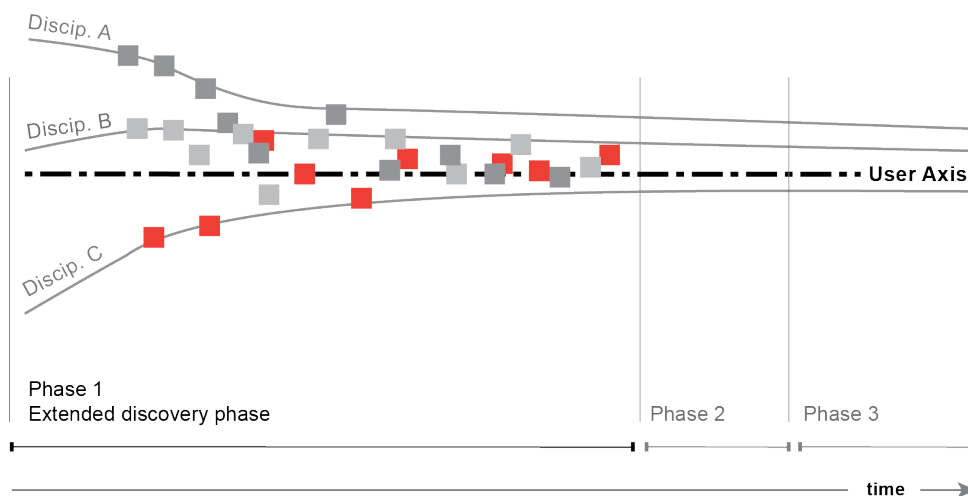


Fig. 2. Alignment of disciplines toward user axis and joint reflective practice.

The interdisciplinary attitude brings shared commitment, acceptance of approaches from other disciplines, and a way of looking at the problem from various perspectives [1]. It will allow openness to other perspectives and a willingness to share information. We consider the interdisciplinary attitude as a mind-set that encourages an informal teaching and learning dynamic. When all disciplinary knowledge is contextualized (for the project at hand), it will be easier for team members to understand diverse perspectives and see the relevance of diverging viewpoints [25]. To achieve good understanding as a team, each member needs to interact with others and become aware of all aspects and priorities presented by diverse disciplines.

### 2.2.2. *Joint reflective practice*

As HCI design situations are complex and problems are interconnected, the design tasks require the confluence of a variety of expertise. When more people

become involved in the design process, we also see more value conflicts. Schön [24] emphasizes the "complexity, uncertainty, instability, uniqueness, and the value conflicts" of situations of professional practice and explains that these situations are not problems to be solved. They are problematic situations, which are uncertain and unclear, but they need to be understood. Reflective practice which consider design as an "action-oriented" activity [24], makes this understanding easier at an individual level. The theory behind this concept is that "designers are active in structuring the problem" [24] and they evaluate their actions in structuring and solving the problem. Designers have "reflective conversation with the situation" [24]. Introducing a joint reflective practice, where stakeholders are collaborating actively in structuring the problem, allows the team to change its perspective, bring together diverse knowledge and skills, notice interconnected problems, have a dialogue with the problem, and challenge the concepts and theories by which it makes sense of knowledge. As a consequence of joint reflective practice, a project-specific team will bridge different understandings, formulate the project differently, and deal with uncertainty.

### **2.2.3. *Extended discovery phase***

During this phase the team is brought together to collectively set the problem [24] and establish the guiding principles of the project, which allow the development of the solution. Interdisciplinary attitude building and joint reflective practice play the role of foundations for this phase while design activities are used as method for creating meaningful communications among the team members and help them converge toward the user axis.

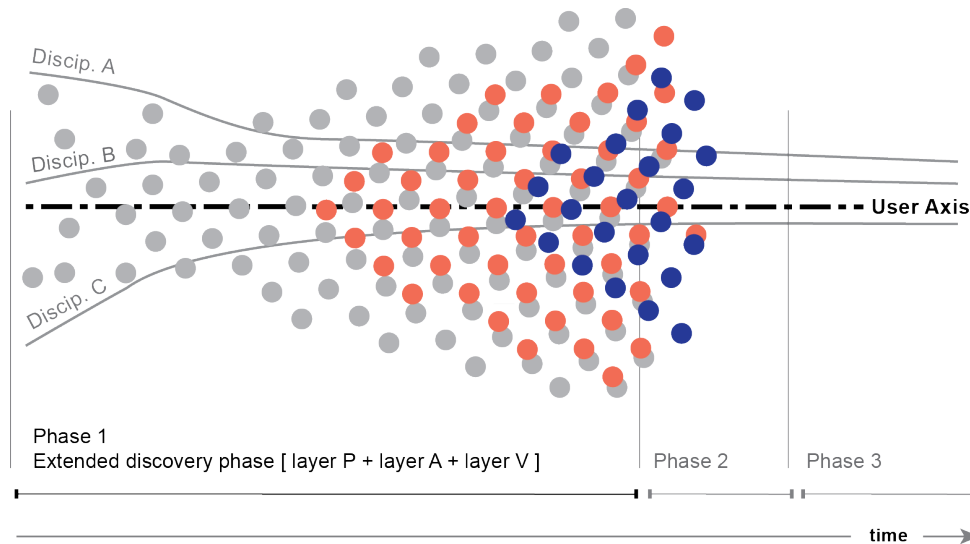
It is essential for the multidisciplinary team to consider the following four factors when they participate in the extended discovery phase : the uniqueness of each project, the continuous change of user needs, the rapid development of information technology, and that HCI projects are generally complex and messy situations. We believe that to design with usability and sustainability in mind, the team needs to consider these factors and understand the relationship between them.

In a HCI design, there are three types of activities which are interwoven during the extended discovery phase : setting the problem, represented by "P layer"; outlining the information architecture, represented by "A layer"; and creating the visual design guidelines, represented by "V layer".

The design process starts with the P layer and evolves around the user axis. Interdisciplinary attitude helps the team to create a common language and achieve consensus on project goals and priorities. The next step is tackling the A layer in order to define the structure of the project. Joint reflective practice supports the development of this layer. The final step is the V layer, which needs to take into account many elements that the project wants to communicate through the



interface such as history, culture, message. Figure 3 shows the interaction of these layers with each other and with the user axis.



*Fig. 3. Superposition and alignment of layers in phase 1.*

Development of these layers and their interactions lead to a better understanding of the project and to the discovery of solutions.

### **2.3. Part two - validation**

Having developed the model in part one of the research, the second part called for validation to complete the research [5, 9]. Semi-structured interviews with three design experts were conducted. The experts had the following profiles : one was a researcher and an educator; the other one was a senior design practitioner with many years of teaching experience; the third expert was a senior designer in HCI. Interview data collected from the conversations affirmed the validity of the concepts and relations depicted in the model as well as its transferability potential to other complex contexts. The model's limits were also discussed. They are: time management for this model can be demanding, as stakeholders need to make themselves available for a few consecutive days and concentrate on a single project, and particular knowledge is needed to facilitate the model's operation. It was also discussed that flexible tools could be developed for the model in order to make it easily operational.

As a result of the positive response during this validation process, at this point no changes is made to the model.

### 3. Intensive workshop

To make the model operational, we designed an intensive workshop in which all stakeholders participate actively during an uninterrupted period of time. The workshop allows for collaborative learning opportunities (i.e. principles of usability, scenario making, iterative design process, etc.) that combine theoretical and practical aspects. It encourages joint reflective practice. During the workshop, the three layers, P, V and A become functional. The workshop includes :

- Tools to support knowledge sharing and team performance (i.e. visual representation of processes, instructions for creating personas and use scenarios, systems like wikis for contribution and access to information, etc.);
- Design activities which are used as a method to facilitate communication, common understanding and collaboration, (i.e. problem setting, sketching, prototyping, etc.).

Through the model and the workshop, we sought to build the particular sense and the know-how for the project, to enrich and harmonize the understanding of the users' needs and motivations, and to create conditions for interdisciplinary exchanges.

The dynamic and the productivity of the intensive workshop depend not only on how the workshop plays out, but also on the effectiveness of the designer as mediator. In fact, in this model, the designer is attributed the additional and central role of mediator that facilitates the convergence of disparate foci and ways of thinking.

To stimulate the emergence of team expertise, the workshop seeks to :

- Encourage contact between stakeholders;
- Incite knowledge sharing leading to a holistic perspective;
- Encourage critical thinking and direct feedback;
- Make resources readily accessible to all at the opportune moment;
- Advance the project in an efficient manner, on time, and while respecting the process.

The activities geared to support each workshop need to be carefully designed and facilitated by the designer. We believe that the designer is the most appropriate team member to accomplish these tasks because of his expertise in the following areas : she/he is trained to develop a holistic view of the situation despite its' wickedness and fuzziness; communicates visually; can diagnose problem areas; can rapidly develop mockups and prototypes that would be used as tools for helping teams exchange ideas. Referring to Cross [6, 7], she/he has a "designerly" way of thinking, knowing and acting.

#### 4. Conclusion

The intensive workshop supported by interdisciplinary attitude and joint reflective practice mirrored the theoretical model. We found that it is possible to encourage the design team in the early stage of the project, to approach the problem with a research stance, while keeping their focus on the end-users. When made operational, the workshop showed how communicating meaningfully through design helps collaboration. As discussed earlier, openness, sharing, trust, engagement and reflective practice, encourage this particular collaboration. The workshop also significantly reduced the development time, and added value to the project by becoming a sustainable design. This situation brings up the idea raised by Manzini [20] that the transition toward sustainability is by "a radical change in ways of being and doing".

As a result of our research, we believe that the designer needs to be trained for this new role that we call designer/mediator. Additional knowledge and a set of new skills will be required to enable the designer to organize and run the intensive workshop, facilitate the interactions among the team, facilitate the achievement of the needed attitude, keep the team focused on the goals, create a synergy and mediate the informal situation of learning and teaching.

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