EMPATHY: a conceptual framework for the design of enriched experiences

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Abstract

One of the greatest features of technologies has being to connect people remotely and

interactively. This social component has been mixing real with virtual in daily life and affecting

the way people behave. Studies approaching Presence and emotions have pointed that the line

between real and virtual tends to blur when users' emotions and feelings take place in mediated

interactions. By looking at users' experiences as the heart of those applications, we propose a

conceptual framework that connects human factors to application/technology. EMPATHY is the

acronym for the framework elements. With the EMPATHY conceptual framework we intend to

contribute to and support the design and conception of applications/technologies, while

considering human factors – such as mind models, emotions, physiological responses, as

determinant factors.

Keywords: Conceptual Framework, Design, Presence, Emotions, User Experience.

1. Motivation

By looking at users' experiences as the heart of applications, our motivation in this work is to

contribute to the design of enriched virtual interactions. As part of this human relevance, we will

construct a paradigm starting from Human-Media Interaction (HMI) to mediated Human-Human Interaction (HHI), since the latter has important social components added to it. The human-human interactions, either in face-to-face or mediated (through a medium), are conducted by emotions, feelings, behavioral responses, facial expressions, mental models. Those factors can be affected by the level of involvement between people that take part in the interaction. From the technological point of view, emotion is a topic often approached by researches in the field of artificial intelligence, by analyzing human behaviors in real situations aiming at the development of virtual humans or intelligent agents, robots, and so on. From the human point of view, emotion is a topic that has been extensively explored in psychology and sociology. However, in the context of mediated human interactions – for both HMI and HHI, emotion still is an underexplored topic. In the related literature, most presented frameworks are designed to support specific applications, or for the interaction between designer and users. By the lack of a conceptual framework that approaches Presence, mental models and emotions in the context of mediated human interactions, we propose a conceptual framework under the acronym of EMPATHY. This framework is elaborated and presented at an abstract conceptual level, by placing human factors as determinant factors to the design of those applications/technologies. The outline of the paper is as follows:

- in the next section we will discuss how emotions and Presence have been approached in virtual interactions and how this topic has been brought into design;

- in the following sections we will construct and propose the EMPATHY conceptual framework, by connecting human factors to applications/technologies, at an abstract conceptual level. This conceptual framework aims at giving support to the design of applications.

We intend to bring more awareness to the relevance of including human factors in the conception of applications.

2. Background

In the related literature, most of the frameworks were developed to support specific applications. Examples are the works of (Yu, Qin, & Wright, 2006) and (Rogers, et Al., 2002).

Other researches, such as: (Creed & Beale, 2008), (Katagiri, Takahashi & Takeuchi, 2001), (Lewis, 1998) and (van Welbergen et Al., 2009) focus on the design of human-agent interactions. The work called "A framework for empathy in design: stepping into and out of the user's life", developed by Kouprie & Visser (2009), introduces empathy in design as a process of four phases to give insight into which role the designer's own experience can play when having empathy with the user. Therefore, the goal of their work is to treat the empathy between the designer and the user of the application.

2.1. Presence, Emotions and Remote social interactions.

Some applied studies have approached affect and human-computer interaction in different contexts. Claire Dormann (2003) described theories and studies relevant to the evaluation of affective home applications, such as, interactive television programs, recreational shopping or home music services, in order to contribute to the development of other affective applications. In her conclusions, she highlights that usability might not be the most fruitful approach for the evaluation of affective home applications. Furthermore, she points out important aspects for future researches, as for example, to establish taxonomy of affective applications and to explore the relation between users, emotions and context.

A project developed by (Kaiser & Oertel, 2006) is an affective e-learning system using an emotion recognition sensor system, to enable a better learning as well as a greater satisfaction,

and supporting the user to handle negative emotions. The approach was a first attempt to build an affective e-learning system and allowed to draw that affective procedure needs to be adapted individually.

Other relevant projects are presented in (Liu & Picard, 2005) intending to illustrate the design of systems that are intentionally empathetic. The paper argues that by embedding empathy into interactive health assessment systems, it is possible to design for enjoyable, long-term interactions, and that those systems can play a significant role in creating a better user experience in human-computer interactions. As conclusion, they stated that the idea of embedding empathy into health technology systems that interact with people in ongoing ways can potentially be vital in the acceptance and success of these types of technologies.

Besides approaching emotion from the psychological point of view, Parkinson (2008) focuses on how the different communication media and modes of interpersonal contact affect the relation process. He concludes that the media constraints together with unnoticed mismatches between the participants can lead to failures in emotion presentation. The knowledge of the medium parameters and explicit information about the other's intention and affective stance helps to transcend limitations. In addition, he suggests that further research is necessary on the dynamic interpersonal processes of interaction in real time, for different media contexts.

Riva et al. (2007), in their study of affective interactions using virtual reality, had the main goal of analyzing the possible use of VR as an affective medium. A relationship between Presence and emotions appeared as consequence of previous study. By analyzing this link, they found a circular interaction between Presence and emotions: *the feeling of presence was greater in the "emotional" environments*; *the emotional state was influenced by the level of presence*. The authors also agreed that the role of emotions in mediated experiences has not been systematically

researched yet, although being of importance for the meanings of people experiences and for the way they can feel present in mediated environments.

Based on outcomes of cognitive sciences, Riva (September 2009) offers a view of Presence as a core neuropsychological phenomenon, and discusses in his framework the important role of intention in social presence. In conclusion, one of his suggestions is that "*the more the communicative task is complex, the more are the intentional levels that have to be supported by the virtual environment to induce a high level of presence*".

Järvelä S et al.(2016) investigated how providing socially utilizable information on two different components of emotion – expression and physiology, affected the emotional and social experiences of the participants, e.g., social presence. They got positive results and raised interesting questions for further investigation.

The studies above induce that bringing users' **mental** and **emotional** states to the context of virtual interactions can improve social presence. The importance of intention appears to be connected to the need of correctly transfer emotions.

Inspired by that, we raise key questions:

How would those components – mind states and emotions, be connected to media?

What would be a suitable way to transfer emotional components through media, in those interactions?

Intending to stimulate thoughts towards answers, we will construct and propose an abstract conceptual framework bringing users' mind states and emotions to the context of remote human interactions. We expect to contribute to the design of applications that will give relevance to those components by placing human factors and experiences as the heart of the application.

3. Towards a Conceptual Framework for Remote Interactions

As part of the human relevance in virtual interactions, we will build the framework starting from Human-Media Interaction (HMI) to mediated Human-Human Interaction (HHI).

3.1. Human-Media Interaction – HMI

HMI is referred to when the user is interacting with the application. To the level of more simple applications, it is the interaction of the user with an application interface. Or, for example, in 3D graphics virtual worlds, HMI can occur between an avatar and an agent; even intending to simulate a human-human interaction, this interaction happens between a person, represented by his/her avatar, and the agent or bot, a 100% computer program; although both can apparently have the same looks. The HMI paradigm is represented in Figure 1.
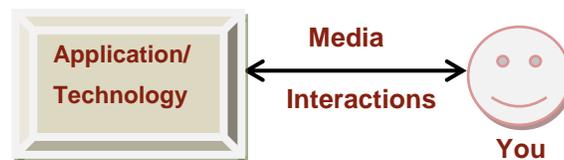

Figure 1. Human-Media Interaction paradigm

Let's take the virtual world example. In order to evoke the users' feeling of being present in the virtual environment and/or to enrich the interaction with the virtual partner/agent, the HMI paradigm should consider some users' mental models components. To represent the user mindset, we will introduce an entity to the diagram that we called **Mind**. This concept representation is to create a connection of the user' mental models with the application, and will bring new parameters to the interaction context. However, in terms of conception and design, it is more functional if one analyses separately which are the parameters to afford the user interaction with the media itself – that we called **Media Interactions** features, and which would be the features to support the user mindset – that we called **Media features for Mind**.

Both, Media Interactions and Media features for Mind connections are incorporated to the

Application in order to afford Presence and to enrich the HMI experience.

Figure 2 illustrates the aggregation of Mind parameters to the HMI paradigm. Under this

approach, we will introduce a subtle line delimiting the users' perception of what is real and

virtual, represented by the dashed vertical axis in Figure 2.
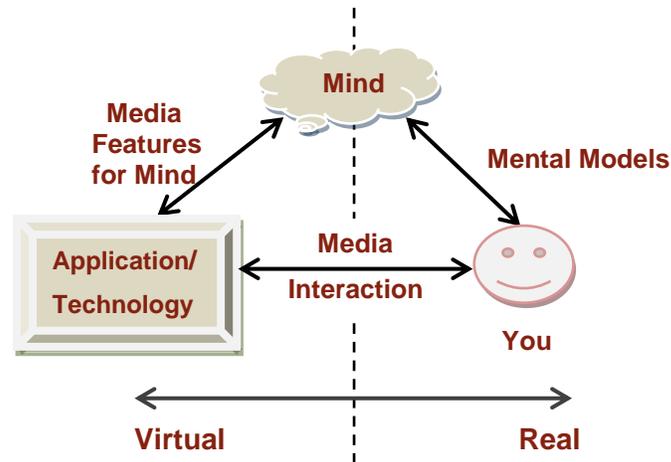

Figure 2. HMI and Presence

To illustrate how this paradigm could be mapped to practice, let's consider the example of a

virtual reality application for phobia treatment. The three entities are: the patient (**Human**), the

virtual reality system (**Application**), and the patient's condition to be treated (**Mind**) represents

the connection of the patient's needs and mental models with the system.

The users' mental states, such as fears, phobias, are represented by the **Mental Models**

connection.

The **Media Features for Mind** should be implemented to afford the mental involvement of the

user with the application; the type of activities the user will be able to perform to support his

treatment – for that, it will be necessary to incorporate the knowledge of the therapist and the

professional requirements for the treatment; how much of mental immersiveness will be afforded there.

The level of user interactivity will be a function of the **Media Interactions** quality, such as the realism of the environment, tools for interactions, etc. The Media Interactions will also include devices like VR headsets, data gloves, sensors or any other interface apparatus necessary to provide the users' connection with the application.

Both connections, the Media Interactions and the Media Features for Mind, will be responsible for the successful Presence experience of the patient and, therefore, to contribute or not for positive results in the patient's treatment. The users' feeling of Presence and engagement can work as a trade-off between reality and virtuality, as it will be discussed further.

3.2. Mediated Human-Human Interaction – HHI

Now we bring the inclusion of a remote human being to the interaction context, which will double the components described for the HMI approach, in Figure 2. Consequently, the interaction process becomes more complex due to the addition of new variables.

Figure 3 illustrates the inclusion of a remote Human for the mediated HHI approach. Because the users will interact with each other, there will be a relationship between the participants to be considered in the application context. For that reason, an extra connection must be introduced representing that **relationship**. As consequence, the emotions and feelings of the participants are then dependent variables of the relationship between the users, which we represent as follows:

$$Relationship = Function \{emotions, feelings\}$$

Looking at Figure 3, we see that the paradigm of Figure 2 is doubled, keeping the concept described before.

Under this model, the Media Features for Mind allows customization for each user, if they have

different functions inside the application, or different permissions, as it can happen, for example,

if one user is a therapist and the other is the patient. Besides people being different in mind,

feelings, and abilities, people should be able to play different functions inside the application,
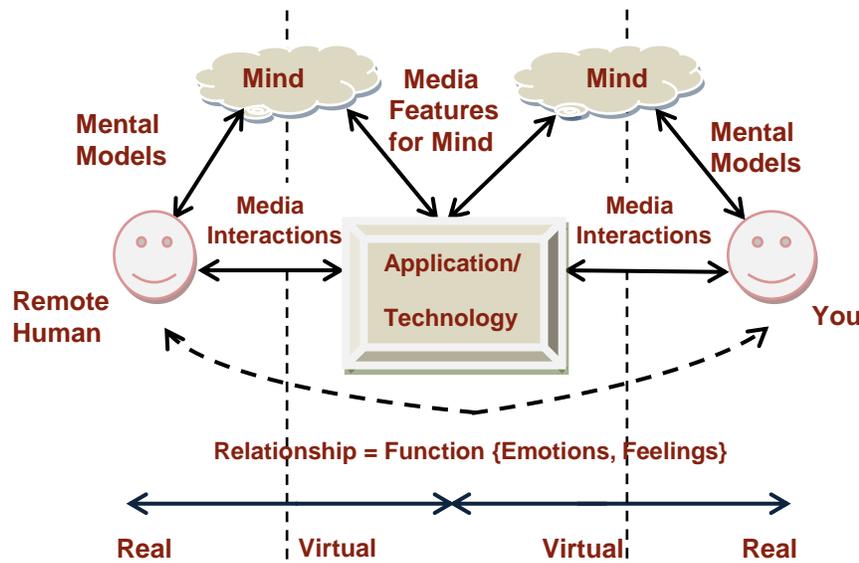
when required.

Figure 3. Human-Human Interaction through media

The Media Interactions features, in opposite, can remain the same for most applications, even

with the inclusion of a second user.

However, Figure 3 shows that the relationship between the users, which brings emotions to the

interaction context, is not connected to the application.

This fact makes necessary to create a connection between the new component – **relationship**,

and the application/technology, in order to afford the transfer of emotions and feelings between

participants. The connection of this new element, **Emotion**, in the structure described above will

complete the conception of our framework under the acronym of EMPATHY.

4. The EMPATHY Framework

The psychological definitions of Empathy, summarized in the work of Kouprie & Visser (2009),

involve the cognitive mechanisms that are part of users' mind models and the affective

mechanisms inherent to users' emotions.

By introducing the Emotion element to the framework, it will then allow to bridge the mind and

emotions of users to the application/technology, by using two split connections. We call it the

EMPATHY framework.

The aim of the EMPATHY conceptual framework is to give support to the design of

applications/technologies, by helping to clarify ways on how to treat those two complex branches,

users' mental and emotional models, with specific approaches. Figure 4 illustrates the EMPATHY.
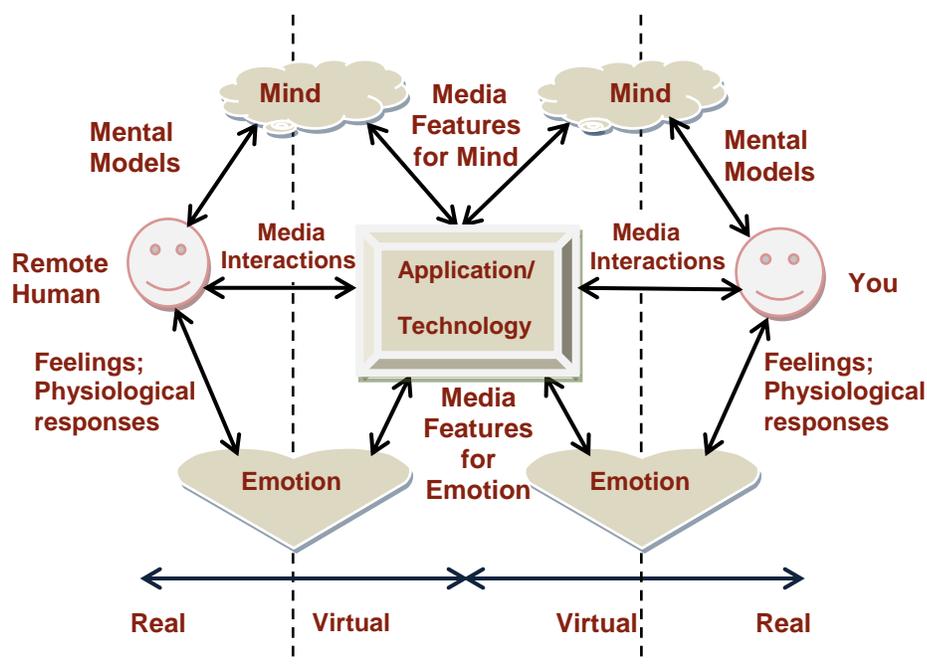

Figure 4. The EMPATHY conceptual framework

The entity **Emotion** is representing the users' emotional states, such as feelings and

physiological responses. The application should now include features to process those

information, which we called **Media Features for Emotion**.

4.1. The E-M-P-A-T-H-Y acronym elements.

The EMPATHY acronym has seven elements. Five of them are variables related to human factors and the other two are variables related to media (Applications/Technology). The description of the acronym EMPATHY is:

E – represents **Emotion –** feelings, physiological responses that take part when You interact with another Human being; the Media Features for Emotion are to support and bridge those human responses to the Application.

M – represents **Mind –** the relevance of mental models like perception, attention, intention, cognition, trusting, belief, during those interactions; the Media Features for Mind are to support and bridge the users' mind states to the Application.

P – represents **Presence –** either the sense of being in a virtual environment (depending on the application) and/or the sense of being connected to someone and sharing the same experience; the both, Media Features for Emotion and Media Features for Mind are to afford Presence and therefore affect the level of users' engagement.

A – represents the **Application** – what is the context of the interaction, and the technical resources available to afford the experience.

T – represents **Technology** that was developed/applied to support the Application.

H – represents the remote **Human –** the person with whom You are interacting.

Y – represents **You**.

The structure of the EMPATHY conceptual framework allows considering the individual differences of users during the design of applications; it gives flexibility to conceive different forms of interactivity related to Presence, either physical presence or social presence. In function of the application, it can be emphasized more of the physical presence or of the social presence,

which mental models and witch kinds of emotional interactions will be supported in the application context.

4.2. The EMPATHY framework connections

Media Interactions – represent the interactions between users and the application. Examples of those features are – level of immersiveness, real-time responses, synchronous or asynchronous communication, type of interface, and the physical devices necessary to afford those interactions. Observe that the Media Interactions features will not necessarily be affected by the introduction of a second human to the application;

Media Features for Mind – those are application features to support users' mind states – mind models like perception, attention, intention, cognition; how the users will be able to feel immersed, connected to each other, and to communicate their mind states; or even not acknowledge the existence of the media. The belief or disbelief, mental involvement, attention during this interaction will now work also in function of the connectedness between the users. Important is to remark that the Presence experience, as a subjective experience, will possibly vary across individuals.

Media Features for Emotion – those are application features to support users' emotional states – sociability, involvement, level of intimacy during the interaction; how the users will be able to feel close to each other and to communicate their emotional states; or even not to acknowledge the existence of the media between them. The happiness or disappointment, satisfaction or frustration will work also in function of the connectedness between the users.

Both, **Media features for Mind** and **Media features for Emotion**, are meant to support Presence. It can contribute to increase or decrease the user's engagement. Those features will allow the user to feel involved with the experience, to express intentions accurately, to transfer or

feel trust; it should afford the transfer of users' emotional states during the interaction; those features should support feelings like arousal, disappointment, happiness, by allowing the user to feel he/she could express the feelings successfully, and feel present either with the other person or in a virtual environment. Not less important, a wrong Media Feature can absolutely break the Presence experience.
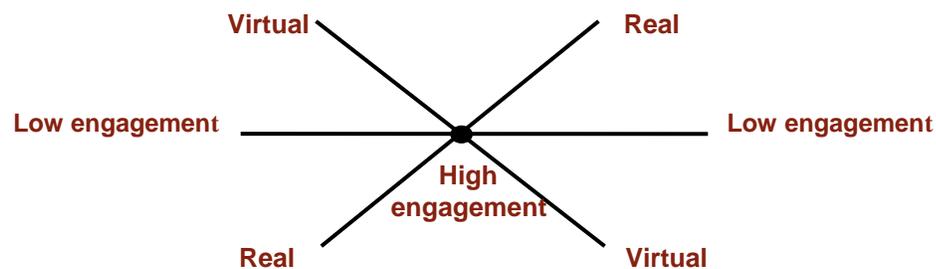
In resume, under this structure of the EMPATHY framework, the Application/Technology has to deal with features for users' interaction with media, for users' mind models and for users' emotions, in order to promote an enriched experience.

4.3. The trade-off between real and virtual

Looking back at the EMPATHY framework in Figure 4, the Mind and Emotion entities are crossed by dashed vertical axes, which represent the delimitation of the subtle boundaries between real and virtual, for each individual.

With the interpretation that what goes closer to the person/environment is the reality, and what goes closer to the media is the virtuality, it is possible to infer that the level of engagement of users' mind and emotions during the interaction will influence the users' perception and feelings related to virtuality and reality.

In order to illustrate this aspect, the Figure 5 represents this trade-off between real and virtual, as a function of user's engagement.

Figure 5. Trade-off between real and virtual as a function of users' engagement

This representation suggests that as more engagement the person can feel in one experience, as more the boundaries between reality and virtuality can become faded.

Taking this correlation to the EMPATHY framework, we make the following interpretations:

- *when the mind models (such as perception, cognition, attention, intention) are pretty apart of the experience, it becomes more evident what is real and virtual to the person, causing low engagement;*

- *the level of emotional involvement and connectedness with the remote person would influence the perception of reality and virtuality.*

Summarizing those interpretations, the trade-off between reality and virtuality can be seen as a function of mental states, emotions, and media features:

 Trade-off between reality versus virtuality = Function {mental states, emotions, media features}

In the next section, we describe an application scenario build on top of the EMPATHY framework conception.

5. An application scenario supported by the EMPATHY conceptual framework

The EMPATHY is an open conceptual framework that intends to support the design of a large number of applications for different technologies.

The scenario described below intends to inspire the conception of applications under the EMPATHY conceptual framework approach, and call attention to the relevance of including human factors in the process of design.

Since we started using examples of virtual environment application for phobia treatment, the scenario below is elaborated over the same idea – a 3D graphics system to support virtual exposure therapy.

Sam has a social psychological disorder. It is time to meet his psychologist at his virtual exposure therapy section. Sam attaches sensors to his wrists and heart before entering the social virtual environment (VE). In the VE, he meets his therapist, better saying, his doctor's avatar. The doctor supervises Sam and helps him to interact socially with other people in the VE. The sensors send real-time information of Sam's physiological changes to the doctor. Besides, the system works with a thermal camera that detects the changes in Sam's skin. The doctor receives visual information through the Sam avatar. Each time Sam's physiological signals alter, and he experience reactions – like blushing, or heart racing, the doctor sees different rendering colors on the specific regions of Sam's avatar body. The doctor also receives the data provided by the sensor measurements. Indeed, because of special features of the system, which treats individual needs, only the doctor can see the looks alterations of Sam's avatar. Therefore, the doctor can follow the precise social situations that make Sam to feel uncomfortable when interacting socially. By the other hand, Sam feels more confident to act in that environment, knowing that he is not been directly exposed to others in his limitations and that his doctor can support him at anytime privately. The system also provides to the doctor the necessary feedback and good ways to support and assist Sam interactively.

The application described in the scenario above gives support to the transfer of emotions, mental states, and to the feeling of Presence between the remote users. An important feature of the system is that it preserves the privacy of the patient, and treats his social phobias aspects with individuality. Also, the system provides different forms of media interactions, both to the doctor and to Sam. Those features are in accordance with the EMPATHY framework concept.

6. Discussion and Directions

With the EMPATHY conceptual framework, our main goal is to stimulate the conception and development of applications that will focus more on individuals, and put the user in the heart of the design. By splitting the media channels into Media Interactions with user, Media features for Mind and Media features for Emotions we expect better affordance for Presence.

The concept helps to highlight the possibilities of analyzing components separately, thinking in modules, to know which models and features would be involved at each step, and to set up more relevance to specific processes during the conception of the application in focus.

The presented analysis also emphasizes the relevance of mind models and emotion factors for the project of the future media.

Based on that, we like to pose the following questions for further research:

- *In what extent emotional components are factors responsible for the blurring between reality and virtuality, in remote social interactions?*

- *When the social component strengthens, would the perception of virtuality tend to go down?*

If we look to the past, end of years 90's, how much had the technology evolved from there to now? It is huge. However, comparing the ICQ chat from that time, later the MSN, and now Whatsapp on Smartphone, they are pretty the same, all have used and keep using the same emoticons through decades.

- *Would the relation between intention versus emotion, and the need to correctly transfer those elements, be the reason for which **emoticons** are so successful in the use of the available media in remote interactions?*

7. Conclusions

By the lack of a conceptual framework that approaches emotion and mind models in the context of mediated human interactions, and from the motivation of bringing human factors and application/technology together, we proposed an abstract conceptual framework under the acronym of EMPATHY, in which human factors are placed as determinant factors to the design of applications/technologies.

EMPATHY is an open conceptual framework for mediated human interactions, which specially offers the possibility of approaching emotion and mind models separately by two split channels. The concept represented by the EMPATHY framework can be applied to a large number of applications in the context of social interactions.

As part of the framework elements, Media Features for Mind were introduced as the component necessary to bridge the mind (mental states) of users to the media; Media Features for Emotion were introduced as the component necessary to bridge the heart (emotions and feelings) of users to the media. That way the media channels were split into **Media Interactions** for user, **Media Features for Mind** and **Media features for Emotion**. All that together intends to better afford Presence.

And finally, with the conceptual framework EMPATHY we want to bring more awareness to the relevance of the appropriate inclusion of human factors in applications, in order to promote successful enriched users' experiences.

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