

# Evaluating UX - Case Studies in Socio-enactive Scenarios

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## ABSTRACT

The current omnipresent and immersive technological scenario presents new forms of interaction. In this context, user experience (UX) evaluation becomes even more complex. In this paper, we use two known methods to evaluate UX in three scenarios with ubiquitous and comprehensive features that are embedded in the socio-enactive project. The AttrakDiff method evaluates hedonic, pragmatic and attractive qualities, while Emoti-SAM evaluates emotional aspects, considering that these are relevant to UX. Both methods were adapted to the context of the scenarios. The results showed that the adaptation of the methods as well as the triangulation of the data was useful to evaluate the UX in the analyzed case studies.

## Author Keywords

User Experience Assessment, AttrakDiff, Emoti-SAM, Pervasive Scenarios, Ubiquitous Scenarios.

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## INTRODUCTION

User Experience (UX) has been widely disseminated and accepted in the Human-Computer Interaction (HCI) field of studies. Among the definitions of UX, in this work, we will adopt the definition of ISO 9421-210 [9] that defines it as: "the perceptions and responses of a person resulting from the use or anticipation of the use of a product". According to [6], the main pillars of UX are hedonic qualities, which refer to pleasure, and pragmatic qualities. Väättäjä [17] saw the UX somewhat more broadly: the author defines it as the user's impressions and reactions resulting from the user's interaction with the system, the tangible results of the system's use, the activity and the context in which the interaction exists.

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For Hassenzahl and Tractinsky [11], experience is a consequence of the internal state of the user, that is, while for someone the use of a product can be an entertainment, for another it can be an instrument for accomplishing a task; by changing context the same user can perceive the task as fun.

We can see that UX is associated with a wide range of diffuse and dynamic concepts, including emotional concepts, affective, experiential, hedonic and aesthetic variables. Just as there is no formalization of all aspects involving UX, there is no specification of how to evaluate that experience. This difficulty may be related to the heterogeneity and diversity of people's experience. Nevertheless, there is agreement on aspects such as hedonic quality, pragmatic quality, attractiveness, pleasure, mastery, among others, as relevant aspects to the experience as a whole [6].

Given the relevance of UX in terms of interaction with technological devices, it is clear that it must be considered in interaction with technology in contemporary contexts, such as those of ubiquitous and pervasive computing, which have arisen over the last years. Weiser [22] referred to Ubiquitous Computing saying that "the deepest technologies are those that disappear. They intertwine with daily life until they become indistinguishable from it. Thus, one of the challenges for UX studies is how to evaluate experience in such pervasive interaction.

Within this perspective, this work is situated in the context of a research project, which investigates new dimensions in the interaction design mediated by information and communication technologies in socio-enactive scenarios (FAPESP Thematic Project (2015/16528-0)) [2].

The presence of these new technologies and new forms of interaction (tangible, wearable and natural interfaces) coupled with the absence of visible interfaces makes the experience more difficult to evaluate with traditional methods.

In this work, we investigate the use of UX evaluation methods to assess the experience of users in three different scenarios with ubiquitous and pervasive characteristics, in which are part of the socio-enactive project. For this study, we selected two different instruments: the AttrakDiff [5] and the Emoti-SAM [7]. The AttrakDiff was selected to evaluate the pragmatic and hedonic dimensions of the user experience, through a questionnaire containing pairs of words that are semantic differentials [5]. The Emoti-SAM [7], a pictographic tool that uses emoticons, was selected to collect affective responses of users to their experience within

the scenarios. Both methods were adapted to the context of the different scenarios.

This work is organized as follows: The next section presents an overview of the socio-enactive systems, where the three case study scenarios are located. The methods used in the evaluations of UX: AttrakDiff and Emoti-SAM are presented, which served as a basis for the evaluations. Also, in this section, we contextualize the Evaluation of UX with children. The following section presents the case studies carried out, showing the three real scenarios to which, the methods were applied, the methodology used in the evaluation and the results. Then we synthesize and discuss the results. Finally, we conclude and suggest future work.

## BACKGROUND

### Socio-enactive Systems and Evaluation of UX

In the past, computer use was confined to the organizational environment and the performance of well-defined tasks. Currently, digital technologies are present in many areas of our lives and are used for a variety of purposes.

The ubiquitous technological scene has brought with it new forms of interaction. These interactions have become spontaneous and natural, in the sense of being infiltrated in the physical scenario. According to this new panorama, the concept of "enactive system" may be more appropriate to the current technological scenario. According to Kaipainen et al. [10], traditional interfaces (i.e., those based on input devices like mouse and keyboard) are not adequate to enactive systems, which do not follow patterns of goal-oriented interaction models and conscious human actions. The main argument is that the interactions involve the body as well as the presence of people in the environment as input elements. Therefore, an enactive system must have the ability to collect information during an interaction and respond accordingly. Consequently, new user reactions generate new inputs to the system in a dynamic cycle.

Thus, based on Kaipainen et al. [10], the enactive systems are defined as computational systems constituted by human and technological processes dynamically linked, that is, forming loops of feedback using sensors and data analysis, allowing a perfect interaction between the human and the computer. The socio-enactive systems project is exploring the social nature of mutual influences of interaction, among the people in the enactive cycle [2].

Invisibility, the lack of conscious actions and the inclusion of technology in the user's natural actions, create potential challenges, above all, for the evaluation of UX. In addition to the complexity implicit in evaluating UX in its entirety, mainly due to its heterogeneous nature, evaluating UX in current interaction scenarios questions the ability of existing evaluation methods to assess UX in these scenarios.

### AttrakDiff

One of the best-known user experience evaluation methods is the AttrakDiff questionnaire, developed by [5]. AttrakDiff consists of a measuring instrument in the form of semantic differentials. It consists of 28 seven - step items whose poles are opposing adjectives (eg "confused - unclear," "unusual - common," "good - bad"). Each set of adjective items is ordered on a scale of intensity.

Each of the mean values of a group of items creates a value for pragmatic quality (PQ), hedonic quality (HQ) and attractiveness (ATT).

The Pragmatic Quality Scale (PQ) has seven items each, with bipolar "bases" that measure the pragmatic qualities of the product. This includes "bases" such as Technician-Human, Complicated-Simple, Confused-Sure. The hedonic quality is separated into two subgroups, HQI and HQS. HQI has anchors like Isolator-Integrator, Cheap-Valuable. HQS has anchors like Typical-Original, Cautious-Courageous. The Attraction Scale (ATT) with anchors like ugly-handsome and bad-good. The anchors are presented on a scale ranging from -3 to 3.

### SAM and Emoti-SAM

The Self-Assessment Manikin (SAM) [3] is a tool for assessment of affective states, that uses the PAD model in its three dimensions: Pleasure, Arousal and Dominance. The fact that it is a pictographic and non-written tool makes it accessible to children, for example. An advantage is that, by not labeling emotions with words, SAM is not confined to a specific language or requires translation.

The first SAM line (Figure 1) shows the varied range of emotions in the dimension of pleasure, with the manikin faces ranging from a smile to frown. The second line represents the arousal dimension, going from excited to drowsy. Finally, the last line represents the feelings of dominance, with the largest figure representing a dominant and in control of the situation manikin, as opposed to very small, submissive and without control of the situation

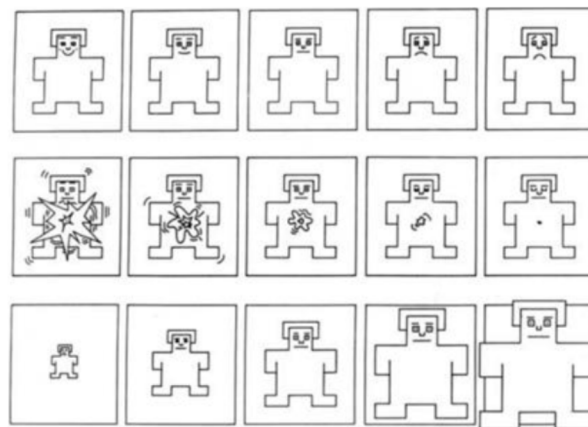


Figure 1 The Self-Assessment Manikin form [3]

SAM has been used in several contexts; for example, in the eCidadania project [1] the tool was used to access the affective responses of illiterate adults in a scenario of digital and social inclusion. Participants interacted with the prototype of a system and assessed how they felt about this system using SAM.

The works of Hayashi et al [7], [8] were part of a study on affective quality assessment of educational systems designed for children. SAM was used to evaluate the affective responses of children after different situations of use of technology. Results of the work [7] showed that improvement possibilities were noticed, and adaptations were suggested resulting in different versions of the SAM tool. One of the consequences of the studies was the substitution of each original SAM figure to a corresponding emoji or emoticon - similar to those commonly used in social networks and instant communication applications. Figure 2 illustrates the Emoti-SAM.

The Emoti-SAM consists of 15 emoticons, representing the three dimensions: pleasure, arousal, and dominance. Each line represents a dimension with 5 emoticons that vary in a scale of 5 points, going from the most positive to the most negative - or the opposite, for the domain dimension. In the dimension of pleasure, the most positive option is the happy face with the thumb up, while the more negative portrays a rabid face with the thumb down. In the excitement dimension, the most positive choice portrays a happy face with hearts and bulbs around representing excitement and inspiration; the most negative response brings a face with closed eyes, simulating someone sleeping or bored. In the dimension of the dominance, the representation sought to translate the sense of dominance in the sense of ease and mastery of the subject (Emoticon representing intelligence, with graduation hat) or difficulty of use (Confused Emoticon) [7].

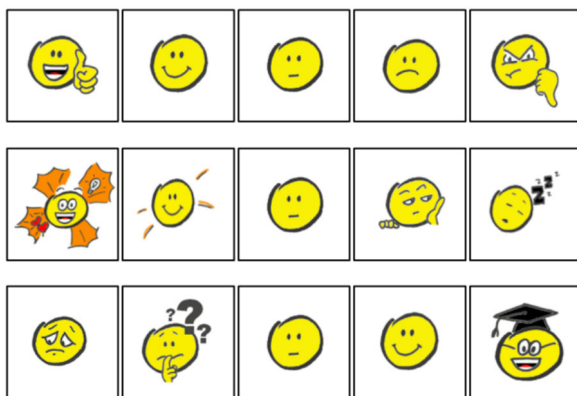


Figure 2 Emoti-SAM [7]

### Evaluation of UX with Children

Studies on UX assessment with children are rare. This may be due to the fact that researchers are still looking for suitable methods to collect data from children directly [18].

To suggest design improvements regarding usability or user experience, care must be taken in drawing conclusions about behaviors and reactions from children. One should always critically question whether children's enthusiasm is truly caused by a positive experience and not, for example, by the fact that, in general, people are more likely to report positive product emotions than negative emotions [15]. For example, in investigating the inner ratios of small children, it is argued that they will tend to evaluate internal attributes rather than external ones and often exaggeratedly [4]. Miller and Aloise [12] argue that these internal reasons do not reflect the actual outcome of events that occur, but those that can be generalized for many situations.

In order to circumvent these problems, several techniques are used to capture real feelings when it comes to children. According to Reynolds and Gutman [14], it is necessary to make a concise introduction to everything that will be done during the interview, activity or evaluation. Although it is obvious, it is necessary to speak clearly and repeatedly if necessary. Other examples of how to obtain genuine responses from children are to use a vocabulary adapted to their context [20].

We understand the challenges posed by UX's assessment, especially when evaluating the experience of children with technology. In this work, we try to adapt the methods that were used in the three scenarios of case studies. For example, when using Emoti-SAM, we distribute the emoticons in a wooden box, without separating the dimensions and without the gradual presentation, thus avoiding bias. In the museum case study, a relaxed environment was created, and the children were encouraged to respond honestly to the issues and assert that there were no correct answers.

### CASE STUDIES

In this section we present the three scenarios in which the study was conducted.

#### Scenario 1: UX and the Magic of Science The workshop

The workshop entitled "The Magic of Science", took place on April 21, 2018, at the Exploratory Museum of Sciences of the UNICAMP. It counted on the participation of fifteen children and four adults who made previous inscriptions. The children's parents were also invited to participate. The length of the workshop was two hours and thirty minutes. Three phases made up the workshop, followed by the UX evaluation:

**Exploration:** In this stage, children explored three interactive installations: the Maned-Wolf, the Memotion and the Monolith. the Maned Wolf artifact is a wolf-shaped artifact, presented with some "hidden" buttons and sensors along its body, which when pressed or touched reveal specific information about the species. Memotion is a black sensory box with textures inside, which evoke emotions and displays videos associated with Internet memes. Inside the box, six buttons covered by different textures (for example,

rough, soft, sticky) when a texture is touched, a related meme is displayed, along with a corresponding sound. Memes and sounds are randomly selected from a collection of 10 memes and 2 sounds for each emotion. A miniature Monolith, in reference to Kubrick's 2001 A Space Odyssey, is an artifact proposed to interact with scenes from that film. While interacting with the monolith, psychedelic images of the film are projected to the audience, in a loop sequence, using a spherical projector. An accelerometer and a gyroscope capture motion are used to control the projection.

**Construction:** participants built an artifact that could be taken home; the artifact basically consisted of: a led connected to a sensor and a battery, which lights up when approaching a magnet. Participants were urged to meet a character from the Harry Potter film, Mr. Olivaras, through the presentation of a short excerpt from the film, in order to arouse curiosity about magic. They were encouraged to create a 'magic potion' which, when approached by the magnet, a led is lit inside a container given to participants as part of an artifact construction kit. In this case, the magnet was embedded in a wand (magic) alluding to the wand of Harry Potter.

**Reflection:** Participants, parents and museum stakeholders who participated in the workshop were invited to reflect on the interaction with the artifacts, with questions about what would be behind the artifacts experienced, and how they believe it would be a museum with interactive arts.

### UX Evaluation

At the end of the workshop, participants were invited to respond about their experience with the workshop as a whole. A questionnaire printed and adapted from AttrakDiff was used.

The AttrakDiff questionnaire was translated to Portuguese and adapted to expressions closer to children. The adaptation also involved the reduction in the number of pairs of words in each category (pragmatic, hedonic, attractiveness), pulling out those pairs considered less suitable for the context of the workshop. Figure 3 shows the questionnaire in its adapted form.

The last step was to enter the data with the responses of the participants in the online tool (at <https://esurvey.uid.com/survey>) (The data of the pairs of words removed were entered with value zero (0), therefore it did not interfere in the general results.). No questions were asked directly to the participants about the method or the workshop.

Com a ajuda dos pares palavras, aponte o que você considera a descrição mais apropriada da Experiência.

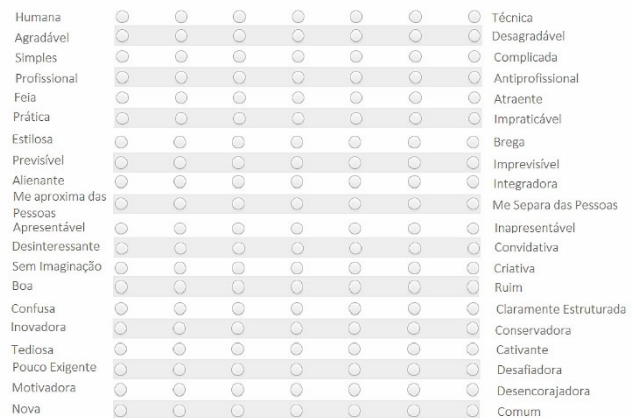


Figure 3 Adapted AttrakDiff Questionnaire

### Results

#### Diagram Description of word pairs

This diagram shows the mean values of word pairs. Extreme values are of particular interest.

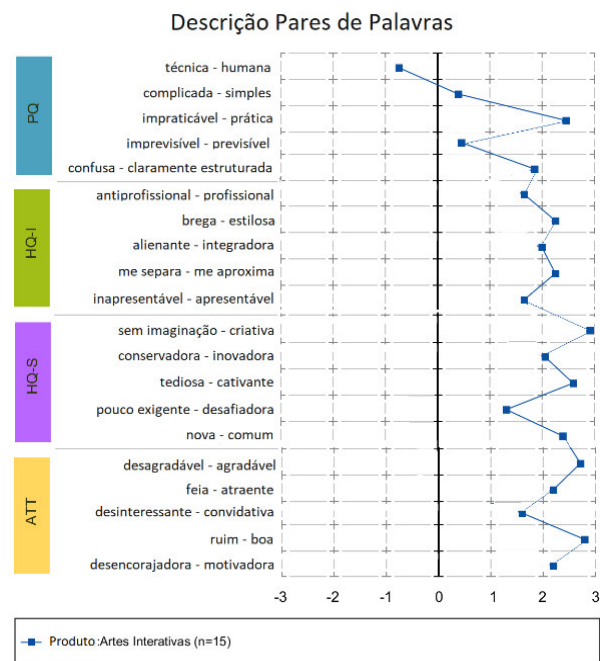


Figure 4 Diagram Description of word pairs Museum Scenario

Regarding User Experience, Figure 4 shows that the line formed by the blue dots link is located significantly to the right, which indicates an excellent experience. The graph shows that the Pragmatic Quality (PQ) in the pair technical - human was the only item positioned to the left of the center line, which indicates that most respondents considered the experience to be more technical than human (the contact of

the participants with technology seems to have prevailed in the experiment).

For Hedonic Quality - Identity (HQ-I), Hedonic Quality - Stimulation (HQ-S) all items are located to the right of the line highlighting the 'unimaginative-creative' ('sem imaginação-criativa' in the free Portuguese translation) items, 100% of the respondents opted for creative.

The users' perception about the attractiveness (ATT), presented all the items positioned to the right of the line with highlight to the adjectives 'bad-good' ('ruim-boa'), where the majority considered the experience as good. In general, the workshop was considered very attractive.

### Results Portfolio

The results portfolio (Diagram of Figure 5) shows the positioning of the mean values of the dimensions: Pragmatic Quality, and Hedonic Quality. The representation of Hedonic Quality values is done vertically, and those of Pragmatic Quality horizontally. The diagram contains the following quadrants:

**Self-oriented and very self-oriented:** A self-oriented or very self-oriented product has high hedonic quality, and low or medium pragmatic quality.

**Desired:** The strong combination of hedonic and pragmatic attributes indicates that a product is desired; that is, it has high hedonic quality and high pragmatic quality.

**Neutral:** Indicates that the experience does not present a significant degree of pragmatic and hedonic qualities.

**Task-oriented and highly task-oriented:** The task-oriented results emphasize the pragmatic qualities of an experience are linked to functional objectives while having low or medium hedonic quality.

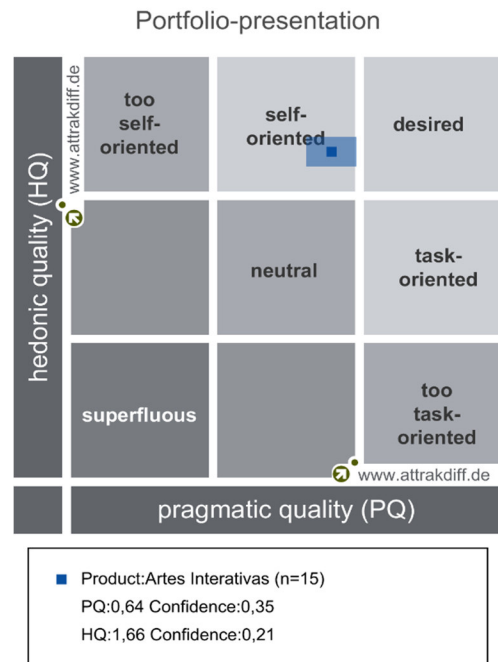
**Superfluous:** Implies a result in which the experience does not satisfy the pragmatic or hedonic needs of potential users; most likely both groups of attributes will not be in equilibrium [6].

The results are interpreted according to the definitions of the quadrants. In the diagram of Figure 5 two blue rectangles are shown, the smallest and darkest represents the mean value of the study dimensions with respect to the user experience, the larger and lighter represents the confidence interval. The rectangle's size shows how much users' opinions converge or diverge. The larger this rectangle, the more divergent the opinions are. These rectangles are used to identify the general location of the responses.

The workshop was evaluated as self-oriented, with high hedonic quality, according to Figure 5. The two rectangles are fully located in the self-oriented quadrant. Reflecting greater convergence between opinions (The results were obtained by means of the tool).

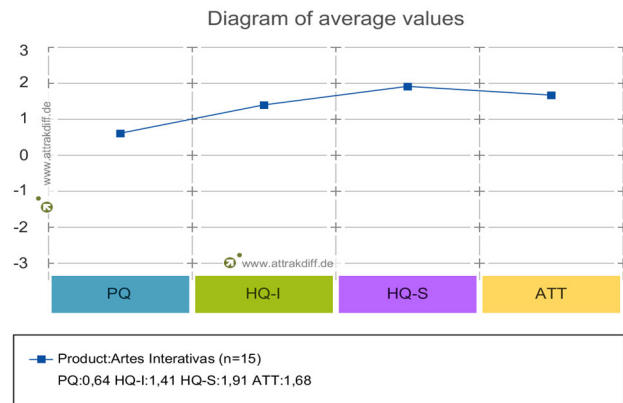
In terms of pragmatic quality, the experience was evaluated positively (0,35). Regarding hedonic quality, the results

show that the users were motivated in relation to the workshop (with a confidence interval (0.21)).



**Figure 5 Portfolio of Results Museum Scenario Diagram of Average Values**

The diagram of average values distributes the mean values assigned by the participants in the dimensions Pragmatic Quality (PQ), Hedonic Quality - Identity (HQ-I), Hedonic Quality - Stimulation (HQ-S) and Attractiveness (ATT).



**Figure 6 Diagram of Average Values Museum Scenario**

The Pragmatic Quality (PQ) indicates the degree of success in achieving the objectives. Figure 6 shows a score of 0.64 in the user experience, indicating that in general, the result is positive.

Hedonic Quality - Identity (HQ-I) indicates the level of identification of the user with the workshop and obtained a score of 1.41, indicating that there was a good identification.

The Hedonic Quality - Stimulus (HQ-S), which measures whether the experience is original, interesting and stimulating, obtained a score of 1.91, the highest classification among the categories.

Attractiveness (ATT), which indicates how attractive the product is to the user, scored 1.68. Likewise, it shows positive results.

### Evaluation with Emoti-SAM - Museum Scenario

To triangulate the results obtained by AttrakDiff, an evaluation was performed in parallel using the emoti-SAM [7] adapted in its application procedure. The emoticons were printed in colored cards and arranged in a wooden box with no explicit structure for the dimensions. This mixture of the cards was made to avoid biased evaluations.

### Procedure




The evaluation with Emoti-SAM was carried out after the workshop "The Magic of Science. The emoticons were printed on cardboard paper and arranged in a wooden box (without the separation of dimensions). Participants were invited to choose one or more "faces" or emoticons that represented their experience with the workshop. All the participants were very enthusiastic to choose a card. The chosen emoticon should be placed in a voting urn that was located next to the box, to be counted later.

### Results

The figures entered in the urn were counted manually, all children who participated in the workshop chose one emoticon, although it was mentioned that they could choose more than one.

We collected 15 emoticons (one per participant); of which two belong to the pleasure dimension, with the most positive response, which would be smiling face with thumbs up. Ten selected emoticons belong to the excitement dimension, all of them being the most positive response in that dimension, i.e. the face with drawings of hearts and bulbs around. Three emoticons belong to the dominance dimension; similarly, the most positive response: hats with graduation hat, as shown in Table 1.

**Table 1 Emoticons Collected – Museum Scenario**

Emoticon	Quantity
	2
	10
	3

All the emoticons collected in all dimensions are the most positive responses in each dimension.

These results suggest that the children had a pleasant experience, which provoked remarkably positive affective responses in the three dimensions (pleasure, arousal, dominance). In this way, you can see that there is consistency between AttrakDiff and Emoti-SAM results.

### Scenario 2: Assessing UX in School Context with a Narrative The Workshop

The workshop was held with teachers and children from the Division of Early Childhood and Complementary Education of UNICAMP, which is a socio-educational space for children of employees and students undergraduate and postgraduate courses of UNICAMP. Two workshops took place on May 22, 2018, in the morning between 09:00 and 11:00 and in the afternoon between 15:00 and 17:00. In total 26 children participated, 12 in the morning and other 14 in the afternoon, aged between 4 and 6 years.

The workshops context was the "Little Red Riding Hood" fairytale, that was adapted with a robot (mBot) playing the wolf. For the workshop, with their bodies in movement, the children had to conduct the wolf to Grandma's house, that was a laboratory in which the wolf could be fixed. In this way the children would represent rangers guiding the wolf to Grandma's laboratory. The goal, therefore, would be for the children (forest rangers) to be able to take the wolf (mBot robot) to the laboratory (Grandma's House). Should this occur, a series of applause would be emitted. However, if the wolf left the scene, it would indicate that he would be lost. In this situation, sounds that symbolize a car crash would be emitted. The scene was delimited by a set of EVA blocks (green color, representing the forest), surrounded by black blocks indicating the end of the forest, and containing a small black circle in the center, representing Grandma's laboratory. The robot was programmed to walk continuously forward until it encounters an obstacle. In this case, it recedes a few centimeters, rotates 45 degrees to the left or right and continues its movement.

The workshop consisted of 4 steps:

**Step 1:** Presentation of the scenario and narrative. The children were gathered in a circle and an audio was played narrating, from the perspective of the wolf, the scenery.

*"Hello, little friends! Today I want to tell you the story of Little Red Riding Hood, in my version of the wolf, of course. I'm a robot wolf. I'm not made of flesh and blood. I'm made of steel. One fine day I was strolling through the forest when I saw Little Red Riding Hood passing with a basket full of screws, gears, and sensors. I talked to her and learned that her grandmother was a great inventor and she was taking this material to build something in Grandma's lab.*

*I was very curious, but I forgot to ask where Grandma's lab was. I also did not find the lab by GPS, because it is broken.*

*I need you forest guards to help me get to Grandma's lab before my battery runs out!*

*Beware the limits of the forest!*

**Step 2:** Children were organized into groups of 3 to 4 members representing rangers. Each child used a "boot" (made with EVA with a sketched design that was produced by the students with the help of the teachers) on one of the feet. They were instructed to interact with the robot before facing the challenge, to familiarize with the effects of their movements in the robot's movement. Each group of children was then instructed to help the wolf to get to the lab, preventing the wolf from getting out of the forest (surpassing the green EVA). It was said to the children that this was a group activity, that is, the wolf would only reach its destination if everyone collaborated with each other.

**Step 3:** Researchers, teachers, and children gathered in a circle to talk about the robot and the narrative and share their impressions on the workshop. What worked? What could have been better? How was the interaction with the robot?

### UX Evaluation






The children's experience was evaluated through Emoti-SAM [7]. However, the method was adapted to the context where it was applied, the adaptation was made based on the suggestions of the teachers involved, who had previously applied it with the children. The adaptation consisted of instead of choosing one of the emoticons and depositing in an urn, choosing and painting one of the emoticons printed on a paper sheet. Only the pleasure dimension of the method was used, to simplify the evaluation with the children. In addition, a white space was provided so that they could draw something that caught their attention (Figure 7).

Then the teachers asked the children to explain their draw and their choice of emoticon; the answers were written on the back of the sheet. This identification is an important part of the assessment.

DEdIC  
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Data: \_\_\_\_\_ Idade: \_\_\_\_\_ Gênero: Masculino\_\_ Feminino\_\_

Avaliação da Oficina:

				
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**Figure 7 Emoti-SAM Adapted to the School Scenario**

### Results



Through the application of Emoti-SAM, it is possible to perceive the children's perceptions regarding the experience they had during the workshop.

The children indicated, in a range of emoticons, their perception about the workshop, painting the desired emoticon.

In the dimension of pleasure, the most positive option is the emoticon with the happy face and the thumb up, while the negative one portrays an angry face with the thumb down.



As mentioned earlier, there were two workshops: the first took place in the morning and another in the afternoon. The first one counted on the participation of 12 children. The evaluation was conducted in both groups. To evaluate the results, we counted the emoticons that were chosen by the children (the choice was made by painting the emoticon). Table 2 shows the number of emoticons collected in the morning workshop: 11 of the 12 children opted for the more positive face, only one child opted for the second most positive face. With this data, we can see that the experience was extremely positive.

**Table 2 Emoticons Collected in the Workshop School-Morning**

Emoticon	Quantity
	<b>11</b>
	<b>1</b>

The afternoon workshop was attended by 14 children. Table 3 shows the emoticons collected and their quantities. Of the 14 children who participated in the workshop, 10 chose the most positive emoticon, 3 chose the second most positive and one of them chose no emoticon, but she drew what she liked most in the workshop (robot, herself and the teacher).

**Table 3 Emoticons collected in the Workshop School-Afternoon**

Emoticon	Quantity
	<b>10</b>
	<b>3</b>

## UX Evaluation by Children’s Drawings

In addition to the choice of emoticons, the children were asked to draw what caught their attention during the workshop.

One of the methods used to evaluate the experience with children is the drawing [18], [23]. This method is suitable for young children because when drawing, children are relaxed and generally do not consider a task or a duty, but a fun. The children's drawings incorporate a variety of information about the child and his experience [16]. Xu et al. [23] argue that children's drawings are reliable, especially by the fun factor. The same authors argue that the use of drawings in the evaluation of technologies per child, why they can produce drawings, even if they are not able to write proficiently. They can also capture some of the user experience in a way that cannot be easily expressed in words.

### Evaluation Results

To evaluate the results, we quantified the drawings made by the children. 39 drawings were collected in the workshops. Each drawing was identified on the back by the teachers who attended the workshop. The children were asked individually what they had drawn, the notes were placed on the back. This identification is due to the difficulty of interpretation of some figures.

All the children made drawings, were cooperative and seemed to be at ease. All children have designed the robot, this may mean that the robot was an important element of the workshop. Six children designed the settings for the workshop. The other numbers are shown in Table 4.

**Table 4 Number of Drawings Collected -Morning**

Drawing	Drawing Quantity
Robot	12
Scenario	3
Grandma's house	4
The Child	3
Boot	4
Robot Control	1
Robot Sending Message	1
Arrows	1
Sun and Clouds	3
Carpet (Magic Forest)	6
Teacher	1

Similar to the morning period, the children of the afternoon made drawings symbolizing what they liked most in the workshop. Table 5 shows the amount and drawings made by the children in the afternoon.

**Table 5 Number of Drawings Collected - Afternoon**

Drawing	Drawing Quantity
Robot	11
Scenario	4
Grandma's house	5
The Child	3
Boot	4
Robot Control	1
Arrows	1
Sun and Clouds	4
Carpet (Magic Forest)	5
Teacher	1

In the afternoon workshop, only one child did not draw. Eleven children designed the robot. Six children designed the settings for the workshop. The other numbers are shown in Table 5.

Our interpretation of the drawings was not only quantitative (number of drawings represented), but also qualitative, searching for representations of the action itself. Observing the children's drawings, they represent not only a static scene, but they also drew dynamic aspects of it, for example, the robot sending a message. This indicator suggests a high level of involvement with the experience [16].

### Other data

Both workshops were recorded in video. The videos were then analyzed with the purpose of identifying how the children interacted with each other and with the robot and about the interaction in general. Among the aspects of the interaction to be identified, are the social interaction, the relationship among them to achieve the goal, the use of the body during the interaction, the interaction with the robot, among others.

**About articulation:** Among the highlights are the articulation of the children on how to take the robot to Grandma's laboratory. At one point, children who were in a group of four, divided into teams of two to achieve the goal.

**About body use:** during the workshops, children were using boots made with E.V.A; by putting them in front of the robot, it changed direction. At one point of the workshop, they were all invited to sit in a circle and take the robot together to Grandma's lab. Some of the children naturally take off the "boot" on their feet and put it in their hands.

Another example of body use was when one of the children mimicked the behavior of a robot.

**About Interactions:** It was observed that the children joined together for the purpose, even when they were not participating, they were supporting each other. One of the children said: "This is true teamwork."

**About interaction with the robot:** Except for a few exceptions, the children quickly realized that the approach of the boot in front of the robot changed its direction. Also, soon realized that the sound was not coming directly from the robot, but a speaker, positioned next to the computer containing the program controlling the robot.

### Scenario 3: The Hospital Case Study

#### The workshop

The workshop took place at the hospital SOBRAPAR - Brazilian Society for Research and Assistance for Craniofacial Rehabilitation.

The workshop was held on June 18, 2018 in the auditorium of the hospital, in the morning, for approximately two hours. Six children, aged between 7 and 12 years old, participated with the parents or guardians of each child and health professionals.

The purpose of the workshop was to introduce the SOBRAPets (stuffed animals embedded with some type of technology) in the context of the hospital. The children are treated in the hospital, and were invited for the workshop, taking advantage of their consultation day with their physicians.

In a large room, previously prepared, several plush animals were arranged, some with embedded technology and other common ones. Among those who had technology were Chico and Corujita.

Chico is a plush monkey that has the function of measuring the intensity of hugs (abraçômetro), through a sensor, when hugged with little intensity, a sound message is emitted, requesting a stronger hug.

The Corujita is an owl-shaped plush animal with a small camera to take pictures of some activities, for example, when a strong hug on Chico is detected. With such situation, Corujita is notified and, in 4 seconds, takes a photo of what she is observing. The photos are immediately arranged on a display, which is composed of both the intensity of the hug (abraçômetro) and the last seventeen photos taken.

In addition to the stuffed animals, hats representing different animals were distributed. Each child chose one of the caps to attend the workshop. To contextualize and create a playful environment for the children, a story was told of how the SOBRAPets came to the hospital: *"In a cave lived beautiful creatures, but the cave became cold and they had to choose a new place to live. When they heard about SOBRAPAR, they decided to move there, but to feel welcome they need strong hugs."*

The purpose of this initial activity was to present the SOBRAPets to the children and the environment and to discover new ways of inserting them in the daily life of the hospital, crossing the hospital boundaries.

#### The workshop consisted of 4 steps:

**Welcome:** contextualization of the project and what would be the workshop proposal. At this stage, the parents of children and other participants signed the terms of consent and assent needed to carry out the project.

**Discovery:** There was the delivery of the caps, the narrative of the introductory story, all the children were invited to hug the SOBRAPets. This activity had the intention of familiarizing the children with the Pets and arousing their curiosity regarding the pet containing the technological devices.

**Experimentation:** Chico (who has the device that measures the intensity of the hug) was delivered to each child, one at a time. Then they were invited to hug Chico if they wished. With each hug, a photo was shot by Corujita (Pet that contained a camera).

**Reflection:** At this point, the children were informally asked if they liked the activity, which SOBRAPet did they like the most.

**UX Evaluation:** The evaluation of the children's experience was done through the Emoti-SAM [7] and attrakDiff [5] was used to evaluate the UX of their companions and other adult participants.

#### Procedure with Emoti-SAM





As in the museum case study, the emoticons were printed on cardboard paper and arranged in a wooden box. Participants were invited to choose one or more "faces" or emoticons that represented their experience with the workshop. All the participants were very enthusiastic to make their choices. The chosen emoticon should be placed in a voting urn that was brought to them by one of the researchers, to be counted later.

#### Emoti-SAM Results

Table 6 shows the collected emoticons from children who participated in the workshop. We can see that the experience was evaluated positively. The first emoticon belongs to arousal dimension portrays a happy face with hearts and bulbs around representing excitement and inspiration. The second emoticon chosen belongs to the dominance dimension, and is the most positive expression in that dimension, seeks to translate the feeling of mastery in the sense of ease and mastery of the subject (Emoticon representing intelligence, with graduation hat). The third line shows the emoticon with a smiling face, which is in the pleasure and mastery dimensions. In the last line, chosen by two children, the smiling face with lines around which seek to represent joy.

We can see that the experiment was evaluated positively since all the chosen emoticons were positive.

**Table 6 Emoticons Collected Hospital Office**

Emoticon	Quantity
	2
	2
	1
	1

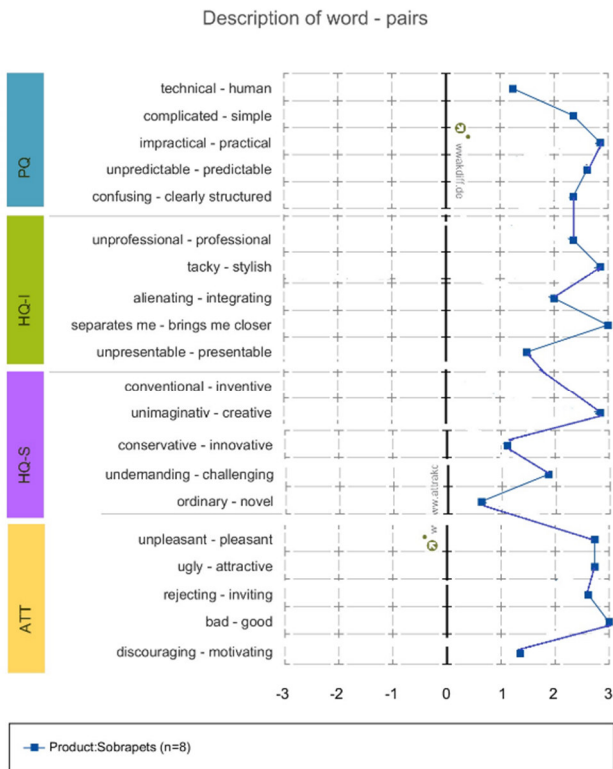
**AttrakDiff Procedure**

At the end of the workshop, the children's relatives with them in the workshop (6) and two psychologists were invited to respond about their experience with the workshop as a whole. A questionnaire printed and adapted from AttrakDiff (Figure 3) was used, as in the museum case.

**AttrakDiff Results**

**Diagram Description of word pairs**

This diagram shows the mean values of word pairs. The extreme values are of particular interest (Figure 8).



**Figure 8 Word Pairs Diagram Hospital Scenario**

Regarding User Experience, the diagram shown in Figure 2 (translated from Portuguese) shows that the line formed by the blue dots link is located to the right, which indicates an excellent experience.

The graph shows that the Pragmatic Quality (PQ) in the items (impractical - practical) were better evaluated, indicating that the vast majority of respondents judged the experience as practical.

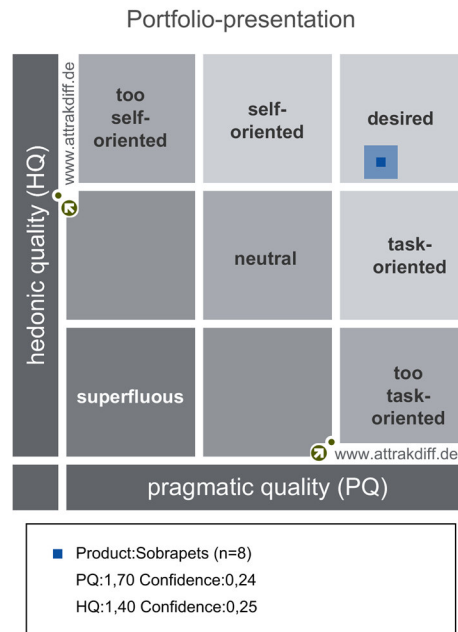
For Hedonic Quality - Identity (HQ-I), Hedonic Quality - Stimulation (HQ-S) all items are located to the right of the line highlighting the items (separates me – bring me closer), which was chosen by 100% of the respondents.

The users' perception about the attractiveness (ATT), presented all the items positioned to the right of the line with highlight to the adjectives 'bad - good', in which the majority considered the experience good. In general, the workshop was considered very attractive.

**Portfolio Results**

The experience with the workshop was evaluated as 'desired' with high hedonic quality, according to Figure 9. According to the location of the blue rectangles (the smallest and darkest represents the average value of the study dimensions with respect to the user experience, the largest and lightest represents the confidence interval). Both rectangles are entirely located in the desired quadrant. The larger rectangle that represents trust, is small, which means good convergence among users' opinions.

In terms of pragmatic quality, the experience was positively evaluated. Regarding hedonic quality, the results show that users were motivated in relation to the workshop (with a confidence interval of 0.25).



**Figure 9 Portfolio Results – Hospital Scenario**

## Diagram Average Values

The mean value diagram distributes the mean values assigned by the participants in the Pragmatic Quality (PQ), Hedonic Quality - Identity (HQ-I), Hedonic Quality - Stimulation (HQ-S) and Attractiveness (ATT) dimensions.

The Pragmatic Quality (PQ) in Figure 10 indicates the degree of success in achieving the objectives and obtained a score of 1.70 in the user experience.

The Hedonic Quality - Identity (HQ-I) indicates the level of identification of the user with the workshop and obtained a score of 1.71, indicating that there was a good identification.

The Hedonic Quality - Stimulus (HQ-S), which measures whether the experience is original, interesting and stimulating, obtained a score of 1.09.

Attractiveness (ATT), which indicates how attractive the product is to the user, scored 2.14, the highest among the categories.

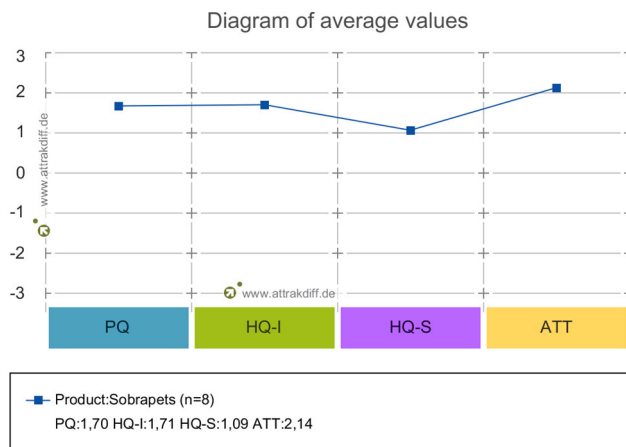


Figure 10 Mean Values Diagram - Hospital Scenario

## DISCUSSION

UX assessment of products such as applications, websites, and conventional systems is more easily measured, since the focus is on the product to be evaluated, although hedonic and emotional aspects are taken into account.

In ubiquitous pervasive environments, it is possible to have several devices (or products) that interact with each other to provide a service. Interaction is often not traditional, such as using a mouse or keyboard or using an application. In the interaction in these environments, the user may not interact directly with a product, but with a service, or with 'things' in communication.

Evaluating this interaction is a complex task. To circumvent this product-oriented view, we focused the assessment on the general experience and not specifically on the artifacts present in the three scenarios.

Moreover, the use of drawings to collect data was also useful as drawings represent greater spontaneity on the part of the children, validating the emotional responses given by them.

Although AttrakDiff has closed questions, adapting to the context and triangulating the data, showed that the results obtained by it are consistent with the results obtained by Emoti-Sam.

## Conclusion

Contemporary scenarios of technology use (ubiquitous, pervasive) present several challenges in assessing the user experience. This work seeks to situate itself in this context, investigating and understanding how the user experience can be evaluated considering the new forms of interaction.

Likewise, UX assessment of children is equally challenging. In part, due to the lack of adequate methods to obtain the data. These methods should be supported by several theories.

In this work we used two methods of evaluation of UX: the AttrakDiff that seeks to evaluate hedonic, pragmatic and attractiveness qualities, considering that these characteristics refer to a product or service. We also used a second method called Emoti-SAM, since we consider that affective aspects are relevant to the experience as a whole.

The results showed that the adapted methods were capable of capturing essential aspects of the experience. We believe that the adaptation to the contexts of the case studies as well as the procedures used during the evaluation, coupled with the fact that the evaluation was done immediately after the interaction, allowed that aspects of the experience were not lost. One of the factors we believe to have led to the capture of the experience is the fact that in all scenarios participants were asked to take into account the experience as a whole.

The triangulation of the data through the use of two methods showed effective for evaluation in the situated scenarios. Future work involves extending the results of this study towards the creation of a set of guides to evaluate UX in socio-enactive scenarios.

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