Visitor experiences with intelligent voice-based exhibitions

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Abstract  
In this positional paper, we are interested in understanding visitors’ reactions to IRIS+, an artificial intelligence powered by voice exhibit, and how this machine-man conversation is embedded into the museum space.

Introduction  
The use of multimedia features in museum and art spaces has a long tradition [1]. Technology has been studied for more than 20 years on how it can shape museum visits and assist in heritage interpretation [9]. Audio guides and video guides are present in most of the museums and have played an essential role in informing visitors. With the recent advances and popularity of mobile devices and artificial intelligence systems, visitors may dialogue with exhibits having new experiences in museums. This paper is a first attempt to understand visitors’ reactions to an artificial intelligence powered installation that provokes reflections about current humankind challenges and give recommendations to visitors to deal with those concerns.

Related work  
Previous studies have also investigated dialogue installations in informal learning settings [4], [13]. Others considered understanding the impact of visual and audio features on visitors [11] and investigating robot’s behaviors [5], [14]. Environmental issues were also examined highlighting that visitors typically spend less than 20 min in exhibitions, independent of the topic or size [11]. Art exhibition spaces and outdoor settings usually are crowded and noisy, and the visits are characterized by moments of enjoyment. Therefore, the duration of engagement is also a matter to be planned when conversational systems are available for interaction in physical spaces. [3] found that museum-
guide robots verbally summarizing the exhibit information while using a "lean back" gesture were very effective to disengage visitors as human guides often do. Another factor which may disengage people with conversational systems is when the agent behaves in a repetitive manner, which decreases the user satisfaction over time [6].

In this positional paper, we are interested in understanding visitors' reactions to an intelligent voice-based exhibit: IRIS+, and how this machine-man conversation is embedded into the museum space.

**IRIS+ at The Museum of Tomorrow**
The Museum of Tomorrow offers a narrative about how we can live and shape our next 50 years on this planet. The museum traces a journey towards possible futures, from the big questions that humanity has always asked, such as: "Where do we come from? Who are we? What are we? Where are we going? How do we want to get there?". This space also seeks to promote innovation, spread the word about the advances of science and publish news about the vital signs of the planet. IRIS+ is the first expansion of the central exhibition held at the Museum of Tomorrow since its opening. The launch of the new experience gives new meaning to the Museum's call: "Tomorrow is Today and Today is the Place of Action." The dialogue system (IRIS+) placed at the end of the exhibition trail was developed to questioning visitors who passed through the central exhibition (Cosmos, Context, Anthropocene, Tomorrow). The IRIS+ inspires the visitor to think about their role in society and truly participate in the search for more awareness, tolerance and sustainable tomorrow. The initial interaction of the visitor with Iris+ is through a voice dialogue. The conversation system guides this discussion. The dialog begins with a question: "Considering what you saw in the exhibition, what are you most concerned about?". The visitors can answer, and IRIS+ will provide more questions based on the visitor's response. Follow an example of visitor interaction with Iris+:

01 **IRIS+ (I):** The Museum of Tomorrow shows in its main exhibition the opportunities and challenges of this era of great transformation. Thinking about it, what worries you the most in today's world?
02 Visitor (V): Pollution.
03 (I): Pollution really is something of concern. Within this great theme, what else worries you?
04 (V): Contamination of waters.
05 (I): Can you change that scenario? What can you do?
06 (V): Propose not to throwing garbage anywhere.
07 (I): Thank you very much for your participation.

At the end of a conversation, IRIS+ recommends some social initiatives connected to the concerns mentioned by the visitor. IRIS+ has a database of previously registered efforts, and a recommendation component is responsible for identifying up to 3 social initiatives that are consistent with the concerns of the visitor. Subsequently, to seeing recommendations, the visitor can take an optional photo. This photo is projected on a large visualization video wall to highlight the most relevant themes for visitors, and it reveals clusters of people concerned about the same issues. The whole experience lasts 5 to 7 minutes. Figure 01, 02, 03, 04 e 05 show the space visitors interact with IRIS+.

**Observing the user experience with IRIS+**
The objective of this preliminary field study was to have a glance of user experience with IRIS+ in situ [12]. The field study included observations and brief interviews with visitors. The semi-structured interviews were designed to be short not to disturb or delay visitors. Twelve visitors described their experience to a researcher. The interviews were audio-recorded and consisted of only one question Q1: Please tell us how would you describe your experience with this exhibit for a friend that will not be able to visit it. Four employees also shared with the researcher the central questions visitors ask them about the installation. The interviews also served as a clarification of the behaviors observed by the researcher during visitor's sessions. We also gathered the text interaction logs of 380 visitors, and
audio/video recorded a day of visit interactions with IRIS+

Data analysis
This analysis is a first attempt to understand visitors' experience with IRIS+ in situ. We investigated, inspired by other conversation analysis studies [8] [7] [12] [14] how visitors structure their interaction with Iris+ in a public museum space and which kind of social actions occurred because of this interaction. To investigate the rational social action of visitors, we first explore here onboarding interaction situations that were directly observable and reportable to people present in situ. [2]. And then, we describe the perceptions of visitors reporting their own experience with IRIS+.

Preliminary findings
In this session, we highlight the main issues identified in the observation studies grounded by the video and audio recordings gathered during this investigation. 
Analyzing the sequence details of interactions, we identified visitors’ reactions to an intelligent voice-based exhibition. We selected a couple of interaction fragments to illustrate attitudes and some strategies visitors used to interact with Iris+.

Onboarding visitor strategies to interact with Iris+
Iris+ is localized at the end of the main museum trail. Although most of the visitors interact with it after seeing the main spaces of the museum, some go across the corridor and interact first with Iris+. We notice an evident difference from the ones who interacted with the museum spaces before. Those visitors, we call here experienced visitors, know what to ask and answered the questions with more words and property. The others requested ideas of what to ask from the museum attendants, or give up more easily in the middle of the interaction. The experienced visitors, in most of the observed cases, know how to start the interaction using the museum card, it is also used in other museum spaces. (Figure 6). Due to similar shape displayed on the tablet screen, not experienced visitors more often tap the card on the screen mistakenly. The right place to tap it is on the figure on the wall beside the tablet. This behavior happens even though, there is written information on the screen: “To start, tap on the logo beside the tablet and wear the pair of headphones.” We also observed that both types of visitors often laid the card on the logo beside the tablet through the whole experience. They were afraid the exhibit would stop working if they take the card out. What it was a misconception.

Another curious and misconception behavior was to lean forward and to whisper to IRIs+. It was like they were telling a secret to Iris+. Visitors were aware that Headphones had microphones because attendants advised them to hold the microphones to have a better experience, even so, they engaged in this behavior. In Figure 7, we can see a visitor pointing to the tablet of his partner to advise to talk near the screen. Visitors are familiar with audio guides in museums, but not used to respond back to devices. The museum attendants helped visitors that did not know how to react to IRIS+ advising them that was a voice-based interaction. We observe visitors’ behavior before asking for this kind of help. In those situations, they tap the screen for more information, they looked at the next visitor interacting with the installation, or they verbalized the need for assistance to the museum attendant. An excerpt of the data illustrates this:

01 (participant looks for clues looking at her neighbor interacting, and turns to the museum attendant and asks a question))

02 P12: Do I have to answer here, right?

Visitors also enjoyed the exhibit accompanied. We observed the cases when visitors were alone; they frequently repeated the experience inviting acquaintances for the second or third time. Second, third-time visitors usually taught the novices they invited and evoked conversations around the IRIS+. (Figure 9). Additionally, we noticed that several times when visitors were accompanied, only one was wearing...
the headphones, which caused some misinterpretation from the person who was only seeing the screen. The person who was observing sometimes tap on the screen, resulting in discomfort for the one wearing the headphones, who had to gesticulate signs (waiting, stop hand signs).

We also observed other interaction situations in several steps of the interaction process (e.g., visitors taking their picture, sharing their concerns on the visual mural and conversation close actions with IRIS+). We are still analyzing those steps to report in future publications.

Visitors perceptions of dialoguing with an intelligent voice-based system

Visitors also reported how they felt talking to an artificial intelligence system. IRIS+ invited participants to reflect on museum themes and connect those to their own lives. It surprised participants and created a social situation where sharing those concerns with a machine was not natural. A participant accompanied by his partner commented:

01 R: Please, tell me how was your experience with this installation?
02 P8: I found it very strange when the machine asked me: What is your concern for the future? I was not even thinking about it. (.) when I left the museum exhibition. It is a very personal and very comprehensive question. So, I was like this, with no way to talk (0.2), and I already had to speak in public, too, right? I'm ashamed to speak in public.

More visitors displayed the same behavior, and many verbalized they did not know what to answer to Iris+. In that situation, IRIS+ employed repairs actions [10] to avoid interaction breakdowns in the dialogue. In line 03 and line 05 of next fragment, Iris+ applies repair mechanisms to bring P8 back to the dialogue subject.

01 I: considering what you saw in the main exhibition, what are you most worried about?
02 P8: I don’t know. I don’t know. ((smile)).

IRIS+ also captured some environment noises, likewise a sound similar to waves from another exhibit and utterances of visitors talking to each other. In those situations, IRIS+ continued the script and recognized the utterance as not related to the questions asked. Visitors hear a repair question when a not recognized utterance is verbalized for the first time (line 3). And for the second time, IRIS+ processes the ((sound of another exhibit)) and asks a new question (line7).

01 I: considering what you saw in the main exhibition, what are you most worried about?
02 ((sound of another exhibit))
03 I: I could not understand what you said. I’ll repeat the question. Considering what you saw in the main exhibition, what are you most worried about the world today?
04 P11: Population growth
05 I: By 2050 the trend is for the world to have 10 billion people. This growth must be reconciled with economic, social and environmental development. In your opinion, what are the main challenges that this population will face?
06 ((sound of another exhibit))
07 I: Considering what you are able to do, how can you change it?
08 P11: It’s through recycling
09 I: Thank you very much for your participation!
In this case, P11 answered the second question (line 3) and responded to the question in line 7 considering the line 5 information provided by Iris and his previous answer (line 4). In this case, P11 ignored the question at the end of line 5.

Next we show a transcription of a semi-structured interview with three visitors that know each other (P3, P4, P5). P3 grabbed the audio recorder from the researcher (R) and interviewed her companions.

<table>
<thead>
<tr>
<th>Line</th>
<th>Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>R: she {{(looking at P3)) did not hear the voice of the Iris, right? [If you had to tell her how it felt to talk to a machine.}}</td>
</tr>
<tr>
<td>02</td>
<td>P3: {{I feel out with her].}}</td>
</tr>
<tr>
<td>03</td>
<td>P5: First the daughter, (.) then the false nephew. {{(P3 grabs the audio recorder and points to P4)}}</td>
</tr>
<tr>
<td>04</td>
<td>P3: What did you think of Iris?</td>
</tr>
<tr>
<td>05</td>
<td>P4: I found it very strange, actually because I kept the microphone in my hand talking to a machine, (.) I felt kind of stupid.</td>
</tr>
<tr>
<td>06</td>
<td>P3: she made you afraid?</td>
</tr>
<tr>
<td>07</td>
<td>P4: no {{(laughs)}}. In fact she was very nice.</td>
</tr>
<tr>
<td>08</td>
<td>P3: so why to be afraid, thinking you are an idiot?</td>
</tr>
<tr>
<td>09</td>
<td>P4: because I was talking on my own (0.2) in theory.</td>
</tr>
<tr>
<td>10</td>
<td>P3: no you were not alone in your imagination.</td>
</tr>
<tr>
<td>11</td>
<td>P4: only in my imagination {{(laughs)}}</td>
</tr>
<tr>
<td>12</td>
<td>P3: what about you?</td>
</tr>
</tbody>
</table>
| 13   | P5: I was a little anxious. Because we did not [Not obviously, right {{(laughs)}} I'm single.]
| 14   | P3 [wanted to meet the iris? You wondered what Iris would look like, green, blue eyes?] |
| 15   | P5: because you really have no idea where it goes, what path of discussion we will have [when we are talking to a human being has a self-driving discussion, we became subordinate to her initiative, it causes certain anxiety, but I did not feel scared.]
| 16   | P3: [but it depends on your answer, you lead] |
| 17   | P3: just anxious (.) congratulations you are the future. |
| 18   | R: Thank you all! |

In this fragment, we notice that P4 share her feelings of embarrassment to others by feeling she was talking by herself in a public space (line 03). And P5 demonstrates his anxiety of controlling the interaction (line 11 and 13). We also notice, P3 expectation of why P4 felt stupid (line 4). P4 and P5 also leaned towards the tablet and whispered to the machine, what shows evidence of P4 uncomfortable feelings in public. Likewise P4 and P6, other visitors we interviewed reported similar feelings.

**Discussion**

Our analysis shows that integration with visual and verbal elements are essential for onboarding interaction with the intelligent voice-based devices. We also unveiled visitors’ social actions in situ while interacting with IRIS+. Highlighting those behaviors may help designers, developers and museum curators to think carefully how to tailor conversation technologies to visitors and how to take advantage of those social actions to intensify visitors experience in museums.

It was evident that visitors stopped and took a moment to reflect on their visit while talking to Iris+ and their tomorrow commitment to the planet. We noticed that experienced visitors (the one who visit the main exhibition) engaged with IRIS+ answering questions related to themes previously seeing in the museum, and were satisfied with recommendations to take future actions provided by IRIS+. In further work, we will analyze how visitors structure their interaction with IRIS+ through the whole experience - sequential to onboarding - and will examine the text interaction logs collected in the field. In doing so, we expect to provide design recommendations to improve even more the experience with voice-based systems in exhibition spaces.

We expected that participating in the Voice-UX workshop will bring inspiration to explore in deep our collected data. We also hope to have insights from other attendees and share our expertise in qualitative research and design of dialogue systems.

**References**


