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Design Patterns to Enhance Teens' Museum Experiences

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Teenagers are an understudied group within the Interaction Design and Children community. Museums and cultural heritage spaces offer solutions for young children but do not target teenagers in particular. Teens, are a large pool of potential museum audiences. They should be given a "voice" and involved early in the design process to maximize chances of involvement in the museum practices and offers, hence, it is crucial to study their interests and desires to deploy a high quality and enjoyable product. For these reason, we deployed several co-design sessions with a total of 155 teenage participants, in order to understand how would they prefer to engage with museum tours. The authors, based on Madeira island (Portugal), used the Natural History Museum of Funchal as a case study. The participants were asked to ideate a mobile museum experience that they would enjoy. Through qualitative analysis, we gathered insights regarding six main themes that they reported as prompts in order to visit the Natural History Museum of Funchal, such as 1) gaming, 2) interactions, 3) localization, 4) social media, 5) aspects of the museum studied, and 6) photos. These findings are preliminary and still need testing and validation.

Museums. Design methods. Qualitative analysis. Teenagers. Gamification. Co-design.

1. TEENAGERS EXCLUDED FROM MUSEUMS' CURATORIAL STRATEGIES

Museums often fails to engage teenagers (Tzibazi, 2013), weakening the potencies of museums as fundamental institution in a society where cultural heritage is an important value (Hooper-Greenhill, 2001). According to Falk (Falk, 2009), the so called "one size fits all" type of experience does not apply to museum visitors. Moreover, museums often cater for children and adults, producing personalised and targeted tours for them, but do not have specific products and guidelines to secure the engagement of teenagers. As a result, this generation is identified as an audience group that is often excluded from a museum's curatorial strategies (Tzibazi, 2013).

2. TEENAGERS AS AN UNDERSTUDIED GROUP

Research within the field of Interaction Design and Children (IDC) is often centred on the evaluation of existing and novel interactive technologies focusing on children age 4-11, which leaves a gap in the literature for children 12-17. As argued by Yarosh and colleagues (Yarosh, Radu, Hunter, & Rosenbaum, 2011), "investigating and addressing the needs of these groups would expand the body of IDC work and provide avenues for new insight and innovation." Additionally, Katterfeldt and colleagues (Katterfeldt, Zeising, & Schelhowe, 2012) highlight that this target group "requires more attention in research and there is a need for appropriate methods to involve them in design processes." However, because teens represent a rapidly growing group of technology users (Amanda Lenhart, 2015), researchers are aware of the importance of finding ways to involve them more fully in the design process (Fitton et al., 2014; Poole & Peyton, 2013; J. Read et al., 2011). However, methods for carrying research with teenagers within the interaction design has been discussed (J. C. C. Read, Horton, Iversen, Fitton, & Little, 2013). We build on this body of work in order to extend it.

3. METHODOLOGY

We follow our framework presented in (Cesário, Matos, Radeta, & Nisi, 2017) to engage teenage audiences in the design of interactive experiences for museums. We engaged 155 teenage participants in a single session of multiple co-design short bursts, gathering teens' ideas about their values concerning engaging museums visits. The data was later analysed, looking for trends, and concept

generation, according to Hakkila et al.'s methods (Hakkila et al., 2016). When analysing the data collected, we focused on what teens perceive as must-have items for an enjoyable Natural History Museum tour. The data was extracted from pen and paper compiled sheet, where participant designed and expressed their preferences and ideas. We followed Druin's methods (Druin et al., 2001) on how to work with young participants, such as wearing informal clothing, sitting instead of standing, asking the teens for their opinions and giving them time to articulate, using informal language, and taking notes discreetly.

3.1. Sample

This research was conducted through several months, during 2017, where the principal researcher approached students from different schools, classes and regions of Portugal, such as two secondary schools in Funchal, students doing internships at Madeira Interactive Technologies Institute and students taking part of a summer camp at the University of Porto. In total, 155 participants aged 15-19 took part in the studies (Table 1).

Table 1. *Graph containing the sample of the participants split by age and gender.*

Age	Female	Male	Total
15 y	9	12	21
16 y	4	30	34
17 y	10	27	37
18 y	15	26	41
19 y	11	11	22
TOTAL	**49**	**106**	**155**

3.2. Procedure

The sessions took place in their normal classrooms and took 90 minutes to complete. It started with an introduction, followed by the co-design session.

3.2.1. Introduction to the session
The researcher introduced the goal of the session, which was to gauge teens' interests and ideas in enhancing museums offerings. The Natural History Museum of Funchal was then introduced through a series of photos of their collection. The map of the museum was displayed through a picture highlighting 13 numbered points of interests related to the main exhibits of marine animals (Figure 1). Participants were then asked to think in terms of mobile interactive experiences they would enjoy.

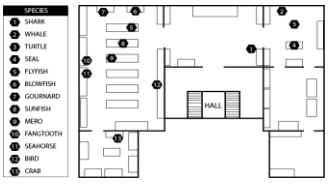

Figure 1. *The map of the rooms from the Natural History Museum of Funchal.*

3.2.2. Co-design session
155 participants in total were divided into 46 groups, and given two different working sheets per group (Cesário et al., 2017):

Sheet A: Concept sheet. It was meant to capture the overall concept for the experience. Students were guided by the following questions: *1)Narrative: what is the narrative underlying the experience?; 2)Species/Artefacts: how do visitors interact with the museum's artefacts?; 3)Mechanics/Tutorial: which steps do users have to take to complete the experience?*

Sheet B: Interface design sheet. It contained the wireframe of a smartphone's screen, where students were asked to draw detailed screenshots for the mobile application's interface, grounding the concept previously described on Sheet A.

When the groups were settled (Figure 2), they were advised to brainstorm encouraging the "feeling that everything was possible" (Druin et al., 2001). Some examples of the teens design work can be found in Figure 3.

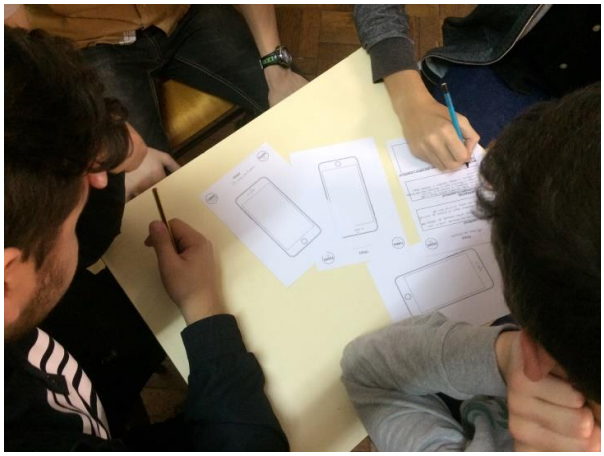

Figure 2. *Picture illustrating one of the groups working on the application wireframes, during one of the sessions.*

4. ANALYSIS

The data gathered was analysed through "thematic analysis" with the NVivo 11 software. This technique is used for classifying, analysing, and reporting patterns within data (Braun & Clarke, 2006). All the data was grouped together to classify the themes related to teens' perceptions towards their desires of must-have items for interactive exhibitions for museums. A detailed analysis of sheets A and B was conducted to evaluate the ideas of the groups and drawings. The words and phrases that each group wrote on sheet A and draw on sheet B were transcribed (we refer to them as transcripts, where each self-standing word or sentence or graphic element stands as one transcript) and then categorised into codes, highlighting patterns and

trends emerging from participants transcripts. Finally, the codes were grouped into themes.

5. RESULTS

Over 805 individual transcripts were extracted from the sheets A and B and were subsequently grouped into codes, reflecting patterns and trends. Then those codes were grouped into 6 main themes, namely 1) *Gaming* (361), 2) *Interaction* (272), 3) *Localization* (109), 4) *Social media* (29), 5) *Aspects of the museum studied* (24), and 6) *Photos* (10). All the themes are reported below along with their codes and frequency of appearance among the 805 individual transcripts.

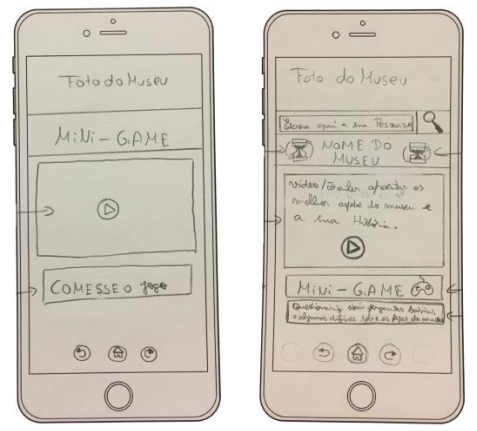

Figure 3. *Drawings from group 8. From left to right: 1) the first screen of the app depicts an introduction to the game through a playable video (**Theme**: Gaming; **codes**: tutorial, game); 2) the second screen shows a video of the museum's information and buttons to start a mini-game (**Themes**: Gaming, Museum Related; **codes**: game, museum).*

5.1. Gaming

The theme of *Gaming*, with a total of 361 transcripts, was derived by 361 mentions of game and gamification elements in the teens' concept sheets. This theme was the result of the grouping of 18 codes:

- Achievements (59 times): *To get the surprise prize*
- Quiz (57 times): *Answering to basic questionnaires*
- Clues (37 times): *Follow the clues given*
- Points (30 times): *Get points by getting the questions right*
- Game (24 times): *Start the game*
- Ranking (23 times): *Check your position in the raking during the museum tour*
- Collect (22 times): *Check all the animals discovered*
- Complete (19 times): *Complete all the steps, leaving none to be done*
- Riddles (18 times): *Find parts of the story and in the end, join them and understand what happened*
- Unlock (16 times): *One part of the map is unlocked*
- Help (13 times): *Receive help from various species*
- Treasure-hunt (12 times): *Find the treasure in the museum*
- Levels (8 times): *Whenever "pick up" certain species you go up on the level*
- Progression (8 times): *Watch the progress of the game*
- Tutorial (5 times): *Video tutorial of the experience*
- Shop (4 times): *Buy food to feed the virtual animal*
- Timer (4 times): *Limit number of lives and time*
- Feed (2 times): *Digitally feed the animal and make it grown*

5.2. Interaction

The *Interaction* theme, with a total of 272 transcripts, is based on the teens inclusion of interaction elements in their concept sheets. We grouped this theme into two subthemes: "User's interaction with the artefacts" (172 transcripts), and "Technology" (100 transcripts).

5.2.1. User's interaction with the artefacts

This subtheme is about information delivered in different ways, such as through text, sound, image and video. Also, transcripts that recall the users to have the power to select options in the form of "categories" to choose which kind of content they want to consume. Moreover, under this subtheme it was also encompassed transcripts regarding the user taking the role of an artefact, for example, a user visiting the museum through the eyes of a selected marine animal. This subtheme (172 transcripts) was the result of the grouping of 5 codes:

- Information: textual, sound, video, image (98 times): *When the animal is found, it shows all the information about it*
- Categories and choosing (41 times): *Choose a species to start the tour throughout the museum*
- Interactions (16 times): *Capacity to rotate the picture of the animal*
- User takes the role of an artefact (11 times): *The user stands in the place of the fish and navigates through the museum*
- 3D object (6 times): *3D effect of the species found*

5.2.2. Technology
The "Technology" theme encompassed all of the technologies that the participants mentioned in their concept sheet. This subtheme (100 transcripts) derived from 8 codes:

- Augmented reality (25 times): *Open the camera view to see the fish*
- Beacons (22 times): *Each species has a beacon in which information appears*
- QR Codes (17 times): *There's a QR code on each exhibitor to discover*
- Catch codes (14 times): *Each species has a sticker that it is how will make them appear in the app*
- Virtual reality (VR) (11 times): *VR glasses in each species*
- Image recognition (4 times): *Point the camera at the object and the animal appears*
- Gestures (4 times): *When making the fishing gesture, clues will appear*
- Holograms (3 times): *Interact with species through kiosks with access to the smartphone as a way of observing holograms*

5.3. Localization

The *Localization* theme, with a total of 109 transcripts, divided into 4 codes, is based on the movements teens designed as part of the experience within the museum as well as the discovery of artefacts.

- Search (62 times*): Walking to search the animals*
- Map (22 times): *The user has a map with various points of interest*
- Location (18 times): *The user can check their location pin on the map*
- Orientation (7 times): *Sound and visual signals for guidance of the users*

5.4. Social Media

The *Social Media* theme is related to the concept including social media channels. This theme grouped a total of 29 transcripts into 4 codes:

- Social networks (18 times): *Share on social networks*
- Profile (7 times): *Build your own profile*
- Friends (2 times): *Create a group of friends who want to participate*
- See what others have done (2 times): *Online score from other people who have already been there*.

5.5. Aspects of the museum studied

This theme concerns the aspects related to the museum as a physical space that the participants remembered and made a reference to when writing/drawing. The *Aspects of the museum studied* theme grouped a total of 24 transcripts into 1 code:

- Museum (24): *Video about the best features of the museum*

5.6. Photos

The *Photos* theme grouped a total of 10 transcripts into 2 codes. This theme is related to all the concepts that involve taking pictures and selfies:

- Normal photos (6 times): *Option to take photos during the visit*
- Photos and selfies with AR (4 times): *Selfies/photos with the animals in augment reality*

6. CONCLUDING REMARKS

From our results, teenagers have lots of ideas on how they would prefer to engage with museums and are excited to share them, given the opportunity. Designers and cultural heritage professionals should take advantage of this and create opportunities for this exchange. In essence, our study highlights how much teenagers valued technologies, interaction and gaming as must-have items in the Natural History Museum used as a case study. They appreciate the integration of playful approaches with the learning goals of this institution to have more exciting and less mundane experiences. In fact, our results resonate with the broader literature which indicates that young people today are born into the world flooded by novel technologies (Wikia, 2013). The contribution of this paper highlights a handful of identified must-have items (themes and their codes) which should be validated when applied to a real-life scenario. However, we believe that these must-have items could be seen as generic regarding museum spaces in general and not only targeted to Natural History Museums.

Current and future work is taking these findings and creating more structured insights and prospective validation to inform the design, research and evaluation of interactive technologies in a museum context aimed at teenagers. This research direction could provide a foundation to inform and inspire work within IDC and teenage generations.

Furthermore, we understand that our study presented limitations: the sample contained more males than females, and in consequence, the groups were not split by gender. To minimize this

fact, the females were distributed among the groups. Additionally, we believed the reported findings are based on the age of the individuals and not on the gender. **Acknowledgments**: ARDITI, project number M14-20-09-5369-FSE-000001.

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