Designing Tangible Tools for the Creation of Personalized Visits by Museum Professionals

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ABSTRACT

Museums aim at offering personalized visits to encourage visitors to visit more than once. Few approaches consider the specific skills of museum professionals when designing tools for this purpose. We conducted a three-step iterative and user-centered design process with 13 museum professionals from six museums. This analysis led us to a main finding: the most complicated task

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TEI '20, February 9–12, 2020, Sydney, NSW, Australia
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ACM ISBN 978-1-4503-6107-1/20/02.
https://doi.org/10.1145/3374920.3374977

KEYWORDS

Museum; Tangible Interaction; User-Centered Design; Personalization; Multidimensional Design Space.

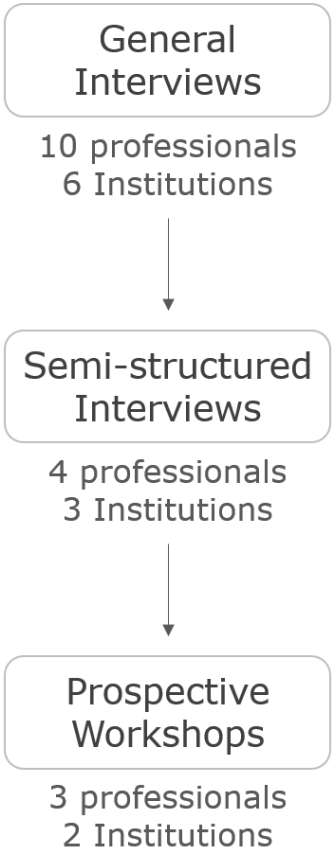


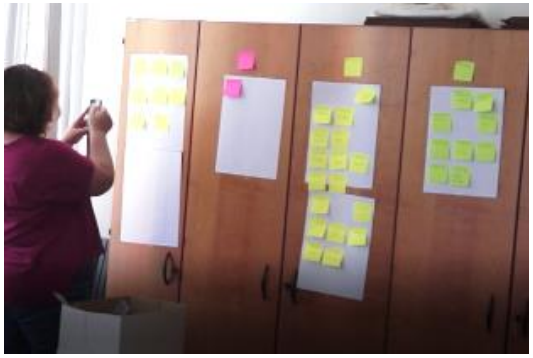
Figure 1: Three-step approach for the user needs analysis

for museum professionals is to explore their design space, composed of all possible visitor profiles for which to create visits. We propose a visualization for this multidimensional design space and six potential interactions on this representation. In an exploration space, we classify them on two axes: the selection approach and the type of interface (GUI versus TUI). We analyze their benefits and limits and, based on a pilot study, we propose insights and questions for future design.

INTRODUCTION

With the growing competition of entertainment industry, museums are facing new challenges. They must reach a wider audience, build local visitors' loyalty and tailor their content to the diversity of this public. Relying on temporary exhibitions or guided tours is too expensive for small museums. The creation of self-guided visits relying solely on the choice of a theme does not respond to all constraints and desires of the visitors. The personalization of visits based on visitors' characteristics and preferences is a possible solution to meet these challenges.

The personalization of visits in museums so far mainly dealt with modelling visitors from explicit and implicit data, and the automatic generation of suitable multimedia content and paths [1]. However, these automated solutions are not perceived by the public as being personalized and possibly lead to duplicate contents and inconsistencies [4]. Few approaches take better account of the specific competences of the museum professionals in creating quality content adapted to their public. The European project CHESS [12] proposed personalized narrations and digital games adapted to the visitors of the Acropolis Museum (Athens, Greece) and the Cité de l'Espace (Toulouse, France). They used questionnaires and personas [10] in order to profile their visitors, and provided an authoring tool to curators for creating stories for self-guided tours [12]. This approach was based on personas and therefore did not consider groups of visitors. The meSch project [9] provided tools and methodologies to empower professionals in using tangible objects to foster the engagement of their visitors in their exhibitions [8]. They focused on the use of tangible artefacts in the exhibition and not for the creation of visits by museum professionals. To be able to offer truly personalized visits, it is necessary to have a system that helps museum professionals create tailor-made visits that adapt to the desires of groups of visitors and individuals. In this article, we present the design of a solution to empower museum professionals in selecting visitor profiles for the creation of personalized visits. We first present the main results of the three-step user-need analysis (Figure 1). We then expose the design exploration of the visualization of their multidimensional design space containing all visitor profiles and the manipulations for the selection of profiles for whom to create visits. The six design solutions are presented in an exploration space, organized by interaction type (GUI, TUI) and selection approach. We finally describe the results of a pilot study with this space of solutions. This pilot study provided us first insights to explore a tangible solution with design-research probes, constituting a "tangible expression of our research".



2 people (couple/do it together)						3-10 people	+ 10 people			
ld	7-12 years old		13-18 years old		+ 18 years old		3-6 years old	7-12 years old	13-18 years old	+ 18 years old
ı adult	same age	with adult	same age	with adult		Base	with adult	with adult	same age or with adult	
llery us ıtres) ffet cchus Venus ard!	o Gallery (focus coktail) o Buffet (focus aroma) o Art of living o All aboard!	o World wine tour o Gallery o Buffet (focus aroma) o Art of living o All aboard! o Drinking and the dark side	o World wine tour o Gallery (focus coktail) o Buffet (focus aroma) o Art of living o All aboard!	o World wine tour o Gallery o Buffet (focus aroma) o Art of living o All aboard! o Drinking and the dark side	o World wine tour o Gallery (focus coktail) o Buffet (focus pairings) o Art of living o All aboard! o Bacchus and Venus o Drinking and the dark side	• World wine tour • Galerie • Buffet • Art of living o Bacchus and Venus • All aboard!	• World wine tour • Buffet • All aboard!	o World wine tour o Buffet o Art of living o All aboard!	o World wine tour o Buffet o Art of living o All aboard! o Bacchus and Venus ?	• World wine tour • Buffet o Bacchus and Venus • All aboard!

Figure 2: Observations of the prospective workshops of multicriteria visit creation. Top: first workshop in an archaeology museum, the participant expressed the need to manipulate tangible artefacts to create the visits. Bottom: second workshop in a cultural wine foundation, the participants felt the need to create an Excel table to monitor the selection and completion progress of the visitor profiles while creating the visits.

USER NEEDS ANALYSIS

We employed a user-centered design approach [2] in order to take better account of the needs, skills and behaviors of the museum professionals. Over a period of nine months, we conducted a user study involving six cultural institutions. The institutions varied in their type (thematic museum, science center, theme park, cultural foundation) and their size (between 8 and 130 employees). As shown in Figure 1, we conducted the user needs analysis in three steps. First, we conducted general interviews with museum professionals having diverse profiles (museum directors, curators, cultural mediators, communication and IT professionals). We extracted from this analysis the main requirements of museum professionals concerning the visits. Second, we refined these requirements by interviewing museums' public service specialists. We extracted from their interviews six main characteristics to consider in addition to the theme when personalizing the visit: the available time, the visitors' expertise, their motivation (e.g. playful exploration, in depth learning), their age, a potential disability, and the number of visitors in the group. These characteristics must be combined in order to assess all possible profiles of visitors. A group of expert students with two hours available will not visit the same way as a family with a child under seven years in one hour. Third, in two in-situ prospective workshops, we asked cultural mediation specialists to create a maximum of visits according to the previously mentioned characteristics in a limited amount of time (Figure 2). The observations of this prospective activity led us to a main finding: the most complicated task is the exploration of the visits' design space, composed of all possible visitor profiles. The goal for museum professionals is obviously not to create a visit for each of these profiles, but to identify, prioritize and group profiles in order to capitalize on already created visits and ensure not to forget any important visitor type. We extracted three main tasks for the museum professionals: Task 1) visualizing all possible profiles and their completion; Task 2) selecting visitor profiles; and Task 3) creating the visits for them. In the following, we intend to design tools to address the two first tasks.

DESIGNING A TOOL FOR CREATING PERSONALIZED VISITS

Having an overview of all visitor profiles and their completion (TASK 1) would help museum professionals prioritize and group the profiles to address. They need a simultaneous visualization of all possible profiles, structured by the visitor characteristics, and see if personalized visits have been created for them or not. We propose a visualization of this design space (Figure 4), based on the grid produced by the users during the second workshop (Figure 2 Bottom). An example of visitor profile is: {1-hour, 2 people, +18 years old, beginner, wish to experiment, visually impaired}. For each profile, the completion of the visit creation can be set to "irrelevant" (e.g. a 6-year old by his own, meaning no visits need to be created), "to do" or "done". In our visualization (Figure 4), each profile corresponds to a single cell, and the color of the cell represents the value of the completion of the visit for this profile (grey: irrelevant; white: to do; green: done). There are 6! possible arrangements of the characteristics in the table headers (lines L1, L2, L3; columns C1, C2, C3), i.e. 720 possible organizations of the cells in the table. This visualization must be complemented by dedicated interactions to ease the selection of cells, i.e. visitor profiles (TASK 2).

Figure 3: Selection of several profiles at once.

Exploring the Solution Space for Multidimensional Data selection

Based on this visualization, museum professionals need to select one or various visitor profiles (TASK 2) in order to create a visit for them (TASK 3). These profiles can be in non-adjacent cells. Three different approaches can be adopted (as described in Table 1). The first one is to prioritize the characteristics by assigning them to row headers (L1, L2, L3) or column headers (C1, C2, C3). For example, setting "Age" for L1 will bring together all cells representing "adults". The second approach is to prioritize the characteristics by swapping them between the different headers. For example, if swapping "age" and "number of people" for L1, the cells representing all "couple of adults" will be adjacent and easier to select with interactions as shown in Figure 3. The third approach relies on the direct selection of the values of characteristics constituting the profile (e.g. selecting "two people" and "adult"). In this approach, the whole table is reordered automatically in order to bring together the cells corresponding to the chosen profiles.

C1	C2	C3	L1	3-6 years						7-12 years						13+ years						Adult					
			L2	beginner			advanced			beginner			advanced			beginner			advanced			beginner			advanced		
			L3	1p	2p	3-6p	1p	2p	3-6p	1p	2p	3-6p	1p	2p	3-6p	1p	2p	3-6p	1p	2p	3-6p	1p	2p	3-6p	1p	2p	3-6p
Learn	None		30min		P7	P7					P2	P2				P4	P4	P6				P9c	P9c	P9f		P10	
			1h		P8	P8					P1	P1				P3	P3	P5				P9n	P9b	P9e	P12	P12	P12
			1h30																			P9	P9	P9d	P11	P11	P11
	cognitive		30min																								
			1h																								
			1h30																								
	auditory		30min																								
			1h																								
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	visual		30min																								
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			1h30																								
Have Fun	None		30min																								
			1h																								
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			1h30																								
Experiment	None		30min																								
			1h																								
			1h30																								
	cognitive		30min																								
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	auditory		30min																								
			1h																								
			1h30																								
	visual		30min																								
			1h																								
			1h30																								

Figure 4: Visualization of the multidimensional space: combination of the table created by the users during the workshop and the visualisation of cartesian products.

Table 1: Description of the Interaction Techniques of Figure 5

Choosing a characteristic (Line 1 in Figure 5)	
GUI: Scrolling through a list of characteristics on the corresponding header.	**TUI**: Manipulating a cubic object for reordering table (cubes extensively used in TUI [7]). Inspiration: correlation between a Rubik's Cube's faces and the crossing of rows and columns headers in the table.
Limitations: choosing one header modifies the value of another header.	

Swapping characteristics (Line 2 in Figure 5)	
GUI: Drag & drop (D&D) the characteristic from one header to another.	**TUI**: Each marble (inspired from the marble answering machine [3]) embodies a characteristic that can be placed inside a header for reordering table.
Advantages: flexibility of interactions, unicity action and perception. Limitations: manipulation of the structure and not the data itself.	

Choosing values for characteristics (Line 3 Fig. 5)	
GUI: D&D values to compose the profile for which the experts want to create a visit.	**TUI**: Tangible figurines represent the values (a big figurine for an adult, a smaller one for an adolescent etc.). Selecting them reorders table.
Advantages: direct manipulation of the data. Affordance of figurines. Limitations: if many objects are used, the user may feel disoriented by the automatic reorganization of the visualization.	

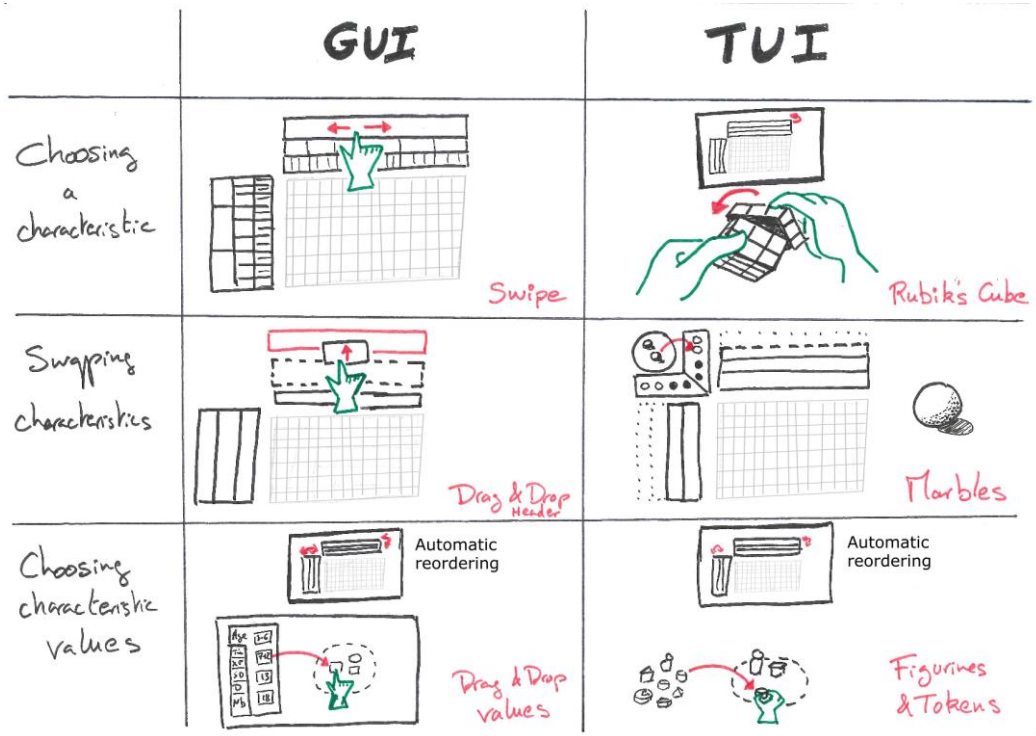

Figure 5: Exploration space for manipulating the multidimensional representation: 6 different solutions (GUI & TUI, columns) for reorganizing the grid according to different approaches (rows).

We explore both graphical (GUI) and tangible (TUI) interactions for each one of these approaches. The technique and design inspiration for each solution are described in Table 1. GUIs are mainstream devices which museum professionals are familiar with. TUIs on the other hand can ease the manipulation and organization of information in a grid [5], help distribute cognition [6] and support collaboration [11]. This leads us to explore a space of six solutions (Figure 5) organized along two axes: the three approaches for the selection (choosing a characteristic, swapping characteristics, choosing values) and the two interaction techniques (GUI or TUI). We aimed at identifying coherent interactions between GUI and TUI. The organization of this exploration space leads us to various design questions. On the horizontal axis, the usability of TUI versus GUI can be studied. On the vertical axis, the comparison of the first and second rows questions the effect of embodying the unicity of the characteristics. And comparing one of these lines with the third one raises questions about the impact of the automatic reorganization of the table on user orientation. We hypothesize that manual rearrangement of the table better supports the creation of a mental map of the spatial arrangements of the table.

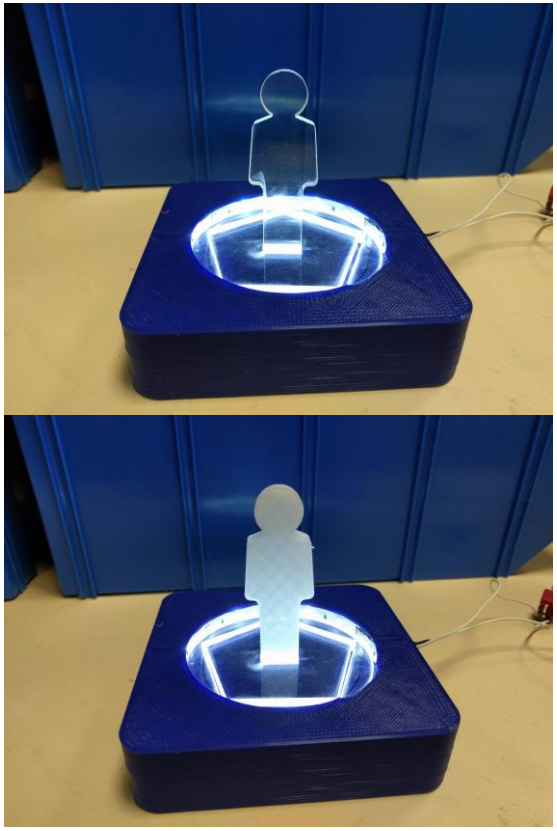

Figure 6: Design explorations of illuminated figurines.

ACKNOWLEDGMENTS

We thank all the museum professionals who participated in our study, and all reviewers who provided helpful comments on previous versions of this document. We also thank Denis Geral (ESTIA) for his help and advices with the illuminated figurines.

Pilot Study

We explored this design space in a pilot study with two public service managers (P1, P2). Both sessions lasted one hour. Both public service managers understood the multidimensional table (visualization in Figure 4) well. They both agreed on its usefulness for seeing the range of possibilities, choosing the visit to create and being systematic in the design process. Yet, P1 found it stressful to see how much there is to do and feared that this might lead to the "writer's block". For the selection of the profiles to address (interaction solutions of Figure 5), P2 found it interesting to prioritize the characteristics, because some characteristics impact the visit more than others (e.g. disabilities). For P1, the Rubik's Cube and the Marbles evoke complicated games and therefore she believes that she could not handle these devices. For both, the figurines are the most appreciated solutions, since they say it is interesting to "*have all the criteria in hand*", that "*you immediately visualize your set of criteria*" and that they can project themselves onto the visitor profile. While there are a few common points between both participants, we found that they do not envision using the prototypes in the same way. P1 imagines composing the complete profile (all six characteristics) before creating the visit, and P2 imagines choosing one characteristic value and adding the other characteristics' values one by one to see what to change in the visit. This pilot study allows us to confront the visualization and interaction solutions for exploring the multidimensional design space to the users' perspectives. Thanks to this early feedback, we can draw some preliminary conclusions: 1) the proposed visualization is well understood and reported as useful but visualizing all that needs to be done at once can discourage, and 2) the solution that uses iconic representations for the visitor characteristics is the most appreciated and supports two design strategies. We are thus currently exploring a solution based on tangible illuminated figurines that represent the visitor's characteristic value. The light filling of the figurine can express the completion progression of the visit creation for the corresponding value (Figure 6). As different visits can be created for the same value (e.g. "adult") depending on the five other characteristics' values in the profile (e.g. "single adult" or "couple of adults"), the setting of the figurines and the calculus of their illumination remain to be investigated.

CONCLUSION AND PERSPECTIVES

Through this work, we contribute to a better understanding of the activity of creating personalized visits by cultural mediators and to the design of tools to support this activity. We explore how to harness the expressive power of a multidimensional design space without exposing users to complex representations, and how to address the variety of user design strategies in the creation process. Future work will validate these first findings in a more comprehensive user study. We plan to compare the luminous filling of the figurines, which is less precise, with the representation of the more complete but also more impressive multidimensional grid. The impact of the automatic reorganization of the grid with the figurine and the comparative usability of TUI and GUI must also be assessed by proper studies.

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