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exhiSTORY: Smart exhibits that tell their own stories

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HIGHLIGHTS

- In exhiSTORY exhibits know and tell their own stories.
- Smart, self-organizing exhibits that cooperate with each other.
- Multiple stories told by a single set of exhibits.
- Comprehensible, rich, diverse, personalized and highly stimulating experiences.
- Exhibits can be moved freely and the exhibition will be reconfigured automatically.

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ABSTRACT

Museum exhibitions are designed to tell a story; this story is woven by curators and in its context a particular aspect of each exhibit, fitting to the message that the story is intended to convey, is highlighted. Adding new exhibits to the story requires curators to identify for each exhibit its aspects that fit to the message of the story and position the exhibit at the right place in the story thread. The availability of rich semantic information for exhibits, allows for exploiting the wealth of meanings that museum exhibits express, enabling the automated or semi-automated generation of practically countless stories that can be told. Personalization algorithms can then be employed to choose from these stories the ones most suitable for each individual user, based on the semantics of the stories and information within the user profile. In this work we examine how opportunities arising from technological advances in the fields of IoT and semantics can be used to develop smart, self-organizing exhibits that cooperate with each other and provide visitors with comprehensible, rich, diverse, personalized and highly stimulating experiences. These notions are included in the design of a system named exhiSTORY, which also exploits previously ignored information and identifies previously unseen semantic links. We present the architecture of the system and discuss its application potential.

1. Introduction

Museum exhibitions are far more than mere groups of exhibits, randomly selected and placed in a room. Quite the contrary, an exhibition tells a story [1]. Out of the abundance of items that they possess, museums select only a handful to put on display [2]. And to do this they employ curators, individuals who combine high expertise in the content's area (e.g. archeology, art, culture, folklore, etc.), good museological skills, understanding of educational methods and a creative temperament. It should come as no surprise that curators are typically highly trained [3] or that curation makes up for a major part of a museum's budget [4].

In theory, the result of the meticulous work of the curator is a story that is told in a space [5]. In practice, curators view the items in the exhibition, identify the implied links among then and see the story they are meant to tell. For most visitors, they are mere sets of exhibits, accompanied by some information such as the name of the creator or the year in which they were created [6]. This is why a museum experience is rarely complete if not combined with the use of a print, audio or human guide, who can reveal the hidden story. But even so, the aforementioned conventional way of setting up exhibitions marks a huge missed opportunity. Each individual exhibit in a museum has many stories to tell: for example Goya's monumental work "The 3rd of May 1808 in Madrid" (Fig. 1) [7] can tell us about Spanish resistance to Napoleon's armies; about the horror of war; about how different people face death; about the history of Madrid; about the artist's personal style or the trends

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Fig. 1. Goya's "The 3rd of May 1808 in Madrid".

Fig. 2. The conventional experience.

of the artistic period; and so forth. And when individual exhibits are combined, the number of stories they can tell is merely countless, however out of these stories only one is typically selected and highlighted in each exhibition. Works such as PEACH [8], HyperAudio and HIPS [9] take into account the museum content – typically stored in some knowledge base – and the current context to create context-aware museum guides, where the stories told are automatically synthesized through narration generation algorithms, which consider the museum knowledge base content. The generated stories can be further refined or filtered to match the user interests, the visitor model, the interaction history or any other context parameter. However, even in these works, when exhibits are introduced, removed or moved in new locations, the knowledge base hosting the content on which creation of personalized experiences relies must be done manually, introducing a laborious piece of work. Moreover, museum curators may register in the knowledge base only a fraction of an exhibit's semantic content (e.g. the part that is highly related to the current exhibition), missing thus opportunities for discovering and presenting non-trivial and unexpected relationships between exhibits.

In this work we explain how items in a museum can become *smart exhibits* that know their own stories and can present themselves to the visitors, offering rich, diverse and highly stimulating experiences. Moreover, we develop exhiSTORY (from the Greek word $\epsilon\xi\iota\sigma\tau o\rho\epsilon\acute{\iota}$: tells a story), a framework that allows for self-aware exhibits positioned close to each other to cooperate and work together, to produce self-organized exhibitions, each one telling a coherent story. In addition to the data contributed by the exhibits, exhiSTORY also considers information regarding each individual user, such as interests, visit context, user device capabilities etc., thus generating tailor-made museum visiting experiences, adjusted to each one's preferences, interests and style, increasing the overall quality of experience.

The rest of this paper is organized as follows: in Section 2 we discuss the stories that could be told by self-aware and information rich exhibits, while in Section 3 we explore different methods for implementing smart exhibits in the context of IoT and discuss how self-organization of exhibitions can be accomplished in each option. Continuing, in Section 4 we present the architecture of exhiSTORY, the framework that generates the stories to be told, and in Section 5 we see how the system delivers the stories to the museum visitors. Section 6 presents an experimental simulation-based evaluation of the system. Finally, Section 7 overviews related work and we close our discussion in Section 8 with our concluding remarks.

2. The stories told by exhibits

In a conventional museum, a lay visitor finds herself in front of an exhibit, which is accompanied by an information label. Depending on the case, this label may contain information such as the title of the work, the name of the artist and the time of creation, possibly complemented with a brief description. For example, when presented with the exhibit in Fig. 2 [10], the visitor sees that its name is "coffin and mummy of a long-nosed shrew", it was created in the period 332 B.C. to 50 A.D., it was found in Akhmim, Egypt and some information on the material used; this is a typical amount of information presented to the visitor.

Of course, via the process of curation, the museum holds a lot more information regarding this item. This typically includes the context of the creation (who ordered it, who funded it, where it was created), the context of the artist (who taught him, who inspired him), the context of the content (what is depicted, what the artist meant to convey, what other theories exist regarding its meaning or intentions) as well as the history of the exhibit as an item (who was it owned by, how did the museum acquire it, where it has traveled, in what exhibitions it has been included in and so forth). This information forms the *context of the exhibit*. Various museum information standards, including the Cataloguing Cultural Objects (CCO) standard [11] and the SPECTRUM standard [12] organize this additional information into concrete structures, and describe best practices for populating these structures.

This additional information cannot be presented in the conventional setting because:

- Usually, there is limited space on the information labels placed next to the exhibits
- Information other than the most general facts, regarding the title and the creator of the item, may not be of interest to everyone
- Including too much information for all items would lead to a cluttered exhibition, inflicting cognitive overload to the visitors.

However, by shifting the narration viewpoint from the whole of the exhibition space to the exhibit and allowing the exhibit to present itself exploiting its own plentiful information and taking into account the context of its surroundings, richer experiences could be offered to visitors.

For example, regarding the presentation of its own information, it is now possible for the exhibit "The 3rd of May 1808 in Madrid"