A Critical Analysis Of EMDialog : Bringing Information Visualization into the Museum

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***Abstract*—EMDialog is an interactive information visualization installation that was integrated at the Glenbow Museum in Calgary, Canada as part of the *Emily Carr: New Perspectives on a Canadian Icon* exhibition. EMDialog consists of a large interactive display showing two interlinked visualizations that present commentary and imagery about Emily Carr's life and work along temporal and contextual dimensions. Visitors can explore these visualizations through direct touch interaction. To make the visualizations on the display visible to a larger audience, the contents are cloned and projected on a wall. The installation also provides ambient forest sounds of water, wind and birds through embedded speakers to convey Emily Carr's experience of painting in-situ. An observational user study conducted post the integration of the installation at the museum throws some light at the reception of this technique of artistic information visualization**

***Index Terms*—interactive information visualization, interactive displays, direct touch interaction, artistic information visualization**

I. Introduction

Since the very beginning, traditional museums have operated on the fundamental methodology of displaying original artworks and artefacts for the society to appreciate [2]. However, due to the limitations of space, venues and schedules, the total number of artefacts that see the light and come into direct contacts sometimes get truncated. One can consider the National Palace Museum (NPM) of Taiwan as one such example. The museum contains more than 650,000 domestic and foreign antiquities and has continuously increased it's collections by purchasing or accepting donations of artefacts. The entire collections will take over 30 years to exhibit if each exposition is run for three months at a time [3]. This would thus reduce the functioning of the museum to an antiquity warehouse rather than the important role it traditionally plays, of making heritage a part of peoples' lives. Based on this aspiration, the digital curation of a museum has become a research area of utmost importance in both, the academic and public sectors. One can see an interesting harmony arising between technology and societal impact in the field of museum digitization [2]. Knowledge sharing and exchange of idea are two methods by which the importance of cultural heritage are realized. Thus, the primary focus of the museum should be on visitor experience rather than technology. However, this cannot be achieved without the aids of advanced technology and thus there exists a dichotomy.

In this critical review, we first discuss the design challenges and the visualization discourse of the EMDialog installation. We would then focus on the reception study of this installation and the observations that the authors made. Lastly, we would look at suggested improvements to the technology and replacements to it, which might better digital curation.

II. Related Work

The problem of digital curation falls under the larger umbrella of casual information visualization [4]. This form of visualization generally deals with real and virtual public spaces and thus encounters new challenges everyday due to the wide range of audience for which it is intended. The physical public spaces that are of wide interest in casual information visualization include libraries, museums, and art galleries. In these spaces, large display technology and information visualization can work in tandem with each other to provide a more immersive and engaging experience [[5], [6], [7], [8]]. Information visualizations can not only present data that do have a physical representation but can also display artefacts that do not have them. Such type of information are usually presented in text panels. The presenting of information in museums can reach greater heights with the use of such techniques to display data visually that also support interactive capabilities. Large displays presenting casual information have been

previously studied in [[9], [10], [11]] which include physical spaces such as hallways of office buildings, conference socials and student residences. These semi-public spaces however only include a truncated audience set that broadly share the same interests or background. On the other hand, museums consist of an audience which are not only diverse but also undergo only short, one-time interactions. Previous studies on how people explore a museum [[12], [13]] and how to augment these experiences with interactivity [[14], [15]] have been of immediate relevance and were referred to while designing EMDialog.

III. Background

EMDialog was proposed during a time when augmented reality was in it's nascent stages and hence while arguably including such technologies would make the user experience even more interactive, the authors have done a really great job at tackling the problems prevalent with the technologies in demand at the time. When proposing such a system, it was important to take into consideration the diversity of people that visit a museum. Different diversity of people have different expectations and ways of exploration. On top of this, the visitors are under a pressure of seeing "everything" in the limited amount of time that they have. Thus, an exhibition which does not capture their attention and is unable to convey the information in a span of less than a minute or so, is generally ignored. These are the primary challenges that information visualization in a museum aims to tackle.

Through the deployment of EMDialog and the subsequent different visualizations that were studied in the recent era, a few key observations were made with respect to the success of such installations. All successful visualizations generally emphasized on interactivity. The important data that is displayed on the installation is generally put up in the public sphere for everyone to see and learn. In an idle state of the installation, the visualization is still in active mode via animations to attract visitors. Lastly, it is not the amount of data but the way the data is being represented that is important. As a result, successful installations limit the dataset to make room for a narrative [16].

IV. Discussion

A. Design and Setup

The information visualization setup should be easy to explore, to avoid awkward interaction techniques that generally discourages people. The authors kept in mind to adhere to the "walk-up and use" principle and thus kept the installation as lightweight as possible. Another important observation that the authors relied on was the need to eliminate unusually long instructions and let people figure out the usage through "trial and error". Information sequencing is another principle of utmost importance in the context of digital curation of a museum as it is responsible for how the narrative would unfold. This could either be incorporated into the visualization technique itself or by providing additional support such as the ability to return to previous installations. Lightweight interaction displays that integrate direct touch response were chosen. In particular, a large high-resolution interactive display (65" diagonal, 1920 ×1024 pixel) designed by SMART Technologies Inc. tilted by a 45° angle to resemble a digital drafting table, was chosen [1]. With the help of infrared lights at the edges and infrared cameras at the corners, direct touch was enabled. To convey the surrounding in which Emily Carr used to work, embedded speakers emitting ambient forest sounds were integrated. In addition, a large projection surface (101 × 56 inches) was arranged on the wall next to the interactive display, to cater to a larger audience and draw in visitors as shown in 1.

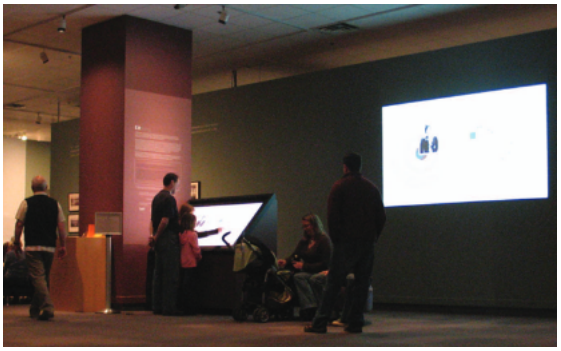

Fig. 1. Projected Screen to draw in visitors (image courtesy : [1])

The dataset consists of 103 written statements and 71 pictures. All pictures are works of Emily Carr. The statements have been collected from the comments of various authors' about Carr's work and Carr's own publications, journal entries and autobiography. The dataset has then been integrated into a conceptual framework with six different contexts defined. These contexts include : identity, modernism, feminism, Carr's Canadian identity, First Nations, and nature. The framework then divides the aforementioned contexts into six different node-link tree diagrams (henceforth trees) where each tree represents one context in which Carr's work and life can be interpreted. This division has been made using the concept of mind-mapping , an example for

which has been shown in 2. The tree structure contains approximately 1000 nodes in total and the authors, with their artistic perspective, aim to capture the overall theme of the exhibition : *Carr's work over time in various contexts*.

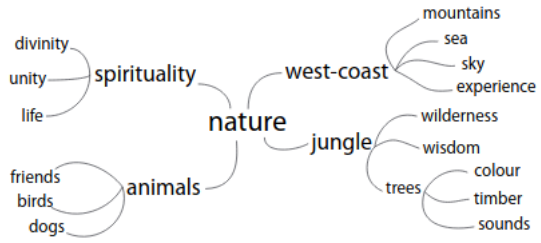

Fig. 2. An example partition of the nature tree diagram (image courtesy : [1])

B. Visualization Discourse

As mentioned previously, the authors have tried to capture Carr's work across two dimensions : **time** and **context**. They have used two different visualization techniques for the two different dimensions with an interlinking between them for an enriching experience. The two different techniques will be discussed separately.

1) Cut Section Visualization (Time Dimension): The timeline of Emily Carr's work starting from 1890 to 2010 has been depicted as a cut section of a tree with each tree ring depicting a decade. Statements from various authors about Carr's life, along with her own excerpts and paintings are depicted as small circles and are arranged within the tree rings. The statements on a tree ring are grouped by theme however there is no ordering within a theme. The cut section supports both, point-and-touch and continuous touch interaction. Touching a tree ring in a cut section, pops up the ring through lens effect. If a transparent circle is touched, it reveals the associated statement with it. One can simply select the statements by touching and releasing the finger from the display. Apart from this, it is also possible to have a smooth information browsing by running a finger across the cut-section continuously while touching. Thus, with the help of the aforementioned design, a broad temporal overview is provided. Another thing to keep in mind are the colors of the circles in the rings. Each circle is assigned one of six colors depending on the context to which it belongs and it is this feature that essentially links both the dimensions together.A sample visualization of the cut section has been shown in 4.

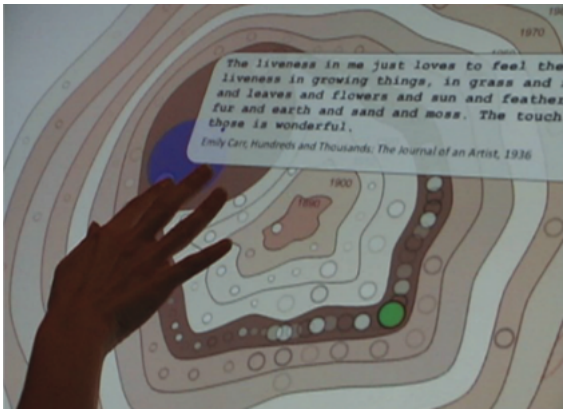

Fig. 3. Sample Cut Section visualization (image courtesy : [1])

2) Tree Visualization (Context Dimension): The statement or picture selected in the cut section on the left side of the interface is supplemented by the contextually related tree on the right side **??**. This tree pops up when a statement or picture is selected in the cut section. Circular tree nodes depict a word or short expressions. Statements or pictures are depicted as leaf nodes and are represented as squares. The spatial arrangement of tree nodes is follows a radial tree layout, where leaf nodes are aligned in semi-circles around their parent while the length of the connecting line between leaf and parent is fixed for all nodes of one level. The contextual dimension is captures by the tree by integrating the statements and pictures in an hierarchial graph. The branches of the tree can be followed by the visitors to gain complete contextual background behind a statement or a picture. In order to avoid clutter due to the large size of the dataset, the tree is never expanded fully. On touching a circle in the cut-section, only the corresponding node-link diagram is displayed with only those branches expanded that are in

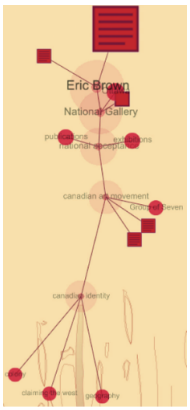

Fig. 4. Sample Tree Section visualization (image courtesy : [1])

direct connection with the statement. Correspondingly, touching a closed node in the tree section, will reveal it's children and collapse other open nodes based on a degree of interest function and a threshold [18], if need arises. Thus, visitors can now completely explore one of the six contextual trees. Touching a square icon on a leaf node enlarges it in the tree view and brings up the corresponding statement in the cut section. As touched upon at the end of the previous one subsection, one can now see that the two visualizations are interlinked. Each visualization can thus steer the direction for the other visualization. A complete overview of the installation is shown as 5.

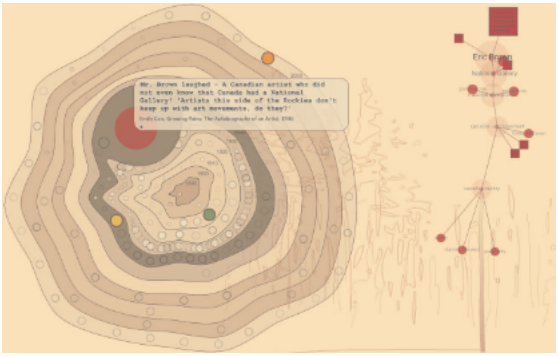

Fig. 5. Complete Overview (image courtesy : [1])

C. Audience Reception

The authors also conducted an observational study on the reception of their installation by visitors from which they learnt the following lessons -

- *Reward both, short-term and long-term exploration :* Based on the nature of visitors, some spent little time on the visualizations while others spent a significant time gathering the details. Thus, it is important to reward both kinds of interactions. The short-term interactions could be rewarded through the visual data representation. The long term exploration can be rewarded by an interactive design.
- *Supporting collaborative information exploration :* It was observed that in the context of a museum, people explored exhibitions in groups of people. Thus, there is a need for collaborative data exploration. The installation needs to support both, parallel and close collaboration, with close collaboration having a somewhat higher priority.
- *Making information exploration appealing :* With respect to individual exploration, the authors noted that the idle state of the installation (shown in 6), was interesting enough to capture an individual's attention. Thus, piquing curiosity in an individual was not a difficult but rather getting them to explore did raise some problems. The large display on the wall of the visualizations on the screen, although did gather in more visitors, it also made the individual exploring the installation a bit more reluctant. This was a result of individuals being afraid to "make mistakes" in public. Thus, this was a trade-off and the authors suggest putting up a brief exploration instruction on a template next to the installation to resolve this issue.
- *Supporting various exploration styles. :* The authors in this paper, aimed to promote exploratory style of data examination. The overall response to this was generally positive, however it was sometimes deemed as confusing. Thus, one needs to look into alternate techniques of exploration. Additionally, one can solve this issue without changing the framework by simply putting in subtle animations that guide people towards meaningful data exploration.

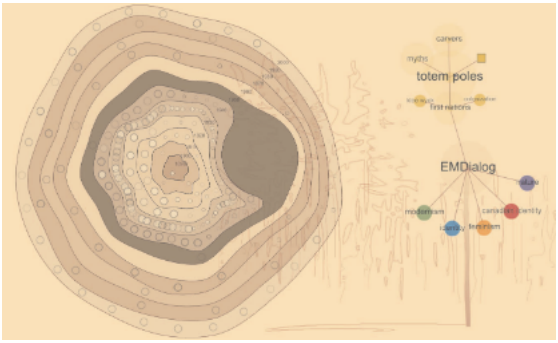

Fig. 6. Idle State (image courtesy : [1])

V. Scope of Improvement

Throughout the scope of analyzed paper and the literature survey conducted, certain drawbacks were briefly reflected upon. This technical paper attempts to provide alternate solutions which could either be used orthogonally to the deployed framework or completely substitute it, depending on the problem context.

A. Substitute the Tree Analogy

> "Visual representations of objects are often misinterpreted, either because they do not match our perceptual system, or they were intended to be misinterpreted." [20]

While true, that the currently deployed framework is visually expressive and promotes exploration. Another important factor to take into consideration is whether any misinformation is being conveyed. While this factor could have been lenient in any other public space, in the context of a museum, it is of utmost importance to not mis-convey any information. The depiction of Carr's work using transparent circle in the tree section to express decades, might wrongly convey one fundamental aspect about Carr : *the amount of contributions to the society over time.* The ever increasing radii of circles, might lead to the false assumption of more contributions in the latter years just because the visual representation might depict so. The cluttering of colored groups together may also raise false depictions of Carr contributing more to a particular context in any arbitrary time cut-section. An alternative form of visualization that this paper suggest is to use a setting of **streams and rivers**. The individual author works could be depicting as streams, while similar author works could then be clubbed together into a river. Let us focus on an individual artist. One could have a time scale running in parallel from the beginning to the end of an artist stream. Whenever an artist makes a contribution in a different domain, a streamlet could originate from the original stream. The width of these streams and streamlets are in proportion to the number of artworks contributed for that particular domain in the slotted time frame running in tandem with it. Different streamlets could be depicted in different colors to highlight each domain. When it comes to clubbing artists together, the artists of similar styles could be strategically clubbed together into a river. The representation of statements and pictures at the molecular remains the same as the EMDialog framework, with each genre depicted by a colored or white circle based on whether the streamlet is colored or not. The idea for this visualization technique was borrowed from the concept of stacked graphs. In particular, *ThemeRiver* (shown in 7) was a source of inspiration for the proposed technique.

B. Personalization and Multi-Device Handling

Personalization is an important fundamental that digital museums need to tackle with in order to boost the museum's relevance. Personalization of museum experience not only deals with the mutli-party or group explorations of exhibits but also promotes customer loyalty by establishing a one-to-one relation [2]. This can be accomplished by making use of the visitors' mobile devices for personal adaptation of information. This is a promising prospect of integrating the visitor's own device into the

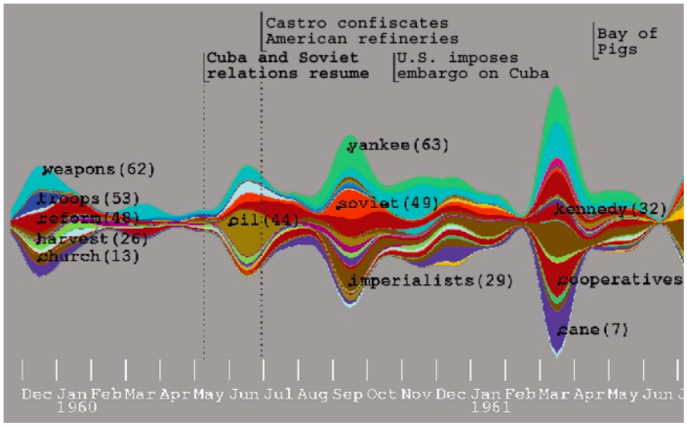

Fig. 7. Theme River (image courtesy : [19])

digital museum ecosystem. This promotes different dimensions of information visualization on a personalized screen by automatically filtering data depending on the artifact which is viewed or the different story line being followed. Thus a visitor's location and interactions would play the decisive role of the personalized visualization being demonstrated. Traditionally, exhibits are structured chronologically and thus the visualizations could be built on a timeline. Based on a visitor's location or the position of an object, it would provide the opportunity to experience additional information or stories [21]. A basic sketch of the proposed personalization technique is shown in 8.

Fig. 8. Proposed personalization technique (image courtesy : [21])

VI. Conclusion

EMDialog was designed to engage museum visitors in the process of exploratory data examination and was more than successful in doing so. It was well received by the visitors and was termed "graphically appealing" and "interesting" . People were able to appreciate the linkage of chronology and context along with a fun experience. It led to a better understanding of the timeline of her career and gave them a better sense of time and place. The

visitors felt that the installation enhanced the museum experience because it presented tidbits of background information which were not available anywhere else in the exhibit. The aforementioned receptions were gathered from a survey conducted in the museum. EMDialog with it's success opened the doors for tabletop visualizations in the context of museums and promoted new exploratory visualization techniques [22].

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