

A Collective Intelligence Assessment Approach through Alternate Realities in ‘The Museum of Gamers’

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ABSTRACT

“The Museum of Gamers” is a work in progress to program an online and digitally enhanced museum experience within an ecosystem of alternate realities. It demonstrates an integration of prototypical ideas as a special installation of three engagement types. The first deploys a laptop, a Kinect sensor and a wide-screen monitor; the second one runs through smartphones and tablets; and the third type of engagement is a 3D virtual reality cave system that uses three tablet devices and an embodying screen in front. In order to demonstrate the user engagement in this ecosystem, this paper depicts a digital heritage case scenario based on a public demo show at the national museum and art gallery of New Zealand, Te Papa Tongarewa. As an integrated part of the case scenario, an assessment model is delineated with preliminary results to discuss how this ecosystem is planned to manage the added value of its participatory process for digital content making. With the assessment model, this paper is among the first to investigate the cybernetics field to design a feedback mechanism between alternate realities for digital content generation in a collaboration between the fields of TV and GLAMs.

CCS CONCEPTS

Information Systems → Data Mining

KEYWORDS

The Museum of Gamers; digital heritage; association rule mining; museum; cybernetics.

1 INTRODUCTION AND RELATED WORK

“Why Don’t More Americans Go to Museums?” An arts blogazine, Hyperallergic, asked this to followers on Twitter, noting that “in the past we may have turned to pollsters or psychics, while today we turn to Twitter to look at the hive mind and discover why...” [1]. Museums look for a change in the way they communicate with the public. Although the above example sounds hypothetical, it is undoubtedly a clear representation of the current challenge in museology. Rethinking the contemporary structure of museums, RICHES project was funded by European Union’s Seventh Framework Programme for bringing cultural heritage and people together and for finding new ways of engaging with heritage in a digital world [2]. In this regard, the Pop-Up Museum is an exemplary partnership between Noterik (NTUA), The Netherlands Institute for Sound and Vision (NISV) and KU Leuven. The modular installation of the Pop-Up Museum hybridises digital and physical exhibitions while defining its own ecosystem of alternate realities through the merged lenses of the virtual and the real. In

theory, these developments can be seen a part of the demand for democratisation of museums’ dominant role on defining ethical values such as authenticity and aesthetics [3]. What makes the sharing of this role with the public impractical is that there is no clear mechanism for controlling the process of an inclusive content generation [4,5].

To respond to these claims, The Museum of Gamers proposes a participatory and democratic ecosystem for museum experiences through alternate realities, in which the added value is assessed by segmenting the subject-matter, i.e. user-generated content, into commensurable units. The assessment module relies on a cybernetic feedback mechanism that projects a network of alternate realities at three levels; immersiveness, agency and transformation. These three aspects are identified as the three key pleasures of cyberspace by Janet Murray [6] (see Figure 1). Below presented previous works motivate The Museum of Gamers for a unified approach on these three aspects. In parallel, we choose to classify related works in terms of, immersiveness, agency and transformation.



Figure 1. Murray’s ‘3 key pleasures in cyberspace’ are shown with medium, user and content respectively. ©Aydin

From the 1970s, The New Museology movement started to question the authoritative position of museums, offering the initial thought experiments in the museology field for adapting to immersive Virtual Reality technologies [7]. Usually seen through the lens of the infamous Reality-Virtuality continuum [8], virtual museums have been developed to primarily increase public engagement. The first of its kind was the Guggenheim Virtual Museum (1999) that was designed to navigate through an immersive 3D virtual museum space. At present many museums provide virtual online tours of their physical museum space, e.g. The Louvre [9]. Among VR applications, wearable technologies and immersive caves receive growing enthusiasm [10,11,12]. In order to increase the sense of agency, hence meaningful role-playing, serious games have recently been a productive area for museum projects [13,14]. However, they are still designed to teach a particular view on the authentic object and the presented content remains to be ‘sacred’ and untouchable. In other words, hitherto examples are bound to a dual relationship between immersiveness and agency, mostly marginalising the role of transformation. Interestingly, by many critics games are considered to have the upperhand in demonstrating a use of cyberspace as a social, and transformative medium [6,15,16]. Yet, The Museum of Gamers is about an organisational change for a

novel museum experience in lieu of merely developing new media applications. Bridging game design expertise to the design of alternate realities in a digitally-enhanced online museum experience, this work draws on the role of transformation in participatory content generation.

2 THE MUSEUM OF GAMERS

We prefer to interpret the need for an organisational change in museums as a provocation to embark on a task for dispatching their authoritative power on the transformation of content with peoples' collective intelligence. Here our focus is on the subject-matter of the proposed digital online ecosystem. Based on the act of collecting, the subject-matter that we refer is user-generated content that reflects individuals' understanding of authenticity and aesthetics. With our assessments, we dig insight out from the outcome of a participatory digital heritage making process.



Figure 2. Virtual tours in *The Museum of Gamers* are supported by the Sketchfab platform to publish, share and discover 3D content online and in VR [17]. ©Aydin

In this paper, the qualitative findings from the association rule mining method is presented within a case which is instrumental to reading the delineation of the feedback mechanism. In this case, Kashgar, which is a historical town on the ancient Silk Road, provides the heritage content to be translated into digitally interactive environments (see Figure 2). The here-presented case scenario is based on a public event at The Museum of New Zealand Te Papa Tongarewa in Wellington between March 17 and 19, 2017.

2.1 Alternate realities

The alternate realities in this case scenario can be seen through two different lenses based on the type of connection which is to enhance the role of transformation.

The first one is a software-based connection between two interactive online games that are run on a computer and a smartphone. The games are named as 'The Trace' and 'Missing Duppa'. The first game is based on a photogrammetric model of the historical Kashgar's narrow alleyways, whereas the second one follows an indie-style representation of the architectural elements of the ancient town. The system is designed to observe the memorisation processes of individuals while transforming the content of two games in which the mechanics are interlinked. In 'The Trace', the players act to repair the virtual model, whereas the other player breaks the voxelated low-poly forms. The more repaired parts in the first game generates negative feedback by respawning the broken units in the second and vice-versa. These two games can be played either by two players without being informed of the interlinked mechanism. Or a single player can hold a smartphone to play 'Missing Duppa' and at the same time

interact with 'The Trace' in a physical sense recognised by a Kinect sensor (see Figure 3).



Figure 3. Alternate realities in *The Museum of Gamers*. Left: 'The Trace' played on a computer. Right: 'Missing Duppa' on a smartphone. Bottom: 3D sketching in Hyve-3D. ©Aydin

The second connection type is in fact a system on its own. This VR system is titled as Hyve-3D which becomes a subsystem. It is run on a computer from which a digital scene is stereographically mapped on a mirror reflecting the view onto a fabric screen that ergonomically suffices to encapsulate the viewer's isovist. The size of the curtain installation defines a physical boundary for a social environment with a 5 meter diameter from outside [18,19]. In this case scenario, we propose to connect the embodying environment of this subsystem to the rest of the activities through a hardware solution by using beacons (see Figure 3).

2.2 Collecting objects

Relying on the information and data generated throughout the transformation of content, the assessment system looks into the act of collecting by users interacting with/within these alternate realities.

In 'The Trace', the player navigates through the photogrammetric model of narrow alleyways in the historical Kashgar. Following an initial familiarisation with the virtual environment, an online visitor is asked to fix the missing parts with texture recorded throughout the flythrough experience. The texture images that are saved in a data folder constitute a library of the visitors' experience (see Figure 4).

Similarly, 'Missing Duppa' is an online interactive environment to familiarise the visitor with individual architectural elements. The low poly representation of these elements provides a faster understanding of the relationship between essential elements of Kashgar's architecture (Figure 4). Meanwhile, players generate a library where each item represents an architectural element that is broken into a cube-form brick within the game. Therefore the transformation of the content that holds certain relationships between items become subject to our association rule search methods.

Connected to tablet devices, the Hyve-3D system allows participants to have control over navigation as well as to draw sketches within the 3D virtual environment (see Figure 4). These drawings are then analysed with virtual location-based techniques in relationship to each other. The immersive cave-like environment creates a smooth boundary for people to socialise as the system enforces communication that provokes active collocated collaboration to draw meaningful sketches. Immersive view on the curtain and orthogonal complementary views on tablets facilitate diverse scales and views of the heritage content (see Figure 5).



Figure 4. Collection of objects. Left: 2D patterns in 'The Trace'. Middle: 3D low-poly geometries in 'Missing Duppa'. Right: 3D sketch lines drawn in Hyve-3D. ©Aydin



Figure 5. Hyve-3D becomes a social platform when populated by people to navigate through virtual spaces and draw sketches at the same time. ©Aydin

During a public exhibition at New Zealand's national museum, Te Papa Tongarewa, different types of users participated in the collaborative drawing activity (see Figure 5 and 6). Our observation is composed of three main findings.

Firstly, the Hyve-3D system is highly immersive in a pure physical sense. Yet the sense of immersiveness should be first improved in connection to the role of agency, i.e. meaningful play.

Secondly, the socialising physical space is used in different ways by particularly kids, depending on the content. Adults prefer to stand in the middle of the sphere, whereas children's behaviours are not predictable except that they tend to stay away from the screen if the content is more realistic. They are shown mashup models with much less sense of gravity, kids chose to stay closer to the screen. We deduce that the realistic content becomes repulsive since the size of the screen is designed for adults. With regards to the position of kids (age: 5-11), another point to highlight is that they mostly preferred to be immersed in this kind of environment rather than in immersive VR headsets. As kids are an important determinant for a collective satisfaction of visiting families, the immersive aspects of Hyve-3D convinces us for

further integration of its system to the rest of the alternate realities in The Museum of Gamers.



Figure 6. Hyve-3D's space allows the participation of people with different physical demands. The intuitive 3D sketches of participants are collected and exported as .DXF files. ©Aydin

Last but not least, based on this demo show, we propose to use beacons to enhance the level of personalised content in a museum experience in our case scenario. By that, we aim to connect the Hyve-3D to the general ecosystem of alternate realities in The Museum of Gamers. With beacons set up throughout the physical space of a museum, users can view personalised content on their smartphones based on their interaction that is assessed in terms of the meaningful association that are to be revealed by our assessment model.

3 ASSESSING COLLECTIVE INTELLIGENCE

3.1 Feedback mechanism

In order to integrate these prototypical medium of alternate realities, The Museum of Gamers hypothetically propose to look into transformation of the content as a collective sum of parts. This reveals our purpose as to reframe the complexity of the proposed ecosystem into basic units of each interaction, following Pippenger's "diversity of phenomena that can arise through the interaction of simple components" [20].

The act of collecting becomes the strongest determinant of content transformation. And collected objects from each medium become data that is loaded with meaningful insight to be revealed via datamining techniques, e.g. association rule mining. First we demonstrate the place of these techniques within our proposed ecosystem.

The feedback mechanism shown in Figure 7 is developed to effectively aid the design of a system for participatory digital heritage content making. Diagrams of the mechanism display the integrative approach on three aspects of digital engagement; immersiveness, agency and transformation.

The three feedback loops have no pre-defined hierarchical priority over each other, yet this relies on the controlling agent at a specific time-frame. In terms of the player data collected before any action taken in the ecosystem, the outer feedback loop answers who the visitor is based on surveys. Middle feedback loop informs the system about the data that is instantly generated during the interaction once the user is an active game-changer.

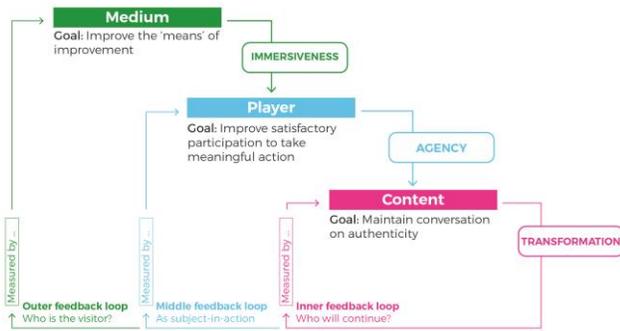


Figure 7. *The Museum of Gamers. Top: Diagram of the feedback mechanism [21]. ©Aydin*

And lastly, the inner feedback loop is about the transformation of content as well as the visitor’s perception and cognitive abilities. In order to gain full insight from these relations, physiological data need to be gathered during the active engagement. This paper only focuses on the transformation of content and its messages to the rest of the system.

3.2 Association rule mining

Association rules between pieces of data that represents individuals’ collection of objects are conditional statements such as ‘if there is a door, there is a handle’. These rules help uncover relations between discrete pieces of data in a relational database. Therefore association rules inform us about relationships of data, which are otherwise not obvious. For example, the results of our initial experiments suggest following relationships based on the patterns collected by one player in ‘The Trace’. The transaction of this player was comprised of {Metal Door, Timber Wall Structure, Brick Wall}. They are found to have associations with other 1-itemsets searched within the whole dataset in the following order {Rec Cobblestone}, {Timber Structure}, {Mud-Brick Wall}, {Hex Cobblestone}, {Blue Door}, {Mosque Gate}, {Red Door}.

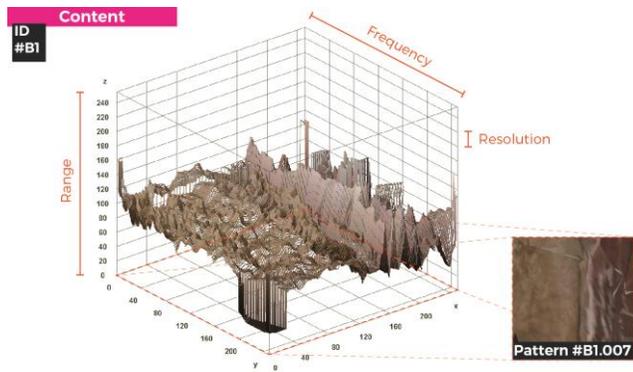


Figure 8. *Defining the values of resolution, frequency and range of a user-generated content item in ‘The Trace’ becomes instrumental to identifying a pattern collected by a player. ©Aydin*

Besides using simple semantic information that are tagged on the content, the collections are further segmented into basic units (see Figure 8). The values of range, frequency and resolution help define a basis for comparison between the items of the visitor’s unique collection library. In other words, narratives are divided

into modules which are segmented by units by analysing visual, geometrical and semantic elements. This project proposes to communicate these units as dynamic components of transformation that is necessary for a dynamic narrative and museum experience. This approach is in contrast to the stabilising approach that is called atomic narrative units (ANU) [22]. With ANU, the narrative information cannot be broken into discrete segments. Yet, we see the here-presented approach as a game-changer for restructuring the investigative role of museums towards a deeper level.

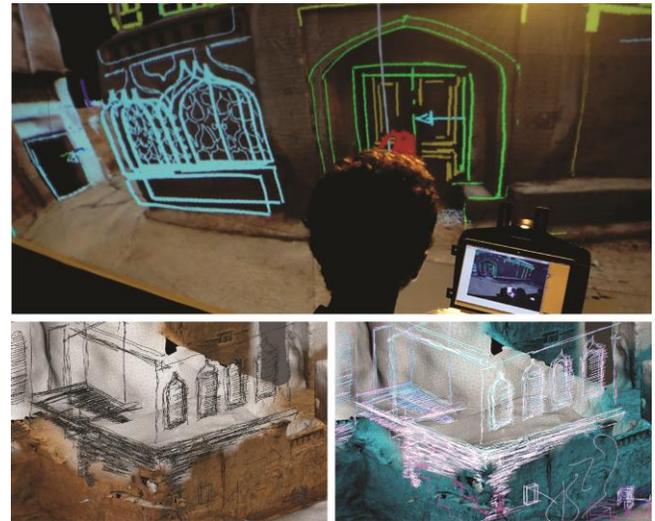


Figure 9. *Analysing 3D sketches from the interaction into visual segmentation of units. ©Aydin*

Similarly, the lines that are collectively sketched in Hyve-3D can be assessed with its own values of resolution, frequency and range for a universal comparison. This builds up information networks on the basis of the user-generated data from which the feedback mechanism gathers insight emerging from local and topological relations between the segmented units of the user-generated content rather than assessing the outcome as it is. In Figure 9, the top scene is captured during a collaborative sketching session through Hyve-3D in a workshop in Melbourne, which is remotely contributed by participants from Montreal. In the bottom part, it depicts two views from the relational assessment of the lines drawn during the Te Papa’s public event. The proposed assessment method based on the segmentation analysis of basic units which will be published with details in a future work. This paper underlines the possibility of using this type of information generated through the user-generated datasets. Potentially, this process can easily be integrated into broadcasting means for more personalised experiences from our homes, which we will discuss in the next section.

4 DISCUSSION

By combining leading-edge cyberspace applications, this work aims for an online ecosystem that is extended up to the use of TVs and smart gadgets to augment the sense of reality in a digitally conceived museum experience. The Museum of Gamers chooses to salute TV and aims to integrate its facilities to the designed platforms through alternate realities that are run via the shared aspects of cyberspace.

The invention of hyperlinks has increased the cyber-journey between online media platforms from news sites to the ones for shopping. An added technology is hypervideos that are promising to link broadcast to broadband. HbbTV technology is one of the recent popular investments of the design and research in the field. Despite the emancipation that hyperlinks and hypervideos promote, the present cyberspace that we can define as Web 2.0 is occupied in a turn-based and looking participatory on surface [23,24]. Beacons [25], smart watches [26], second screen companions apps such as those made for Game of Thrones for iTV [27] will help the world move ever closer to the Internet-of-Things. The Museum of Gamers proposes a contemporary technological integration between alternate realities based on an assessment scheme that focuses the user-generated content. This requires us to design feedback cycles for information management between different medium. In this ecosystem, designing a cybernetic model without a dominant control room is possible. With the current iBeacon technology that is programmed to sense the low-proximity of a mobile device, it is possible to hand over the control based on the rules of the system that is less biased towards the outcome, which is the input of the individual, than the relations between input items that are analysed on an indexical comparison table.

4 OUTLOOK

At present, the project continues with the work for correlating and assessing the decomposition of narratives in each alternate reality into smaller and commensurable units. This research approach is based on the hypothesis that the narrative quality is not solely dependent on atomic narrative units that do not offer change in basic media units, i.e. the technical level. Instead it chooses to see it as a whole issue by focusing on the associations between these units which require a high-level cybernetic feedback model. Cybernetics is an influential field of feedback systems. Yet, its potentials remain to be discovered. This paper is to aid the online media and TV sector in taking advantage of their facilities to assist museums to be more participatory and prevalently accessible in our daily lives. The work is presented based on textual and diagrammatic explication of a demo show with a set of interactive environments at Te Papa Museum in Wellington. Content-based outcome is analysed through game player modelling methods. Qualitative findings of this paper suggests a discussion to bring closer the domains of museology and TV and online media. The presented study aims to promote acceptance of content-based analysis for designing a system of alternate realities. Yet, its experiments are obliged to be conducted with larger number of participants and further development in its approach. In fact, this paper is among the first to investigate the cybernetics field in terms of designing a feedback mechanism between alternate realities for digital content generation in a collaboration between the TV industry and the GLAMs sector.

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