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# **Games as Crowdsourcing Tools for Digital Heritage in the Gallery, Library, Archive and Museum (GLAM) Field**

A Model Design for Cultural Crowdsourcing Games Through  
the Lens of Interactive Narrative

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## ABSTRACT

GLAM crowdsourcing game is an emergent form of serious game that is designed to collect and promote cultural heritage. However, as to date, the gameplay is quite boring and the data (e.g., tags) such games can crowdsource is limited; potential participants are restricted and crowdsourcing games for GLAM remain to be improved.

In entertainment games, Interactive Digital Narrative (IDN) is a commonly used method to engage players and improve playing experience. There are some successful entertainment games that embraced both the cultural heritage and crowdsourcing intentionally or unintentionally.

To make cultural heritage more creative, attractive and engageable, this paper proposes to combine Interactive digital narrative with Gallery, library, archive and museum Crowdsourcing (IGC) to create a new model for use by cultural institutes, scholars and the general public. Main methods for this paper are literature review, comparison and analysis based on literatures and real cases and model design.

This paper first studies cultural crowdsourcing games to analyse the relationship between crowdsourcing and in-game narrative. Subsequently, the IGC model, which combined models from the cultural digitisation process and interactive narrative will be proposed as an analytical tool for case studies; with the examination of *Animal Crossing: New Horizon* and *Ingress*, a preliminary validation of the IGC model application is demonstrated in different contexts and projects. Finally, we discuss future research approaches to making the IGC model as applicable and useful for digital heritage as possible.

**Keywords:** Interactive Digital Narrative, IDN, SPP Model, Hermeneutics, Hermeneutic Strip, Media Design, Intangible Cultural Heritage, Tangible Cultural Heritage, Digital Curation, Crowdsourcing, Digital Humanities, Digital Heritage, Interactive Narrative Design, Gamification, Animal Crossing, Ingress, Serious Game, Participatory Design

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## **List of Abbreviations**

|             |   |
|-------------|---|
| <b>CCI</b>  | Crowdsourcing Classification Initiative |
| <b>CTT</b>  | Correction and Transcription Tasks      |
| <b>DCLC</b> | Digital Content Life Cycle              |
| <b>DH</b>   | Digital Heritage                        |
| <b>GLAM</b> | Gallery, Library, Archive and Museum    |
| <b>ICH</b>  | Intangible Cultural Heritage            |
| <b>IDN</b>  | Interactive Digital Narrative           |
| <b>IGC</b>  | IDN for GLAM Crowdsourcing              |
| <b>NPC</b>  | Non-player Character                    |
| <b>SPP</b>  | System, Process and Product             |

# 1. Introduction

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## 1.1 Idea, Background and Motivation

Inspired by the idea of games for learning – enabling people to enjoy the process of learning while keeping the academic rigour and having fun, this research began with a comparison between the concept of a serious game and an entertainment video game. According to Zyda [1], the former is “a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives” whereas the latter is normally dedicated only to entertainment [2]. Despite the definitions given, sometimes a video game not designed as a serious game can also be played in a way other than entertainment. This is beyond the game developer’s intention and the notion of serious gaming [2] originated from here.

Consistent with these features, serious games are becoming a type of digital experience through which people can interact with cultural heritage. Barbara’s research has [3] indicated that: “[serious] games whose aims are education and appreciation of cultural heritage may manage to stay away from popular genres but still find themselves repurposing the digital representation of the historical space [...]”. In addition, among some cultural heritage initiatives [4-7], serious games (e.g., [8, 9]) that using crowdsourcing procedures, have been discussed by scholars (Hildebrand et.al). In particular, crowdsourcing games for Gallery, Library, Archive and Museum (GLAM) is an emergent form of games that try to collect cultural knowledge from the public, attract players to engage in cultural heritage and promote the heritage by these processes.

However, currently, only limited gameplay (e.g., tagging and competition) is provided in GLAM crowdsourcing games and the audience group is small (mainly the professional and some amateurs). How to improve the gameplay and the experience of crowdsourcing games to attract more participants for GLAMs remains an open question.

## 1.2 Creative Demands in Digital Heritage

The GLAM crowdsourcing game is a good illustration of how creativity in relation to cultural heritage can be used to engage people to contribute to and learn from a specific culture. Making digital heritage projects creative can help maximise the re-use of digitised cultural materials, sometimes even attracting people to enjoy learning cultural heritage and integrate it into their daily life.

In terms of the theory of such projects led by GLAMs, the first discussion of experimental museology appeared in 1889, where George B. Goode [10] gave the lecture on ‘the future of the museum’. He claimed that one day the museum will have the equivalence between a library and a laboratory. This means the museum could take more responsibilities to connect people and professionals through experiments. Nowadays, experimental museology always embraces the constantly changing landscape (the development of multimedia technology, co-creation, etc.) and

visualisation as a way to mapping data in experimental museology “has been used for centuries to reveal patterns, to communicate complex ideas and to tell stories” [11]. The discussion of experimental museology allows us to think about the relationship between data and the method of visualisation in the contemporary society and how creativity can be incorporated.

In the context of Europe, the European Union (EU) Commission’s brochure [12]: “Digital for Culture Preserving and Promoting Our Cultural Heritage” proposed the use of most digital technologies (e.g., 3D, artificial intelligence, virtual reality, etc.) to record, preserve and promote Europe’s culture heritage, to make digital heritage projects more accessible, and to foster creativity and encourage innovation. EU also committed to promoting museums and cultural organisations to embrace technology that can ultimately offer innovative experiences online and offline [13]. These calls can also be transferrable to digital heritage projects and scholarships worldwide to achieve a sustainable heritage.

### **1.3 Research Questions and Goals**

In this research paper, the discussion will mainly be focused on the critique and improvement of current GLAM crowdsourcing games that can meet the creative demands. This paper (a) assumes that GLAM Crowdsourcing games are useful to people and /or cultural heritage institutions; or (b) will show some benefits as found by the literature (in later chapters). The main research question of this study is:

What strategy is needed to attract more audiences/players/participants as a GLAM crowdsourcing project?

By using the versatility (e.g., education, game design [14] and heritage [3]) of Interactive Digital Narrative (IDN) to address the research question, this paper proposes a new model to improve the attractiveness of current GLAM crowdsourcing games. The proposed model is expected to be the preliminary finding of a guideline for creative digital heritage projects prototyping that uses the concept of co-creation.

### **1.4 Research Method**

Three methods were utilised in this research. To address the research question, this research firstly applied an analytical approach to establish the setting based on literatures. Followed by reviews and comparisons of existed models from interactive digital narrative and GLAM fields, the IDN for GLAM Crowdsourcing (IGC) model is defined. Lastly, through case studies, the application of IGC model is specified.

### **1.5 Outline**

The remainder of this paper is structured into five parts. Section 2 presents a literature review and defines key concepts related to the creative digital heritage, to establish the research context. Section 3 presents the development of GLAM crowdsourcing games with case studies and then the proposed IGC model, which served as the methodology for the case study of two games in section 4: *Animal Crossing: New Horizons* and *Ingress*. Section 5 will discuss the generality of the model, including its

potential usage in areas beyond GLAM crowdsourcing games and future research prospects. Finally, section 6 concludes the paper.

## 2. Literature Review

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In this section, a literature review will be conducted to support the development of the IGC model theoretically. First, the concept of the model design – Interactive Digital Narrative (IDN) will be introduced as the basis of this research. Consequently, the analysis of innovative concepts and examples will be given to examine the deeper reasons for creating a new model from IDN for GLAMs.

### 2.1 Interactive Digital Narrative

Unlike the legacy narrative structure such as Aristotle’s Dramatic Arc, in the digital media context, narrative can be dynamically changed based on the way people interact with the computer [15, 16] and the perception of human mind [17, 18]. Followed by this discourse, the concept of IDN was raised; a theory towards IDN – the SPP model has therefore been developed by Koenitz.

#### 2.1.1 SPP Model

The SPP model (see Figure 1), which consists by system, process and product, emphasis on the narrative as an interactive computer programme with the potential of instantiating narratives through user interaction [19].

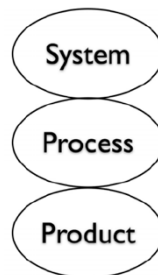


Figure 1 SPP Model Diagram [20]

As Koenitz [20] defines, a system (e.g., programming code, assets, network, etc.) is the digital artefact that saved in a storage medium along with its running environment – hardware. It is also the place where the data such as pictures and sounds in a game store. Those data could act as the ingredients to facilitate the construction of “potential narratives”. The process could be generated by the user interaction with the system, whereas a product is the instantiation of “walkthrough” from user interaction and system narrative output, which is analysable through the traditional narratology.

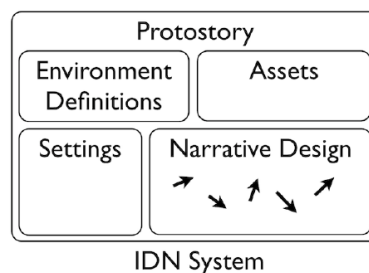


Figure 2 Protostory and Narrative Design in IDN System [20]

To better describe various characteristics of IDN, the terminology – *Protostory* (Figure 2) was coined. It includes the combination of environment definitions, assets, settings and narrative (vector) design, which can indicate potential narratives through a process of instantiation from both the programming and artistic perspective. Specifically, environment could be the runtime system, operations systems, etc.; assets can be in-game 3D Objects, pictures, user data, programme code and so on. Settings in most cases define the way of playing game (e.g., online or offline). The narrative (vector) design can be construed as potential results or plots in traditional literatures produced by a player’s interaction with the programme – i.e., imagining when driving a car on the road, turning left leads the gamer to a desert while turning right leads to the seaside.

### 2.1.2 Hermeneutic Circle/Strip



Figure 3 The realisation of SPP Model through Hermeneutic Strip [19]

Based on the SPP model, the development of the Hermeneutic Circle/Strip (see Figure 3) was to address the narrative paradox between ludology and narratology [19]. The upper strip illustrates the system and narrative affordances and the player’s understanding of the game mechanics [19, 21]. Meanwhile, the bottom strip shows the instantiation of the player’s current action. In this research, the concentration will only be given on the analysis of Hermeneutic Circle applications.

## 2.2 Innovative Digital Heritage

In addition to the creative demands mentioned in chapter 1, this chapter will also help people to understand approaches that how researchers design a Digital Heritage project, and culture learners ‘manipulate’ the digital heritage objects. Together with the IDN, the innovative digital heritage threads expect to back up the paper from conceptual perspectives.

### 2.2.1 Digital Heritage and Interpretation

Digital Heritage (DH), as an emerging field of study, has called many scholars to research and digitise cultural and historical knowledge (e.g., China Biographical Database [22], China Historical Geographic Information System [23], the Comfort

Woman AR Map Project [24], Bagan [25], etc.). According to Rahaman and Tan [26], digital heritage is “any digital content that possess cultural values either in the form of 2D (such as text, image and motion pictures) or 3D (such as navigational virtual environment, three dimensional objects)” or the combination of both forms. Regarding the goal of Intangible Cultural Heritage (ICH) [27], heritage should also share culture with the general public, transmit culture to the next generation [27, 28] and promote a thriving culture inheritance in the digital context.

Three dimensions of digital heritage [29] are documentation – getting the data in, representation – modelling and rendering, presentation and dissemination; the most critical stage to fulfil DH’s presentation and dissemination objective is to build the ‘culture uniqueness’ for end-users and give them polyvocality of interpretation [26]. The term heritage interpretation was thereafter discussed and described [30, 31] as “an effective learning, communicating, and managing tool that increases visitors’ awareness of, and empathy to, the heritage site or artefacts”.

In 2017, four objectives towards heritage interpretation: satisfaction, provocation, learning, and multiple perspectives of the past for digital heritage were proposed by Rahaman and Kiang [30]. However, there was no development of a comprehensive interpretive method (e.g., historical knowledge presented and interpreted by human-computer interaction technologies, with the central concerns from end-users) that has been discussed in the discourse of digital heritage. The analytical model suggested later in this paper could also help to prepare for prototyping such an interpretive method in the DH field.

### **2.2.2 Affordances of Interactive Digital Narrative**

In line with the IDN, an approach to realise the ‘culture uniqueness’ and the heritage interpretation is possible. As explained in section 2.1, the process of creating IDN per se is instantiating unique experiences and interpretation (e.g., Lower Hermeneutic Circle - the instantiation of IDN). The affordances above are based on the agency (the basis of games) and the ‘fourth layer/fourth wall’ of narrative (the dissemination of gaming experience).

While the agency was defined by Murray [15, 16] as “an aesthetic pleasure characteristic of digital environments [...] happening in the dynamically responsive world”, the user agency, in the context of IDN, is more related to the concept of what Murray called a dramatic agency [16] where “a procedural and participatory environment that makes use of compelling story elements, such as an adventure game”.

Moreover, the fourth layer proposed by Eladhari [32], was described as the gaming experience re-telling process from a player. This can be done through multiple channels such as posting a thread in online communities [33], creating video reports based on an in-game event [34], etc. Thus, the fourth layer (retelling) can be extended also to an interactive experience with the help of user agency that can dynamically construct a narrative and break the fourth wall.

From an IDN’s affordances point of view, user agency, or to be more accurately, the participants’ agency in the context of participatory design is suitable to be a part of

the creative DH research infrastructure. This is because the agency offered participants the ability to choose and have a personalised experience. In the meanwhile, the fourth layer extends this agency from human-machine interaction to the physical world to make an impact on people's real life.

Furtherly explained the affordances of IDN, Chen et.al [35] suggested the interactive documentary (i-doc) for digital heritage initiative. They made an i-doc that allow users to explore the Indonesian intangible cultural heritage – Batik through making choices, watching videos, online discussion, manipulating 3D models and playing the mini-game Batik design. The emergence of this research project turned out the possibility of prototyping digital heritage projects based on the Interactive Digital Narrative.

### **2.2.3 Citizen Humanities**

In 2016, the term - citizen humanities - was coined and discussed [36], despite its long-term practice. Citizen humanities represents the 'citizen science' in the humanities field with focuses on "understanding texts and artefacts, thus favouring methods of interpretation, critical thinking, and analysis" in addition to explaining [37]. Due to its interdisciplinarity (e.g., archaeology [38], linguistics[39], etc.), researchers and the public have the chance to contribute and learn humanities knowledge together in a scientific approach, and this enabled the digital heritage study to join the discourse of citizen humanities.

A good illustration of historical data collection in the citizen humanities' context is the Ancient Lives project that successfully attracted hundreds of thousands of participants in their transcribing task as a part of an Oxford research project since 2011. With 250,000 participants worldwide [40], it asks "volunteers to transcribe ancient Greek text on fragments from the Oxyrhynchus Papyri collection" and as a result published two papers to date [38]. It is obvious that transcribing as a way for crowdsourcing is not attractive enough and limited the diversity of participants – in this case, all volunteers are well educated and people without contextual knowledge of ancient Greek are actually excluded; the situation especially mattered when citizen humanities projects have another focus or multiple objectives such as learning while crowdsourcing, which means project organisers may need different ways to approach participants.

Depending on the design of implementation methods in citizen humanities, it is possible to discover various approaches to attract volunteers from different educational backgrounds. The research of Heinisch et.al. [37] suggested gamification as a method "to make tasks more appealing to participants". They also mentioned some crowdsourcing games using tagging mechanisms, which will be introduced in chapter 3. But this form of games cannot give players an attractive instantiation from the IDN's angle as the gameplay is monotonous. In addition, it also cannot generate 'culture uniqueness' concerning the heritage interpretation as an affordance of IDN. Therefore, a redesign of the gamification process that encompasses more interactive narrative elements in the citizen humanities project is promising.



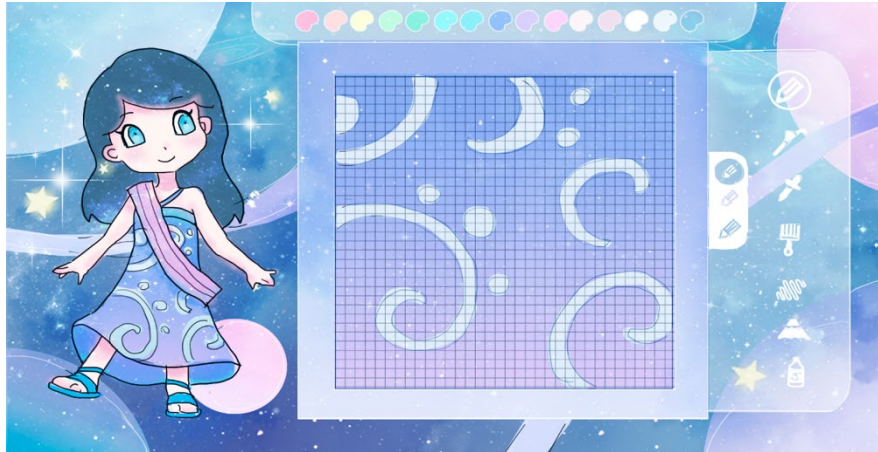


Figure 4 User Interface of the Mini-game Batik Design [35]

The design of gamification with IDN may also turn the citizen humanities project into a platform where participants can contribute to a specific humanities research, “increase their knowledge of the topic, apply more critical and connected thinking [and] use generic platforms as tools for learning” [41]. This can also allow people who do not have a particular cultural background to gain knowledge through learning from gameplay and instantiated narrative. In the i-doc’s example mentioned in the previous chapter, after the audience learned the motifs of Indonesian Batik through videos, interactive maps and the exploration of 3D models, they are allowed to design their own batik cloth (Figure 4), save the design and share it with the online discussion community. It can be argued that this process does not only contain learning but also creating knowledge and developing a culture.

#### 2.2.4 Media Innovation

Media Innovation was invented by Storsul and Krumsvik according to the interrelationship between the innovation and invention; an innovation is the application of a new idea or theoretical model (an invention) in a social setting [42]. Media Innovation considers five aspects [43]:

1. Product innovation relates to changes in the products/services offered by an organisation.
2. Process innovation refers to changes in the ways in which products/services are created and delivered.
3. Position innovation involves changes in how products/services are positioned or framed within particular contexts.
4. Paradigmatic innovation includes changes in an organisation’s mindset, values and business models.
5. Social innovation is innovation that meets social needs and improves people’s lives.

In the context of digital heritage, product innovation may relate to new platforms development (e.g., a mobile application that allows users to explore a historical place of interest virtually and post comments wherever they want, a web platform that offers cultural crowdsourcing tasks). Process innovation could mean how the GLAMs initiate an event and new technologies to deliver heritage content and invite people to participate in cultural heritage such as the ‘comfort woman’ project [24] that combined GIS and Augmented Reality.

Meanwhile, position innovation for GLAMs in the COVID-19 context may refer to the transformation from offline service to online environment and operation strategies in the post-pandemic era. As to the paradigmatic innovation, GLAMs could seek for a suitable operation model for their future development such as how to collaborate with scholars and engage the public; especially during this time, people’s life pattern has been changed drastically. In the education sector, schools are trying to use the online-offline blending mode for teaching and assessing students [44] whereas, in the business sector, people who used to buy fresh foods in stores now tend to do online shopping [45].

Regarding social innovation, digital heritage will change how people study, perceive cultural knowledge and sometimes even ingrain the ICH into their daily routine; students may have more options to learn history apart from textbooks (e.g., experiencing an interactive documentary [25]). They can also contribute to a knowledge database if they participated in any cultural crowdsourcing initiatives.

Media Innovations could impact on many aspects, this include but not limited to: (1) technology, (2) market opportunities and user behaviour, (3) behaviour of competitors, (4) regulation, (5) industry norms, (6) company strategy, (7) leadership and vision, (8) organisational structure, (9) capacity and resources, and (10) culture and creativity. [43]

In this research, media innovation expects to impact the society through technology, user behaviour and culture and creativity. In the i-doc’s case [35], the interactive documentary was developed and proposed as a platform that can connect the professionals and the general public as a way to encourage the interaction between people and ICH and consequently influence people’s everyday life. Similarly, crowdsourcing games supported by GLAMs could also have the potential to promote the cultural heritage and indirectly effect people’s life.

For this paper, IDN based crowdsourcing game design will also be deemed as a media innovation as it could change the current landscape of GLAMs and develop a better strategy of digital heritage material collection, reuse and assembly. The focus of this paper will be on the discussion of the digital heritage in entertainment games and the current design of GLAM crowdsourcing games. Together with IDN’s affordances, citizen humanities initiative and media innovation theory, a new model will be suggested for future exploration.

### 3. State of the Art in Crowdsourcing Games

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In this section, a study of crowdsourcing game practices will be conducted to show some of the design and enhancement techniques of GLAM crowdsourcing games. Reflecting upon existing practices and their associated challenges will help towards developing a new model to improve the current design.

#### 3.1 From Waisda? To Art Controller – The Critical Design Process

##### 3.1.1 Why cultural crowdsourcing games?

Before the awareness of crowdsourcing, audio-visual materials were hard to manage since the mass amount of time was spent on cataloguing and adding descriptions to those materials. This is because viewing the material could take a long time, which during this process, cataloguers need to take notes of programme type, reusability, shots used to assemble the video piece, etc [46]. To address this issue, the concept of outsourcing – “[the] transfer by a business of ancillary jobs functions to a third party in order to lower costs and improve efficiency and to focus on core responsibilities”[47], was introduced to invite amateurs (audiences/users) collaborating the classification process.

The concept of crowdsourcing further extends this idea by also inviting experts. As a result, in the context of GLAM crowdsourcing, the crowdsourcing procedure contains the participants from both professional communities (researchers and GLAM staff) and the ‘third party’, or the general public. Crowdsourcing technology may facilitate the management of audio-visual materials, accelerate the progression of collecting data and allow innovative material reuse.

It is not only the management for cultural institutions that encountered problems, but also for the non-professionals. The user sometimes can have a semantic gap when searching a keyword in a database. This gap is caused by the different usage of terminology between audiences and professional cataloguers (e.g. user searching for ‘stapler’ but received no result as cataloguers used a wider term ‘stationary’) [5, 48]. The arrival of GLAM crowdsourcing games addressed such problems while providing the chance for audiences to contribute additional factual and contextualised information [5], which backed up by the idea of collective intelligence better than individual judgements [49]. This means the crowdsourced information could also have a chance to be added to the terminology corpora in order to narrow the searching semantic gap.

Despite some intrinsic challenges in this approach such as the quality assessment and quality control of the crowdsourced data, through the method design, a solution to re-evaluate the individual’s knowledge is possible [50]. In addition, those knowledges can constitute a complement to academic knowledge especially in the humanities field [51]. Thus, due to the benefits of crowdsourcing technologies, creative, cooperative and interactive methods are likely to be implemented when researching and solving humanities problems, especially during the process of digitisation – “the technical conversion of analogue information into digits form” [52] and digitalisation – the social application of digitised products [53].

### 3.1.2 GLAM Crowdsourcing Game: *Waisda?*

The creative method used for sorting audio-visual materials is making a game with purpose(s), where it is believed to be both having fun and contributing to the world [54]. The mutual interest between audiences and GLAM: love towards a specific culture, is the main factor that drives people to participate in a cultural crowdsourcing project [55, 56]. In this context, the emergence of *Waisda?* – a social tagging game - aimed to better serve a diverse group of users for the reusing of audio-visual materials regarding online audio-visual searches. With the help of crowdsourcing techniques, tags are being added efficiently to support diverse queries and provide better search results as to resolving the semantic gap.

### 3.1.3 Innovation: Design Principles, Gameplay and Narrative

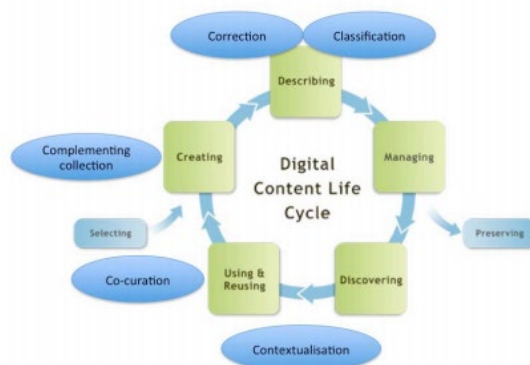


Figure 5 Digital Content Life Cycle with Crowdsourcing Classification Initiative[5]

The design of *Waisda?* was based on *Digital Content Life Cycle* (DCLC) and *Crowdsourcing Classification Initiative* (CCI). The DCLC was developed from the concept of digitisation [57]: “the act of making a digital copy or digital recording of analogue information”. The process of digitisation also revolutionised the art and cultural space [58]. Specifically, historical videos, sounds and photographs can be converted from physical/analogue form into digits, and stored in disks. As to this trend, DCLC was invented by the National Library of New Zealand. The cycle suggested that with good practices, digital contents can be used sustainably [57]. This feature allows DCLC to work in cultural crowdsourcing projects. The CCI (Table 1) described what can crowdsourcing do in digitised cultural projects; It also explains in which process could different crowdsourcing activities deploy and integrate (see Figure 5).

Table 1 Crowdsourcing Classification Initiative[4]

| Type [of Process]            | Description  |
|------------------------------|--|
| Correction and Transcription | Inviting users to correct and/or transcribe outputs of digitisation processes  |
| Contextualisation            | Adding contextual knowledge to objects, e.g., by telling stories or writing articles/wiki pages with contextual data |
| Complementing Collection     | Assembling additional objects to be included in a (web) exhibit or collection  |
| Classification               | Gathering descriptive metadata related to objects in a collection. Social tagging is a well-known example            |

|              |   |
|--------------|---|
| Co-curation  | Using inspiration/expertise of non-professional curators to create (web) exhibits   |
| Crowdfunding | Collective cooperation of people who pool their money and other resources together to support efforts initiated by others |

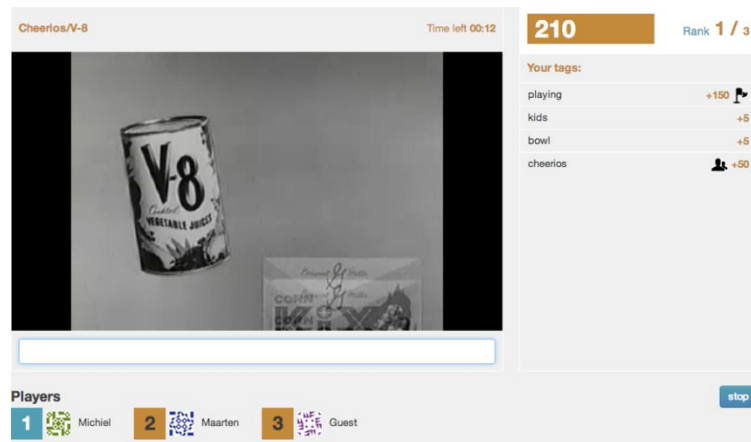


Figure 6 The Interface of Waisda![8]

*Waisda?* (Figure 6) managed to fulfil the CCI by integrating the gameplay design with crowdsourcing types. Inviting and paring up players to tag video elements simultaneously<sup>1</sup> is the main idea [8] meanwhile awarding points for both gamer’s response speed and accuracy of tags [5]. It was not only the points awarded but also the categorisation of points that formed an incentive system including titles such as ‘all-time heroes’, ‘fastest typers’ and so on. This design can be understood as a badge system, where badges steer the user to increase their online participation and contribution [59]. These intentions also allow the potential narrative to happen.

The potential narration came both from the process of scoring, gaining achievements and competing with other players (sometimes with bots). This can also be explained by breaking the ‘fourth wall’ [60], which claims, “a violation of the invisible boundary between the audience and the narrative world”, to some extent. However, to explore a more powerful narration, new methods that embrace a social environment to further break the ‘wall’ is needed.

### 3.1.4 Further Development of *Waisda!*

The Art Controller is a crowdsourcing game that used images from the database of the Swedish National Heritage Board with a cultural heritage purpose. Comparing to *Waisda!*, the core function is the same: collecting tags from players to add descriptive metadata for GLAMs. The rule of the game is described as follows:

Players of the game become art collectors – they compete with each other for art pieces (i.e., images) in order to build the richest private art gallery. Being the richest means having the highest value, calculated as the total value of all pieces in a gallery. The value of a piece is determined by the total amount of tags associated with it,

<sup>1</sup> A ‘correct’ tag is based on the premises of the same vocabulary input(s) of two players.

multiplied by 10. For example, an image with 5 tags has a value of 50. [9]

The appearance of the *Art Controller* did enhance the cultural crowdsourcing experience by introducing the online social feature and more advanced gameplay. One of the ongoing challenges addressed by *Waisda?* is “attracting a sizeable number of players who commit to playing the game over periods of time” [5]; the tagging game – *Art Controller* is based on the concept of the casual game from social media (e.g., Facebook) that have potential ability to attract abundance of audiences. Since casual games are lightweight, they are designed for people without any gaming experience using simple controls and gameplay and only required players’ fragmented time [61, 62]. Moreover, back in 2013, when *Art Controller* was produced, Facebook has more than 1 millions of monthly active players [9], which makes the game possible to reach out to people from all genders and ages and thereby form an ‘ideal’ crowdsourcing game [9, 63].

The gameplay of *Art Controller* has two dimensions as there are two rounds for players to explore. As the author presented: In the first round,

[Four] tokens are credited for each new tag and 2 tokens are given for each matched (pre-existing) tag [...] Images that have received at least 4 tags are automatically added to the public gallery<sup>2</sup> from where they can be challenged in the second round. [9]

Whereas in round two, the main task is choosing an art piece, guessing tags from either public gallery or private gallery. Players are invited to guess the tag provided by other players (Facebook friends), which connected the player and his/her social network. This might increase the number of players and bring much more information (tags) for cultural heritage.

As Facebook’s number of daily active users showed a declining trend in recent years [64], people who play web-based casual games could be decreased. However, games that embracing cultural crowdsourcing still have the potential to discover, as social media changing rapidly and game technologies updating frequently. For example, in the pandemic and even post-pandemic era, games like *Animal Crossing* are becoming a new form of social media [65]. People can have fun and enjoy their social life inside a game. They can attend a conference in *Animal Crossing* [66] as well as participate in a virtual exhibition [67]. The rapid transformation of the gaming environment prompted the examination of an updated design of GLAM crowdsourcing experience and the reuse of metadata generated by the gamer.

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<sup>2</sup> Pictures from the public gallery are fetched from the Swedish National Heritage Board database. Only when the player gave the correct tag that matches the pre-existed tag in round 2, the picture will be added into the player’s private gallery.

### 3.1.5 Concerns

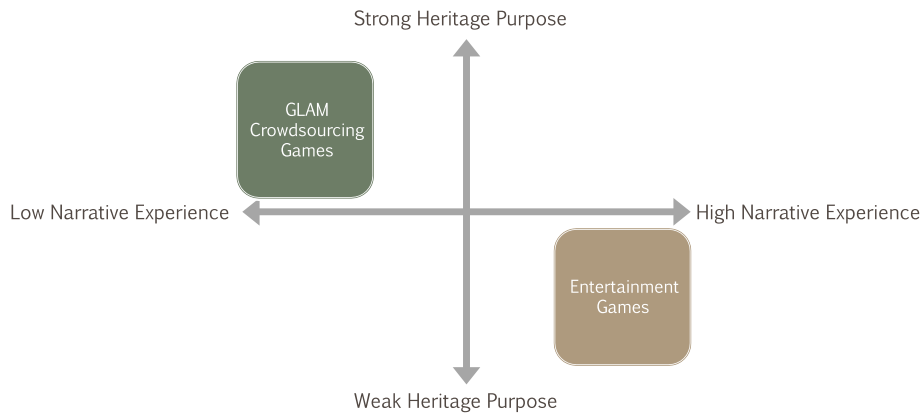


Figure 7 Game Genre - Narrative Experience Matrix

From the previous game study, it can be known that both *Waisda?* and *Art Controller* are designed exclusively for tagging cultural heritage, which means they only serve the people who are already knowledgeable in a particular field. In addition, the current narrative experiences of GLAM crowdsourcing games, instantiated by the result of tagging competition between players (victory or defeat), is monotonous and weak, comparing to the rich experiences (e.g., various choices, rewarding mechanisms like a badge system) in entertainment games (see Figure 7). As a result, the current design of such games could hardly fulfil the ‘ideal’ crowdsourcing [63] – multifariousness of participants. The concern thereby elaborates the research questions in chapter one:

How to use interactive digital narrative to attract more audiences/players/participants as a GLAM crowdsourcing project?

With those questions, the next section will explore the possibility to have an adapted model for the future design of GLAM crowdsourcing games and co-creation digital humanities initiatives.

### 3.2 Analysis Foundation – Model Adaptation

While some entertainment games also included cultural heritage elements, the boundary between a serious game (a combination of utilitarian functions and a video game [2]) and an entertainment game is sometimes blended. As an example of this blended trend, three-dimensional models of Notre-dame de Paris' were used in *Assassin's Creed*, which raised a concern for restoring culture in the gaming industry. Ubisoft, the game company, gave the public free access to this game after Notre-dame's fire and intended to spread the cultural atmosphere in cyberspace[68]. However, compared to entertainment games, the serious game is only circulated in a small group of people for a particular purpose.

In this research, *Digital Content Life Cycle* (DCLC) and *Crowdsourcing Classification Initiative* (CCI), as current concepts being used for GLAM Crowdsourcing game design, still have the potential to be improved, to attract a large number of audiences[5]. Successful crowdsourcing platforms like Wikipedia have

hundreds of millions of users, which marked a ground-breaking way to distribute and share knowledge in the internet era. As to some crowdsourcing projects, the more people participated in, the more meaning to the society and the collectors could be produced. To address the research question mentioned in chapter 1, a new method towards GLAM crowdsourcing game design that could increase the number of participants by experience design should be considered.

From the computer and cognitive science point of view, the interactive narrative framework utilised widely in games enables the detachment of traditional narrative forms [20] and thereby creates new areas for investigation. Consequently, in entertainment games, specifically the narrative game, the potential of Interactive Digital Narrative (IDN) acting as an incarnation to engage players, construct and improve playing experiences grows to be feasible; The instance of *Assassin's Creed* shows intentional or unintentional cultural heritage application in game, which sparks the IDN resolution, as the intersection between digital heritage and game design, for the future development of GLAM crowdsourcing games/digital humanities projects. To accommodate IDN in the context of GLAM crowdsourcing games, a new model combining the *System, Process and Product (SPP) Model*, its extended version and CCI will be proposed.

The SPP model is applied to distinguish IDN works from traditional media narrative by understanding the synergy of system, process and product [20]. In the SPP framework, two concepts are significant: Protostory and double-hermeneutic circle. The Protostory explains “the concrete content of an IDN system as a space of potential narratives” [20] whereas the hermeneutic circle adds a layer on player interaction, system interpretation and experience instantiation [19].

In the meanwhile, CCI, which derived from the DCLC defines basic crowdsourcing types happening in Gallery, Library, Archive and Museum, can also provide a space for the potential narratives. In the previous study of *Waisda?* and the *Art Controller*, only one crowdsourcing type was implemented per game design and the core gameplay is solely tagging and competition between users. To improve the present GLAM crowdsourcing games, pivot views can be suggested to blend the existed models and form a new IDN model for the GLAM Crowdsourcing experience.

The IGC model (Table 2, 3, 4) can first explain a direct in-game crowdsourcing experience concerning its crowdsourcing type. It then gradually investigates the hermeneutic circle in the crowdsourcing context. In the final step, the prompt of design involving protostory and crowdsourcing tasks enables a more approachable method for experience prototyping in digital GLAM initiatives. The model explained the interrelationship between crowdsourcing tasks and current IDN patterns and is suggested to examine later case studies.

Table 2 Crowdsourcing Task Experience Design

| Crowdsourcing Type                       | Crowdsourcing Experiences |
|--|---------------------------|
| Correction and Transcription Tasks (CTT) |                           |
| Contextualisation                        |                           |
| Complementing Collection                 |                           |
| Classification                           |                           |
| Co-curation                              |                           |
| Crowdfunding                             |                           |



*Table 3 Crowdsourcing Task – Hermeneutic Circle Chart*

| Crowdsourcing Type       | Player Interaction + system interpretation | Player interpretation of current narrative instantiation |
|--------------------------|--|--|
| CTT                      |  |  |
| Contextualisation        |  |  |
| Complementing Collection |  |  |
| Classification           |  |  |
| Co-curation              |  |  |
| Crowdfunding             |  |  |

*Table 4 Crowdsourcing Task – Protostory Relation*

|                  | CTT | Contextualisation | Complementing Collection | Classification | Co-curation | Crowdfunding |
|------------------|-----|-------------------|--------------------------|----------------|-------------|--------------|
| Environment      |     |                   |                          |                |             |              |
| Assets           |     |                   |                          |                |             |              |
| Settings         |     |                   |                          |                |             |              |
| Narrative Design |     |                   |                          |                |             |              |

## 4. Case Study

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To begin this section, the criteria for case selection will be given to indicate what type of games is suitable for analysing the creative digital heritage projects in cooperation with GLAMs and the replicability for future development (producing such project). Coming next describes the detailed approach of how to use this analytical model, with a focus on previous similar usage and improvements. Lastly, two case studies will be conducted based on the case selection criteria and case study approach given to further explore the application of the IGC model in the real world.

### 4.1 Case Selection Criteria

The idea of the IGC model discussed in chapter 3.2 was inspired from games with a culture-related crowdsourcing purpose but lacking interactive narrative experience. To select study objects and apply the new model, entertainment games with cultural heritage features could be the best fit because:

- 1) the personal and social experience generated by the gameplay (supported by the Hermeneutic Circle and Media Innovation theory mentioned before) is much more meaningful than current GLAM crowdsourcing games.
- 2) these games are also pragmatic to analyse from both the angle of Digital Content Life Cycle and crowdsourcing which followed by some GLAM crowdsourcing games.

Afterwards, two case studies are chosen for demonstration: *Animal Crossing: New Horizons* and *Ingress*.

The first case so far has more than 22 million players [69] and highly personalised gameplay, which provides the capability to connect the general public with GLAMs. At the same time, some real-world events have been held in the game, including the event associated with a museum.

The second case has a multi-layer structure [70] (e.g., activity logs, external communication platforms, etc.) to strengthen player's connection while crowdsourcing geoinformation. Similar to the first case, GLAMs also have the chance to encourage people to take part in digital preservation initiatives due to the huge amount of players [71].

Looking through these cases can help the professional in GLAMs to understand the importance of a narrative-based crowdsourcing experience design that related to the Interactive Digital Narrative.

## 4.2 Case Study Approach

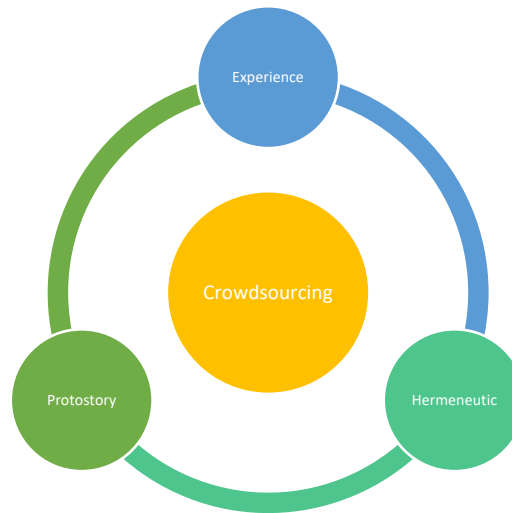


Figure 8 Interactive Narrative - GLAM Crowdsourcing Diagram

To understand the relationship between the interactive narrative and GLAM crowdsourcing initiatives (Figure 8), first, a case study from the interactive narrative's aspect using the SPP model will be provided. This is to explain how a potential narrative constructed through the comprehension of system, process and product. Next, the potential narrative will be further explained through the core of SPP: protostory, narrative design and narrative vectors, as a basis for connecting cyberspace with organisations and events in the real world. The first two steps were also used by Koenitz [20] and Rezk's [72, 73] interactive narrative case study. Finally, there will be the analysis of the IDN for GLAM Crowdsourcing (IGC) model application that can enhance the understanding of the potential narrative described before, the instantiation of real events and possible actions being taken by different stakeholders. Through the analysis, the hypothesis can be tested, and therefore laying a foundation for the possible future digital heritage research with an interactive narrative infrastructure.

## 4.3 Case Study - Animal Crossing: New Horizons

*Animal Crossing* is a life simulation game series released by Nintendo and only available on the company's own game consoles. Its latest version, *Animal Crossing: New Horizons* (2019), has sold more than 22 million copies until August 2020 [69]. This means a huge community including at least 22 million users has established. The game's specificity contains the construction of the virtual island and interaction happening between cute animal characters, players and friends of the gamer; these features satisfied the people's social demand to some extent [65], which also drove virtual events to occur inside the game. In this game, the main task is building a prosperous island to attract K.K. Slider – a virtual singer/idol to hold a concert on the player's land. The 'prosperity' can be achieved through the building instructions provided by Tom Nook and Isabelle – NPCs (Non-player Characters) from the city hall. The process of island construction includes the building material selection, animals/neighbours to invite, house decoration, etc. In terms of the narration, there are no overarching plots in this game because events synchronising with the real world will be updated seasonally and the gamers are encouraged to explore and develop

their lands freely. Besides, a community sharing system allows up to eight players to play the game on the same island [74]; people are able to show and exchange items on the same island. As a result, a possible place for online cultural heritage occurred in this game.

#### 4.3.1 Animal Crossing: New Horizons – System, Process and Product

Three dimensional models of island infrastructures, animal characters and a human character and the algorithm to calculate user’s input and environmental output (e.g., season and time corresponding to real-life) consist of the basic software of the system. The interface of this game can be understood as places where you make your own choice; this includes but is not limited to the process of naming the island, visiting online friends’ islands, shop and use the terminal machine for buying and selling in-game objects. In addition, the assets such as ornaments/furniture for house decoration, fish, insects, fossil and famous artworks for museum collection together with hunting tools, equipment and money are important for exploring the island.

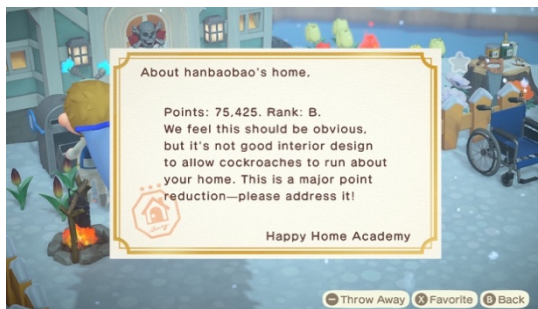


Figure 9 Grading with points and rank



Figure 10 Rating with stars

Moreover, how players interact with these assets are dynamically tracked to give the rate of the island. The construction is quantified through the periodically in-game mail from ‘Happy Home Academy’ with a numeric point and rank in Alphabet order (Figure 9). Apart from that, another rating system based on stars (Figure 10) can indicate the satisfactory degree of the island from animal villagers. When it hit three stars over five, the main ‘story’ is completed, which allows players to build their land facilities without restrictions. Regarding the hardware, Nintendo Switch is the only platform to run this game. Although the number of end-users could be limited, a pure in-game community is easier to establish without concerning cross-platform compatibility issues.

In terms of the game process, *New Horizons* belongs can give an instant calculation (output) with regards to the player’s inputs (behaviours). One example of this output could be the change of an animal villager’s emotion from happy to angry and walk away from the player when a player beating an animal character with a butterfly net. The *instantiated product* is made by in-game choices, conversation with characters and the creativity (design ability) of gamers. In addition, the construction of the island, the decoration of the house, how many animals have been invited to be the resident, how the player interacts with characters (including NPCs and online players) and so forth are also critical for the formation of the *final product*.

### 4.3.2 Animal Crossing: New Horizons – SPP Extension and Hermeneutic Circle

As to the *protostory* of the latest *Animal Crossing*, in general, there are no principal plots. However, one important blueprint is made clear to players; Gamers are suggested to attract a famous performer K.K. Slider to hold a concert on their island by reaching three stars over five in terms of the island prosperity. After attracting the performer, players will be able to terraform their island landscape, thereby focusing on upgrading their design and exchanging ideas with friends or the online community.

Although inviting K.K is not the prerequisite of island development, it does construct the main potential narrative experience and therefore become a narrative vector which determines ‘the island’s future’. For example, after terraforming, the island is capable to be decorated into a Japanese style garden where people can have a virtual tour or even a tea party. Through the mobile app: Nintendo Switch Online, players are brought together into actuality by a voice call. Without the terraforming feature, people cannot change the landscape (e.g., stream, terrain) and therefore decrease the social simulation experience. In this case, the realisation of potential narratives is unpredictably created by the participants.

To scrutinise the hermeneutic circle in *New Horizons*, it is not possible to include key narrative in this game analysis as there is no primary plot. Nevertheless, it is feasible to focus on players’ actions both in the game and real-world, and the computational output - penitential plots. In *Animal Crossing* Series, the animal characters have personalities, and some may even have a biography. For example, Agent S who believed to be the Kid Cat’s sidekick [75], is a squirrel villager. She has a peppy personality and sometimes could over-react in conversations triggered by users [75]. This brought a systematic narration where gamers interacting with in-game characters through talking, visiting characters’ house, chasing, etc., when looking at the upper hermeneutic circle.

With regard to the bottom circle, it encompasses the “player’s interpretation of currently instantiated narrative” [19]. In the hermeneutic system, two aspects regarding the instantiated narrative are selected for analysis. The first is the in-game character and player’s instantiation, which could be explained when a player talked with one of the animal villagers. This instantiation can also apply to players’ friends. When a friend coming to the island, characters on the island could remember each visitor’s name if they had a conversation before. In response to the second talk between a friend and an islander, the latter will recall the player’s name and start a new conversation. The second aspect is in-game character and events instantiation, which in most cases could be elucidated through tasks from island dwellers and Nintendo official seasonal updates. For instance, with the new year update, players are able to have the counting down event in front of the city hall square with animal residents on New Year’s Eve. They are also encouraged to invite friends to the island to celebrate the day with them through online play and in-game voice chat by using Nintendo Switch Online App, which is meant to reduce physical contact amid the COVID-19 situation. Inspired by these instantiations, in the next chapter, the application of hermeneutic theory will be discussed in various contexts.

### 4.3.3 Animal Crossing: New Horizons – From the GLAM’s façade

By applying the IDN for GLAM Crowdsourcing (IGC) model proposed in Chapter 4.2, this section will reveal the relationship between GLAM, cultural crowdsourcing and game design in *Animal Crossing: New Horizons*. Later, an analysis will be conducted based on a virtual curation in *New Horizons* held by the Museum of English Rural Life. In May 2020, the organisation called for a participation for the design of smocks in Twitter to engage people in virtual space and extend its previous smock online exhibition[76]. Not only the public but also some professional artists joined the event. Some of them cited specific smocks in the museum collection while others contributed their own design[67]. Here, GLAM through the entertainment game and social media, realised the digital heritage. To divulge from the theoretical side, the IGC model will be applied.

Table 5 New Horizon Crowdsourcing Task – Experience chart

| Crowdsourcing Type                       | Crowdsourcing Experiences  |
|--|--|
| Correction and Transcription Tasks (CTT) | By uploading text to the server (e.g., naming the design/sketch)   |
| Contextualisation                        | ‘Crafting’ a stylish island for a specific purpose (e.g., virtual tour)  |
| Complementing Collection (CC)            | Designing clothes that include the cultural meaning  |
| Classification                           | Organisers from the real-world call for a culture-related crafting event, the collection will be classified by the creator |
| Co-curation                              | Personal Collections/Design, Online visiting (friend’s/curator’s island), Social Media Hash Tag                            |
| Crowdfunding                             | Government, Art Institute, NGOs...   |

The first chart of the IGC model (Table 5) described some possible experiences related to GLAM initiated crowdsourcing events happening in *Animal Crossing*. It led curators and researchers in arts and humanities to think about possible activities that can generate data for collection and reuse purposes. For example, players can have their creations in the terminal machine/mobile and collections in their inventory, in which design and items can be exhibited; the online play feature allows the user to have an online co-curation experience. In this process, crowdsourcing happened when several players brought their design and visited the same land by connecting the global Nintendo server. Also, in this chart, some other possible outsourcing instances are provided to show the potential of games for cultural crowdsourcing purpose.

The second table, Crowdsourcing Task – Hermeneutic Circle Chart (Table 6), elaborated the crowdsourcing experience created by a museum from the hermeneutic aspect, which further divided the crowdsourcing experience into the interactive narrative analysis. In this case, it is used to evaluate a GLAM project happening in games as it revealed the correlation of player’s actions, potential narration and event holder’s expectation.

Table 6 Crowdsourcing task – Hermeneutic Circle Table for New Horizon

| Crowdsourcing Type                       | Player Interaction + system interpretation (Upper Cycle)  | Player interpretation of current narrative instantiation (Bottom Cycle)                                 |
|--|---|---|
| Correction and Transcription Tasks (CTT) | Naming the design of smock + Uploading the name to the server database  | Waiting for responses from museum experts   |
| Contextualisation                        | Design process + In-game objects decoration + Social media threads  | Crafting and create meaning, Contributing to the <i>Animal Crossing</i> community and cultural heritage |
| Complementing Collection (CC)            | Design of clothes, drawing on a drawing board Interface + uploading the design to the online database                 | A virtual event initiated by The Museum of English Rural Life, Participating Smock Cultural Heritage    |
| Classification                           | Placing items (smocks) in proper order in a specific in-game space + Downloading the design data from Nintendo Server | Virtual curation, Acting as a designer/curator/visitor  |
| Co-curation                              | Communicating with the event organiser to explain their design through social media (extension of the system)         | Proposing and Design Submission   |
| Crowdfunding (possible actions)          | Seeing an in-game poster, Player interaction on social media  | Donating the organisation   |

To be specific, in terms of the Co-curation crowdsourcing type, what happened in *player interaction + system interpretation (upper circle)* and *current narrative instantiation (bottom circle)* need to be understood. In the former process, players are required to communicate with the event organiser to explain their design through Twitter (Figure 11). The latter one is construed as the behaviour of proposing design and submission.



Figure 11 the Participant Communication with Event Organiser via Twitter

Another instance could be the complementing process. As to the *upper circle*, a design of smock will be done by the author through the in-game or third-party pattern editor (Figure 12) and consequently upload the design to the Nintendo server so that other people in the community can have the access to the design. In this process, the player can realise that he/she is participating in a virtual event hold by a museum and contributing to the cultural heritage (*lower circle*).

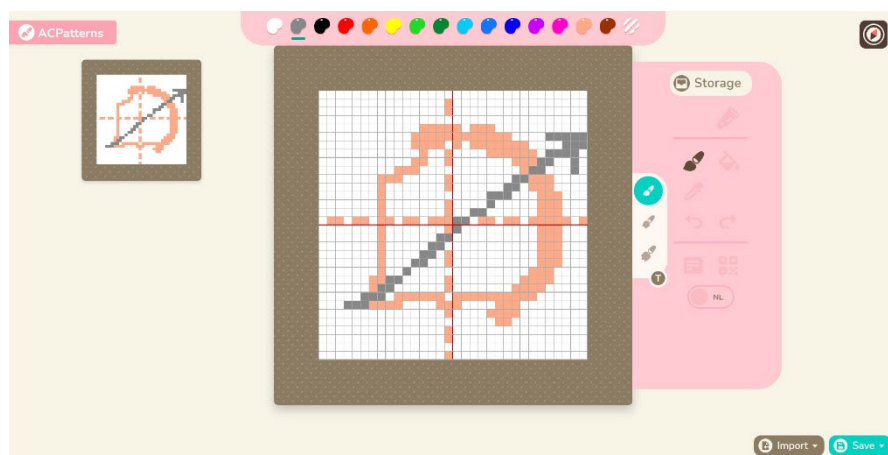


Figure 12 ACPatterns[77] - a Third-party Pattern Editor for New Horizon

A detailed interpretation of the online cultural heritage event held by the Museum of English Rural Life was given below. It is worth mentioning that although there is no financial concern at this stage, the possibility of crowdfunding of this online curation is also being explored in the next two lists as costs are essential for maintaining a digital heritage project.

The last table (Table 7) explores how crowdsourcing tasks are relevant to protostory. The pivot view below showed how the smock exhibition crowdsourcing tasks be implemented in the context of the protostory of *Animal Crossing: New Horizons*. Three examples will be given to assist the grasp of the table.

Table 7 Crowdsourcing Task - Protostory Relation for New Horizon

|             | CTT           | Contextualisation  | Complementing Collection | Classification            | Co-curation  | Crowdfunding (Potential)                      |
|-------------|---------------|--|--------------------------|---------------------------|--|---|
| Environment | Space in Game | Space in Game, social media and organisations                        | Space in Game            | Organisation              | Space in Game and Social Media                         | Space in social media, organisations and bank |
| Assets      | Players       | Administrators, players, people who engaged in the online discussion | Players                  | Administrators, 3D Models | Reaction Animation, 3D Models, Players, Administrators | Players, Patrons                              |
| Settings    | Online play   | Online play, social media  | UI, Nintendo Database    | Nintendo Database, social | Nintendo Databases                                     | N/A   |



|                  |                  |   |  |                             |                                     |   |
|------------------|------------------|---|--|-----------------------------|-------------------------------------|---|
|                  |                  |   |  | media posts                 | e, Online Play                      |   |
| Narrative Design | Naming the smock | Adding contextual knowledge (meaning) to the design and helping the community know about the design | The accomplishment of smock design (which will be turned into a 3D model by the gaming system) | Design Acceptance/Rejection | Online Curation Event Instantiation | Advisements in a game or social media, Design added to an external database |

As to the example of Correction and Transcription Task (CTT), the environment can be understood as an in-game space because uploading the text (the name of a design) to the Nintendo database only happened in the game. Assets are players as they provide the infinite narrative for the game during their creation process such as the story behind the design. One of the participants, Lyndsay Peter, who resides in California, decorated her smock design with California poppies and prickly pear cactus to indicate her wishes to see the poppies in real life [67]. Settings, in this case, is the online play feature. Meanwhile, the narrative design is the naming process that may engage the author to consider the history of a particular smock design.

In terms of contextualisation task, the environment is in-game space, social media and organisations. Alongside the three-side collaboration plus the netizens' discussion (assets), there will be a chance to lead to a narrative design under this task: the dissemination of the designer's idea as contextual information and other people in this community (curators, administrators and other players) learned culture in this context. The setting is where the people-to-people communication happened. This includes online gameplay and social media as the intermediate to pass on the information.

Concerning the classification procedure, the organisation – Museum of English Rural Life acts as the environment as it hosted the whole event and will play an important role – administration in classification. Assets in this context, are administrators and 3D models which were turned from the designer's sketches by the gaming system in the complementing collection task. Administrators are here for the evaluation of a particular design (see Figure 11) that retrieved from settings: Nintendo Database or social media posts. Altogether with steps before, a narrative design formed with the acceptance or rejection of the design. Though there is no refusal, in this case, the alternative could therefore become whether the design has been promoted by the museum's official account/media coverage or not.

The analysis in this chapter can preliminarily suggest that through the interactive narrative design, a systematic scheme, which exemplifies what can be brought to the audience and what can the professional gain, is able to be made for a GLAM crowdsourcing project. The next chapter, therefore, moves on to discuss the case of *Ingress* – another entertainment game that used for cultural crowdsourcing, to test the replicability of the model.

## 4.4 Case Study – Ingress

*Ingress* is both a location-based game and Massively Multiplayer Online Role-Playing Game (MMORPG) developed by the Niantic Lab. Until 2018, the game achieved more than 20 million downloads with more than 2,000 real-world events[71]. Multitudinous players from the globe are acting the role of agents (either belonging to the enlightened or the resistance faction) in the game to battle with their opponents by taking up portals. At the same time, over the interaction with portals, people are discovering culturally significant sites which are rarely being noticed in the players' daily routine[70]. In this sense, cultural heritage in digital and immersive context can be realised.

Recent research also suggested the potential of *Ingress*' cultural crowdsourcing functionality. An example is using the Augmented Reality (AR) feature of *Ingress* for GLAM gamification; Researchers from Japan developed a virtual museum called “*Field Museum*” [78] through *Ingress*, Twitter and website. In this initiative, players (also called reporters) are invited to submit new portals, heritage sites and activities of Sagami-hara City while the professional (curators and supervisors) are in charge of editing social media posts and website blogs. Some missions developed by the event organiser also provide a venue for a cultural tour. As to this participation, a gamification method through game has been proposed by Shirai et.al. In this case study, the focus will be given to the IGC model validation in the context of the *Field Museum* project.

### 4.4.1 Ingress – System, Process and Product

The software *system* of *Ingress* encompasses portal submission, AR map interface, play's interaction with portals (hacking, deploying, destroying, linking, etc.), point collection function (e.g., Actions Points, Exotic Matter), inventory and achievement algorithm. The game interface includes the place where gamers submit geoinformation (metadata) of a cultural site, in-game choices that determine player's action (to be an enlightened or resistance, to hack a portal, etc.) and inventory to store and use in-game objects.

In terms of assets, in-game objects from portal keys to weapons to powers cubes are the most critical ones as they help players to control portals. In the meantime, portal mods are used for the enhancement of portals in different ways; the basic unit of energy and experience in *ingress* - Exotic Matter (XM) and Access Points (AP) are also parts of assets, each time when player executing a task, the XM will be consumed, and AP will be earned. What's more, gamers are also inspired to propose a portal containing the cultural significance; more advanced players (after Level 7) are invited to create missions that allow people to have a guided virtual tour via AR. Those activities will in return influence the assets and intrigue the software system for rewarding.

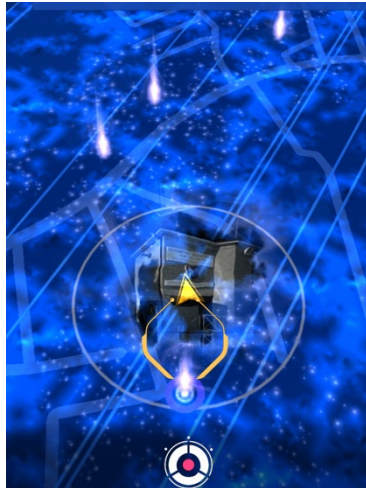


Figure 13 Ingress User Interface with AR

With regard to the game *process*, the player's action (input) will be calculated immediately; the result (output) will be displayed on the screen at the same time. For instance, when a player walking around a city, through a specific algorithm, the current coordinate data will be traced and displayed by a circle on the map. Meanwhile, as to the AR algorithm, the nearby portal will also be demonstrated with its photo laid on the map (Figure 13). The formation of *Instantiated product*, in this game, can be a dynamic process that consists of fighting against the opponents by hacking, deploying portals and building control fields for the player's faction.

#### 4.4.2 Ingress – SPP Extension and Hermeneutic Circle

Unlike the game *Animal Crossing*, there is an overarching narrative for the *Protostory* in *Ingress*. As told in the game tutorial, players should join one faction (the green or blue) and have to fight with their opponent team because two teams have different views towards the exotic matter (XM). The Enlightened (green) believe XM can inspire and increase creativity and leading the future of human beings whereas the resistance (blue) believe XM will invade people's mind and therefore jeopardise people[79]. Even though *Ingress* has a background story, the narrative is still flexible as *Ingress* is an open-world game happening in real-world that allows people to explore places of interest to collect XM as well as interact with portals; the interaction process is where a potential narrative originates because the more people explore the more people get to know the world (including the physical and cyber form).

Based on the *ingress'* protostory, the *Hermeneutic Circle* can be explored with two folds: the upper circle and bottom circle. As to the former, two factions provide at least two potential narratives as computational output. For example, assuming the player chose to be a member of resistance, he/she encountered the enlightened faction's portal, and the result will be either the success or failure of taking up this portal using in-game objects such as portal keys. It is noticeable that, in this case, inputs are the player's choice for his/her faction, the narrative of the enemy (output) can be changed with the player's belief and *ingress* offers a chance of switching one's faction[80].



Figure 14 Ingress Report - All Female L8 Portal

When looking at the bottom circle, an *instantiation* of *Ingress* could both from online and offline. This can be exemplified in the work undertaken by a group of Australian women that aimed to build the world-first all-female level-eight portal in the game. Within the game, they were all from the enlightened faction, and they built the highest-level portal in collaboration. Outside of the game, those women were all from the medicine field; They gathered for the first time in Melbourne in front of a statue of the Royal Women’s Hospital (Figure 14); and through the Ingress Report on YouTube [34], they also claimed that the enlightened there are embracing the diversity.

The player, as an agent in *Ingress*, is not alone as there are multiple ways to interact with the game and to generate different narrative instantiations. To be microscopic, social media (e.g., Ingress Report on YouTube, Twitter, etc.) and instant messaging applications can help build a local/regional community where people can be gathered offline and finish a task together. In contrast, massive regional groups and cultural contribution can form a global scope transmedia narrative[81]. This regionalism to globalisation narrative is visualised through the intel map<sup>3</sup> and eventually construct the potential narrative instantiations from a global perspective. Apart from the previous player-self-organised example, GLAMs can also be engaged in *Ingress*; What roles can the GLAM play from IDN’s perspective will be more concrete in the coming chapter.

#### 4.4.3 Ingress – From the GLAM’s façade

In this section, the IGC model will be applied to the case of *Field Museum* [78, 82] mentioned before, as GLAM tried to use *Ingress* for gamification purposes and no study has been done from the interactive narrative arena. For this case study, crowdfunding consideration will be excluded as the funding conditions is similar to the Museum of English Rural Life’s study [67, 76].

The Ingress Crowdsourcing Task – Experience chart (Table 8) illustrated experiences that could happen in *Ingress* concerning the digital GLAM initiatives. In-game crowdsourcing again provides a channel to connect the professionals (e.g., curators, government officers) and the citizens. A notable example is the process of Correction and Transcription Tasks (CTT) where players are allowed to write text description to

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<sup>3</sup> The Intel Map is a tool for players to see the current global state in *Ingress*. Through this interactive map, players can communicate with others as well as plan links and fields of portals.

a culturally specific site (Figure 15). At the same time, the description is based on a photo and geoinformation (e.g., longitude and latitude) of the site as a part of complementing collection process. The procedure of submission, report and removal of portals belong to the crowdsourced classification, where agents together with ingress official comprise the administrator to ensure the credibility of portals. It is also worth mentioning that there are various channels to realise co-curation task; for example, given there is an *ingress* mission containing a virtual tour of city heritage, to finish it, agents need to physically go through all portals appointed in the task and sometimes they even need to hack a portal or deploy the portal with ‘Resonator’ (an in-game object) followed by mission instructions provided by the creator.

Table 8 *Ingress Crowdsourcing Task – Experience chart*

| Crowdsourcing Type                       | Crowdsourcing Experiences  |
|--|--|
| Correction and Transcription Tasks (CTT) | By writing text description for the portal submission                          |
| Contextualisation                        | Creating missions that match cultural heritage purposes                        |
| Complementing Collection                 | Uploading Geoinformation and pictures into the game database                   |
| Classification                           | Submission portal for a specific site, report and removal of an invalid portal |
| Co-curation                              | Off-line meetings, Social Media, missions, external websites                   |

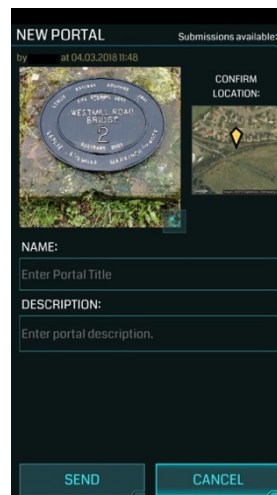


Figure 15 *Ingress Portal Submission*

When it comes to the Crowdsourcing task – Hermeneutic circle for *Ingress* (Table 9), a detailed connection between a player and system interaction and narrative instantiation will be given. Regardless of the crowdsourcing type, system interaction (e.g., adding/deleting portals and missions) here is mainly based on the backend database of *Ingress* that could include fields such as agent id, uploaded picture path and text description. However, player interactions correspond to diverse instantiations. While agents adding metadata to a site in the CTT, they will have to wait for the decision (approval/rejection) of submission from the game operators. Another explanation of the correspondence is that in the contextualisation process, the player could create a mission for the community that interacts with portals (visiting,

hacking, etc.). This means people will have the chance to take this mission and experience a documented cultural tour as what was did in “Save Hayabusa” mission (participants/players visited Shinden Inari shrine to pray; then were also went to Japan Aerospace Exploration Agency via Yobawari Mountain on the Hatsumode – the first shrine visit of Japanese New Year) as a part of the Field Museum initiative [78].

Table 9 Crowdsourcing task – Hermeneutic Circle Table for *Ingress*

| Crowdsourcing Type                       | Player Interaction + system interpretation (Upper Cycle)   | Player interpretation of current narrative instantiation (Bottom Cycle)                                |
|--|--|--|
| Correction and Transcription Tasks (CTT) | Adding text descriptions (metadata) to a specific site   | Waiting for the result of success or failure submission  |
| Contextualisation                        | Creating a mission   | Based on the intention of cultural documentation (e.g., virtual tour), making an exploration task      |
| Complementing Collection                 | Taking photos, Inputting geoinformation  | In the progress to achieve in-game milestones, contribute collection(s) to the game and GLAM community |
| Classification                           | Submitting a portal with descriptive text as classification/purpose(s), creating a mission                           | Contributing to the specificity of the metadata, making the metadata meaningful                        |
| Co-curation                              | Posting on social media, In-game exploration, intel map, online/offline events by cultural institutes or governments | Taking part in an immersive exhibition and online or offline discussion                                |

The final Crowdsourcing-Protostory list (Table 10) shows how crowdsourcing tasks alongside the protostory drive the *final product* of interactive narrative in the *Field Museum*. Before the further analysis, there are two clarifications: 1) administrators are made up of event organisers (scholars from tertiary education and staff from the museum) and Niantic Lab officials, 2) organisations are comprised by Kanagawa Institute of Technology and Sagami-hara City Museum.

For the protostory application of *CTT*, the environment is in-game space and physical space around the agent as this task require them to scrutinise a cultural object such as the memorial or heritage site in real life and document it via descriptive words. Since the player is the operator in this process, the asset is the players. The settings are based on an online crowdsourcing environment, where people can stop in front of a real site and think about the story behind it. All these lead to a narrative design - players learning the culture site and documenting it using text.

As to the *contextualisation* in protostory, the space in and outside *Ingress*, social media and organisations are critical environments. This is because contextualisation can occur in both cyberspace as well as physical space. In *Field Museum*, the researcher also used social media such as Google+ and Twitter to communicate with potential users including people who do not know about *Ingress*. What happened in



the offline world is that people were gathered to accomplish an *Ingress* mission (Figure 16) proposed by the event organiser, where administrators, players and people who engaged in the online community became the asset. The setting keeps unchanged: the online play (the same for other crowdsourcing tasks), as it is the prerequisite to support all potential in-game and outside-game events associated with the player and organiser. The narrative design, in this respect, is the formation of cultural heritage knowledge.



Figure 16 Participants and Official Score of Ingress Event

Regarding the *complementing collection* task, the environment encompasses space in-game and real-world as players can only create portals in the vicinity of a cultural site and the data transmission from a mobile phone to the Niantic server is not visible. In terms of assets, there are players, administrators, photos and geoinformation since they have a significant contribution to this crowdsourcing process. In the project, initially, 700 portals were built by *Ingress* gamers in Sagamihara city [78]. But later the event organisers created and submitted more new portals that include historic sites (text description, coordinates and photos). Co-creating portals is also where the idea of *co-curation* has been applied to. Settings are User Interface (UI) for portal submission and *Ingress* database because players need to type the text into the UI (see Figure 15) and create a record in the backend database. As a result, the narrative design becomes the contribution to the knowledge database in *Ingress* by submission a portal, which also can be viewed by other players through intel map or the game UI.

In terms of the *classification* task of protostory, the environment is Niantic Lab and organisations because the authorities here can decide the value of a submitted portal. Therefore, the assets here are administrators. It is also notable that the mission here can also be a part of classification since it can be a thematic trip. Settings, in this case, contains the *Ingress* database and online play. The database has specific information of a trip such as the portals' location, text description, navigation, etc. that can reflect the classification of the trip – i.e., what is the trip about and where to go. With concerns above, the narrative design here turns out to be the submission of portal/mission with classification information being accepted or rejected.

The *Co-curation* shares most feature with other crowdsourcing tasks as its representation is the mission which is based on existed portals. The difference is that in the protostory asset, administrators are necessary because they are knowledgeable and will judge the portal submission. Also, *co-curation* will use the collected assets

during the *complementing collection* task. The WordPress and its plug-in photomapper were implemented into the *Field Museum* project to assist the mission’s participants to appreciate the Sagami-hara city’s heritage and traditional Japanese customs (e.g., Hatsumode). Therefore, one more channel: website, can be added to the environment, which also addressed the concern of website UI in settings. In this sense, a physical tour with the help of the *Ingress* AR application that unveiled the ‘other side of the world’ (richness of culture and gameplay) illustrated the narrative design.

Table 10 Crowdsourcing Task - Protostory Relation for Ingress

|                  | CTT  | Contextualisation   | Complementing Collection  | Classification                   | Co-curation   |
|------------------|--|---|---|----------------------------------|---|
| Environment      | Space in the game, real world  | Space in the game and real life, social media, organisations        | Space in Game, real-world   | Niantic Lab, organisations       | Space in Game, real-world, website, social media  |
| Assets           | Players  | Administrators, players, people who engaged in the online community | Players, Administrators, photos, Geoinformation, text   | Administrators, missions         | Photos, text, Geoinformation, players, administrators   |
| Settings         | Online play with physical environment interaction  | Online play   | Ingress UI, Ingress Database, online play   | ingress database, online play    | Ingress database, online play, Website UI   |
| Narrative Design | Learning a cultural object through observation and turning the result into descriptive words | Formation of the cultural heritage knowledge                        | Contribution to the knowledge database in ingress (which also can be viewed by other players) | Submission acceptance/rejection, | A physical tour with the help of the ingress AR application that unveiled the ‘other side of the world’ |

Two analyses in this chapter showed the replicability of the IGC model; they also shed the light on the future design process of a creative and purposeful digital heritage project applying the concept of interactive narrative (e.g., the use of crowdsourcing tasks to fulfil playful and educational purposes). The chapter that follows moves on to consider the prospects of this research.



## 5. Future Development and Conclusion

Although in this paper, IDN for GLAM Crowdsourcing Model is analysed from the game façade. It is not only limited to the cultural crowdsourcing games but also opens a space for the design of other GLAM crowdsourcing and digital humanities projects that requires participants' physical and online reactions.

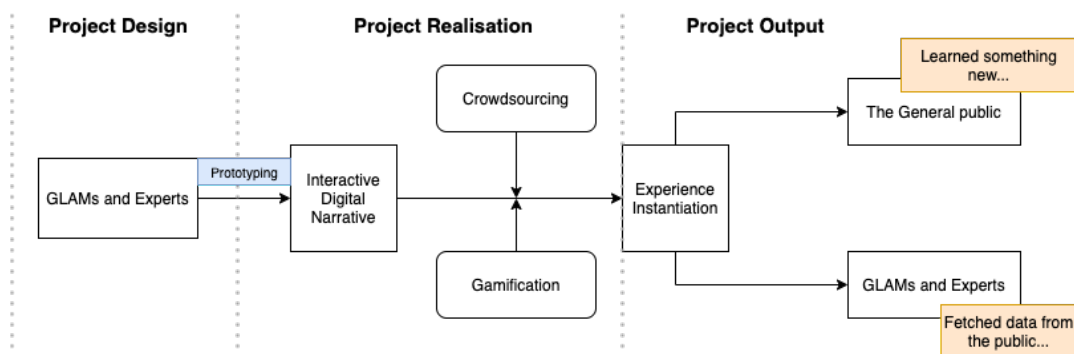


Figure 17 IGC Model Diagram

Therefore, the model suggested in this paper is still under development as it needs to be tested in the real project design process (see Figure 17). Theoretically, GLAMs can use this model to make public participation possible; as the by-product of this process, a personalised experience (e.g., knowledge gaining) based on the interactive digital narrative could be generated. It can also possibly be used for educational purposes such as learning history, with the help of other interactive media forms.

The interactive documentary (i-doc) format, as any projects intending to document the reality by using digital interactive technology [83], could be an instance of this media, because of its potential for co-creation and gamification in the context of digital heritage [25, 35, 84]. These characteristics of the i-doc format could alter the way people learning culture through a customised story based on the user's choice and provide the possibility of documentary co-creation through crowdsourcing, whereby a user-computer-user interaction can be formed.

As a result of these features, i-doc also provides a better narrative infrastructure that could bring a methodological (human-computer interaction) resolution to heritage interpretation mentioned in chapter 2. Theoretically, the interactive narrative has analytical models such as the SPP model and Hermeneutic Strips. Practically, people can realise the idea of i-doc through developing the AR/VR/XR experience with a game engine like Unity and Unreal or web service through JavaScript, CSS and HTML5.

The next step of this research is to explore how the IGC model can be applied to other digital humanities projects. By prototyping an i-doc with scholars, the public and GLAMs using web development technologies (e.g., Angular, MySQL, Node.js, WebGL, etc.), practice-based research can be conducted. Some further research questions are developed as follow:

1. How the IGC model, through the interactive documentary, can be used for other purposes (e.g., education, curation, storytelling, etc.)?

2. Comparing to traditional media forms, what can be gained for scholars, GLAMs and the general public, through the use of IGC model?
3. How to evaluate the interactive narrative user experience for the digital heritage project?
4. How to gauge the learning effect of such projects?

Before proceeding to conclude this paper, it is necessary to also address approaches to realise the future research project; a pragmatic method that combines empirical (programming and field research), qualitative (interview with the professionals from GLAMs and universities) and quantitative (questionnaires) investigations will be used to measure user experience. This will be based on the IDN user experience evaluation research[85], with possible changes subject to the i-doc project's demand.

In conclusion, the study set out to build an interactive-narrative-driven model that aims to attract participants by prototyping cultural crowdsourcing experience for digital heritage projects. The observation of *Animal Crossing: New Horizons* and *Ingress* has also shown the connection between the collected cultural data, purposes of GLAM crowdsourcing and the creative use of data through IDN for GLAM Crowdsourcing (IGC) Model. Those findings can be insightful for future digital heritage projects design to fulfil the creative demands of cultural heritage.

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