

# Walking into the Past: Design Mobile App for the Geo-referred and the Multimodal User Experience in the Context of Cultural Heritage

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**Abstract.** Information technology and new mobile revolution could be a strategic resource in the field of humanities studies and a powerful tool to bring culture in the people's everyday life.

The research explores the potentialities of the Web 3.0 applied to Cultural Heritage and tests three of its specificities: the semantic information architecture and the associative organization of contents, the geo-location of information in the physical environment and the social dynamics between people and places in geo-social networks.

Starting from a theoretical analysis the work maps and classifies the existing best practices both for semantic knowledge-based platforms and mobile apps developed by the most important international museums, historical house-museums and private galleries.

On the basis of these theoretical statements, of a literature analysis and a benchmark, the research explores and experiments – through a case study – the potentiality of a hybrid design process – both user-experience and technology driven – to revive a masterpiece of Italian literature – *The Betrothed* by Alessandro Manzoni – through a multi-layered historical storytelling approach to contents and a geo-referred experience of the places, monuments and routes described in the novel (XVII sec.), lived by the author (XIX sec.) and today thanks to a mobile app.

Using the technical repertory of geo-referred data, AR, QR-Code and multimodal contents – videos/audio, interactive documents, shared dairies and UGC – the pilot of *The Betrothed 3.0* allows the users to discover Milan.

The user can navigate through the timeline and decide to visit the city experienced by the protagonists of the novel or by the author who lived and dwelt in the places described, but in another time period – his house-museum is one of the main touch point of the app – making comparisons with the contemporary reality.

The project tries to set a design pattern for engaging in an effective way people facing the Humanities through technology.

**Keywords:** Geo-localization, geo-localized interaction, user experience design, mobile application design, digital story-telling.

## 1 Cultural Heritage and the Web 3.0

Information technology and above all the new *mobile revolution* could be a strategic resource in the field of humanities studies and a powerful tool to bring culture in the people's everyday life.

The research explores the potentialities of the so-called *Web 3.0* applied to the context of Cultural Heritage and tests three of the specificity of the third generation of Internet: the *semantic* information architecture and the associative organization of contents, the possibility to *geo-locate* information in the physical environment thanks to mobile devices and the *social dynamics* between people and between people and places in geo-social networks.

Starting from a theoretical analysis, the work maps and classifies the existing best practices both for semantic knowledge-based platforms – i.e. *Europeana*, *Culture-Sampo* – and virtual tour or mobile apps developed by the most world-wide known museums, historical house-museums and private galleries in the field of Science, Art and Cultural Heritage.

### 1.1 Archive vs. Museums

The museum sector was one of the first places where the Internet was early adopted thanks to the intrinsic nature of repository which is very similar to the structure of the web: a large world-wide archive enriched by increasing new entries, constantly updated and cataloged [1], as well as the museums are the places of the collection and preservation of memory, relics of the history and evolution of human culture in its various fields.

Since its inception the web has *enabled* to break down one of the most narrow limits of documentary sharing of historical memory: the *space-time* of the museum, in its physicality.

Internet has opened the *closed box* of the Wunderkammer culture letting it accessible, usable, *surfable* to users and public that would otherwise be left out in a sort of – to paraphrase Rifkin [2] – to *physical-divide*. Now, let us go back to the second half of the nineties – to coincide with the bursting of the new economy and the internet phenomenon – the web-sites of major museums such as the Louvre, the Hermitage or, in Italy, the Uffizi in Florence.

In this first Internet *era* web-sites were seen as a *reproduction* or *duplication* of the museum in its physical dimension shaped along the spatial paths, the rooms succession and exhibition halls.

In fact, technologies – such as QuickTime VR or VRML – already made possible to explore real/virtual environments through spatial movements to 180-360° based on a physical and photographic mapping of environment, but the poor performance of the connections to put still-massive adoption of these instruments while already ripe for exploitation.

## 1.2 *Mimesis* and Showing: The Museum 1.0

The Net – according to this first model 1.0 [3], which we can define *hypertext archival*– uses the medium according to a spatial metaphor of the real domain of the object represented. But the cyberspace virtual nature of the network is a world without limits or boundaries in which – as pointed out by Cappelli [4] – the culture is no longer something given and fixed, but a *continuum* fluid and always changing, instead to be forced to the physical dimension which reproduces the rooms, the fittings, the provision and exploring sequentially, with a re-curent tendency to overlap between reality and digital representation.

The museum in the web isn't a *representation* limited and constricted to the space of a page – in the two-dimensionality of the monitor – the museum and its collections were translated – from a linear sequence/succession of rooms – into static maps slavishly pointing out the location of the masterpieces with a correspondent page, sometimes enriched by re-call context shaped on the model of the encyclopedia's *lemma*.

The act of communication meant to be the replacement and equal to the enjoyment of art, the science of historical memory or ephemeral of an exhibition and *un-mediated* personal experience of the viewer/user and his relationship with the material shown and the aroused emotions of memory, aesthetics and knowledge.

The great revolution introduced by digital technology – instead – is to open places and archives to the collective and massive dimension, and sharing of knowledge itself to make knowledge diachronic and distributed beyond the four dimensions (3D and time) in a kind of rearticulated *space-time* and displacement where the “here and now” are just a *click*.

## 1.3 Fluid Culture: Mounting and Nomadism

The natural evolution of the spatial hypertext network has enabled us to deconstruct real-mind, not just the physical space of the museum, but also the conceptual space of the collection and of the belonging. The works are primordial *cells*, atoms of culture and memory that aggregate and/or dissociated are re-framed in conceptual links other than a static exhibition. The concepts are *nomadic* and transverse intertwine in [a] continuous movement that stratify of interpretations, documentazions and contamination. And utopistic space in which the same pattern, the same work, the same piece of history can simultaneously belong to a physical place and multiple virtual places that reunite it in a dialogical relationship between similitaty and diversity, the *if* and the *else*. Moreover, the metadata, ontology and semantics, applied to a single object, build infinite levels of meanings and interpretations: the chimera of multidimensional cataloging, which generates – without ever exhausted – the Escher architecture, the spatial-diplayed key-images and catalogation of the Mnemosyne by Warburg [5] or the universe of multi-faceted classification of Ranganathan [6].

The knowledge becomes sedimented/interconnected link, questioned according to specific logic concentric which expands its orbits of knowledge incremental up to exo-disciplinary fields – otherwise unsearchable – for quality, quantity and multidimensionality of content accessible.

#### 1.4 Digital Media: *Medium* and Subject of Exhibiting

If the first use of the Internet was a sort of *hyper-propagation* of information, a second area arose opening and experimenting *digital* and *interaction* in various forms. Technology becomes both a medium and a subject itself of exhibition. That's the case of the *meta-museum* in Karlsruhe, built in 1989 become a physical exhibition place – hard to find an appropriate definition – for this act of *experinence* of such a museum where masterpieces are immaterial and *alive* just when performed by the visitors.

The museum presents a wide range of pieces: from the first concept aimed to *reificate* – making real whatever *real* means – the Gesamtkunstwerk concept that means the multimedia-like *Licht Raum Modulator* of Laszlo Moholy-Nagy – kinetic sculpture made by the temporal unfolding of light, form and space – to the most recent virtual artificial intelligent or interactive environments as *Lorna* by Lynn Hershman which dialogs in a game of reflecting mirrors between *human* and *artificial* in a conceptual research of common language in the balance between *identity* and *alienation*, *real* and *digital* [7].

The museum is a kind of evolutionary path between the two extremes: on the one multimediality physical or instrumental – as suggested Donald Preziosi [8] – a virtualization more and more thrust. In this extreme, the digital becomes the pure form of a dialogue/interaction between human beings and himself and the human beings and the art.

Another facet of the open world of technology, the exhibition space starts to have more and more their forms and specifications. The *camouflage* pattern of the new medium and a metaphor hyper or – vice versa – slavishly realistic, in an attempt to become transparent to the user within the exhibition. And the research and experimentation of new languages will increasingly close to its potential, which divides into two prevailing models: the 2.0 archive and interaction proxemics.

#### 1.5 Archive and Spatial Interaction: The Multimodal Performance

The first model – the archival organization – adopts an instrumental approach based on the structure of databases: the objects on display are cataloged and exposed according to research carried out by the user and the criteria identified to implement a strategy exploration of the underlying material – but at the same time to reinterpret what concerns the mode and dynamics of data mining intend.

Thah's the case of the Dutch group LUST, author of projects such as the *Graphic Design Museum* or *Random Generation*. The metaphorical model of reference is the *stack* – the archive of the earliest forms of hypertext of the highties – repeated on an interactive-table queried dynamically with gestural interfaces (NUI) in a physical space. The two-dimensionality of the surface that runs horizontally along the lines of the *infinite plane* is given depth, both conceptual and physical, through the ability to zoom in and out deeply diving into the content presented in a gesture that brings to the foreground or background of the individual units textual and multimedia information to the user.

The second one uses the full potentiality of the medium in its multi-dimension-modality and interactivity.

A good example is carried out by the research group Art + Com based on conceptual stages such as that implemented the installation *Zerseher/De-Viewer* (1992), and in which the gaze of the viewer distorts the picture itself – a reproduction of an oil painting by Giovanni Francesco Caroto – *reflecting* over not only the relationship between the work and the visitor, but above all – quoting McLuhan – the medium and the message. Concept which is resolved in the performative act in a co-authorial involvement of the user.

The approach of immersive physical and virtual museum scenario is extended and structure in the work of Studio Azzurro or in the info-productions of IO where physical interaction, proxemics and proprio-ceptive relationships with the environment, come out of the 2D space of the monitor and became pervasive as an overlapping layer of knowledge displayed on reality.

And the direct manipulation of *non-existent* – which query the physical object – interacts with a virtual space and the conceptual load of information [9].

If the traditional models of interaction permit to stage object in a fixed spaces, pre-determined, strictly separated from the place where the user is located and from which orchestrates the interaction, the experience is rather symbolic and organized according to a metaphor based on the principles that interaction must according to.

The current boundaries digital design exhibition, however, operating according to a logic similar to the real world, in which place of inter-operation and location of the staging merge and where the user's gesture is no longer projective and metaphorical, but natural – or at least – simultaneous of the physicality.

The exhibition then becomes a layering of knowledge and languages, ranging from physical to digital, from the real to the cognitive *continuum* in a modulation of communication models coordinated by an act of *directing*: the author – on one hand, – and the user as a co-author – on the other.

To this new paradigm corresponds, therefore, a change in perspective – if you do not plan a second contact surface, but an interactive event, a performance that will *re-frame* the space-time dimension of the user.

The task of the designer, the multidisciplinary skills brought into play, it seems so similar, not so much to the architecture planning, but rather to the director culture. This opens new perspectives in the research of new languages, that should be capable of finding a dimension that exploits the potential of the media, as original and experimental research of new and appropriate expressive solutions.

## 2 From the Wunderkammern to the Multimodal Storytelling

The concept of *Wunderkammern* (from the German *wunder = kammer = bed* and *wonders* and *chamber of wonders*) is the predecessor to the modern museum and the steps that led to this evolution are three:

- **collecting**: all kinds of European encyclopedic collection from the sixteenth to the late eighteenth century, a varied set of objects, which aims a project collecting. So we have the concept of pure wunderkammer;

- **cataloging** in the “room of wonders” were preserved natural objects (dried plants, stuffed animals, minerals) next to art objects, scientific instruments, objects of

ethnographic interest, apparently amassed without any criteria. Subsequently, the objects begin to be arranged in a specific order, although not immediately obvious to the eyes of the modern observer, it is particularly famous case Quicchenberg Samuel, who published *Inscriptiones speed tituli theatri very broad* (1565). The purpose of these exhibitions was essentially *autocelebrare* rich magnificence of her house through the vastness of the apparatus and the rarity of the objects collected, and especially to arouse the wonder of the few noble and cultured lucky visitors. This transitional phase allows to define taxonomies then serve the next stage;

- *exhibiting*: initially around these places were created of real networks of intellectuals who exchanged their knowledge and their "wonders", but they also begin to feel the need to catalog the objects with the ultimate goal of showing their exposures to a wider audience outside their circle.

The next step is the analysis of the meaning of the two words that make it up: *house-museum*. First, we must break down the word: house and museum, the first we mean everything that is life, the history and experience of a person who can be summarized with the word user experience. Museum, whose birth the meaning has been explained previously, is the set of objects that are shown to the public.

In particular, the case study considered is the house-museum of Manzoni in Milan, which is located in the house on Via Morone 1, where the author lived with his family from 1814 to 1873, the year of his death.

The report writer is very close to Milan in 1848, revolution broke out of the Five Days of Milan, makes the three sons to take part and although one of them was taken prisoner and hostage of the Austrians, signed an appeal to all peoples and Italian princes because they help the people of Milan.

The tie that binds the writer to his city can also be found in his works: *History of the pillory* and *The Betrothed*.

The project was focused on the latter novel, set from 1628 to 1630 in England, especially in Milan, during the Spanish occupation, was the first example of the historical novel in Italian literature. The roman is based on a rigorous historical research and episodes of the seventeenth century, such as the story of the Nun of Monza and the Great Plague of 1629-1631, all are based on archive documents and chronicles.

### **3 The Betrothed 3.0: A Mobile the Geo-referred and the Multimodal User Experience**

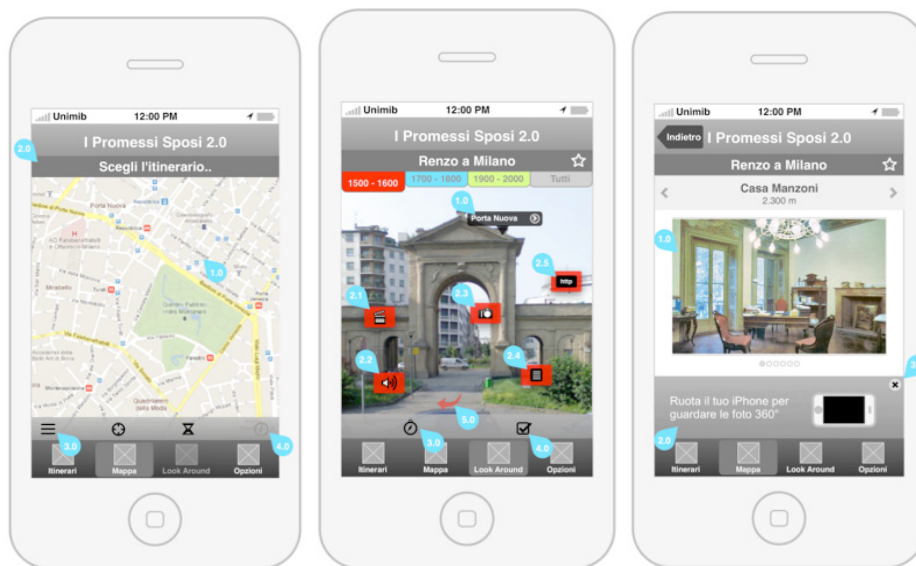
The project, *The Betrothed 3.0*, describes the second journey made by Renzo in Milan as he goes in search of Lucia, complete with contents that show the house-museum Manzoni.

The path is analyzed according to three historical periods: 1500-1600, a period in which the novel, 1700-1800, a period in which he lived the author, and since 1900, which is the most recent history of Milan, illustrated not only from a perspective of cultural history, but it is also full of ideas and suggestions of tourist in order to allow the visitor to the city even further from the gastronomic point of view, traditions and commercial.

To understand the concept of the mode and multi-mode you can insert content related to the example of Milan's Porta Nuova (because the story board refers to that place), divided according to the historical period.

The Betrothed 3.0 is a research project that concluded with the design and prototype development of an iPhone application.

Starting from the path taken by Renzo Tramaglino the streets of Milan in the seventeenth century, were drawn 3 historical, mentioned earlier, that trace the steps of the protagonist of the novel. Each route has its own historical setting and are shown for each of the points of interest that are associated with multimedia content in context at the time of the itinerary.



**Fig. 1.** Wireframe showing the functionalities and Use-cases

The Betrothed 3.0 uses the technique of story telling # to propose such content. This allows for a more dynamic and less tedious in the aspect of information presentation.

The goals that you place the research team for the design of the app are:

- Create a link between the novel The Betrothed by Alessandro Manzoni and the city of Milan, where he set a part of the book
- Create a link between the home and museum of Manzoni Milan
- Provide a tool that allows to follow the path by Renzo Tramaglino been going through the streets of the city
- Create a series of tours starting from the location mentioned above
- Associate a historical context for each route
- Show a series of multimodal content associated with points of interest
- Use the storytelling to offer content
- Use the geolocation and augmented reality for a better user experience
- Give the user a chance to co-author the content offered

- Create a guide historical alternative to the city
- steal the best from the applications on the market trying to improve the limits.

You once chosen your route, is guided from the streets of Milan the Map shows the route with the relevant points of interest and directions on how to reach them. For each there is a tab-depth where are shown the multimedia contents mentioned above. The user not only has a role of spectator but was invited to co-author the content offered. In fact on the cards, it is possible to add photographic material, video and text. Furthermore, there are buttons for sharing on social networks most used (Facebook, Twitter and Google+). This approach is closely linked to the world of social networking and UGC (User Generated Content) upon today is based on the operation of the Internet. Users play a dual role, both active and passive at the same time, they are called to increase and share knowledge.

The application has a function (*Look Around*) that uses Augmented Reality and that shows on the screen of your smartphone multimedia content at the points of interest around the city. In addition, small arrows show the direction to follow to reach the next stop on the itinerary. The user then has two ways to follow the routes proposed by the APA and the Map and Look Around. The first allows him to have an overview of the data path can also display the tabs of the various stages, while the second allows him to directly access to multimedia content if it is located in proximity of one of the stages. The application, therefore, acts as a guide and a navigator for the routes. It is also proposed as an alternative historical guide to the city of Milan.

#### **4 *Open-Air Cultural Heritage: Geolocalization and AR***

In recent years we have seen the increase of the use of the internet, with a consequent increase in its importance in the process of renewal and cultural diffusion, facilitated the development of a user without boundaries. A large virtual community of people made real and virtual interactions, that is not bound to a place but only the accessibility to the network, able to communicate instantaneously with the rest of the world.

This connectivity together limitless virtual evolution of relational and social gave birth, and the subsequent huge growth of social networks that have misinterpreted the concept of privacy on the Internet so that now there is a widespread sharing life mania, ie 'irrepressible desire to share anything of our lives, including their geographic location, with all our contacts even if unknown.

This trend has been ridden by social networks, seeing this trend in the ability to reach more and more profit, have equipped their applications Mobile Location Based Service that services that allow you to geographically locate a mobile device by means of a GPS receiver or by the Cellular networks, thus enabling geolocalize an individual in real time.

Applications geo mainly do two things: communicate their location to other users and connect you to a real reference. This enriches the user experience in the information processed by the APA change depending on the context that changes depending on where you are located.



Today all smartphones are equipped with a GPS receiver which, by communicating with a series of satellites, calculates the exact position in which there is located, returning of the coordinates that correspond to a precise point on a map. When the GPS signal is not available, the smartphone using the information from the cell phone with which you can determine approximately its position.

#### **4.1 Augmented Reality and Georeferred Interaction**

The For Augmented Reality refers to the enhancement of human sensory perception through information, generally handled and conveyed electronically, that would not be perceived with the five senses."

Unlike virtual reality in which you are immersed in a world composed entirely of sequences of bits, Augmented Reality combines real world with computer graphics. The means by which you live the two sensory experiences are very different. AR is sufficient for a display and an optical sensor, components that are supplied to all smartphones on the market.

Technically Augmented Reality is a technology that:

- Combines the physical world with computer graphics
- Allows interaction with objects in real time
- Trace the environment in real-time
- Allows the recognition of images and objects
- Provides an environment that changes in real time

The software that generate Augmented Reality, show on a monitor of the virtual objects at particular points that can be defined through the coordinates of the markers or visual as for example the QR code. Applications using Augmented Reality without any kind of marker are called markerless show of virtual objects by simply using the position of the smartphone and its motion sensors such as the gyroscope and accelerometer. The optical sensor is thus superfluous if not to show on the display the real world that surrounds the user.

#### **4.2 Maps and *Look around*: An Immersive Geo-located Ux**

The Starting from the path taken by Renzo Tramaglino the streets of Milan in the seventeenth century, were drawn three historical routes that follow the steps of the protagonist of the novel. Each route has its own historical setting and are shown for each of the points of interest that are associated with multimedia content in context at the time of the itinerary. The Betrothed 2.0 uses the technique of story telling to propose such content. This allows for a more dynamic and less tedious in the aspect of information presentation.

You once chosen your route, is guided from the streets of Milan using the geolocizzazione. On The Map shows the route with the relevant points of interest and directions on how to reach them. For each there is a tab-depth where are shown the multimedia contents mentioned above. The user not only has a role of spectator but was invited to co-author the content offered. In fact on the cards, it is possible to add photographic material, video and text. Furthermore, there are buttons for sharing on

social networks most used (Facebook, Twitter and Google+). This approach is closely linked to the world of social networking and UGC (User Generated Content) upon today is based on the operation of the Internet. Users play a dual role, both active and passive at the same time, they are called to increase and share knowledge.

The application has a function (a Look Around) that exploits the Augmented Reality markerless ie without the use of external markers. At the points of interest that make up the route is shown on the display of the device, a label with the name of the place, and a button to view the data in-depth. Are also proposed a series of comics that indicate the existence of one or more multimedia content associated with the area that you are framing with the camera of your smartphone. The display also shows the direction to follow to reach the next stage of the route.



Fig. 2. Map view, look around and social features of the app

The user then has two ways to follow the routes proposed by the APA:

- *Map* that allows to have an overall view of the path giving the possibility to access the cards attached to the individual stages.
- the *Look Around* allows direct access to multimedia content in case you are standing near one of the stages.

The application, therefore, acts as a guide and a navigator for the routes. It is also proposed as an alternative historical guide to the city of Milan. The geolocation is the technology upon which the operation of The Betrothed 3.0 as it allows the user to be located on the map of the city in real time and to be guided along the route proposed. In particular, the application identifies its location and shows the path to follow to follow the selected route through the stages that compose it.

When you start the app, it shows an alert that asks the user if he wants to be geolocated and if the answer is positive, the indicator is activated GPS iPhone calculated the exact position and indicated on the map. The user must then select one of the routes and after having explored the information, the app will ask to be guided to the first stop on the route chosen. The application does nothing more than offer the fastest path to reach point B (the first stage of the path) from point A (current position). All the movements are monitored and displayed on the map. The directions change in the event that the user reaches a check point that is a point where there is a

stage or a change of direction. Once you reach the first stop, start your tour itself and the user is guided sequentially through all the points of interest that make up the route in the same manner as described earlier.

The geolocation is crucial to the operation of the Look Around that exploits the Augmented Reality, as the app takes as a reference point, the position of the user and displays the contents, previously georeferenced, which are closest to him.

A final use of this technology is to signal to the user, through the notifications, the presence of multimedia content closer to its position in the case in which the application was in the background ie both remained running despite the user has closed . The notifications are displayed through the alert accompanied by a beep and invite you to look at the content or proposed to deepen the knowledge of a stage.

All resources that form the basis of the application is georeferenced information that are assigned to each of the coordinates and placed on the map. When the user is close to the stage and its content, the app activates all the functions described above to enable you to explore, condidverli and enrich them.

The application, The Betrothed 3.0 provides for the use of Augmented Reality markerless ie without the use of external markers. At the points of interest that make routes through the Look Around, is shown on the display of the device, a label with the name of the place, and a button to view the data in-depth. Are also proposed a series of comics that indicate the existence of one or more multimedia content associated with the area that you are framing with the camera of your smartphone.

The display also shows the direction to follow to reach the next stage of the route.

## 5 Conclusions

The research project is based on a specific case history; however the project can be generalized – easily extended – and represents a reproducible experience for different disciplines focusing on the problem of knowledge sharing. The stratified/multi step approach to the problem of the cultural heritage allows actually to realize in many phases the translation in digital form and the consequent sharing of the cultural heritage avoiding the risk that the historical documents will remain unknown and on the worst case will get forgiven and lost and/or relegated in specific *containers* and places apart from every day life.

A first level is the storytelling approach that allows to disseminate specialized information to the public at large crossing the border to different disciplines and cultural experiences.

The second level – that of the implementation of search tools specific of the data basis contents and mainly focussed on the geofenced search and cultural domain the historical documents pertains to – the content distributed on the mobile platform in different/multimodal ways become then more an efficient *cultural tool* than a simple low-level digitalization.

The third refers to the creation of a social community of interest and experience that starts from the distributed editing and produces links and exchanges extending to a wider field and longer lasting than the original project.

The actions of exploiting innovation technologies and of designing user experience will be carriers of innovation and winning strategy to overcome the chronic lack of grants for the public projects fostering the sharing and the exploitation of the treasures of a cultural heritage.

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