# The Museum Building of Trinity College:

# an Interactive Geology Playground

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**ABSTRACT**
*This paper describes "Playground", a sub-section of the Museum Building of Trinity College Dublin website (www.museumbuilding.org). "Playground" tells the story of the Museum Building by focusing on the Geology Museum hosted in the building. It engages its visitors in elaborate and meaningful interactions that relate to real-life to deliver information about geology within an easy to use and intuitive interface. Thus, it stands as a playful, interactive, and simple platform aimed mainly at a young audience but also at a larger audience willing to learn playfully about geology and the Geology Museum. By adopting a playful approach to represent the Geology Museum we wanted to build a virtual museum that would stimulate visitors' and particularly children' interest in geology by giving them a memorable experience similar to a visit in the real world. Thus, our section differs from most museum websites by adding strong interactive metaphors to educational information.*

*This project is part of a larger project that consisted in building a website dedicated to the Museum Building of Trinity College Dublin. It was completed by a team of three members, a designer and two programmers under the theme "Kids, Play, Education". The author was in charge of research, planning, and programming.*

**Author Keywords**
Education, children, interactive, playful, museum, geology, embodied cognition, designing with blends, media equation

## 1. INTRODUCTION
The Museum Building is an outstanding building built on Trinity College Dublin campus. It stands out by its Venetian style, and detailed architecture made of carvings depicting natural scenes and colorful Irish stones. Despite its strong character, this building does not have a documented reference for itself but is instead always mentioned in literature as one of the projects of Thomas Deane and Benjamin Woodward. Thus our initial purpose is to tell the story of this building to reveal its uniqueness.

The Museum Building was purposefully built in 1857 to host geological collections of 80,000 specimens dating from 1777 in the Geology Museum on the top floor. For this reason, we chose to focus on the Geology Museum to capture the essence of the building by concentrating on its original purpose.

The purpose of the Geology Museum is to educate about geology by giving students and visitors the opportunity to see and learn about real rocks. More generally, the Museum Building itself demonstrates Irish architecture and richness of Irish soil since the marble used is mostly Irish (except four columns of Lizard serpentine on the ground floor) [1] [2]. Thus, considering the educational purpose of the museum we gave our project the same educational goal.

Then, realizing that museums are media organizations that convey ideas just as other media [3] but in the 3D space, we found that as media, museums are also competing with other media such as television or the Internet. In that sense, the experience lived in a museum could also be translated in another media, with the difference that as an institution that benefits from government and education support, the museum has more credibility than other media [4].From that point, we decided to translate the experience of the museum to the Internet to reach a greater audience and we tried to make it as relevant as a real visit.

In museums, there are two approaches to display an exhibition. Either it is by displaying objects in a 'traditional' way or by providing 'hands on experiences' [4]. When visiting the Museum Building we realized that it is a traditional display museum. However, studies show that the challenge for museums in the future will be to be more interactive. Indeed, as children grew up with technology they are used to learn with entertainment. More over, in the U.S 43% of museum visits in 2006 were remote [5]. So museums will have to convince people that the exhibition they display is worth going out for [6].

Thus our project takes up the challenge of making the Geology Museum more interactive by being an online extension of it that motivates interest in the museum and geology, but it is not an online

replica of the museum. Besides, since our content is educational our target audience is mainly children aged from 8 to 11. As mentioned, children are used to learn with entertainment, so our main research consisted in finding ways to add entertainment to educational information and make that information memorable for the child.

## 2. DESIGN

### 2.1 Games

Initially our main focus was to remove the bias children have about museums that categorizes museums as 'boring' places to visit, even online. So, our first approach to add entertainment to an educational content was the concept of games. The child could play a game in order to learn about geology. We based our initial approach on the Honda website www.problemplayground.com/ where the user has to solve very simple games such as puzzles to reveal the content (video, text etc.). We first imagined to integrate these small games in the navigation of the main website. But since this integration might be intrusive to other sections and might focus the attention of the child more on the game itself than on the information, we kept the entertaining aspect of games but researched another way to captivate the child's attention.

### 2.2 Social computers

Children often take television literally, it is only when they grow up that they realize that there is a frontier between the real-world and television. And as part of a social study it has been shown that individuals often interact with computers, and new media in a social and natural way, by replicating the interactions they know from real-life. In other words, media equal real life [7]. Since we are used in real-life to a very responsive world that reacts to our actions with physical forces, we tried to apply this principle by building a world that is highly interactive. In contrast with traditional websites where there is only a menu bar with which the user can interact, we therefore tried to make the interface react to many of the user's actions. Thus, most of elements onscreen are interactive and do not only reside in a menu bar but are integrated in a scene familiar to children. Eliminating the traditional menu bar eliminates the 'boredom' children might also feel online about traditional websites. Also, since children react socially to computers, we created a fossil character 'Annie' the ammonite to link sections together and to talk to the child. Following this principle it was also important to keep all the graphics and the scenes familiar to the child. For that reason we adopted an arts and crafts style and the scenes are always related to geology but use elements easily recognizable to the child.

### 2.3 Designing with Blends and Embodied Cognition

Instead of developing games that would distract children we kept on investigating ways to link education and entertainment by using the media equation mentioned above. According to the Embodied Cognition theory, cognition is the result of the environment and of the body. In other words, acting is learning. For that reason it is often recommended to students to learn by writing since the learning process occurs in the correspondence of the hand gesture with the information being written. Using this theory we applied a design principle known as "Designing with blends" [8] that consists in blending real-life situations from 3D to a 2D context onscreen to design an intuitive interface the user can easily navigate through by remembering from his or her past experience. Thus, we researched interactions that would replicate gestures from real-life onscreen to make the information delivered memorable. Instead of developing games we therefore used metaphors from real-life and developed elaborate and meaningful interactions accordingly. We based our approach on the Mercedes website www.a-to-s.co.uk/home.php where the user needs to interact with gestures from real-life to discover the content. Thus, our interactions integrate real-life concepts such as gravity, and more reality analogies that we researched and adapted to the screen.

### 3. RESEARCH

Our research process was to research geology content and interactions from real-life in parallel.

### 3.1 Content

Geology is the science that studies the Earth and rocks. In this way, to tell coherently the story of the Geology Museum we focused on the Earth as the central element that would link all our sections. We used [9] and [10] for our content research . Thus, we chose to organize the information according to the place of the Earth and divided the content in five main sections contained in five small worlds:
- First world: The Earth and The Museum - this world informs about the Geology Museum, its story, its content and small facts. It introduces us to the museum.
- Second world: The Earth and Ireland – this world informs about stones in the Museum Building and where they come from in Ireland. It relates geology to Ireland and the Museum Building.
- Third world: The Earth Mechanics – this world informs about mechanisms involved in a volcano's eruption. It shows that the Earth is dynamic.
- Fourth world: The Earth Composition – this world

informs about the different layers that compose the Earth crust. It shows the diversity of the composition of the Earth.

- Fifth world: The Earth and the Universe – this world informs about the place of the Earth in the solar system. It shows that the Earth is part of the universe.

We organized the information about the Earth relatively to space from a local to a global perspective and we chose information about the Earth that had an interactive potential and that was contained in the Geology Museum. However, even if the museum contains much information about fossils and evolution, we decided not to focus on fossils as they are not directly related to the study of rocks but relate more to biology. Instead we integrated fossils in the background by introducing the little character Annie the ammonite.

### 3.2 Interactions

In parallel to researching content, we researched interactions that would blend geology phenomena and real-life interactions to digital interactions. We tried to find digital interactions more elaborate than a simple click to encourage learning. We found interactive gestures that we could exploit:

- Using the mouse:
  - Drag and drop to:
    - Throw an object with gravity [11]
    - Pull a string with elasticity [12]
    - Pushing an object to make it fall [13]
    - Draw a shape that could animate once drawn [14]
    - Shake an object to trigger an event [15] [16]
    - Wipe a surface to discover a content [17]
    - Peel a surface to discover a content [18]
  - Rollover to:
    - Catch an object like a magnet [19]
    - Make a surface expand
    - Slip over a surface
  - Click to:
    - Trigger a punctual event
    - Simulate pressure on a surface [20]
  - Move to:
    - Have an object following the mouse
    - Use mouse movement to trigger an event
    - Use mouse speed to control an event [21]
  - Scroll to:
    - Control an event
  - Cursor to:
    - Change the mouse cursor into an object [20]
- Using the keyboard:
  - Type a key to:
    - Show information related to a specific letter on the keyboard
    - Move objects using the arrow keys
    - Enter user input
- Using the microphone
    - Blow in the microphone to trigger en event [22] [23]

Once we found existing digital interactions applicable on the web, we linked them to geology phenomena and built our scenes and interactions accordingly.

## 4. IMPLEMENTATION

We implemented our project using ActionScript 3 (AS3) as it is a standard for interactive web-based applications.

We created our graphics using Adobe Illustrator and Photoshop CS4.

Our interface consists in a homepage that contains five small worlds about geology and the Geology Museum.

### 4.1 Homepage



**Figure 1 – Homepage**

#### 4.1.1 Description

Applying the design principles cited above, our homepage represents a range of cabinets drawn from the cabinets that exist in the Geology Museum. Each cabinet contains an animated small world that informs about geology and the Geology Museum.

#### 4.1.2 Interactions

The main interactions of the homepage are rollover and click.

When the user rolls over a cabinet, the cabinet opens and reveals the small world inside. When the user rolls out an open cabinet, the cabinet closes. When

the user clicks on the revealed small world, the view zooms in the small world and the small world scene becomes full screen. Once in a small world the user can go back to the homepage to navigate to another small world by hitting a return button.

### 4.1.3 Real-life experience

On the homepage we allow the user to chose a non-linear exploration and chose amongst the cabinets so that he or she experiences the same act of opening a cabinet when visiting a museum in real-life out of curiosity. The closed cabinets and the animated worlds' interactivity stimulate curiosity. Our representation of the Geology Museum enhances the experience lived in real-life in that what is inside a cabinet is highly interactive and playful contrarily to the rocks that cabinets in the museum really contain.

## 4.2 First World: The Earth and the Museum



**Figure 2 - The Earth and the Museum**

### 4.2.1 Description

This world represents the Museum Building in its context surrounded by trees and nature on TCD campus. This world informs about the story of the Geology Museum and about small facts such as the number of specimens it hosts, the opening hours etc. It introduces the user to the Geology Museum.

### 4.2.2 Interactions

This scene contains four interactive elements: the museum building, the cloud, the grass and the trees. Given a scene of the building in its context, the challenge was to find appropriate interactions for each element to display the information we gathered on the Geology Museum in our research. The interactions were distributed on each object as follow:

### 4.2.2.1 Museum Building

The Museum Building opens as a box when the mouse rolls over it from down to up, replicating the movement of opening a box in real-life. When the box opens, a popup text bounces out with a different text about the museum each time the box opens. Each popup moves the last popup away.
This interaction illustrates that the information is about the museum, so that the child makes the connection

between the museum and the popup text without having to read the sentence "The museum contains 80,000 specimens " to understand what the information is about.
Also, the idea of a box opening was adopted to remind of the arts and craft style we adopted, and of a popup box out of which a surprise usually comes. Thus we tried to exploit again the innate curiosity of children for a closed box that initially sleeps and that they need to open and wake up to discover a surprise. This interaction personalizes children' relationship with the building.

Technically, we tried to exploit scrolling from down to up to open the box on rollover but we encountered the difficulty that AS3 does not support the MOUSE_WHEEL event for Apple laptops.
So to avoid integration problems we reoriented our approach towards using the MOUSE_MOVE event to track the movement of the mouse from down to up to trigger the box opening. AS3 therefore checks the position of the mouse at each frame of the animation and compares it to its previous position to decide whether or not to trigger the box opening. We animated the box opening by animating three different images of the box opening from a closed to an open position.

### 4.2.2.2 Cloud

The cloud has three interactive events associated to it. First it can be dragged and dropped, and moved around the scene. As the dragging begins, it starts to shrink, and when it is dropped, it expands back to its initial size. Second, when pressed long enough, the cloud starts pouring raindrops over the scene and when the mouse is released the rain stops pouring. Third, when raindrops hit the ground, the grass and trees that were not present at the beginning of the scene grow out of the ground.
This interaction simulates pressure on the cloud object by giving a feedback on a clicking action when it starts shrinking. The action of provoking the rain uses the metaphor of squeezing a sponge to dry it of its water, hence the shrinking effect.
This idea of the cloud pouring rain was adopted to allow the user to build the scene from the rain, using a simple real-life situation of a cloud pouring rain.

Technically, in order to separate the rain dropping event from the drag and drop event which are both mouse clicking events, we made a movie clip of the cloud shrinking that plays when the cloud is clicked and that plays backward when the mouse is released. We used the MOUSE_DOWN and MOUSE_UP events.

### 4.2.2.3. Grass timeline

Once revealed by the rain, the grass was used as a timeline to display the story of the Geology Museum from its creation to its status today. When the user rolls over the grass, picks grow out of the ground displaying a date. When the user rolls out of the pick, it shrinks down. When the user clicks on the date a popup jumps out and goes in the middle of the screen to display information related to this date. To move out of the popup the user needs to roll over another pick. The grass timeline remains optional in that it displays a date and the user can chose to see the information it contains or move to another interaction. We made the timeline optional to not get it in the way of the user when he or she explores the scene.

Technically the grass timeline is the most complex interactive element of the scene. The grass is made of three movie clips: the body, the picks and the dates. Mouse events needed to be handled carefully to produce the effect of a fluid timeline that can be open and closed using only two mouse events: rollover and click. Thus, the challenge was to manage Event Listeners appropriately using Booleans and the MOUSE_DOWN, MOUSE_OVER events on each element of the timeline.

### 4.2.2.4 Trees

The trees can be clicked to display photographs of the Museum Building in its natural context surrounded by trees to show how the presented world relates to the building. We chose to use the trees to display the photos to link the natural context and trees surrounding the building.

## 4.3 Second World: The Earth and Ireland



**Figure 3 - The Earth and Ireland**

### 4.3.1 Description

This world represents a map of Ireland, the texture of the rocks used in the Museum Building is displayed on the county from which they come from. The goal of this scene is to link the rocks used in the Museum Building to their location in Ireland and show how they are used in the Museum Building.

### 4.3.2 Interactions

The main interaction of this scene is to peel a county off the map to make a text pop up on the screen displaying information and photos of the rocks inside the building. The peeling effect was chosen to relate to the real-life action of peeling off stickers from paper to discover some content.

The author contributed by taking the photographs used in the scene.

## 4.4 Third World: The Earth Mechanics



**Figure 4 - The Earth Mechanics**

### 4.4.1 Description

This world represents a volcano ready to erupt. The goal of this scene is to educate about the process of a volcano eruption and about the formation of rocks during that process.

### 4.4.2 Interactions

The main interaction of this scene is to blow into the microphone to trigger the volcano eruption. When the user blows into the microphone the animation reacts to input sound volume and when a certain volume level is reached, the volcano erupts. Later the user needs to blow into the microphone again to blow clouds into the scene that would pour rain and illustrate the process of erosion. In this world, gravity is enabled and when rocks erupt out of the volcano the user can play with them and throw them away, with a drag and drop action to which a gravity effect was added.

According to Lumley [4], cited in the introduction, the problem with display museums is that displaying object is not enough, the museum has to recreate the context in which an object is used. Thus, particularly in this scene we tried to put the volcano eruption in context to enhance the experience we cannot have in a display museum.
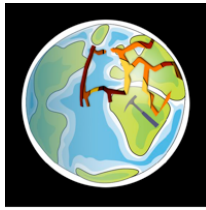
## 4.5 Fourth World: The Earth Composition



**Figure 5 - The Earth Composition**

### 4.5.1 Description

This world represents the Earth globe. The goal of this scene is to discover the layers that compose the Earth crust.

### 4.5.2 Interactions

The main interaction of this world is to hit the Earth globe with a geology hammer to discover what is contained inside the Earth. The hitting movement is controlled by the horizontal position of the mouse. The hammer replaces the mouse cursor. When the mouse moves right, the hammer rotates right, when the mouse moves left the hammer rotates left , hits the Earth and discovers a crack on the Earth surface. Depending on the rotation and speed of the hammer, the crack gets greater. When the user hits the surface enough times, the entire surface breaks and the broken pieces start shaking. When the user hits one last time on them, they fall and discover the composition of the Earth. The hammer cursor then changes into a magnifying glass.

Technically, the challenge was to implement realistically the hammer movement to have a strong metaphor of the hitting movement that would be more elaborate than a click, or a drag and drop action. Another challenge was to discover the cracks realistically where the user hits. This was done by using a dynamic mask to cover a static image of the whole crack in the background using the MovieClip.mask property. Once the pieces are all discovered, another challenge was to make them fall realistically starting from the piece hit followed by its neighbors. When the user hits a piece, the piece starts to fall down, and all the pieces that surrounded it fall, spreading the same reaction to its neighbors. We used the MovieClip.rotation and MovieClip.y properties associated to an ENTER_FRAME event handler to animate the falling movement of the pieces dynamically. Animating dynamically rather than on the timeline allowed us to customize easily our animation.

## 4.6 Fifth World: The Earth and the Universe



**Figure 6 – The Earth and the Universe**

### 4.6.1 Description

This world represents the planets in the solar system and informs about the place of the Earth in the universe.

### 4.6.2 Interactions

The main interaction is to collect pieces onscreen with the mouse acting as a magnet. Once the pieces have been collected they form a planet that places itself in the solar system. We used the metaphor of gathering pieces to relate to the formation of planets built from pieces of meteorites that collide into each other.

### 4.6.3 Note

Due to time constraints this last part could not be implemented in the final piece.

## 5. CONCLUSION

This project allowed us to reinforce the knowledge we acquired during this academic year in programming (mostly AS3), photography, aesthetic design, narrative, moving image and cultural studies. We learned how to apply concepts to the implementation of an interactive digital project. In our teamwork, we also learned and experienced the different roles and relationships involved in implementing such project from the designer, to the programmer and the writer. Thus, in this project we were able to demonstrate our skills acquired over the academic year to build an original interactive piece able to tell coherently the story of the Museum Building.

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