

How do you adapt a museum installation in order to enlighten and engage youth?

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Scary weather

Table of contents

Introduction	2
Who did we talk to?	3
Background	4
Design principles	7
How we executed the tests	8
Equipment	9
Phase one: Introduction	9
Phase two: Usertest	10
Phase three: Interview	10
Phase four: Climate survey	10
Findings and design implications	11
Findings from the survey	11
From low sound, interruptions and dubbing... ..	13
... to better sound, partition and subtitles!	14
From unclear themes... ..	16
... to crystal clear themes!	17
From look, but do not touch	18
... to look at this, touch this!	19
From underrated maps and challenging navigation... ..	20
... to impressive maps and improved navigation!	21
From moderate enthusiasm... ..	23
... to interactive learning!	26
Conclusion	27
Sources	28

Introduction

The climate on earth has changed over the last hundred years and we know that the changes will continue in the years to come. An important climate communicator has traditionally been media such as newspapers and TV, where both local changes on "Bryggen" in Bergen and forest fires in the Amazon have been a focal point. On the other hand, we see that climate and weather dissemination also has become a popular feature in museums around the world in recent years. A museum setting can help teach younger people about climate in a more interactive and visual way. This is highly relevant as it is important to engage and help make the younger generation understand climate change.

In this project we have collaborated with the media company Scary Weather, which produces stories about weather, climate and global warming with the help of visual tools and physical installations. Scary Weather is the creator of The Globe Room installation at the University Museum in Bergen, which we will evaluate in this report. The purpose of the evaluation of The Globe Room was to investigate whether the room functions as an arena for providing information about the weather and climate for younger users, as well as whether the visual tools in the room are suitable for this.

The evaluation is written as an exam paper at MIX202 Design for Media Use in the spring of 2020. The course is part of the Bachelor's program Media and Interaction Design at the Department of Information and Media Science at the University of Bergen. The course leader was Professor Lars Nyre. Subject teachers were Professor Andy Opel (Florida State University), Senior Engineer Zulfikar Fahmy, PhD Fellow Fredrik Håland Jensen, PhD Fellow Oda Elise Nordberg and Master Student Jonathan Lindø Meling. The evaluation is translated into English by Kristin Eidsheim.

Firstly, in this report, we will explain who we talked to and why, further we will elaborate on the background of the project and describe the contents and functions of The Globe Room. Then we will go through relevant design principles and present the methods we have used in the evaluation. Furthermore, we will present the most important findings and suggest improvements. Lastly, we will make a summarizing conclusion.

Who did we talk to ?

To evaluate The Globe Room, we recruited 10 informants aged 18-19, from two different high schools. This target group is the next generation and forms a large part of society. It is important to gain insight into what tools are needed to influence and engage this target group.

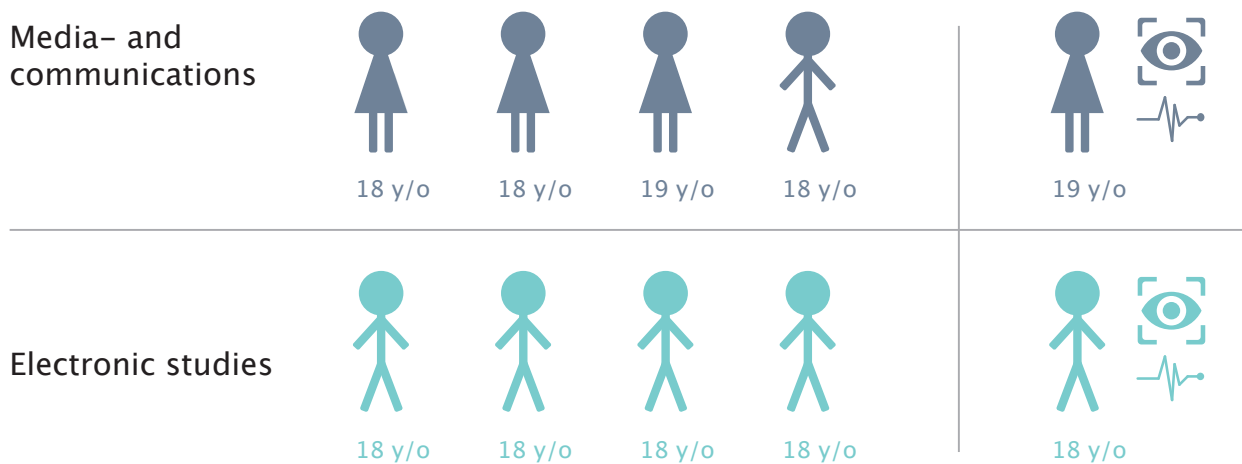


Figure 1: Overview of gender distribution and the age of our informants

Half of the informants attended an industry-based vocational school while the rest did general studies with a major in media and communications. The reason for this choice was our assumption that vocational students would not be as engaged and emotionally invested in the themes of global warming and climate change, compared to students from general studies. If this turned out to be true, it would give us a deeper insight into how a wider range of personality types within the target group experience The Globe Room.

The assumption is based on the fact that industrial vocational studies are characterized by a great deal of masculinity and uneven gender balance. Statistics show that women are more likely to perceive climate change as harmful to the future and earth species (Ballew et al., 2018). Since general studies, in statistics, has a smoother gender balance, we assume that there will be more people in this group who are concerned about climate change. According to SSB in 2016, media and communications had a gender distribution of 50/50, while electrophysics had 95% men at that time (Statistics Norway, 2017).

In addition, there is a high likelihood that most industrial vocational students will in the future work in less climate-friendly companies, such as the oil industry. This, we assume, can affect how willing and interested they are in the content of the Globe Room.

Background

By evaluating The Globe Room, we wanted to give Scary Weather feedback and specific tips for improvements, both for The Globe Room and for future installations they will make. We also want others to benefit from the findings and insights we have made, with a view to how best to communicate climate change information to high school students.



Figure 2: The Globe Room with a big leather globe in the middle.

The Globe Room is a room at the University Museum in Bergen that contains three round screens with a corresponding control panel for each screen. The screens visualize a map of the globe and each screen has a specific theme; weather, climate and the sea. In the middle of the room there is a large leather globe with contours of mountains and land that museum visitors can both touch and spin. According to Scary Weather, they want to teach young people through The Globe Room about how weather, ocean and climate change are linked, and how global warming is affecting the globe.



Figure 3: The control panel in front of one of the screens in The Globe Room.

To navigate, visitors can interact with the granite ball on the control panel, causing the on-screen map to rotate like a globe. If the navigation ball is at rest, real-time data on ocean currents, wind and temperature on the earth will be displayed, in the form of colors and dashes moving across the globe. On the control panel you can choose between Norwegian and English language and it is possible to connect headphones. The volume switch only works with headphones are connected.



Figure 4: One of the control panels showing the navigation ball, volume switch, headphones input and buttons that allow you to switch between Norwegian and English language.

As the navigation ball is turned, the movements are mirrored by the navigation circle, which is a circular cursor on the screen. By looking around the map you will find several white icons that represent a small globe. These represent different videos that are played when the navigation circle is placed over them. Since each screen has its own theme, the videos on the map also convey the screen theme.

Design principles

Our analysis of the room and the subsequent design implications is made in light of the fundamental design principles of Don Norman. Emphasizing design principles will create good interaction design and user experiences (Nordbø 2017, p. 37-38) In this project, we have used the design principles: visibility, feedback, hints and consistent design.

The principle of visibility says that the functionality of the system must be easily visible to the user. It must be clear what functions the object has and how they are used. Second, the product must provide feedback to the user if changes in the condition or when a function is performed. The feedback should address what action has been taken and what this has led to. This can come in the form of vibration, color change or sound. Furthermore, it is important that the design gives the user hints on how to use the product and the functions must be self-explanatory. The principle of consistent design is that functionalities that are almost identical should function in a similar way (Nordbø 2017, p. 38–46).

How we executed the tests

We chose to combine the following methods in our evaluation of The Globe Room: eye tracking and stress measurements, observation, semi-structured interview and survey. The combination of these methods has led us to view the situation from several viewpoints and resulted in a more comprehensive understanding of the informants' user experience (Østbye et al., 2013, p.125-126). Because of this, we also ensure the validity of our data as it is difficult to draw conclusions from eye tracking and stress measurements by itself.

The data we have collected in the project is approved by NSD and below you can see our overall plan for the user tests.



Figure 5: Overall plan for the evaluation, the bullet points marked in bold apply only to the user tests with eye tracking and stress bracelet.

All the user tests and interviews were conducted at the University Museum. The procedure was approximately the same for all informants except for the eye-tracking tests which took place outside of the museum's opening hours. The interviews were held separately, while the user test was conducted with two and two students from the same school, inside The Globe Room. The purpose was to make the test situation more authentic, as it is more natural to go to a museum with friends or classmates.

Only two out of ten students were tested with eye tracking and stress bracelet. We conducted the first eight user tests in four days, which included observation and interview. The experiences we took from the initial interviews and observations made us better equipped to conduct the eye-tracking tests based on the complexity of the equipment added.

Equipment

In order to measure the eye movement of the students, we used eye tracking glasses Tobii Pro Glasses 2. We can divide the eye's movements into the categories; fixations and saccades. When the eye fixates, eye movements are stabilized over an object of interest, however, with saccades the gaze will jump with small movements from one fixation to another (Bergström & Schall, 2014, p. 5).

We also used the Empatica E4 stress bracelet to measure physiological data during the user test. The stress bracelet measures heart rate, temperature, blood volume, heart rate, movement and sweat (Lazar et al. 2017, p. 383). By analyzing this type of data, we can get an indication of which elements or events in The Globe Room are causing reactions such as stress, fear and joy.

Furthermore, we will explain the evaluation process in light of the phases from Figure 5.

Phase one: Introduction

We first informed the students about the study and gave them consent forms to sign, when they arrived at the university museum. Then we put the stress bracelet on the two informants in question, this was to get ten minutes of baseline on the physiological data so we had something to compare with, in case of any physiological changes during the test.

It was important to lighten the mood and create a comfortable environment for the informants. We did this with the help of unpretentious opening questions followed by small talk.

Phase two: User test

In the first part of the user test, informants were allowed to explore freely so that we could observe how they interacted with the room without interruptions. For some, this situation can be so artificial that they start to behave in a way they would not normally; this influence is referred to as the Hawthorne effect (Preece et al., 2015, p.471). We were aware of this and therefore tried to make the situation more comfortable for the informants.

After the exploration, we asked them to watch three specific videos, if they had not already seen them. We did this to have a better starting point to evaluate and compare what the different informants thought about the content and the way it is communicated.

Phase three: Interview

After the user tests, the informants were interviewed about their experience in The Globe room via semi-structured interviews. We prepared an interview guide in advance, which includes the following topics: sensory impressions, interface, content and finally input and ending.

The interviews were conducted by two people, one who interviewed and one in charge of taking notes as well as asking relevant questions when appropriate. We recorded all the interviews, and these were transcribed shortly after the interviews were held and then deleted.

Phase four: Climate survey

Since we assumed in advance that there would be differences within our informant selection with regard to attitudes to climate and global warming, we prepared a survey inspired by the New Ecological Paradigm Scale. Dunlap et al. (2000) uses it to reveal views on climate change and global warming. The purpose of this was to find out if the students' climate turmoil could affect the experience of The Globe Room, and additionally to investigate whether the said assumption was correct.

Findings and design implications

Findings from the survey

The results of the survey showed that all informants view man-made climate change as real. As shown in Figure 6, we see that media and communications students largely believe that they can make a difference and the students in electronics/automation subjects are somewhat lower. Nevertheless, the answers from the two schools were similar to what we assumed in advance.

Eating less meat, flying less, etc. is more important than technological innovation such as underground storage of CO₂, renewable energy, when it comes to mitigating climate change.

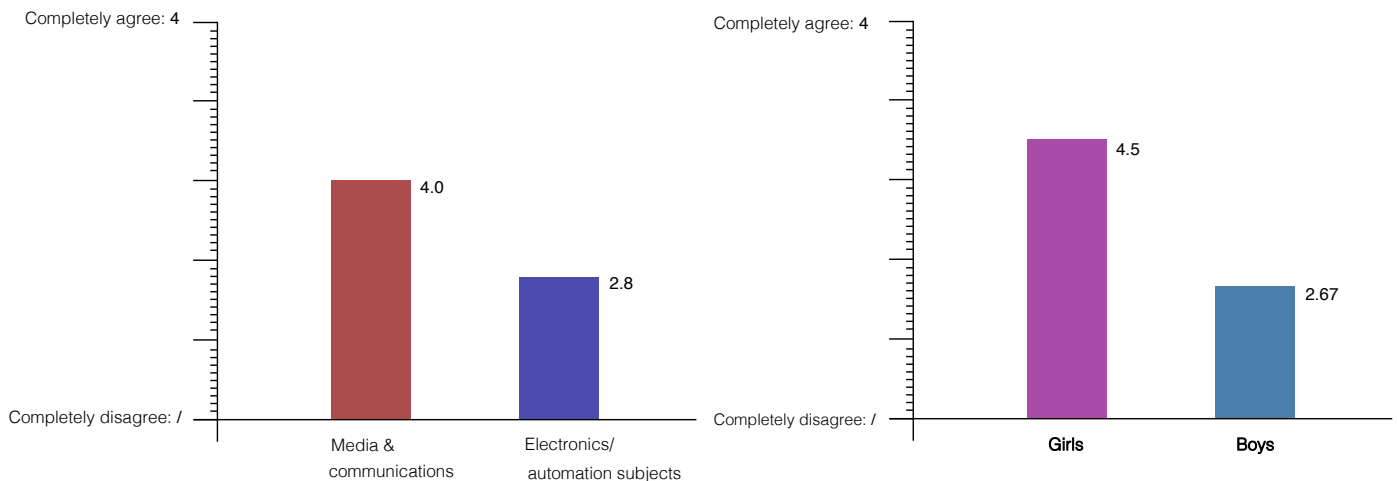


Figure 6: On indirect questions about whether individuals can make a difference in relation to climate change, it is shown that students from media and communications believe in it more than students from electrical (left). Furthermore, it is shown that this difference is even slightly larger when we compare the answers across genders (right).

As previously mentioned, media and communications have a greater gender distribution than electrophysics. From Figure 6 we can see that the girls think that they can make a difference to a greater extent than the boys. We found some differences between the informants at the two schools, but these were not large enough to give the informants different starting points for their experience of The Globe Room. Because of this, we have chosen not to take the informants' differences into account in our further analysis.

The main findings from the user tests show that The Globe Room caught the high school students' interest by distinguishing themselves from typical museum rooms. On the other hand, we found challenges regarding the following elements (Figure 7) that we will elaborate on with specific design implications.



Figure 7: Overview of the challenges the informants experienced in The Globe Room.

From low sound, interruptions and dubbing...

The Globe Room is a relatively small room located next to the reception and gift shop, which is an area that can naturally generate some noise. The fact that several visitors were in the room and watching videos at the same time did, in most cases, not cause major noise disturbances. Through the observations, however, we noticed cases where the informants' gaze could be taken away from the screen by external visual interruptions. In the case of many visitors and a lot of background noise, the informants felt that there was bad sound on several videos. This led some informants to find it difficult to access the content of the videos and remembered very little of the content when asked in the interviews. Four informants attempted to increase the volume on the control panel. This is a feature that applies only to the use of headsets and thus created some confusion. During our stay at the museum, we never saw anyone using a headset.

“It was possible to insert headphones but it is not like I carry them around when I go to a museum.”

Several informants experienced that it was not possible to change language, from English to Norwegian, respectively. In some cases, the video they watched was interrupted and the screen blackened for a few seconds before returning, but then started in the middle of the map and not where the video was cut. This happened on both the "Sea" and "Climate" screens. As a result, someone ended up not watching the videos.

Informant 2 about informant 1:

“And then I noticed that she stopped paying attention when the language was English because she absolutely did not want it in English.”

Four informants also state that it was "distracting, disturbing and strange" to have a Norwegian-speaking voice in the background when the videos were dubbed into English.

... to better sound, partition and subtitles!

The informants who conducted user tests during the opening hours of the museum pointed out that the sound was something that should be improved, this advice we recommend to follow up. The least expensive and most convenient solution for this is to add subtitles to the videos so that what is said can be perceived even with noise. Another option might be to have headsets available for each screen, although this will eliminate the social aspect of viewing and experiencing content with others. Only three out of ten informants chose to spend time exploring the videos on their own, so the majority seem to value socializing and want to watch the videos with others. We think this could potentially be an unfortunate point to overlook, especially considering high school students. A solution which lets more people connect to the headset via bluetooth is therefore a somewhat better solution, although this may not be ideal either.

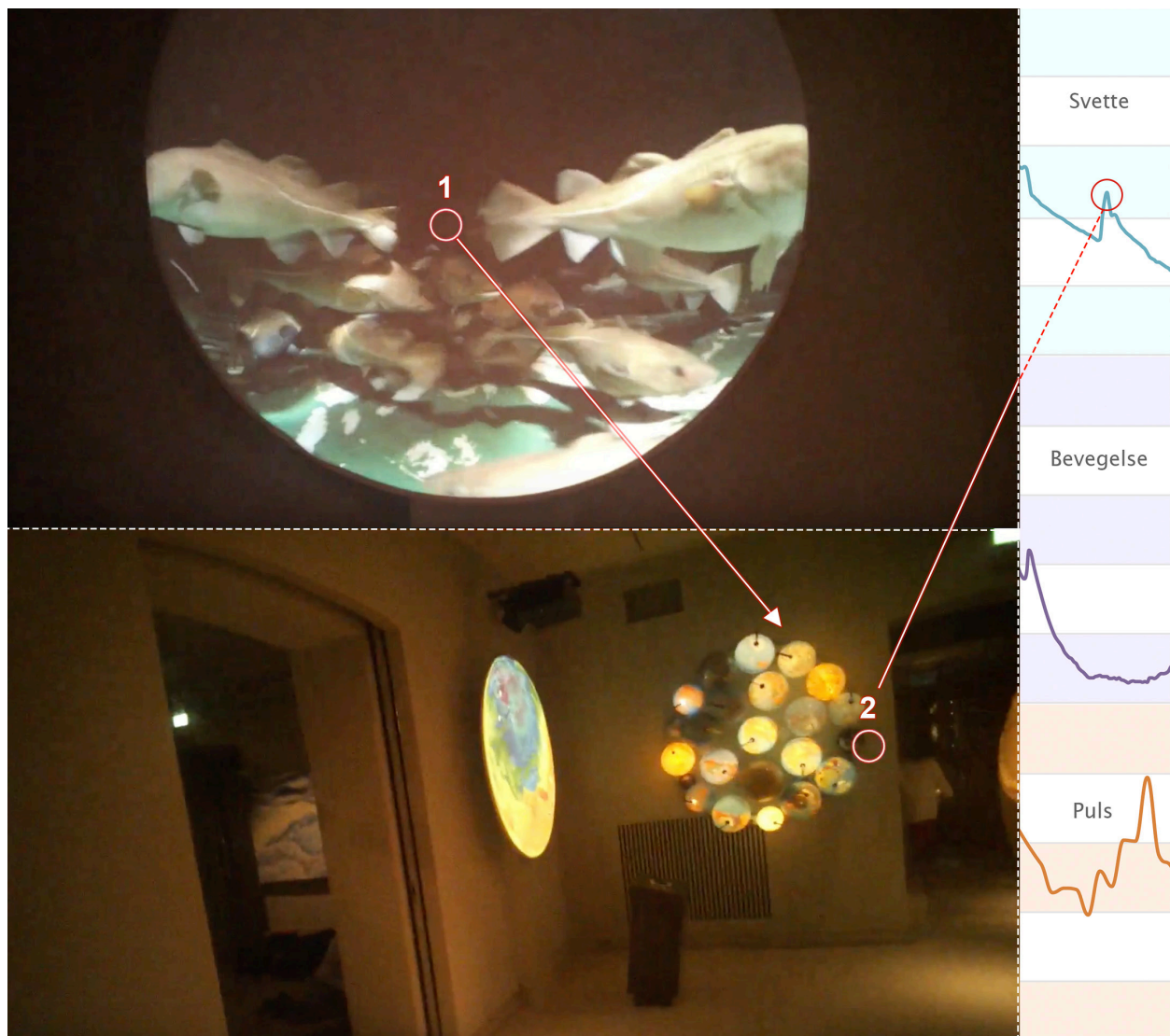


Figure 8: Shows how informant 10 follows the video but looks away because of someone walking through the room. This results in moderate impact in the informants sweat.

In order to limit visual interference from people passing by and others in the room, partitions may be advantageously designed to limit this. If the partitioning are additionally made of a sound-absorbing material, this will reduce the noise level. Disruptions can potentially take the focus away from the content and further reduce the learning outcome. Distractions can also seem stressful, as shown in Figure 8, informant 10 is influenced by a random person passing through the room.

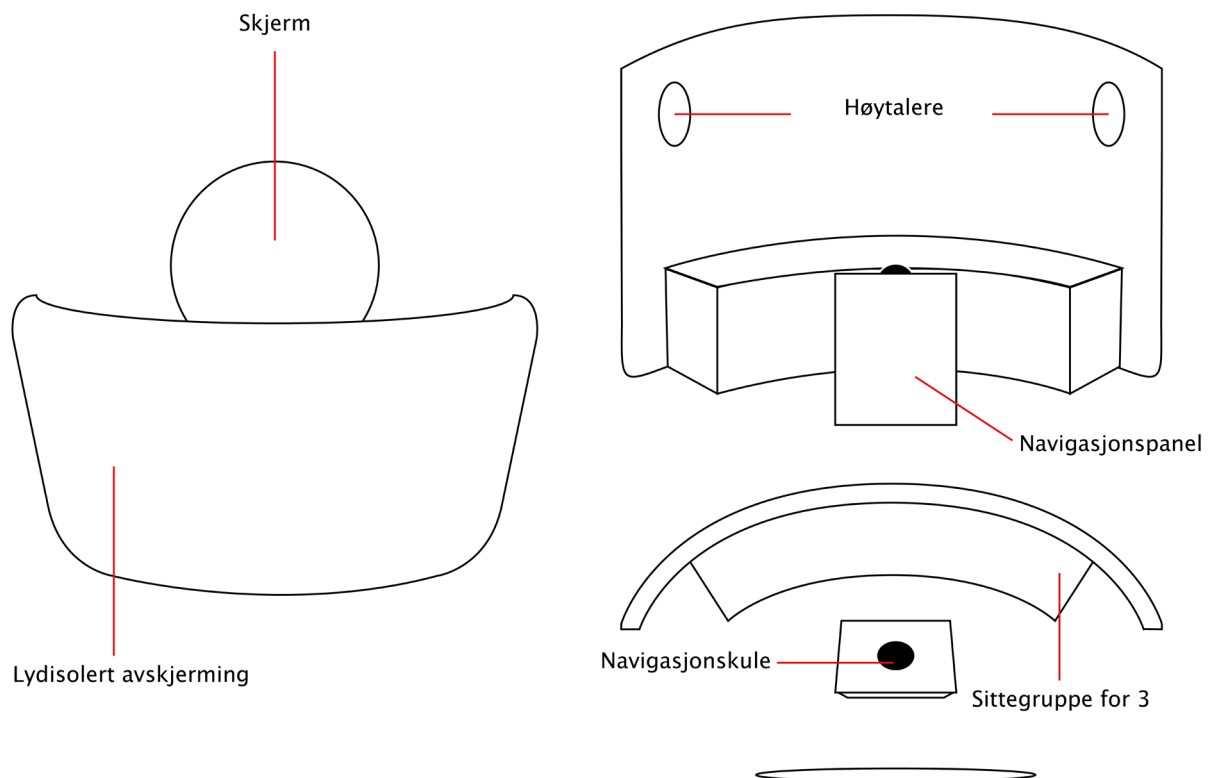


Figure 9: Suggestions for partitioning, seating area and local speakers.

Our concrete advice for improving sound and room partitioning are shown in Figure 9. By building an oval partition in a soundproof material, visitors will be shielded from visual and audio-visual interference. We envision that a rounded seating area will be placed that will allow more people to see the screen, to make navigating easier and to interact with each other. In this way, our solution retains the social aspect the majority of our informants value. In this design, it is also desirable to have built-in speakers that are placed in the back of the screen. One advantage of having the speakers so close is that one does not need a high decibel level to achieve the appropriate sound volume.

The English-language dubbing should also be improved. We suggest removing the sound of the Norwegian version from the background so that it does not become a disruptive element when the videos are played in English.

From unclear themes...

Each screen in The Globe Room has specific themes, but when the informants were asked to recount the themes, we got varying precision in the answers. Several mentioned that it had something to do with global warming or climate change. As Corner et al. (2015, p. 5) points out, classic images of familiar themes such as deforestation and polar bears on melting ice can be an effective way of communicating to the public that "this is about climate change". This tool is used in some of the videos, but it means that the audience must first find the videos before they get that information.

Several informants did not read the information about the themes which is displayed on the control panel. This is also the case for the eye-tracking informants.



Figure 10: Here it is shown how informant 9 read the text systematically (left) and how informant 10 reads only a few words and then the gaze jumps further and finally away from the text.

Informant 9 had a fixed look at the text and systematically read each line, as shown on the left in figure 10. Informant 10 also noticed the text but it was obvious that it was not read in full. To the right of Figure 10 we can see how the gaze is characterized by rapid unsystematic saccades in the text and between other elements, in this case something outside of The Globe Room.

The fact that informant 10 did not read the text was also confirmed through the interview when she pointed out that she was affected by the situation and really "read without reading", which shows that she was influenced by the Hawthorne effect.

... to crystal clear themes!

Since The Globe Room has specific themes on each of the screens, we recommend that this is clarified. If museum visitors get a clear signal about what the screens are about, it can give them a better starting point to both get their message and content and to remember it afterwards. A simple approach could be to use more visual tools in the room itself, such as painting thematic illustrations for each of the screens or decorating with objects associated with the themes. Using different colored lights for different themes can also enhance the visual expression.

A more in-depth approach to attracting attention and providing a unique user experience in The Globe Room would be to employ sensory measures in addition to thematic decorations.










Sea screen	Weather screen	Temperature screen
 Seagulls, ocean waves	 Wind, storm	 Birds chirping
 Blue colored lighting	 White/grey lighting	 Red/yellow lighting
 Sea-based decorations	 Fans blowing air	 heating, ovens etc

Figure 11: tools that can clarify the three themes of the globe.

As outlined in Figure 11, a combination of tools will be used for each display and its theme, which clarifies the three themes for museum visitors. This will enhance the dissemination capacity of The Globe Room and its theme by emphasizing the design principles of hints and visibility, which make the design more self-explanatory.

From look, but do not touch...

The largest element of The Globe Room is the big leather globe located in the center of the room. Both eye-tracking informants confirmed that it was a natural eye-catcher when it was the first thing they looked at (Figure 12). Two of the informants believed that it set the theme of the room and that it was the purpose of it.



Figure 12: The first informant 9 (left) and informant 10 (right) looks at as they enter the room is the giant globe.

The real purpose is to get to know the earth by touching and spinning on the big globe. 8 out of 10 informants avoided doing just that.

“One does not feel like one is supposed to touch museum objects”.

As one informant pointed out, it does not feel natural to touch objects in a museum. When we said that the informants could touch the big globe, everyone did this, and we got immediate reactions like "wow" and "cool". Two of the informants also expressed that it was nice to know the contours of mountains and islands.

As shown to the left in Figure 12, there are several small globes hanging on one of the walls in The Globe Room. These are intended for decoration and should not be touched, however several of the informants chose to do so.

It is an interesting finding that the informants interacted opposite to what was intended. It shows that the design principles of consistent design and hints are not met, since the interaction is different from one element to another and it is not obvious how to interact with the different elements.

... to look at this, touch this!

To address these challenges, we recommend clarifying to museum visitors how to interact with the various elements in The Globe Room. An easy solution is to put up signs with instructions that say "touch me" or "don't touch me".

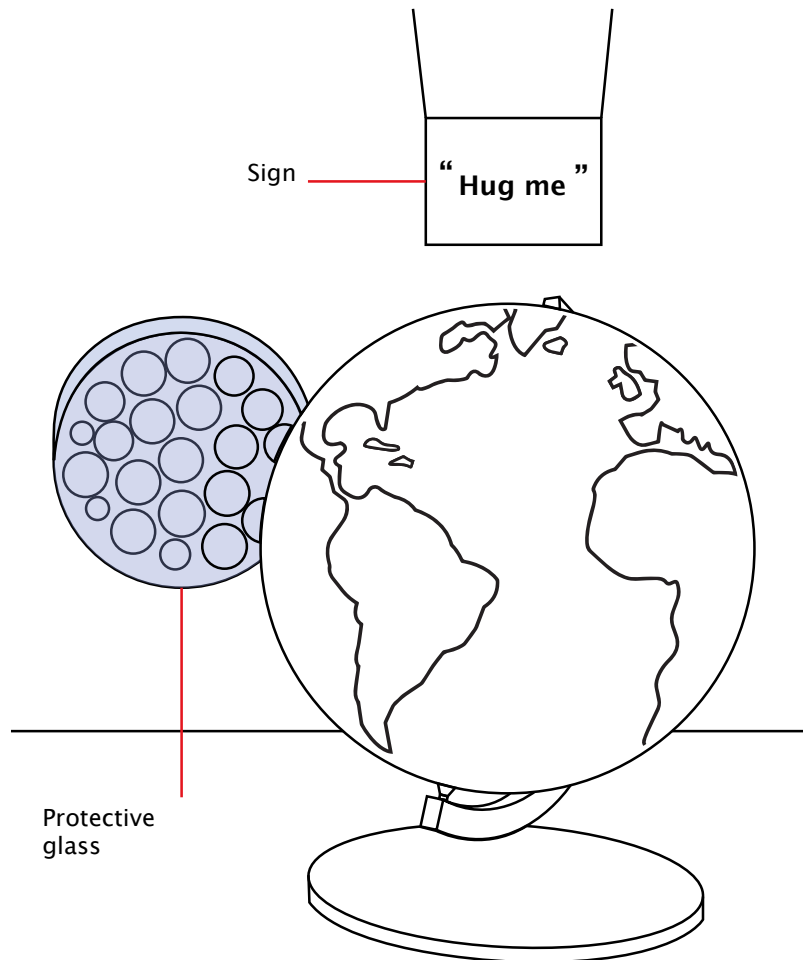


Figure 13: Suggestions for clear hints that make visitors aware of what to interact with and not.

Another solution could be to have consistent design and clear hints, where it is encouraged that everything can be touched, as well as information and instructions disseminated through small speakers that encourage exploration and touch. These speakers can be located close to the elements of the room and activated by a sensor that detects when there are museum guests nearby. If there should be items that are not to be touched, these can be shielded by setting up a glass frame or moving them to an inaccessible place.

From underrated maps and challenging navigation...

The maps on the screens indicate ocean currents, temperature and wind direction, and are based on real-time weather data that represent how the weather is right now. None of the informants realized this and according to one informant this was "not possible". Several of the informants nevertheless appreciated the moving elements and they were among other things referred to as "cool".

Most people had difficulty orienting "where in the world" they were on the map during navigation. It was mentioned that some of the screens had color challenges that made it challenging to distinguish between what was sea and what was land. It was especially the weather and temperature screens which the informants had difficulty with orienting themselves. It was also mentioned that it was especially difficult to recognize in the maps when the globe was turned upside down

Half of the informants expressed that the navigation ball was a "fun" and "cool" concept. Some noted the connection between the circular globe and that the earth is round, and many thought this was more entertaining than traditional navigation methods.

"...it was kind of cool that you are controlling the earth with a round thing since the earth is round."

The navigation balls at all three screens have consistent design. This makes it easier for museum visitors to use the navigation balls on the other screens once they become familiar with one of them.

Nine of the informants found that the concept of the ball worked well; only one informant found it difficult to use and understand. When looking at the functionality of navigation, however, we find some challenges. 9 out of 10 informants experienced a technical error where it was impossible to control certain areas of the map, and had to turn the entire globe around so that it turned upside down to get where they wanted. Several also believed that some of the navigation balls were "slow and heavy to spin" which led to difficulties in getting around the map.

"...even though it was fun, it maybe was a bit, twisty sometimes."

... to impressive maps and improved navigation!

It is unfortunate that museum visitors do not perceive that the screens convey real-time data. When we informed about this, one informant suggested that this could be shown through a symbol indicating that it was "direct". A cheaper alternative is to point this out clearly on the control panels. However, based on our observations, we see that the screens themselves are more natural eye-catchers than the control panels. Another feasible option could be to move the screen information, including an explanation of the data, to a text-based screensaver that is triggered when the screens have been inactive for a given period of time. A more comprehensive alternative is to intermedate this data and allow visitors to see the state of the data back in time. As shown in Figure 14, one could include an extra layer of interactivity by including buttons that change the dataset to previous days.

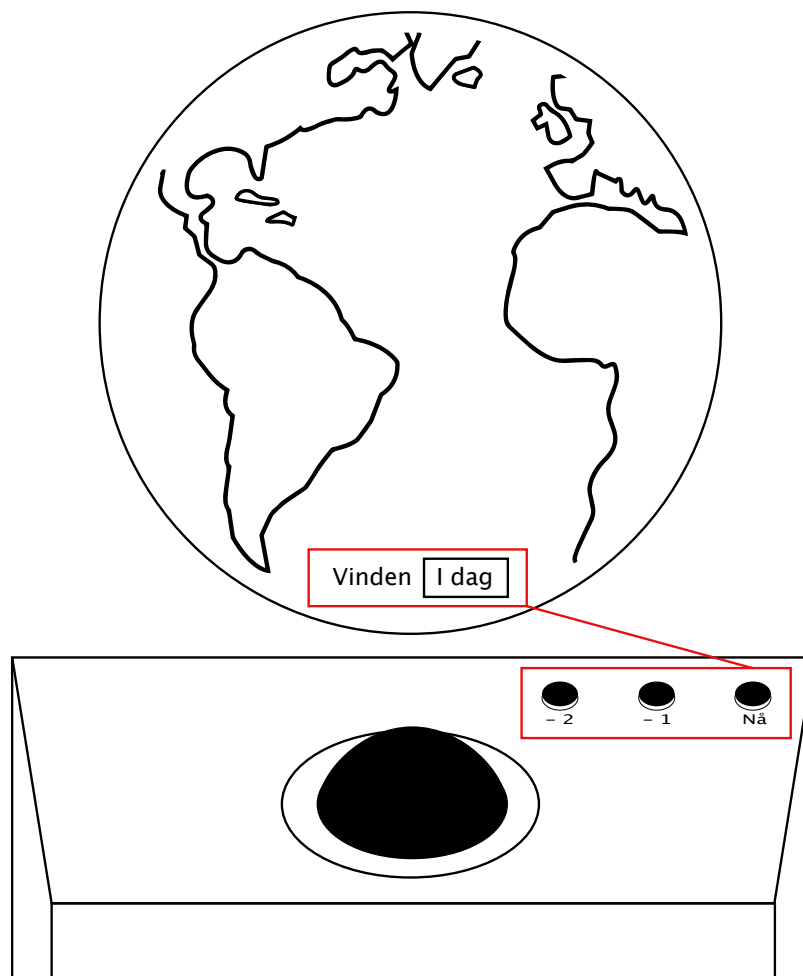


Figure 14: Suggestions to include information about what you see, on the screen and control panel. With the opportunity to choose to see history from previous days.

To limit the problem of visitors getting lost while trying orient themselves on-screen, a simple solution might be to increase the contrast between land and water. In addition, we imagine that marking the poles and equator clearly can serve as good reference points to limit the orientation challenges. Another solution could be a compass that marks the north and south in the right direction depending on where you are on the map.

The informants liked the concept of using the navigation balls to move around the maps, and did not spend a long time understanding which way they had to roll the ball to get in the desired direction. On the other hand, they encountered some technical challenges along the way, which at times made the navigation a little cumbersome. It was sometimes difficult to control the ball and sometimes they were prevented from moving in certain directions.

Our concrete suggestion to correct this is to perform a calibration of the balls, to adjust the sensitivity of the movements and make them more accurate. This will prevent it from becoming difficult to steer the ball to the desired destination on the map. We also see that what now prevents users from steering freely in all directions is taken away. In this way, the user does not end up navigating around the globe to get to a point that is initially close to where the users are.

More freedom to navigate freely around the maps, which are also easy to orientate, could make this a more educational and engaging experience for museum guests.

From moderate enthusiasm...

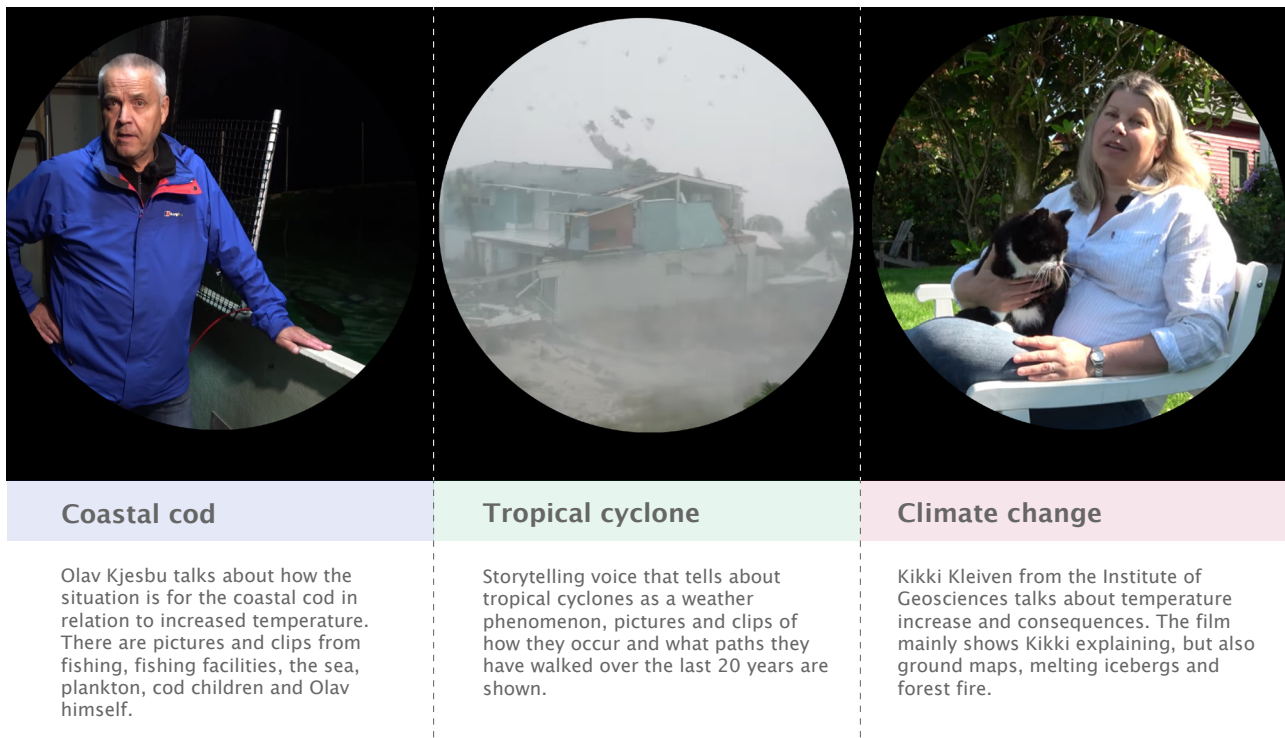


Figure 15: Overview of the 3 specific videos the informants were told to watch.

The 3 selected videos (Figure 15) informants were asked to view, containing all pictures and examples of actual consequences of the content being told. The tropical cyclone video largely uses these tools. The videos on coastal cod and climate change use fewer examples of this and primarily show scientists who convey the message.

Only a few of the informants remembered the specific consequences that were shown in the video on climate change. As Corner et al (2015, p.20) points out, classic images of forest fires, deforestation, polar bears and etc. can be especially useful for an audience with little knowledge or interest in climate change. Several of our informants stated that they did not learn anything new in this video. These findings may therefore point in a direction that the images of the concrete examples of global warming in this case were too generic.

In comparison, there was a greater learning outcome in the video on coastal cod. A few informants pointed out that they learned something new from watching this video. Half of the informants could recount some of the content afterwards. On the other hand, there were no specific incidents in the physiological data of the eye-tracking and stress bracelet informants when they watched this video. Also, none of the informants mentioned this video unsolicited afterwards, which may indicate that the visual tools used did not create much engagement.

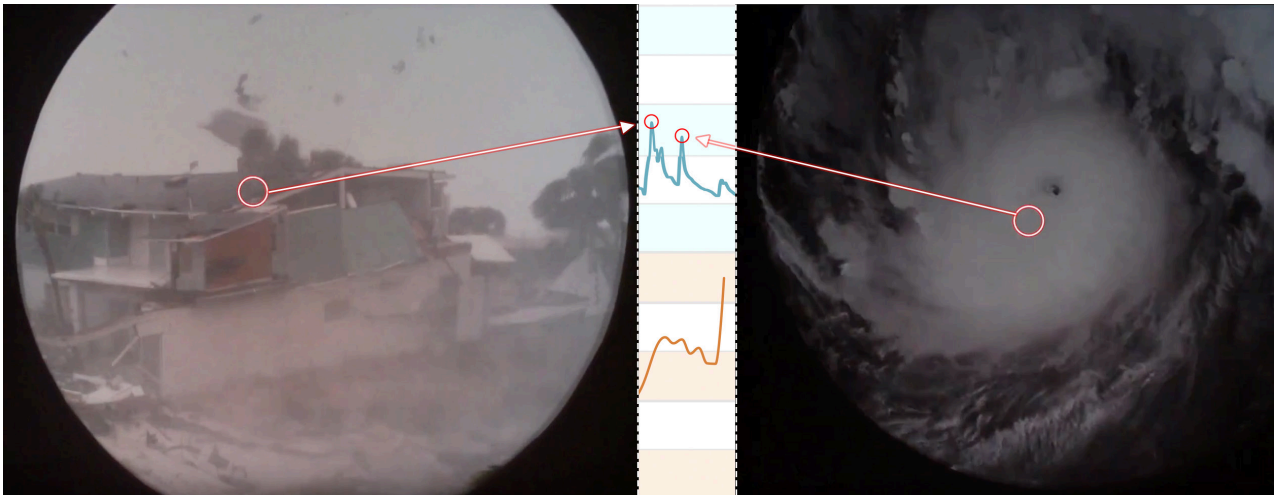


Figure 16: Informant 10 has two incidents with increased sweat during the video of tropical cyclones.

On the other hand, the informants closely watched the video on tropical cyclones and especially when a roof is torn down by a house, two informants respond with statements like "oh" and "shit". Eight informants mentioned this video uninvited in the interview. This suggests that the more extreme clips have made a greater impression on the informants, possibly because these are visual tools. Informant 10 points out that it was fascinating to see "the house that was thrown in the flood." During this video, the physiological data shows two stress-incidents (Figure 16) as well as some saccades from eye tracking as the wind rages around the house.

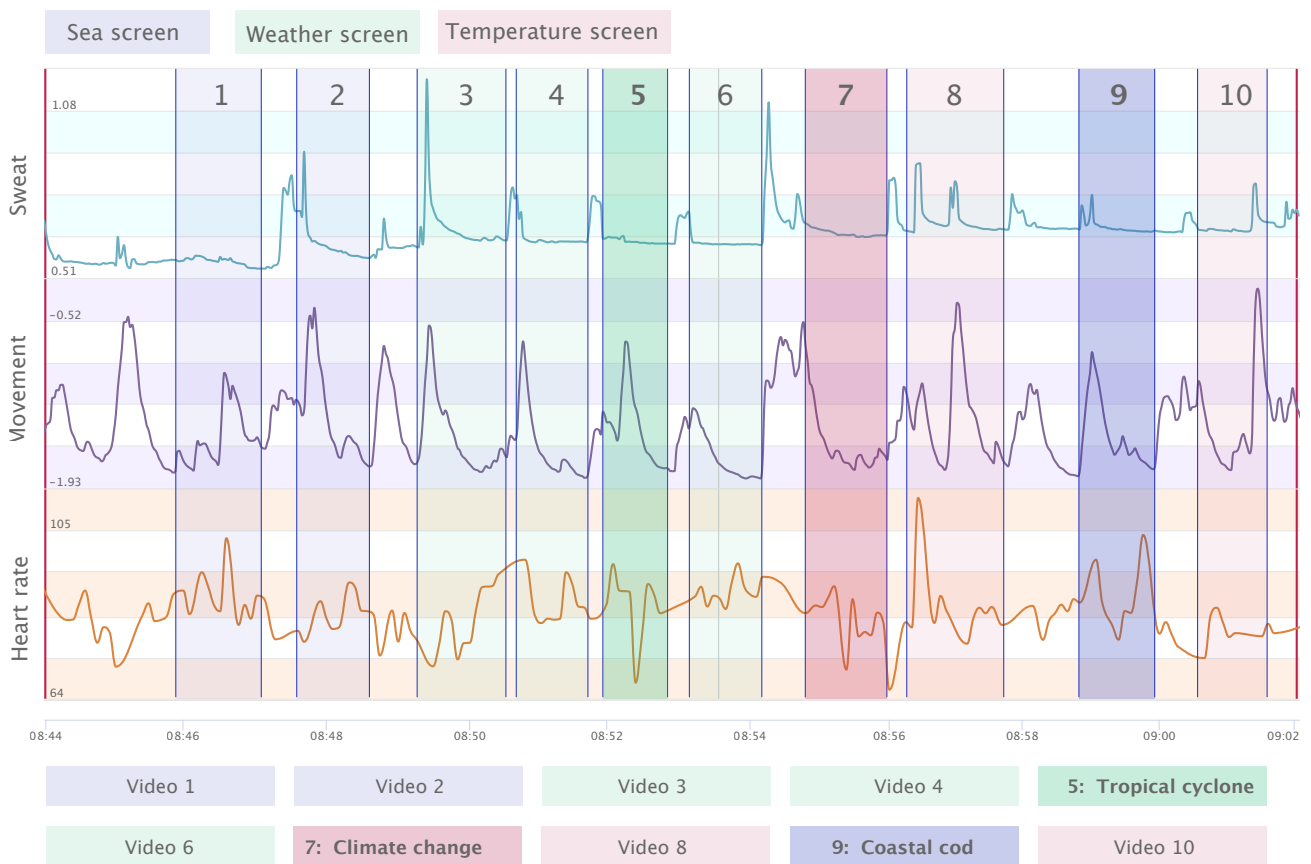


Figure 17: Physiological data from the entire user test of informant 9, with overview of videos viewed. It appears that there are low level of sweat.

As shown in Figure 17, informant 9's physiological data has relatively few cues indicating emotional responses to the videos shown. Most of the sweat-incidents come as a direct consequence of the informant moving. Based on observations and subsequent interviews, the fact that the videos could generally be more engaging is also supported by the majority of informants. In some cases, some of the informants did not finish watching the videos they had started.

... to interactive learning!

Our proposal to create more enthusiasm for a young audience is a combination of the suggestions that have previously been presented, regarding the design and clear hints in the room. More interaction should also be added between the content being disseminated and the audience. One option is to include sections in the videos, where questions are asked with multiple choice-answers on the topic in question. In this way, museum visitors can make up their minds about what is the right answer before it is presented in the video. This solution utilizes the design principle feedback by providing the user with some form of confirmation from the system.

A more advanced solution is to add the ability to answer the questions via the control panel, by directing the navigation ball to a certain direction according to which answer they will give. By involving the museum guests more, by interacting with elements in the room, the user experience can be more unique and the learning outcome can be greater.

Our evaluation shows that more extreme images made an impression on the informants, based on this we would recommend using more visual tools to stimulate engagement through the content. We suggest to limit the amount of information given exactly when these images are displayed, as it will not be the main focus. By being aware that the clips are engaging, one can spread such impressions evenly in the content and potentially keep the visitors interest, which in turn can cause them to spend more time in the room.

Conclusion

Through our evaluation of The Globe Room, we have come up with a number of findings that can be useful for Scary Weather and others, when making museum installations aimed at a young audience.

Taking disruptive factors that can occur while museum visitors are in the room into account, proves to be important. This can be solved in a good way by using noise-reducing partitions and better local sound. The design principles of hints and visibility prove to be central to clarifying the theme the installation is about and to be clear on which and how elements are to be interacted with. Systems to interact with through navigation may be different from typical ways of scrolling, but then there should be a focus on accuracy in movements, as we saw in the navigation balls in The Globe Room, it was negatively pointed out if it did not work optimally. When using maps, it is appropriate to use color contrasts that clearly identify recognizable places. Through the dissemination of content, it was found that the informants remembered best the visual tools that showed more extreme clips and images, but this was at the expense of the learning outcome. We would still recommend using such powerful clips and images, but to distribute it more evenly and not convey much information at the same time as the image or clip is shown. Used in a good way, this can keep the engagement, but also result in more of the content being remembered.

The Globe Room serves as an arena for providing information about the weather and climate for younger users, but as of today, our findings show that some of the challenges leads to museum visitors not getting all of the themes and content. The visual tools are suitable for disseminating such content to young people as they prefer visual dissemination, however there are factors that can be improved to create more engagement and a greater learning outcome.

Sources

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