DCAC 2019

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Edited by

Agnes Papadopoulou
Michail Panagopoulos
Vasileios Komianos
Andreas Giannakoulopoulos

Digital Culture & AudioVisual Challenges - Interdisciplinary Creativity in Arts and Technology International Conference Proceedings

DCAC

2nd International Conference Proceedings
Digital Culture & AudioVisual Challenges
Interdisciplinary Creativity in Arts and Technology

The aim of the DCAC 2019 is to bring together technology, art and culture in the Digital Era, as well as to provide a forum on current research and applications incorporating technology, art and culture, to deepen cooperation,exchange experiences and good practices.

Researchers, artists and scholars are encouraged to participate in the discussion about the interaction between interdisciplinary creativity, technology, arts and culture. Authors are invited to present original papers for oral or poster presentation in the fields of New Media Arts and Digital Culture.

Keynote speaker:
Brigitte Felderer

Guest speakers:
Nikolaos Kanellopoulos, Vouvoula Skoura, Adnan Hadziselimovic, Anna Vassof

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Preface

Welcome to the community of DCAC 2019, the second consecutive International Conference on Digital Culture and AudioVisual Challenges, Interdisciplinary Creativity in Arts and Technology.

The conference was organized by the Department of Audio & Visual Arts - Ionian University, on May 10-11, 2019, in Corfu, Greece. The conference successful organization served as a strong indication that the Department of Audio & Visual Arts, after almost fifteen years, continues to play a pioneering role in the field of digital arts. The DCAC conference continuously evolves as a dynamic platform through which new possibilities perpetually emerge, offering a wide range of possibilities for digital exploitation, and constantly opening the doors to new and as yet unexplored synergies.

In particular, the DCAC conference aims to function as a forum in which progress-oriented individuals, researchers, professionals, technicians, technartists, practitioners in the area of arts and information technologies, as well as industries and institutions find a place to present results, debating and sharing ideas, best practices, and find a wealth of opportunities for networking. All the talks presented during the 2019 conference confirmed our belief that an interdisciplinary approach to the questions of art, technology and media, technoculture and critical theory, is both challenging and necessary.

DCAC 2019 has received more than 50 submissions. The standards for the submissions had been high. The international Scientific Committee was composed of 35 members from 11 countries. We would like to express our gratitude to these 35 experts from Austria, Canada, Denmark, Greece, Israel, Malta, Russia, Spain, Turkey, and United Kingdom for reviewing and recommending papers for the conference. There have been presented by the authors 42 papers at the Conference forum and 22 papers were accepted for publishing. Many thanks to all authors for submitting their work.

We want to especially thank our keynote speaker, Brigitte Felderer and our invited speakers: Nikolaos Kanellopoulos, Vouvoula Skoura, Adnan Hadziselimovic, Anna Vassof.

We greatly acknowledge all those who enriched the DCAC 2019 Conference through their contribution, and who made the conference possible through their dedication and work.

We thank, in particular, Nikolaos Kanellopoulos (Head of the Department of Audio & Visual Arts, at the time DCAC 2019 took place) and Andreas Floros (Dean of the Faculty of Music and Audiovisual Arts, at the time DCAC 2019 took place) for their active involvement and especially for their continuous assistance.

The Organizing Committee of the DCAC works for keeping up the academic dialog between specialists in the involved different fields, spark fruitful future collaborations and explore new areas of cooperation among artists.

<div align="right">

Agnes Papadopoulou
On behalf of the Organizing Committee

</div>

DCAC

Session 1

New Aesthetics - New Dimensions

Fusion of Art and Technology: The First Color Digital Art x Lighting Symposium and Workshop

Kyoko Hidaka[1]

[1]Shibaura Institute of Technology

Abstract

This paper is an empirical case study on how to organize a digital art symposium and student workshop. In March 2019, the Shibaura Institute of Technology, Color and Communication Design Laboratory held its Color Digital Art × Lighting symposium and workshop. The focus of the present analysis is on how art and technology can be fused in such a way that it can reach students in the workshop. The symposium and workshop aimed to be an incubator for future designers and engineers with some round table discussions on the direction and flow of technology for interactive space design and digital art in the next decade. Is it possible for people from different parts of the world to gather together and create interactive digital art? Can such art become a universal tool for communication? These are the key questions guiding the organization of this event. The central aim of this article is to describe a case study for creating digital art in a workshop setting with students and faculty members from diverse cultural, linguistic, and educational backgrounds. The positive and negative aspects of creating digital art in these circumstances are discussed. Cooperative work is required and just as important as different individual skills, such as computer programming, object installation, sound recording, and computer graphics. The boundaries and limitations in academic and professional disciplines can hinder creative potential, especially in digital art, because its nature requires programming and graphic design in addition to architectural installation skills. However, we believe making digital art has an immense possibility for cross-cultural interaction.

Keywords

Digital Art, Lighting, Space Design, Color Theory, Digital Divide

1. Introduction

Digital art festivals and student workshops, such as Ars Electronica in Austria, are growing globally.[1] Students from different countries gathered for workshops and symposia as part of their education in architecture, interior design, lighting, and color studies. This paper is a record of the event. In March 2019, the Shibaura Institute of Technology, Color and Communication Design Laboratory held its Color Digital Art × Lighting symposium and workshop. In this paper, the scheme of the first symposium and workshop on color theory and art education is introduced. [2] The focus of the analysis is on how art and technology can be fused in such a way that they can reach students in the workshop.

2. Objective

The symposium and workshop aimed to be the incubator of future designers and engineers with some roundtable discussions on the direction and flow of technology for interactive space design and digital art in the next decade. Is it possible for people from different parts of the world to gather together and create interactive digital art? Can such art become a universal tool for communication.? Or will the result be another Tower of Babel? These are the key questions guiding the organization of this event. The central aim of this article is to describe a case study for creating digital art in a workshop setting with students and faculty members from diverse cultural, linguistic, and educational backgrounds. The positive and negative aspects of creating digital art in these circumstances are discussed.

3. Program

From 14th March to 17th March 2019, the Shibaura Institute of Technology, Color and Communication Design Laboratory hosted a four-day event in Tokyo called The Color Digital Art × Lighting symposium and workshop. The venue was a basement room of the Shibaura Institute of Technology, located in central Tokyo. The basement room (with an area of approximately 150 m2) was dark and enclosed by a Béton brut wall. The faculty and staff have used this space as a storage unit and some students occasionally play table tennis in there. The topical theme for the event was a "Colorful Playground for Children", and students and faculty were supposed to design the space using digital art. From the view of the organizer of this event, it seemed truly exciting to transform this dark, gray deserted room radically into a colorful playground.

The program of this symposium and workshop was to work on production methodologies for digital art in cosmopolitan settings. The 41 students and 5 faculty members participating have institutional affiliations with the Montfort Del Rosario School of Architecture and Design, Assumption University, Thailand; Kagawa University, Japan; and Shibaura Institute of Technology, Japan. The professors were: Mr. Nattapol Suphawong, Ms. Daruswat Wattanarojjananikorn, Mrs. Apinantaya Bua-iem, Mr. Theeprakorn Lunthomrattana of Assumption University, and Kyoko Hidaka of Shibaura Institute of Technology. The students and faculty have remarkably diverse and cosmopolitan backgrounds, with specializations in interior design, computer engineering, architecture, and information design. Moreover, they represent many countries, not only Japan and Thailand but also Vietnam, Cambodia, China, Hong Kong, the USA, and Myanmar.

3.1. Day 1

Orientation was held in the morning to summarize the entire idea of the event and introduce the staff, facility, and equipment, followed by an icebreaker. The student group who was interested in intercultural communication took the initiative to create a pleasant atmosphere. They played games together to know each other.

We provided each student group with the use of
1. EPSON projector (EB-2265U, 5500 lumen, HDMI, RGB, and WIFI)
2. EPSON projector (EB-2142W, 4000 lumen, HDMI, RGB, and WIFI)
3. EPSON projector (EB-1770EW 3000 lumen, HDMI, RGB)
4. SONY speaker SRS-XB21, Bluetooth
5. Arduino beginner kit for each group

6. NEO PIXEL LED 2m for each group

7. 5,000 JPY allowance for each group (e.g., approximately 40 euro to buy sensors, paper, plastic sheet or any necessary materials)

8. 1 power cord 20m

9. 1 tripod for projector

3.2. Day 2

As part of fieldwork on the second day, we visited teamLab's 'Borderless' exhibition in Odaiba, Tokyo Error! Reference source not found.. teamLab is a world-leading corporate producer of digital art. For artistic and technological inspiration for the participants, it was critical that they viewed previous research and existing work.

3.3. Day 3

On the third day, we held a symposium and a networking meeting to exchange thoughts regarding the digital arts. Joe Nattapol (Photographer and Interactive Designer at Assumption University) and Jun Kosaka (Artist, Graphic and Space Designer at Waseda University) were the invited speakers. The moderator was Kyoko Hidaka (Color Theorist, Shibaura Institute of Technology).

During the symposium, Mr. Suphawong and Mr. Kosaka presented their artworks, and also two ShibaLab students demonstrated their actual art pieces: "Maki Monogatari"—a Japanese Illustrated Handscroll Tale by Yukine Hasegawa and "Shiba Lantern" by Sohei Yamagata. "Maki Monogatari" was a Japanese scroll tale produced as artwork that changed interactively with a scrolling motion. "Maki Monogatari" was produced using an Arduino acceleration sensor and processing via a microcomputer. Originally, Hasegawa was inspired by the idea of sequentially changing pictures of traditional Japanese paintings, such as Choju Jinbutsu Giga (caricatures of frolicking birds, animals, and humans[4]), by applying the interactive action of opening and closing scrolls. The Shiba lantern changed color depending on the distance from the detecting body. The color gradually shifted as the sensor on the lower end of the lantern detected the distance from the observer's hand. If the hand (or detecting body) was close to the lantern, it emitted a warm color, and when it moved away it changed to a cold color.

Hidaka presented the interactive digital art: "Season's Greetings to the World from Shibaura," which she organized at the end of 2018. She composed these greetings in forty languages. She considered greetings the ultimate form of interactivity, and they were triggered as people passed the installation. After a graduate student had programmed the ranging sensor, the animated greetings in MP4 files were projected using an EPSON projector onto the entrance of the SIT president's office on the second floor. The greetings were encoded in various languages and characters and could be read on the ground as people passed by.

Suphawong has worked for the past 10 years on interactive projects including websites, interactive installations, and lighting designs for concerts and parties. He introduced his works in relation to the theme of the Symposium: a 'Colorful Playground for Children'. Kosaka showed his newspaper illustrations, scientific visualization diagrams, space design, and interactive art, applying an algorithm in Unity as the engine. His approach seemed to be rather generative art.

During the symposium, we discussed three ethical issues surrounding digital art. The following

are participants' responses to the questions. The first question: 'What is "Interactive"? Is digital art really new?'

Jun Kosaka:

"I think we need to rethink whether newness really has any value. If digital art truly has value, we will see its value when it becomes old. Technology indeed has value, but the value of technology and that of art are totally different. When we say technological art or digital art, we may very likely misunderstand it. In terms of new or not, I think digital art is new, but if we value it too much for its newness, it is precarious."

Joe Suphawong:

"In my view, digital art is not new. We are still doing the same thing now as we did in 2004, more than ten years ago. But now we have VR/AR, and these became commercial and massproduced. We can see it in the iPhone, in other words, a product. It became really cheap, as you can download digital art using apps."

The second question: "Your view toward the whereabouts of future digital art?" How will we appreciate digital art five hundred years later? For example, a number of people still appreciate Leonardo da Vinci's Mona Lisa (La Gioconda) even though it was painted five hundred years ago.

Jun Kosaka:

"When digital art becomes old, it is possible to become good. Now the newness is one element to draw everyone's interest, yet it will be tested when it has lost its value of newness. If the value is real, digital art will move on to the next step."

Joe Suphawong:

"Now is a transitional period, since we are experiencing physically, and environmentally the imaginary world on screens. It may not change that much, but the future must be oriented toward newer perceptions and minds. Technology has to be updated and become more social. Alternatively, pollution becomes worse, and we may be living in a zombie world filled with disease. Art remains a part of culture, and digital technology is one of the tools. I cannot predict the future, but it will be something beyond now. Or we go back to meditate or something."

The third question: "Can making digital art/lighting be a solution to or relief from the digital divide by generational, linguistic, economic, and educational gaps?" The intention of asking this particular question was that there seemed to be a big barrier, in those people who needed to pay an expensive entrance fee to see digital art galleries, or had to know computer programming languages to create the art.

Jun Kosaka:

"The funds to handle digital content or tools are getting lower. It will be resolved as the older generations change. However, I wonder whether we need to resolve these economic, or educational gaps through digital devices or art, or interactive art. It is not just something which only art should be the key to, but also other aspects are involved."

Joe Suphawong:

"I also think it is tricky to connect problems and digital art. There must be many answers to this question, yet if we consider digital art as a meaningful medium of communication, we can think of it as a tool to facilitate interaction with one another. I have seen many communication

projects, such as those connecting parents and children. I think technology can be used for this. For instance, a kid is teaching using an iPad to his grandfather to fill the gap. As this kind of workshop can be integrated with other things like equipping bus stop or fitness with AI, to make interaction in future, it can be a valuable solution."

During the question-and-answer time after the discussion, the panel took a question asking, "What is the value of digital art?" and an active debate ensued. After this symposium, we had a networking meeting to communicate with students and speakers.

3.4. Day 4

On the last day, a final presentation session was held to share critiques and discuss the outcomes of the workshop and the symposium. In this chapter, a description of each team is given.

3.4.1. Team 1

Team 1 has created a game tool that incorporated a color sensor and motor with a loop. Players had to throw balls into a circulating loop.

Operating environment: Arduino IDE 1.8.1
Materials used: Arduino Uno, mobile battery, servomotor (GWS servo series), a color sensor (S11059-DIP), a wood propeller, iron wire, and a PVC pipe
Theme: Future colorful playground equipment (Propellers turn and light up when you hold the color over the wheel) (Figure 1)
Programmed by Wataru Ikeda the leader of ShibaLab.

Figure 1: Team 1

3.4.2. Team 2

Team 2 created a colorful game using body movement. They used Unity as a game engine, and the player stands in front of the camera, which detects his/her posture and mixes the colors by creating a pose at the same time. For the image, we used a free material site and referenced a library (TensorFlow.js is a learned model posenet, a machine learning library) that can detect poses in a browser.[5] The program was written by Yusuke Yanaka. (Figure 2).

Figure 2: Team 2

3.4.3. Team 3

Team 3 has presented an origami crane moving image, assembled with shadow play of acrylic models. (Figure 3) It was programmed by Qiu Yucheng.

Figure 3: Team 3

3.4.4. Team 4

This team created a colorful space using balloons with cotton including various sensors, and projected images. The color changes in response to the shaking of the balloon. Balloons with LED and cotton are suspended from the ceiling and controlled using a PC and a built-in camera/microphone. The soft appearance of balloons wrapped in cotton attracts children's interest, and the colorful and soft light shines on the children's smiles. (Figure 4) The programmers were Daisuke Inagaki and Konosuke Sawa.

Title: Walk on air
Operating environment: Arduino IDE 1.8.1
Language: C ++
Materials used: Arduino UNO, mobile battery, LED strip light, balloon, cotton, fishing line, S-hook, web camera/microphone (PC built-in)

Figure 4: Team 4

3.4.5. Team 5

This team designed a shooting game integrated with hide and seek. Box walls were placed, and players hid behind these walls. Then, a hunter had to shoot these players by banging the drum (Figure 5).

Figure 5: Team 5

3.4.6. Team 6

This team demonstrated an interactive galaxy using sensors and moving images. If players passed across the galaxy image, the numbers and sizes of the colored circles increased. The more people who passed, the more circles appeared. Their target users were primary school students. (Figure 6).

Figure 6: Team 6

4. Positives and Negatives

4.1. Positives

Student assistants who were experts in computer programming and electrical works were required and their leadership determined the group dynamics. In the multicultural, cross-disciplinary environment, students could brainstorm, and exchange diverse ideas based on their backgrounds. In view of cross-cultural exchange, students could experience solidarity, working together under one common theme. Furthermore, having volunteers from the student group interested in intercultural exchange, was highly successful in creating a positive, friendly atmosphere.

4.2. Negatives

Skill levels, such as computer programming or architecture could be very different; so careful grouping is critical. Also, linguistic barriers may hinder communication. In addition, it was necessary to contact other institutions concerning the equipment or find voltage differences for the devices in advance. Another aspect was the evaluators; Wattanarojjananikorn, one of the Assumption University faculty, suggested it would be better if we could invite actual children and let them play in the artworks for evaluation since the theme was "Colorful Playground for Children" and the target users were children.

Figure 5: Team 5

Figure 6: Team6

5. Conclusion

We firmly believe that art is a universal language that can be used to interact with others. There is currently no accepted standard for digital art workshops; thus, we are pioneering in this area. Collaboration with students and faculty from other countries to produce high-tech digital art can be a challenge. Our intention is to demonstrate a test case of a multilingual and multicultural workshop on digital art. The biggest challenge in organizing this event was making a framework for diverse students and faculty so that they can work together. This symposium and workshop hope to be one of the legacies for future interactive, digital art creators.

As with making a film, cooperative work is required and is more important than different individual skills, such as computer programming, object installation, sound recording, and computer graphics. Establishing a common theme is crucial for developing a shared vision and goal with one's fellow students.

The boundaries and limitations in academic and professional disciplines can hinder creative potential, especially in digital art [6], because by its nature, it requires programming and graphic design in addition to architectural installation skills. To gain a better understanding of other academic or professional disciplines, such as art, architecture, and computer engineering, a cross-disciplinary workshop is effective.

Due to the limited time, we could not hear each participant's comments on this event. The workshop artwork and content, as well as the real interactions between students and instructors, should have been covered in more detail. Exhibiting workshop results in different venues also

seems to be a natural extension of this symposium and workshop. Above all, to overcome this time limit, as well as improve the framework, the future continuation of this symposium and workshop are essential as the next step. It was a significant opportunity to present this event summary in Digital Culture & AudioVisual Challenges 2019 in Corfu, Greece.

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Kyoko Hidaka, Ph.D., is a color theorist and an associate professor at Shibaura Institute of Technology in Tokyo, Japan. Born in Tokyo, she studied Studio Art and Anthropology at New York University (B.S. 1992); won Rotary Foundation Ambassadorial Scholarship to study History of Design at Royal College of Art (M.A. 1998); and Color Theory at Tokyo University of Arts (M.A. 1995; Ph.D. 2001). Kyoko Hidaka's research centers on color order systems, color charts, and the application of color theory into modern design. She published the Japanese translation of Munsell's A Color Notation, Albers' On Designing, and Berlin and Kay's Basic Color Terms

Influences of lighting characteristics to human perception in immersive virtual environments

Antonios Koronaios[1], Stelios Zerefos[1]

[1]Hellenic Open University, Greece

Abstract

This research tries to identify lighting parameters that can influence human perception in immersive virtual environments (VEs). As a testing platform, an immersive VE was created, in order to investigate whether light intensity, light distribution and correlated color temperature can affect spatial perception of an immersive VR space. 90 people navigated in this VE in 3 groups, where the VE in each group was lit in three different ways. Results from the experiment show many similarities in perceptional factors between real and virtual environments. Moreover, female participants showed different depth perception than male concerning color correlated temperature, as well as less discomfort when navigating in a VR environment.

Keywords 1

Virtual Reality (VR), Perception, Lighting Design, Virtual Environment (VE)

1. Introduction

Perception is defined as the complex function by which one acquires knowledge of reality, either directly with the senses or indirectly with the intervention of reason [2]. Visual perception in particular, refers to the ability to interpret the surrounding environment using light in the visible spectrum reflected by the objects in the environment [6].

The study of human perception in virtual environments (VEs) has been a fruitful research field for several decades. Whereas it was found that there is a disparity between judgments of distance in a virtual reality (VR) space, as well as a consistent underestimation of the size of the environment and distance to objects, as stated in [12] and [4], little research is based on the effects that lighting parameters have on human perception in immersive VEs.

Three key features that define Virtual Reality are immersion, interactivity and real-time navigation. Immersion is actually a metaphor term that was derived from the natural experience of immersion in water and is categorized in sensory and mental immersion [8]. Sensory immersion refers to the replacement of natural stimuli by synthetic stimuli and its intensity depends on the virtual reality system itself. For example, full immersion is achieved by using a virtual reality helmet that isolates the user from external stimuli. On the other hand, mental immersion is identified through the sense of presence. It refers to the feeling of being involved or/and participating in the experience and overcoming the natural distrust of the VE by the user. Compared to sensory immersion, mental immersion is largely dependent on the content shown. The second feature, interactivity, is defined as the extent to which the user interacts with the environment in real time. It is a continuous loop of action and feedback. The third feature of virtual reality is real time and refers to the response time

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of the system which must be such that updating any user-generated action does not create obvious time delays and is one of the major challenges of VR.

The scope of this study is to attempt and identify specific parameters of lighting that may affect human perception in Virtual Environments. In particular we explore the influence of light intensity, light distribution (beam angle) and correlated color temperature (CCT) of light sources on relative distance perception (exocentric distance), stereopsis (3d surface/depth perception), perception of the directionality of light sources and perception of brightness, in an immersive VE [3] and [8]. The results presented arrive from several test sessions with randomly selected individuals participating in VR walkthroughs with different lighting conditions in a simulated VE.

2. Methodology

To achieve the scope, an experiment was designed, so as to explore these factors of lighting that can influence visual perception on a virtual space. The design of the experiment included the virtual simulation of a real environment as a test platform, so that users of the environment could relate to both the physical "presence" of the space, as well as the objects depicted. The criteria for selecting the space for the creation of the virtual environment were set according to the requirements of the experiment and aimed at enhancing the sense of presence of users.

Those were:
• The intimacy of the space and the recognition of the included objects, so as to increase the realism and the degree of presence of the users.
• Visual calmness, that refers to the absence of unnecessary visual stimuli that may distract the observer from the point of interest and generally lead to erroneous judgments on the part of the user.
• The ability to control the lighting in the actual room.

An existing building that fulfilled the above criteria is the New Acropolis Museum, designed by architects Bernard Tschumi and Michalis Fotiadis, which houses findings from the archaeological site of the Acropolis of Athens. More specifically, the space we chose to simulate for the experiment is part of the upper floor of the central hall of the museum which houses some of the most recognizable sculptures in the world: the Caryatids (Fig. 1).

Figure 1: Render of the simulated space

This space has all of the criteria needed to conduct the experiment. It is a highly recognizable space with highly recognizable three-dimensional objects that one can navigate about, it is visually calm, since it comprises of a large triple height space with natural light coming from the ceiling and the specific space houses only 5 sculptures, and lastly the space has very limited restrictions on

where lighting fixtures can be placed. This last feature was very important, since it ensured realism of the simulation through different lighting settings.

The VE was modeled after the Erechtheion Caryatids area of the New Acropolis Museum in Athens, Greece, from architectural plans that were kindly provided by the architects, along with additional in-situ measurements and photographs, in order to produce a real scale experience model. The model was realized using 3ds Max for the geometry of the building and Unreal Engine for the materials, the lighting and the programming language used for the real-time simulation of the VE. The technical equipment, consisted of an Oculus Rift CV1 VR headset with a pair of motion controllers and three tracking sensors, connected to a custom workstation PC.

The design of the experiment included the creation of three different groups that would navigate the space in changing lighting scenarios. Each group would experience three lighting scenarios in one walkthrough. Two of the groups explored the effects of CCT (Fig. 2), while the third group focused on the effects of different light intensities and light distribution (Fig. 3). For each group, a subjective quantitative assessment was carried out, as a questionnaire at the end of each walkthrough, as there is no validated objective method in a perception-centric system, as is the case of VR [9].

Figure 2: Real-time simulated space with different correlated color temperature (CCT): 2700K (left), 4000K (centre) and 6000K (right)

Figure 3: Real-time simulated space with different light beam

3. Experiment

The experiment is based on VR walkthrough test sessions that consisted of 90 randomly selected participants aged between 18 to over 70 years, divided into three groups for testing different lighting scenarios, so each group contained 30 participants. The participants were required to enter a simulated VE and were informed beforehand that they would be asked questions, while instructions were also given on what to observe from specific points of view. The answers were recorded in real time by an interviewer, in order to obtain data more accurately.

The design of the groups was as follows:

- Group A. The space was illuminated by sources of different color temperature, warm, neutral and cold lighting (2700K, 4000K and 6000K).
- Group B. The space was illuminated by sources of different light distribution, narrow, middle and open beam (7°, 17° & 30°).
- Group C. The space was illuminated by sources of different color temperature, warm, neutral and cold light, but different light distribution from the first group.

After first giving users some time to get used to the virtual navigation, they were asked to stand at some observation points. The researcher then began to alternate different, pre-set lighting scenarios with the push of a button. The purpose of the experiment was for participants to observe differences between scenarios and to answer specific questions. The main purpose of these questions is to determine if changes in color temperature and light distribution affected perception of depth, relief and direction. The answers were then recorded in a questionnaire by the researcher and analyzed to reach to conclusions.

In the questionnaire the first four questions were general, closed-type demographic questions that addressed age, gender, education and experience with VR systems. The next question related to the perception of depth by asking in which scenario the distance between the rows of the statues seemed larger. The sixth question related to the perception of the relief, asking in which scenario the relief of the three-dimensional sculptures seemed more intense. The seventh question related to the perception of directionality by asking, in which scenario the position of the lighting sources was more evident. The last question dealt with motion sickness from the VR experience.

4. Results

From the Sample of 90 participants who participated in the 3 virtual reality sessions, 50 users were women and 40 men. The age range was very wide, ranging from under 18 to over 70 years old, but most participants represented in the study were aged from 35 to 44 years. Furthermore, the educational level of the participants was quite high as over half of the users had a postgraduate degree. Concerning their previous experience with VR, about 42% answered that they had used a VR device before, which is considered extremely high, given that in a digital marketing survey of a sample of 1900 people in the US, that percentage was only 8% in 2017 and 11% in 2018 [11]. However, this can be explained since the majority of the sessions were made as a demo in a conference related to VR.

Based on the results of the first group, color temperature appears to have a limited effect on the user's depth perception. Moreover, females answered that they perceived greater relative distances under cool light than males. Regarding the sense of relief, females find that details are best rendered under warm lighting while males perceive more intense relief at neutral color temperatures. In any case, cool lighting seems to have the least effect on the perception of the relief. Concerning the perception of directionality, statistics show that for the sample of females cool lighting has the least effect, but the results are not clear (Fig. 4). For males, the results are clearer, as the graph shows (Fig.5) that warm lighting has the greatest effect on directional perception and cool lighting has the least.
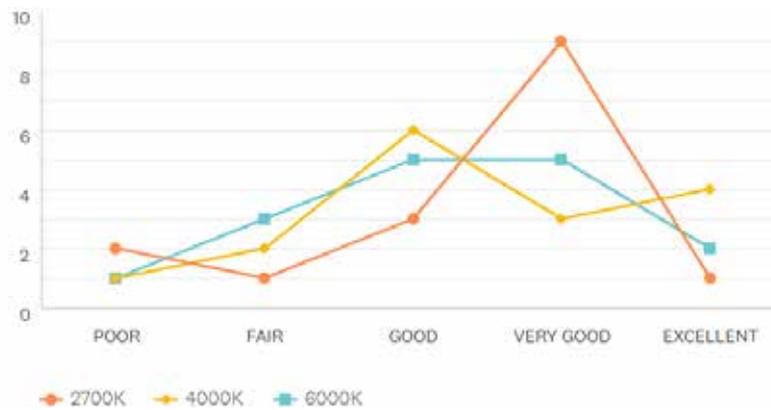
Figure 4: Group A - Light direction perception between light scenarios – Female sample
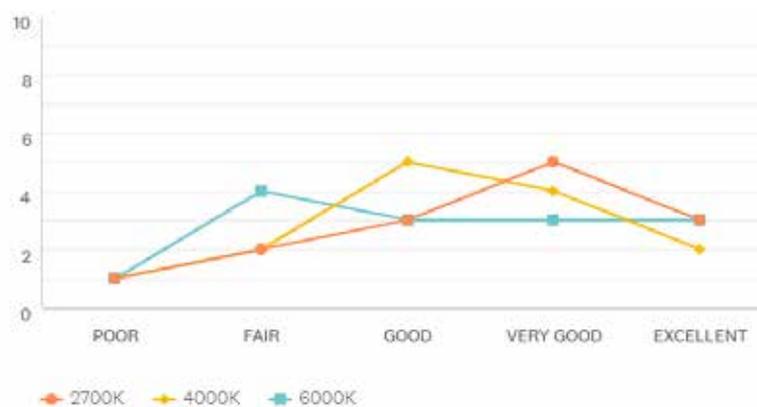
Figure 5. Group A - Light direction perception between light scenarios – Male sample

The majority of the participants from Group A responded that they did not feel uncomfortable. From the male specimens, only about 20% recorded discomfort, while the percentage of females was even lower.

For the participants of Group B, light distribution perception seems to have an impact on females. Almost half of the female participants of the experiment stated that in the scenario where wide beam lighting was used, the distance between the Caryatid rows appears to be greater than in narrow and mid beam scenarios (Fig. 6). On the other hand, in the male sample, changes in light distribution do not appear to have a significant effect (Fig. 7).

Regarding the perception of relief in the different lighting distribution scenarios, again there was a difference between the results of female and male participants. For females, narrow beams prove to provide the best relief to the statues. The male sample did not observe any differences in any scenario. Concerning the perception of directionality, for all users, it has been observed that narrow beams have the greatest effect on the sense of orientation of the illumination. When asked if they felt discomfort during the experiment, the results were similar to those of the first group. More males than females felt discomfort, but overall rates were small.

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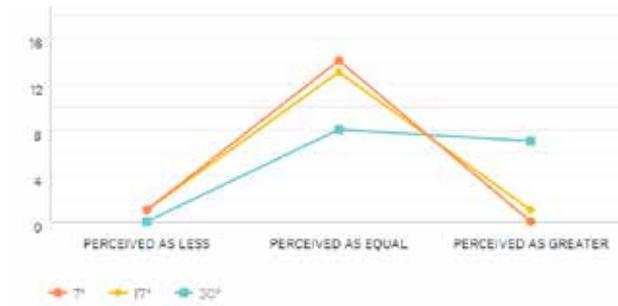
Figure 6: Distance perception between light scenarios – Female sample
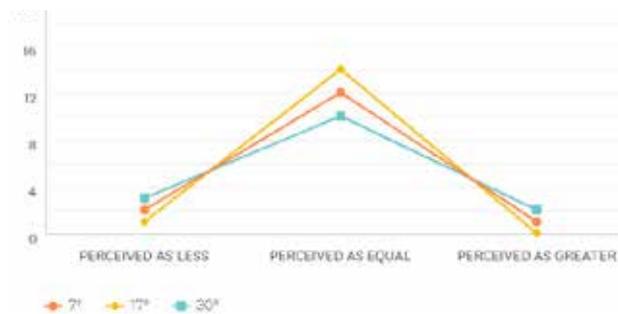
Figure 7: Distace perception between light scenarios – Male sample

Group C was a control group that was created to compare data with the results of Group A. For the perception of the relief in the scenarios of different color temperatures, the results of the groups appear to coincide. Based on the results, females still find that the relief/details of the Caryatids are best rendered under warm lighting (Fig. 8). Correspondingly, males still perceive the relief better at neutral color temperatures. Therefore, changes in luminous distribution do not alter the effect.

igure 8: Relief comparison in light scenarios between group A (top) and group C (bottom) –

Male sample

On the perception of directionality in scenarios of different color temperatures in virtual environments, there seems to be a fairly high degree of agreement between the male sample in groups A and C, as warm lighting appears to have the greatest effect on the perception of directionality. Also in group C of the female sample it appears that warm lighting influences the sense of direction, however, since the results of group A females were not so clear, no clear conclusions can be drawn. However, for all users, cool lighting has the least effect.

5. Discussion and Conclusions

Results from the virtual walkthroughs show that, the female participants experienced less discomfort than male participants. When compared to other surveys, the overall discomfort rates were low. This result contradicts all previous research showing that as a rule the percentage of females who experience discomfort in VR is higher than men (Munafo et al, 2016). It is also noteworthy that the overall VR sickness rates in the present work were much lower than in previous surveys. For example, in the present work discomfort rates were only 13% in the worst case scenario while in the Munafo et al (2016) study it was 56%. As the equipment was equivalent (oculus rift system), the differences in percentages are most likely due to the projected content of virtual reality and probably due to the familiarity of most of the participants in our study with VR systems and environments.

In the female sample, cool lighting showed a limited effect on depth perception in contrast to the male sample that did not appear to have any noticeable effect. The above results of the female sample appear to be in part consistent with research findings in the natural world concerning the effect of cool and warm colors on the apparent perception of depth, where warm colors appear projected into space and the cold recedes [10]. The fact that most experiments in the physical world were conducted with mostly saturated colors or monochromatic light sources may justify that the results in the virtual world are more moderate. The fact that the female sample in this study was more sensitive than the male is something that needs further investigation.

For all users, cool lighting had the least effect on the perception of relief and directionality. Females better understand details under warm lighting, while men under neutral, however, no corresponding experiments were found in literature, that examine the perception of relief and the direction of illumination in the real or virtual world.

For the female sample, wide beams of light increase the apparent distance between objects. As in all experimentation lighting scenarios, the light sources had the same emitted luminous flux (lumen), which implies that changes in luminance distribution affect the illuminance. In other words, the narrow beams are brighter. In this context, the results can be correlated with real-world experiments that have shown that by observing from a fixed distance, objects with the highest brightness appear closer to the observer, while less bright objects appear to subside.

For the female sample, narrow beams also improve the perception of the relief. The males did not notice any differences. No comparative studies were found in the literature to compare these results. The most relevant research in the perception of relief concerns the observation of hollow or convex surfaces, where the results suggest that, as far as the recognition of the relief is concerned, remembering the direction of a light source greatly influences visual perception [1].

For all participants, narrow beams had the greatest effect on the sense of illumination

directionality. The results in the virtual world are again supported by the available research data on physics, where observers had a better sense of the dominant direction of illumination in central illumination scenarios than in more diffuse ones [7].

This research has shown considerable similarities between the perception of lighting characteristics in the real and virtual worlds, which leads us to conclude that most perceptive factors of the real world can also be simulated and experienced in VR. Applications of this study can have an impact on the use of VR environments on lighting design, architectural design, computer games and professional simulation environments.

6. Funding

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Stelios Zerefos is an architect, Professor at the School of Applied Arts of the Hellenic Open University where he teaches lighting design. He has practiced architecture since 1999 and he has taught architectural digital design as a visiting lecturer at the National Technical University of Athens School of Architecture, sustainable design at the European Masters' Degree for Renewable Energy Sources in the University of Athens and the Piraeus Technical University. His research has been published in books, scientific journals, international and conference proceedings, while his architectural work has been published and acquired several awards in international and national architectural competitions.

Antonios Koronaios is an architect (UTH, 2004). His research interest lies in sustainable architecture, computational design, architectural visualisation and the application of virtual reality technologies. He has taken part in various international competitions, exhibitions and workshops to enrich his knowledge and experience. In 2010 he participated in the 6th Biennale of Young Greek Architects, as an external collaborator for the project "Retail Building in Psychiko" by Oikonomidis Architects. He is currently undertaking a Master of Arts in Lighting Design at Hellenic Open University. Part of his research work within his postgraduate course was demonstrated in the VR@GR meetup held in the Onassis Cultural Centre (Athens, 2018).

The challenge as an innovative approach to designing and composing the visual message. Investigating young designers' thoughts on provocative advertising and the disturbance of the visual and emotional quiescence that it brings.

Apostolos Kordas[1], Sofia Stratis[1]

[1]University of West Attica, Greece

Abstract

The aim of this research was to investigate the thinking of new creators with regard to invoking the challenge in advertising as an innovative design approach and as a tool for writing the visual message. The development of the research problem concerned the investigation of the impact of invoking the challenge in advertising on the recruitment or rejection of the message on the part of the young creators rather than the consumers. Consequently, one of the important factors that influenced the research findings of the research is first and foremost the younger age of the participating designers, and secondly their ability to accomplish their intentions (invoking the challenge) through the design capability. Another important factor influencing the research findings is the introduction of a fundamental taboo of the concept of death and the management of this (concept) by young creators. Finally, the main reflection developed during the research, adopts as a theoretical basis the perception that the formulation of provocative questions through advertising is just as important as the effectiveness of the venture itself.

Keywords

Provocative advertising, provocative design, visual message, invoking challenge, verbal communication

1. Introduction

Nowadays, the product market is characterized by intense competition and, in order for a company to cope with this competition, it plans its advertising strategy in a variety of ways. Consumers are exposed daily to a large number of visual messages and this phenomenon is multiplied by the growing emergence of the Internet and social media. This abundance of exposure to visual messages in the mind of consumers makes the message often go unnoticed. As a result, consumers are becoming less and less sensitive to these symbolic messages.

Based on this finding, several advertisers have adopted a different - creative strategy to attract consumer's attention and arouse curiosity in them and in order to escape out of this jungle of images and slogans is the use of provocative advertising. Then, relying on the principle of creativity in its broad scope, ads should show a degree of boldness, and this through the presentation of themes that are based on ideas that violate the norms and are characterized by their distinction and ambiguity

[7].

The challenge in advertising is a deliberate appeal strategy that targets the emotional background of at least a portion of the audience and through its content it surprises, offends, provokes or violates values, social norms, laws, moral or natural perceptions. The use of the challenge in advertising is not only aimed at promoting products or services, but is often also used to inform about various social issues related to public health protection, such as raising awareness of cancer, discouraging alcohol or drugs, or problems related to vulnerable social groups of the population (female, children, homosexuals, refugees), such as prevention of domestic violence, racist behavior, etc.

The issue of provocation as an advertising strategy does, however, raise a set of important concerns. Despite the high level of publicity, by word–of–mouth and otherwise, garnered by provocative ads, it seems important at this point to assess the effect of such a strategy on individual consumers, and to compare the strategy with more traditional appeals used in advertising [8].

Adopted to Vezina & Paul, attempts to shock consumers may generate a high level of awareness, but may also result in a low level of acceptance or even a high level of disapproval. How do these conflicting results translate in terms of purchase intentions, especially in comparison with more traditional appeals? Is it possible for consumers to have a negative attitude towards an ad and still retain a positive attitude towards the brand advertised? Do consumers differ in their reactions towards provocative ads because of their age or their various levels of involvement?

2. Challenge and advertising

In the early 80's, ads with provocative content appeared. Benetton was the first company to use the challenge in an advertising campaign. A strategy was adopted for using iconographic and verbal elements that had nothing to do with the advertised product. Over time, the company has been using more challenge by violating values, social norms, laws, moral or natural perceptions. This strategy has been adopted by other companies, and only in the last two decades the use of challenge has become a complete and deliberate communication strategy.

As mentioned above, the challenge targets the emotional background of at least a portion of the audience, and through its content it surprises, offends, provokes or violates values, social norms, laws, moral or natural perceptions. According to Vezina & Paul this deliberate appeals strategy, has three characteristics of great importance for its success: distinctiveness, ambiguity and transgression of norms and taboos.

The first important feature of a provocative advertising according to Vezina & Paul is its distinctiveness. Regardless of content, an ad that can be considered similar to other ads will lose some of its dynamics. In addition, part of the challenge for an advertiser using provocative appeals is the constant renewal of ads to preserve originality.

Although the distinctiveness as an element of provocative advertising is very important, by itself it is not enough. The second feature in designing the strategy of challenge is ambiguity, i.e. whether advertising leaves room for different interpretations, if not for its content, but for the advertiser's intentions. The basic principle behind this deliberate ambiguity is that a provocative message that contains no ambiguity is more likely to be immediately rejected by those recipients who are overwhelmed and therefore more likely not to process the visual message at all.

Finally, the third feature that mentioned by Vezina & Paul is when the content of advertising

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refers to something that is generally considered by the consumer as a taboo. This feature may be the most critical in the challenge call from the two above. An ad that is only distinguished by its distinctiveness and ambiguity would be difficult to provoke in itself, and rather, tends to simply be rejected.

3. Methodology - research process

As a research tool, the quantitative method according to Bell [2] was based on the positive epistemological example, which is based on data collection and the study of the relationship of factors and variables to each other. The type of quantitative method chosen was sampling (deliberate sampling), i.e. data collection through closed questionnaires.

The research questions were based on two advertising campaigns,adopting different challenging strategies: a.) "No One Deserve to Die" (Figure 1), a non-profit organization "Lung Cancer Alliance" designed by Laughlin Constable (July, 2012), and b.)"Sentenced to Death" (Figure 2) of the Benetton clothing company designed by Olivero Toscani (February, 2000).

Figure 1: No One Deserve to Die.

Figure 2: Sentenced to Death.

The first campaign aimed to change the attitude of the public, towards lung cancer patients and was aimed at raising awareness of the need for greater funding for research and better early diagnosis of lung cancer. The campaign developed in two different time periods. In the first period a) was released with a series of pictures of six different modern social archetypes (a tattooed

man, a hipster, a crazy old-age aunt, a young lady who loves cats, a smug man and a genetically privileged lady) b.) the verbal message "tattooed, cat lovers, ... Deserve to die" and c.) the logo of the organization. The second period of time was followed by a further verbal message, though not so distinct, that it mentioned: "People with tattoos, Cat lovers ... deserve to die. IF THEY HAVE CANCER OF THE LUNG. Many people believe that if you have lung cancer you did something to deserve it. It sounds absurd, but it's true. Lung cancer doesn't discriminate and neither should you. Help put an end to the stigma and the disease at NoOneDeservesToDie.org.

The campaign at its inception stirred several reactions, though expected, because it was a bold and socially complex message, one that's tough to decipher from any ad, much less one that says "[a modern social archetype] deserves to die." The production company says " People lack empathy when it comes to lung cancer, and we exploited that insight in our campaign." The final outcome of the campaign was positive with the biggest positive result was, that four months after the campaign ran, the House and Senate finally passed the Recalcitrant Cancers Research Act which allocated federal research funding according to commensurate mortality.

Benetton's second campaign, with the obvious aim of expanding activities in the United States where the campaign started, apparently overrated the tolerance of some states in America with the imposition of the death penalty. The campaign triggered a reaction storm and a series of convictions in various states. The company accepted the campaign's failure by saying: "Maybe we didn't fully calculate the emotional reaction it was going to cause" and had to make some adjustments.

The opening of the campaign was made with the release of large posters in many states of the United States accompanied by a 96-page insert in the Talk magazine titled "We, On Death Row". The campaign's visual message included a) A series of 26 photos of people (all focused on their eyes) who had been sentenced to death in different states, b) The verbal message "Sentenced to Death" across the width of the photo slightly sloping, c) a small text with the data of the convicted person and d) the company logo. There was no reference and details about the type of crime they had committed.

Both of these campaigns use two basic structures of advertising, photography and text that communicate with each other. These two structures (text, photograph) are convergent, but as their entities are heterogeneous, they cannot be mixed. For this reason, the analysis should relate to each structure separately. And only when the study of each structure is completed, we will be able to understand how they complement each other [1].

Both of these advertising campaigns point to the concept of death at the level of verbal communication, as a tool of visual persuasion for the promotion of goods or services. How different did these two images look like, and how different a visual message would they transmit, if the verbal message was missing? Even more, that the presence of the verbal message in both ads plays a dominant role in the overall composition. In addition, at the level of the visual (symbolic) message, the verbal message does not play a recognition role, but it has aninterpretationrole.

4. Sample of the survey

In this research, involved 81 subjects, undergraduate students of the Department of Graphic Design and Visual Communication at the University of West Attica. Participants had a small age range from 19 to 28 years, with an average of 20.7 years, with the highest proportion being among the

Participants age		
Age	Frequency	percentage
19	26	32,10%
20	27	33,33%
21	6	7,41%
22	10	12,35%
23	5	6,17%
24	2	2,47%
25	2	2,47%
27	2	2,47%
28	1	1,23%
Total	81	100,00%

Gender ratio

40,7

59,3

■ Women ■ Men

Table 1: Participants age. Figure3: Gender ratio

19 and 21 years old. In terms of sex, 48 individuals in the sample were women (59.3%) and 33 were men (40.7%).

5. Questionnaire

The main objective of this research work was to explore the challenge as a functional tool for composing the visual message - an innovative design approach.

The development of the research problem included exploring the impact of invoking the challenge on advertising, in terms of recruiting and critical viewing of the message, especially from the point of view of young creators, and not from the point of common targeting. An ambiguous role admittedly, because the challenge in advertising is difficult to distract the role of the consumer and to keep only that of the designer. Consequently, one of the important factors that influenced the research findings of the research is first and foremost the younger age of the participating authors, and secondly their ability to accomplish their intentions (invoking the challenge) through the design capability. Another important factor, that influenced the research findings, is the introduction of a fundamental taboo of the concept of death and the management by young creators.

With this questionnaire sought to capture the attitude of new creators towards the exposure of visualized messages, which as a key lever persuaded the challenge that surprises, offends, challenges or violates values, social norms, laws, natural or moral perceptions.

Particularly, the parameters studied concerned the indicators: Disturbance of Visual Quiescence (call attention), Disturbance of Emotional Quiescence(emotional challenge), Content Understanding, and Attitude towards Design Challenge. The questions were answered on the basis of the Likert scale (five-point scale, 1 = smaller, 5 = larger). Finally, demographic data (gender and age) was collected to investigate potential differences within the sample based on these factors.

6. Results

Disturbance of Visual Quiescence (call attention)

In the first category of questions pertaining to the Disturbance of Visual Quiescence (call attention), participants were asked to answer three questions with three components each (Virtual, Verbal and Visual Message) for each campaign individually. The questions were:

Question 1: How much you draw your attention to individual elements? a.)Pictorial message,

b.) Verbal message, c.)brand name - Logo and d.) Visual message (overall composition).
Question 2: Which of the following elements, in these two campaigns, did you pay more attention? a.)Visual figures, b.) Verbal figures, c.) Message that the campaign attempts to communicate.
Question 3: How attractive are you finding each of these elements in these two campaigns? a.) Visual figures, b.)Verbal figures, c.) General Sense.

According to the results of the research for the first "No One Deserve to Die" advertising campaign, the majority of the participants evaluated iconographic data from good to excellent (4/5 34.57% (5/5 16.05%), (4/5 43.21%) - (5/5 11.11%), (4/5 40.74%) - (5/5 14.81%), in terms of drawing attention. With regard to verbal figures, the majority of participants rated from good to excellent(4/5 34.57%) - (5/5 33.33%), (4/5 35.80%) - (5/5 30.86%), (4/5 33.33%) - (5/5 16.05%). Regarding the visual message and the general sense, the majority of participants rated from good to excellent(4/5 41.98%) - (5/5 19.75%), (4/5 29.63%) - (5/5 13.58%), (4/5 43.21%) - (5/5 16.05%). Finally, with regard to the brand name, it received a little to moderate acceptance (2/5 39.51%) - (3/5 33.33%) of the participants.

Based on the above results, it appears that the participants evaluated the Visual figures as quite attractive, the verbal figures as particularly attractive as well as the visual message, but to a lesser extent, and finally the brand was rated as little or moderately attractive. It seems clear that for the first "No One Deserve to Die" advertising campaign verbal figures played a catalytic role, while the brand name seems to have little influence on the general sense and the communicated message.

For the second advertising campaign "Sentenced to Death" according to the results of the survey, the majority of the participants evaluated the pictorial data from moderate to much (3/5 33.33%) - (4 / 5 34.57%), (3/5 34.57%) - (4/5 29.63%), (3/5 43.21%) - (4/5 23.46%), in terms of drawing attention. In terms of verbal figures, the majority of participants rated from moderate to much (3/5 32,10%) - (4/5 33,33%), (3/5 22,22%) - (4/5 35, 8%), (3/5 34.57%) - (4/5 27.16%). Regarding the visual message and general sense, the majority of participants rated from moderate to much (3/5 39.51%) - (4/5 29.63%), (3/5 32.10%) - (4 / 5 23.46%), (3/5 41.98%) - (4/5 27.16%). Finally, as far as the brand name is concerned, it has received a small to moderate acceptance (2/5 24.69%) - (3/5 34.57%) of the participants.

Based on the above results, it appears that the participants assessed the iconographic figure and the visual message as moderately attractive but to a greater extent for the visual message, the verbal figures as a bit attractive, and finally the brand was evaluated as a little or moderately acceptable attraction. It seems clear that for the second "Sentenced to Death" campaign, verbal figures were a negative factor of acceptance, while the brand name seems to have little effect on the general sense and the communicated message.

Comparing the results for these two advertising campaigns with regard to Disturbance of Visual Quiescence on the part of young creators, we conclude that a.) Both have almost the same degree of acceptance in the visual figures b.) the verbal figure at the mass communication level, is present in all advertising campaigns and plays a catalytic role in general acceptance; and c.) the brand name appears to have little effect on the sensation and the communicated message. Finally, based on a gender classification, was performed (t-test) data analysis check,of two samples with assumed equal fluctuations, to investigate possible differences between the gender of the participants in terms of drawing attention. From the t test results of the two samples (P(T<=t) two tailed = 0.597) as shown, there are no statistically significant differences (in significance level <5%) between the

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gender in drawing attention.

Content Understanding

In the second category of questions related to the Content Comprehension index, participants were asked to answer two questions per campaign individually. The questions were:

Question 4: How difficult did youunderstand the visual message in these two campaigns?

Question 5: How understandable is the message seeking to communicate with the relationship between the visual and verbal figures of these two campaigns?

According to the results of the survey for the first "No One Deserve to Die" advertising campaign, the majority of participants seem to have had difficulty understanding the visual message from moderate to little (3/5 28.40%) - (4/5 28.40%), while in the relation of visual- verbal figures with the communicated message seems to have been almost the same from moderate to little (3/5 32.10%) - (4/5 25.93%).

For the second "Sentenced to Death" advertising campaign according to the results of the survey, the majority of participants seem to have had difficulty understanding the visual message from moderate to small (3/5 20.99%) - (4/5 24.69%), while in the relation of visual- verbal figures with the communicated message seems to have almost the same difficulty from moderate to little (3/5 24.69%) - (4/5 22.22%).

Comparing the results for these two advertising campaigns with regard to the understanding of the content on the part of young creators, we conclude that a) both campaigns have made it difficult to understand the visual message; b) the same happened in relation to the visual- verbal figures with the communicated message, and c.) the second campaign clearly made it more difficult for both figures. Finally, based on a gender classification, was performed (t-test) data analysis check, of two samples with assumed equal fluctuations, to investigate possible differences between the gender of the participants in terms of about content understanding. From the t test results of the two samples (P(T<=t) two tailed = 0.322) as shown, there are no statistically significant differences (in significance level <5%) between the gender in content understanding.

Disturbance of Emotional Quiescence (emotional challenge).

In the third category of Disturbance of Emotional Quiescence (emotional challenge)questions, participants were asked to answer a question with five components for each campaign individually. The question was:

Question 6: How do you decide on the following reviews and opinions, according to the message? a.) Constant values and perceptions are violated, b.) there are racist implications, c.) The concept of death is used in a provocative or inappropriate way, d.) it shocks you at first glance, e.) It is intelligent and inventive.

According to the results of the survey for the first "No One Deserve to Die" advertising campaign, the majority of respondents stated that Constant values and perceptions from little to moderate (2/5 24.69%) - (3/5 37.04%), whether the campaign has racist references, the participants were almost dealt from not at all to very much, with little prevalence of not at all (1/5 24.69%) - (2/5 19, 75%) - (3/5 22.22%) - (4/5 18.52%) - (5/5 14.81%), whether the campaign use the concept of death in a provocative or inappropriate way, the majority of participants rated from moderate to much (3/5 37.04%) - (4/5 17.28%), whether the campaign is shocked at first glance, the participants

were almost dealt from not at all to very much, with little prevalence of the not at all (1/5 24,16%) - (2/5 18,52%) - (3/5 23,46%) - (4/5 16,05%) - (5/5 14,81%) and whether the campaign is intelligent and inventive, the majority of participants said they were smart and inventive from moderate to very much (3/5 29.63%) - (4/5 28.40%).

For the second advertising campaign, "Sentenced to Death" according to the results of the survey, the majority of respondents stated that Constant values and perceptions,from little to moderate (2/5 22.22%) - (3/5 35.80%), whether the campaign has racist references, the participants were almost dealt from not at all to very much, with little prevalence of not at all (1/5 28.40%) - (2/5 22.22%) - (3/5 24.69%) - (4/5 14.81%) - (5/5 9.88%), whether the campaign touches the concept of death in a provocative or inappropriate way, the participants almost shared a (1/5 25,93%) - (2/5 20,99%) - (3/5 18,52%) - (4/5 28,40%), for the if the campaign is shocked at first glance, the participants were almost totally dealt from not at all to very much (1/5 29.63%) - (2/5 24.69%) - (3/5 22.22%) - (4/5 16.05%), and finally whether the campaign intelligent and inventive, the majority of participants said they were smart and inventive moderate to much (3/5 41.75%) - (4/5 16.49%).

Comparing the results for these two advertising campaigns with regard to the emotional quiescence indicator on the part of young authors, we conclude that a.) both have almost the same degree of acceptance in the component if fixed values and perceptions are violated, b.) both have almost the same degree of acceptance in the component if they contain racially implied c.) as to whether the campaigns touch the concept of death in a provocative or inappropriate way appear to be there is a more neutral attitude as indifferent to the second campaign. Although there is no clear indication (except for 25.93%), it seems that the death sentence (without explanation) is less disturbing, d.) And both have almost the same degree of acceptance in the component they are shocked at first glance with just a little more, the second campaign, and e.) and both have almost the same degree of acceptance in the component if they are smart and inventive.

Finally, based on a gender classification, was performed (t-test) data analysis check,of two samples with assumed equal fluctuations, to investigate possible differences between the gender of the participants in terms of disturbance of emotional quiescence. From the t test results of the two samples ($P(T<=t)$ two tailed = 0.537) as shown, there are no statistically significant differences (in significance level <5%) between the gender in disturbance of emotional quiescence.

Attitude to the Design Challenge.

In the fourth category of questions regarding the Attitude to the Design Challenge, participants were asked to answer one question for each campaign separately and three, in relation to their own attitude towards the challenge. The questions were:

Question 7: The motto: "The end justifies the means " in relation to the message that each campaign tries to communicate, finds you in agreement?

According to the results for the seventh question of the survey, for the first "No One Deserve to Die" advertising campaign, the relative majority of respondents stated that "The end justifies the means" from medium to much (3/5 32.10%) - (4/5 20.99%), while the average male was almost the same (2.88 / 5 and 2.73 / 5). For the second "Sentenced to Death" campaign, according to the results (table 13) of the survey, the majority of respondents said they were poorly accepted from not to all to moderate. (1/5 23.46%) - (2/5 25.93%) - (3/5 30.86%). It is worth mentioning here that the average male number of women has had a fair amount of difference (2.91/5 and 2.34/5).

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Finally, based on a gender classification, was performed (t-test) data analysis check, of two samples with assumed equal fluctuations, to investigate possible differences between the gender of the participants in terms of Attitude to the Design Challenge. From the t test results of the two samples we conclude that: for the first campaign, there are no statistically significant differences (in significance level <5%), but for the second campaign the differences are of moderate significance (P (T <= t) two tailed = 0.063),between the gender in Attitude to the Design Challenge.

Question 8: As new creators, would you use the challenge as a design strategy, violating religious and social values, perceptions, prejudices and taboos?

For the eighth question, according to the results, the relative majority of participants said they would make use of the challenge from not at all to moderate. (1/5 22.22%) - (2/5 19.75%) - (3/5 30.86%). It is worth mentioning here that the average male number of women had a fairly large difference (3.1/5 and 2.5/5).

Finally, based on a gender classification, data analysis was performed to control the two samples with assumed equal fluctuations to investigate possible differences between the participants' gender in terms of using the challenge as a design strategy. From the t test results of the two samples (P (T <= t) two-sided = 0.113) as shown, the differences are of moderate significance, but not of significance <5% between gender.

Question 9: Do you think that such a kind of advertising messages, achieves the final goal?

For the ninth question, according to the results, the relative majority of participants stated that the challenge achieves the final goal from moderate to much (3/5 33.33%) - (4/5 39.51%). It is worth mentioning here that the average number of men had a fairly large difference (3.6/5 and 3.0/5).

Finally, based on a gender classification, was performed (t-test) data analysis check, of two samples with assumed equal fluctuations, to investigate possible differences between the gender of the participants in terms of achieves the final goal. From the t test results of the two samples (P(T<=t) two tailed = 0.0303-3%) as shown, there are statistically significant differences (in significance level <5%) between the gender. This leads us to the conclusion that the achievement of the ultimate goal through the challenge is considered by women to be impossible, while men consider the opposite.

Question 10: Do you think that making provocative questions through advertising, is just as important as the effectiveness of the venture itself?

For the tenth question, according to the results, the relative majority of the participants stated that the formulation of provocative questions is just as important as the effectiveness of the venture itself, from moderate to much (3/5 33.33%) - (4/5 28.40 %). It is worth mentioning here, that the average male-female was almost the same (3.2 / 5 and 3.1 / 5).

Finally, based on a gender classification, was performed (t-test) data analysis check, of two samples with assumed equal fluctuations, to investigate possible differences between the gender of the participants in terms of disturbance of emotional quiescence. From the t test results of the two samples (P(T<=t) two tailed = 0.634) as shown, there are no statistically significant differences (in significance level <5%) between the gender in disturbance of emotional quiescence.

7. Discussion of the results

This study was conducted with a sample of students from the University of West Attica,

which may raise questions about the generalization of findings in other countries. In addition, the sample consisted purely of students - new creators of the Department of Graphic Design and Visual Communication (a soft sample),and what it can bring, to the findings of the survey.

On the basis of the above results of the research, some initial conclusions can be drawn as to the attitude of young creators towards the challenge and which should be set in the context of a new reality in Greece, which has just emerged from a very difficult situation which has led to a conservatism of Greek society (more or less, this remains to be proved). Moreover, their attitude to the challenge of composing the visual message will also be their future creation for the coming years and will therefore play an important role in shaping advertising in the future.

The two advertising campaigns chosen,are far from each other, but far enough from the critical age of participants perception. So, they would judge the visual message without knowing crucial data for these two campaigns. Another thing worth noting is the selection of these ads, in terms of iconographic and verbal figures and the final message that each company wanted to communicate. On the one hand, the "No One Deserve to Die" advertising campaign was purely a social goal to raise public awareness of lung cancer, while "sentenced to Death" was simply aimed at expanding its activities. In addition, the iconographic figures themselves had no sense of challenge, but they were perfectly suited to the entire climate of the visual message, while the verbal figures aimed directly at the thymic.

Regarding the elements of the ads in which the participants focused attention, as mentioned in the results, the components of the verbal figures and the general feeling were evaluated as very attractive, while the component of the pictorial figures is slightly lower than the one above, and the component of the corporate identity was evaluated little or not to all attractive. Here, it seems, that these seminal advertisements are not based on the iconographic figures but on the verbal ones, and thus contradict the analysis by Mzoughi & Abdelhak [4], according to which the use of the image is a key element of " communicative expression ", which is based on a visual rhetoric. Here we can say that the verbal message is the entry gate, seeking to involve the receivers at an emotional level, so that they then succeed in a cognitive engagement. Another element supporting the above observations is the findings of the t test carried out between the components of intelligent advertising-pictorial figures (P (T <= t) twotailed = 0.025) intelligent advertising- verbal figures(P (T <= t) twotailed = 0.151).

Another important finding that is worth noting is that it was difficult to distract the role of the consumer and keep only that of the designer. From the findings of the t test carried out between the components of: «The end justifies the means» and the achieves the final goal (P (T <= t) two-sided = 0.004), they seem not to endorse the purpose but are too sure that this logic achieves the ultimate goal.

With regard to the concept of death, the results show no distinct gender differences, and contradict the conclusions of Manceau &Tissier-Desbordes [3] which argue that issues related to death, suicide and violence, women showed greater sensitivity, considering them as more taboo than men, respectively. Contrary to the above, Sabri & Obermiller [5]concluded that gender does not play an important role in the overall and general perception of taboos in ads, although there is a suspicion that this outcome is responsible, for how the results of the survey were calculated.

Finally, it has to be mentioned that the t test findings carried out on all questions and the different gender components did not show statistically significant differences (in significance level

<5%).

In conclusion, I would like to mention that the research is running the last month and therefore there is still a lot to be studied, further comparisons between the variables, the creation of a new questionnaire with open-ended questions this time, comparisons between the findings of the two questionnaires, as well as comparative studies.

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Apostolos Kordas is a Laboratory Teaching Staff at the University of West Attica, Greece, teaching digital image processing, typography and interactive multimedia at the Department of Graphic Design and Visual Communication, where she works since 1997. She holds a BSc in Graphic Arts, a MSc degree in Graphic Arts and Interactive Multimedia (Hellenic Open University) and is currently working on his PhD, focusing on the Visual Communication and graphic innovations in cinematic environments. For more than 30 years, Apostolos is actively involved in the fields of education, research projects, visual communication, typography, multimedia and digital publishing.

Sophia Stratis is an associate professor at the Department of Graphic Design and Visual Communication at the University of West Attica, teaching Graphic Design, Brand Identity Design, Environmental Graphic Design (EGD), where she works since 1982. She holds a BSc in Graphic Design, a BSc in Architecture, a MSc degree in "Advertising and architecture in the city" and a PhD degree in "Advertising and architecture in the city – A case study in arbitrariness". For more than 35 years, Sophia is actively involved in the fields of education, research projects, visual communication, Graphic Design, Environmental Graphic Design.

DCAC

Session 2

Digital Culture and Technologies I

The Art of Melancholy. Decoding Affective Spatialities in Video Game Environments

Angeliki Malakasioti[1]

[1]Department of Architecture, Aristotle University of Thessaloniki, Greece

Abstract

Widespread digital culture, and especially the phenomenon of immersive gaming environments, are developing today at the speed of an epidemic. The study explores what is already on the horizon: the quest for genuinely emotive spaces, focusing on the case of melancholy, a rather prevalent atmospheric ambience appearing in contemporary gaming experiences. In this context, the study ventures the invention of a common ground among different interpretations of the melancholic phenomenon -philosophical, textual, medical, artistic, digital. The phenomenon is decoded and spatialized through a comparative reading of abstracts of symptomatic descriptions, visual representations, poetic verses, commonplace symbolisms, or theoretical approaches which attempt to capture in a distinct manner its vague and complex nature, and afterwards, are juxtaposed to video game spaces and their interactive elements. Through this process, the intimate, almost 'sacred' interior landscapes of the melancholic subject are transformed into a series of observations about the use of representation, narrative, interactivity processes, or audiovisual language, and are highlighted as potential factors of experiential design in the context of electronic gaming culture. This gesture implies an intention of externalization of any inner mental states, their demystification, their association with a more objective, accessible world of ideas, and finally, their further correlation with the architecture of affective ambiences as well as with contemporary design issues in general.

Keywords

melancholy, video games, digital culture, emotional ontology, experiential design, atmosphere

1. Introduction

Video games are nowadays a complex cultural phenomenon, encountered in multiple interdisciplinary contexts. Technological advancements, combined with the strong impetus of prevalent digitality, have rendered them the number one form of entertainment worldwide in terms of power, popularity and profitability. At the same time, gamification approaches have been introduced in fields such as education, research, advertising, medical practices and others, and therefore seem to infiltrate society with new conceptions of interaction with digital environments. In all cases, the need for genuine and specially designed moments of experience is prevalent today, underlining the importance of including in the overall process multiple design aspects that lead to unique, emotionally driven interactions. This position reminds us of the challenging question of the videogame company Electronic Arts [8] "Can a computer make you cry?", who almost forty years ago presumed ideas such as the 'touchstones of our emotions', 'a language of dreams', or

a 'software artistry', highlighting the ever-present pursuit of video games with affective qualities, as well as the quest of motivating approaches of design within the production of narrative based, digital and interactive spaces in general.

On the other hand, the widespread video game epidemic meets the global depression epidemic, underlining depression as the number one factor of disability worldwide [20]. At a parallel level, video games are imbued by the paramount presence of melancholic atmospheres, who are furthermore juxtaposed to a plethora of complementary scenarios: sociocultural issues, psychological conditions, sadness, inwardness, sublimeness, beauty, utopia and dystopia, life and death, and other mature content. Melancholic features in video games either appear as an overall atmosphere or they constitute carefully designed moments of the individual's experience.

There is a long-held discussion among scientists and researchers about the agency of the videogame-depression relation. In some cases, depression has been linked to excessive gaming, and in other cases, gameplay has been considered as "the direct emotional opposite of depression." [12], or as a new form of "electronic medicine" [17]. This controversy is still missing a common ground of observation and evaluation, but still seems to share an assumption of the contemporary digital 'selves' as 'visceral', deeply personal ontologies or ephemeral and effective constructs. Their mental landscapes, either fleetingly melancholic or clinically depressed, are adapted or transformed due to electronic or virtual environments; thus the individuality of the user "meets the cultural sphere and adopts the 'symptomatological' characteristics of this new era" [11], manifesting a contemporary state of interaction, a new way of 'being' in the (digital) world.

2. Aim of the study: First Juxtapositions

In this context, the study focuses on the prevalent phenomenon of melancholy and attempts to translate its qualities into a textual-spatial construct, which can form a fertile ground for discussion on design practices that deliver digital and interactive experiences capable of affecting their users on an emotional level. In the same way that "architecture elaborates and communicates thoughts of man's incarnate confrontation with the world through 'plastic emotions'", digital space is translated in a vocabulary that has the potential to express the electronic user's mental encounters with the melancholic phenomenon.

Melancholy is a timeless concept, probably one of the most intricate, and controversial states of mind, standing out over the centuries as one of a kind, due to its beauty, permanence and ambiguity. It is a condition with clinical, scientific, artistic, or philosophical implications, and over the centuries it has been interpreted as a sinful state of mind, a silent disease, a type of idiosyncrasy, a proof of genius, or a potential source of inspiration.

Melancholy has an inherent relationship with space. It constitutes a straightforward reference to allegorical or symbolic constructions that do not relate to a strict conception of physics or mathematics, but to a kind of anthropological space, a space that is both elusive and immeasurable, just like digital space. The same happens with the displacement of the self during digital experience. Both the melancholic subject and the electronic user watch their 'demons' - a haunted version of their selves - from a distance (in spatial or mental terms).

Also, the descriptions of the melancholic condition from the past to the present have always been inseparable from the metaphoric use of spatiality. Thus, the research takes the form of a conceptual 'dissection' – it originates from metaphoric schemata and finally tracks a series of design

elements that are in dialogue with the melancholic condition and all the innate characteristics of this intimate and deeply ambivalent human state of mind.

On a parallel level, melancholy is in dialogue with a series of issues that relate to creativity or to compositional practices. Melancholy is the only emotion that encloses shades of all other emotions. When being melancholic, one can relive and reflect on memories and fictions, thus one can experience, joy, love, longing, sadness, and all other possible emotions in the context of one and unique mental state" [3]. This observation demonstrates a very distinct case of emotional ontology that appears to be in need of a differentiated manipulation or design approach.\

Also, the melancholic practice is equivalent to the use of imagination: its reflective nature is imbued by a touch of indulgence. In this way one creates scenarios, as sources of pleasure and meditation, an act comparable to art, cinema and other audiovisual practices. Burton points to the unavoidable spark of creativity when being melancholic: "A most incomparable delight it is so to melancholize, and build castles in the air" [4].

In the same context, the melancholic reverie has a strong associative structure, which strongly relates to a narrative construction mechanism. It is in the unfolding of its narrative and its temporality that this specific emotion develops. This brings forward an overlap with video games as a narrative form - Guillermo del Toro describes, "I think video games are going to completely take over storytelling in our society" [9]. In this framework, melancholy can be further juxtaposed to other time-based media as well.

Finally, its ambivalent and 'bittersweet' nature, its dual interpretation as a sin or a virtue, a pleasure or an agony, an inspiration or a state of despair, offers it an aesthetic quality, a rhythm of components, a strength to shape things, and consequently establishes it as a compositional 'tool', similar to the use of 'light and shadow' in visual arts, or 'the void and the solid' in architecture.

3. A collection of typologies

Following the initial theoretical collocations of multiple research fields, the study ventures the invention of what is missing - a common ground, a shared language or an interdisciplinary 'guide' of notions that will help decode the design aspects of the melancholic ambiance in video games. First, an anthology of concepts is compiled in a monograph about the 'poetics of melancholic space'. In this context, a series of recurrent metaphoric typologies of space relating to melancholic experience are narrowed down and analyzed under the following themes: darkness, night, shadow, descent, demon, pause, silence, polymorphism, reflection, kiaroskuro, distance, transference, passage, absence. This piece of writing is bringing together latent personal experience with diverse interpretations of the phenomenon, and a backbone of architectural thought. Afterwards, these notions are used as a specialized vocabulary in order to test the process of the atmosphere creation in a series of video game environments with a distinct use of melancholic settings, moments or moods.

The initial observations included games that stated an explicit relation to the phenomenon itself, through their marketing 'image' creation, their scope, or their background theoretical support. Thus, games relating to melancholy, sadness, or the depressed condition were studied. However, even greater interest was found in videogames that were excluded from this categorization group, pushing the boundaries of the research study even further, towards games that were at first placed 'out of the box' – in other words, games which make use of the spatial concepts selected in the

first stages of the research, but which play an important role in the creation of the melancholic atmosphere basically for entertaining purposes. There follows below a selective commentation on characteristic videogame examples that manifest the conceptual dialogue between the use of spatial representation and the melancholic atmosphere in digital environments.

4. Selective commentation

The melancholic condition is most commonly expressed through the metaphor of darkness. Environments that are dim, undecipherable, or lack 'perspective' are usually connected with strong personal experiences of sadness, grief or despair. In architecture it is well known that "light affects the state of mind in a way that goes beyond its simple functional role" [6]. In the same way, Pallasmaa describes that "in intense emotional states and deep thoughts, vision is usually suppressed" [15]. Likewise, any absence of light, nightscapes, blindness, or the metaphoric use of black color, appear to 'haunt' many videogames with a melancholic condition. In video game 'Inside', the use of light is very important in the creation of the atmosphere, while making an interesting association with its title, which reminds of the description of darkness as a deeply personal space. Melancholy, just like darkness, "envelops me on all sides and penetrates me much deeper than light space;" [13].

Melancholy and blackness share an aesthetic quality of a lack of color. Contrariwise, color is a shared metaphor for happiness or life. In the game 'Prune' a minimal and colorless representation of the environment forms the setting for growing up trees that struggle to move from shadow to light in order to blossom. The sparse and selective use of color augments the melancholic ambience through the use of contrasting associations.

In other cases, the melancholic absence of color takes the form of a silhouette aesthetic, or of an extended use of shadows as the main visual components in design. Games such as 'Limbo' or 'Lyila and the shadows of war' make use of shadows as artefacts of atmospheric design that denote the melancholic 'presence of an absence'. In both games, the narrative relates to death, therefore, making the viewer contemplate on shadows as bearers of thoughts, memories, or other internal processes.

Another representational gesture that relates to melancholy is the use of descent. The act of descending may refer to a psychological state (the feeling of moving 'downwards') or to the process of 'going deeper' towards the depths of one's 'soul' – what in other words Ferguson would describe as "a retreat from the void of the external world" [10]. 'Silent hill 2' characteristically employs the feature of descending in a deliberately disproportionate and illogical amount of time during the game. "James is constantly moving in a downward direction." […] The amount of time spent descending is, from a purely logical standpoint, impossible" [18]. In other games, one can find differentiated approaches of the idea of 'falling', like the following comment in 'Thomas was alone': "what if there was some kind of inverted fall – some way to 'jump'"? [19]. The use of ascending and descending as a factor of spatial organization of the gaming environment is very common in video games. In 'Elude' for example, the player is asked to move upwards towards the top of the trees finding happiness, despite the fact that he falls and has to climb up repeatedly. Moving in space on a vertical axis has an additional emotional impact as a design gesture, since the physical body's activity on this axis is not that common. Besides, if the body moves 'downwards', it is theoretically crushed on the ground, reminding us of the etymology of 'depression' [14]. Also, the act of descent when combined with the metaphor of darkness, both refer to the direction which is opposite to the sky (verifying the rather mutual assumption about where the 'light' comes

from). In some cases, descending is placed next to a contrasting feeling of flow and tranquility. Both in 'Alto's Adventure' and in 'Alto's Odyssey' the player enjoys an experience of descent combined with a feeling of awe and inspiration, or with the sublime of nature and its temporality: skateboarding continuously from dusk till dawn, offers a melancholic effect of accelerated time, as short-lived days (as well as life) keep fleetingly passing.

The melancholic subject has been described throughout the centuries as a polymorphic haunted being: 'the beast', 'the dragon', 'the blue devil' are some of the symbolisms that have been used in order to depict its flaws and failures or its distantiated ontology from the subject itself. One of the symptomatological dysfunctionalities of melancholy is a sense of rigidity, heaviness or even paralysis of the body, physical states which at the same time underline the vigor of the melancholic mind. Thus, the representation of the melancholic condition has been encountered in multiple melancholic paintings, through the recurrent 'gestus melancholicus' - that characteristic 'head-in-hands' posture, also found in the famous Albrecht Dürer's engraving Melencolia I in 1514.

Any lack of action helps the subject delve into its thoughts or create associations with other mental images. Video games are making use of this tactic. Action that is not really advancing, or encourages inactivity, makes the player inhabit a kind of slow time, or a 'pause' during gameplay. In 'Heavy Rain', "everything is balanced to take the player down to passivity, to almost non-activity, obliging him/her to take the time to feel the emotional experience the game is proposing." [21]. In 'Depression Quest', options diminish over time, while close ups of objects or details, disclose a lack of open or distant view. The sense of free space or of optionable 'movement' is narrowing down. In a similar sense, 'Actual Sunlight's' spatial representation is reflecting an inert state of rumination of the self. Spatial abstracts such as a bath mirror that is long broken, rain falling, or the protagonist lying on the bed for hours are revealing a sense of spatial inertia, stillness, or in other words, an inability change, to move to another state. In this context, the story script mentions "every night you think tomorrow is the day you are going to do it" [1]. In the game 'Please Knock on my Door', the house also manifests repetition of everyday mundane practices, while keep being enclosed by an introvert personal environment. The game remarkably makes use of some rare changes in the camera's points of view, breaking away from the continuous floor plan views by symbolically looking out of the window just for a few moments. In the last two games, the use of detached floor plans, represent an introvert state, a lack of contact with the outside world. In terms of melancholy, the player can observe the situation, from a distance, from above, from another point of view which gives the opportunity to reflect on what one sees, or spare some time to contemplate on the events.

On the contrary, games like 'Flower', offer the player a deeply emotional experience of exploration and travelling, almost flowing freely in natural environments that evoke awe and wonder, leaving him with a positive experience. Or the game 'Everything', manifests that feeling of moving to the next moment, to the next moment, towards eternity, while getting in touch with nature in all levels. In the game 'Journey' flow is juxtaposed to the idea of silence, or wilderness. The melancholic construct in this case relates to the act of travelling in a vast desert, making an interesting association with the journey of life, while still not communicating with speech one finds a companion during the voyage. In a similar way, a lost man on an uninhabited island in 'Dear Ester', is blending his loneliness with the loneliness of the island, the past and the present, or the sense of life and death, through his encounters with shipwrecks and dilapidated structures. In all these cases, the landscape is reflected back to the self, making the player experience a kind of transference of the spatial features, or internalizing his/her relation to the world. As Kiki Dimoula describes: "…

Thus as the window hugged me with one hand, I pull inside the room, the unbelievable loneliness of the street, with the other hand, I grab a handful of darkness, and throw it onto my soul." [7]. In this sense, dystopian or postapocalyptic environments in games, are perfected by a narrative that comments on loss, transience or vanity of existence, resulting in an effective melancholic gaming ambience.

This observation rather relates to the construction of a 'memento mori' effect - which is also articulated through spatial artefacts with historical, temporal, mnemonic connotations. The melancholic mechanism in this case constitutes in the creation of a strong aura, which relates to the sense of realization of a nostalgic absence which is distant in the past or in the future. As Bowring describes, melancholic spaces are perceived as both retrospective and prospective [2]. In 'A-partment', for example, space takes the form of a relic of the past, while players explore a dream-like semblance of an apartment which is at the same time an intimate look at the owner's state of mind as he picks through the wreckage of his relationship with another person. Or in other cases one may reconcile with mortality or the end of things, through paraphernalia like skulls, tombs, poisons, morbid figures, dust, bats, or hourglasses. This reminds of the reason why beautiful environments stimulate a sense of melancholy - whereas melancholic zealots [5] are those who suffer the most from beauty and its ephemeral character.

Ephemerality is sometimes complemented by liminality or seasonality emphasizing on the melancholic emotion. In games like 'Proteus', melancholy proves to inhabit "the liminal, the times and spaces of transition" [2], on the threshold between seasons, which can be anthropologically translated as well as a ritual passage between ages or life stages. This experience of transition can be represented through fleeting elements of nature, such as the twilight or the sunset and their distinct color palettes, the representation of a sunray on a window after the rain, the touch of the wave on the shore, or, all those unique and evanescent moments that last for such a short while and then they are gone. The game 'Passage' boldly shows the transience of life by condensing life journey in just a few emotionally deep minutes (and pixels) of gameplay. In the same way the use of weather conditions in games like 'Rain', 'Three fourths home', or 'It's winter' is strongly related to melancholy. It is not a coincidence that autumn and winter form the highest peak seasons for the onset of depressive episodes. Especially, in 'Heavy rain' "the weather changes right after an important event, from being very sunny to being very rainy, lasting for the entire game and so giving the game its name. The father's apartment is smaller than the previous house with much darker light and almost no color; everything seems grey." [21]. Spatial representation in this case is inseparable from rain, in the same way melancholy is attached to the player's soul during the advancement of the narrative.

Transience shows a differentiated state in place or in time, and this brings to the surface the very essence of the melancholic phenomenon: the aforementioned nature of contradiction, the ambivalence between joy and grief, genius and demonization, nostalgia and relief that follows the phenomenon from its beginnings. "Melancholia appears under the dialectic of illness and empowerment." [16] In many video games one can find an integration of this aesthetic quality in the concept design. In 'You are a 100klights away', inspired by 'The Starry Night' by Van Gogh, loneliness is juxtaposed to beauty through a meditative journey in space, in 'Entwined', the advertising slogan presents a bird and a fish which are 'always together, but forever apart', or in 'Monument valley', spatial interaction of a mother and her daughter reveal the child's journey from dependency to self-sufficiency during the game. In all cases, the contrast or the transition from the

one state to the other is of utmost importance in terms of emotional impact.

'That dragon cancer', an autobiographical game about a young boy who was diagnosed with terminal cancer, is making use of dipoles and paradoxes which are crucial in the expression of the narrative. It probably constitutes one of the most special cases of contradiction in a multiplicity of levels, such as the purpose of the game (it is a game in which you are intended to lose), the nature of challenge (its difficulty to play does not relate to game mechanics but to the player's courage to experience the upcoming tragedy), the representation (the playfulness of the toddler is combined with the finality of his disease). Various image abstracts present a faceless boy, a fluorescent saline solution, a crazy wagon ride taking place in hospital corridors, a playground surrounded by unnaturally huge tree trunks, parents swinging over a dangerous cliff, the boy flying in the sky with the help of balloon-cancer cells.

5. Conclusions

The aforementioned examples are just some of the implications of this research in terms of emotionally-driven design, in the context of digital culture. Video game environments are observed through an architectural point of view - representations, concept design, audiovisual language, interactivity processes are taken into consideration - highlighting in this way multiple issues of spatiality as potential factors of an experiential design. The notion of 'space' forms the guide through which the 'art of melancholy' is observed, revealing multiple metaphoric elements that the melancholic phenomenon introduces such as 'shapes', 'materials', 'structures', 'relations', 'transpositions'. A series of spatial melancholic features collected and afterwards, applied to video games, appear to share a common ground with existing virtual environments or digital experiences.

In this context, the study proposes a process of architectural 'anatomy' of the emotion – the assumption of an inherent spatial identity of game environments, and its further contribution to the overall ongoing research on affective or experiential design. The selection of a game environment does not only imply an architecture, but also an experience, a way of seeing or acting, a version of ourselves that is offered to be 'relished'. This observation forms the ground for analyzing existing virtual environments or digital experiences but is also fostering new ways of designing spaces that will be consumed as potential ways of 'being'.

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Angeliki Malakasioti is an architect, artist and academic, teaching courses on digital media design, audiovisual representations and transcendental cyberculture in different Universities. She has completed a Doctoral Thesis on the "Anatomy of the Digital Body - Spatial Aspects of the Self and the Immaterial on the Web" and currently she has fulfilled a post-doctorate research on "The Architecture of Melancholy – the Case of Video Games". Her academic and artistic interests deal with digital experience, immaterial architecture, audiovisual narratives, speculative design and creative methodologies. She has participated in multiple international conferences, art and film festivals and exhibitions and she has received prizes of experimental film making, photography and "Art as Research" contributions.

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A virtual tour in Ancient Worlds

Nikos Konstantinou[1], Andreas Giannakoulopoulos[1], Iraklis Varlamis[2]

[1] Department of Audio and Visual Arts, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece
[2] Department of Informatics & Telematics, Harokopio University of Athens, Athens, 176 76, Greece

Abstract

The use of video games or 3D virtual worlds in the production of animation projects is a very common practice. However, there is limited research on investigating the impact of a theoretical framework of Digital Storytelling on a machinima production. This paper aims to establish the connection among virtual worlds, machinima and digital storytelling and recommends a method for using them as learning tools. In order to achieve this, we guided high school students from Turkey and Greece, who participated in a e-twinning collaboration project, to produce a short animation film about a local ancient monument of their area using the aforementioned tools. In this work, we present the outcome of the Greek students, who created a machinima film, using Opensim virtual world platform. The approach was evaluated using a theoretical framework for digital storytelling and indicated positive results.

Keywords

Virtual worlds, machinima, digital storytelling, collaboration

1. Introduction

Virtual worlds have been utilized as educational platforms for over a decade attracting the interest of the educational community [1]. The main advantages of 3D environments are their participants' high level of motivation and engagement combined with the authentic and collaborative learning. Moreover, a captivating aspect of virtual worlds is the utilization of the 3D environment in order to narrate stories and to produce short animated films known as machinima.

The purpose of this paper is to present the experience that Greek 16-year-old students had in a project combining 3D virtual worlds, digital storytelling and machinima and their learning outcomes. In this project the main concept was based on a virtual journey in 3D simulated ancient worlds. The 3D platform was the infrastructure, where students from Greece and Turkey who participated in an e-twinning[1] collaborating program were gathered together. Students were taught how to build 3D simulations and representations of ancient monuments from their countries. Therefore, an online virtual world called GEA (Global Educational Area), was implemented on the Opensim platform, which is an open source software for creating 3D virtual environments. In GEA both groups of students were able to experiment and construct any part of the chosen monuments. After constructing the 3D content, students were asked to write dialogues in order to create a role-playing game simulating a story that had taken place in their country's monument. The whole activity of the Greek partner was recorded and used for producing a short-animated film with titled "Odysseus visits Nekromanteion …the Oracle of the dead" [2]. The main concept of the film was

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1   https://www.etwinning.net/en/pub/about.htm
2   https://youtu.be/iNB2Y2cajwI

based on Homer's rhapsody "λ" in which Odysseus descents to Hades. In an effort to combine the myth with reality we decided to place Hades in the Nekromanteion[3].

All students worked in groups, collaborating with each other in order to complete the project. Students from both countries were in contact and exchanged ideas during the whole project, which lasted approximately 4 months. The main objective was for students of one country to experience different aspects of their local history and to inform their peers from the partner country about the local monument.

At the end of the project, students of one country evaluated the digital story of the other, using an assessment tool that was based on a digital storytelling rubric [2]. The results depict an overall satisfaction regarding the quality of the content that was created by Greek students.

During the whole project, we confronted technical problems, such as performance issues and interface difficulties, similar to those cited in the literature [6]. However, the overall experience was positive. Students from both countries had the opportunity to unleash their creativity, to gain and exchange knowledge in an experiential way through the dialogues they wrote and the role-playing game they created and to participate in the virtual environment.

In the following section, an overview of the concepts of virtual worlds, digital storytelling and machinima is performed. In section 3 we provide details on the design and implementation of the project. Section 4 contains details of rubric evaluation. Finally, section 5 summarizes our conclusions.

2. Related work

2.1. Virtual worlds

The educational aspect of virtual worlds was highlighted early on, almost with the emergence of this technology. The 3D content design flexibility, the ability to construct cognitive artifacts, the realistic representation, the virtual meetings and collaboration offer a great learning potential to educational community [4]. Virtual worlds have also integrated gaming characteristics, which enrich and enhance the learning process [9]. Although virtual worlds did not reach the initial prediction [18], they are still being used by thousands of users[4] , while the overall virtual reality application users have reached a huge number of 170 millions[5] showing a global and constant interest in this field.

According to modern pedagogical methods, instructional design in virtual worlds focuses on active and student-centered learning. Teachers play the role of facilitator, thus intervene only when necessary, giving learners more freedom to develop new forms of creative expression and experimentation. Participants feel free to express themselves using avatars [15], they experiment safely, solve problems, understand concepts, interact with the environment and cooperate through role playing [7].

Undoubtedly, educational activities in virtual worlds need to be carefully designed, following modern teaching strategies in order to establish an interactive, collaborating, creative and productive learning environment.

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3   http://odysseus.culture.gr/h/3/eh351.jsp?obj_id=13721
4   http://dwellonit.taterunino.net/sl-statistical-charts/
5   https://www.statista.com/statistics/426469/active-virtual-reality-users-worldwide/

However, an interest regarding the utilization of virtual worlds over time has emerged showing that this technology has not been mainstream mainly due to the lack of funding in educational institutions, as well as in the absence of technical and teaching support [6].

2.2. Digital story telling (DST)

DST is a combination of telling stories by using digital technology such as graphics, text, video, audio and images. Digital stories can be categorized into: personal narratives stories, historical documentaries, stories that examine dramatic events that help us understand the past, and stories designed to inform or instruct the viewer on a particular concept or practice [12].

DST can be an effective tool in the hands of a teacher. It can be used as an engaging mean to present new ideas and attract the interest of students. It can be also an effective tool in students' hands. Based on constructivism theory, students can express their creativity and enhance their knowledge construction by researching a topic, choosing a particular point of view or answering to a dramatic question. At the same time, students who participate in a DST project develop their communication skills as they need to organize their ideas and compare opinions in order to conclude to the final stage, which is the digital story's script. Another advantage of DST is that it can help students present their creativity to an audience or to public through the Web, which means that they commit to a carefully designed and serious presentation. Furthermore, students working in groups can share their digital stories and can be asked to evaluate each others' work. According to social constructivism learning theory this is a valuable learning process in which students construct knowledge being influenced by their peers' work [11].

However, research on the educational utilization of DST shows controversial aspects. Teachers and instructional designers should avoid an uncritical use of digital storytelling [14]. Both students and teachers should take into consideration some specific criteria when using DST, for example the Dramatic Question (a question that must be answered by the end of the story). Furthermore, they must take into consideration what type of technology is needed and if that technology can be accessed and can be used by everyone. It is worth noting that there might be copyright issues when students use digital files. They should be informed about copyright licenses and should be encouraged to use free and open access files.

2.3. Machinima[6]

The use of 3D game technology in the production of short animation movies is an old practice that goes back to the90s. It was established as a culture of using videogames in order to promote players into performers [10]. One of the first known attempts was the "Diary of a Camper" on October 26, 1996, a short animation film based on Quake game. This practice is called Machinima which is based on the phrase machine cinema. Machinima has advantages and disadvantages when compared to other styles of filmmaking. First of all, it is a simpler way to make an animation movie compared to other more advanced and complex animation software, which means that almost anyone can produce a low cost and low effort animation movie. Of course, the simplicity has drawbacks such as the limitation in the available characters' expressions and movements, which are poorer in comparison to more specialized animation tools. However, today some game companies have developed dedicated software in order to endorse people's machinimas.

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6   http://wiki.secondlife.com/wiki/Machinima

3. Implementation

Our project was based on the combined use of the three approaches described in previous section. We decided to use the Opensim3D virtual world platform as an infrastructure, and digital story telling practices supported by machinima in order to produce a short animation film.

The sense of «presence» (like I'm there) is a major advantage of a 3D virtual environment. Students during the construction of virtual monuments were able to feel the coexistence of their peers (from the other country), to solve problems together in real time, to share opinions, to interact with each other, to make jokes and anything else, which describes the meaning of collaboration. The sense of this coexistence in the virtual environment enriched the experience of collaboration between students from the two partner countries and evolved in a form of "virtual hospitality". Consequently students had the opportunity to feel closer and cooperate with their foreign peers. The main objective was students to learn about local monument and history utilizing 3D virtual worlds, machinima and digital storytelling trying to apply the Seven Elements of DST. Some supplementary learning objectives for students were to:

- browse and use basic elements of a three-dimensional virtual world and construct 3D digital objects,
- store, retrieve and organize digital files,
- cooperate in order to solve problems,
- develop their critical ability through interaction with the environment and others,
- write the dialogues for the digital story according to specific DST criteria,
- communicate and cooperate with their fellow students from the partner country,
- interact with local authorities (Archaeological Service, Municipality) for the collection of information

At the beginning, the Greek students were assigned to gather information online about Nekromanteion, the monument they had chosen to represent in the 3D environment. As part of this first step, we organized a visit to Nekromanteion and a discussion with a representative of the local Archaeological Service about Nekromanteion's operation during Antiquity.

Then the next step was to provide our students with the necessary instructions in order to get familiar with the virtual environment and construct virtual items in order to build the virtual monument. Within the environment, the students from both countries were able to participate in virtual meetings (using voice chat), doing small construction steps and gradually completing the final structure of the overall monument.

Figure 1. Virtual meeting with Turkey partners

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The students worked in groups building 3D objects one or two hours per week for the second and third month. Subsequently, they thought of an imaginary event, which would have taken place in the authentic environment of the monument during the era of its operation and they wrote the dialogues that were used for a role-playing game and the digital story. The students spent one to two hours per week during the fourth month in order to write the dialogues for the story. All the material that has been produced during the program was gathered in a digital archive. The final stage was the role-playing game, where 8 students impersonated persons of that time that have been engaged in an imaginary event. The final product was the role-playing game, which was filmed as a digital story and machinima.

Figure 2. The process: A top view of Nekromanteio, was imported as jpeg image in the 3D virtual world. Based on this image the students with the help of their tutor, built part by part the whole monument. On the right is the machinima "Odysseus visits Nekromanteion ...the Oracle of the dead.

During the project, students had to search for dialogs from the script of Odyssey, more specifically from the L rhapsody, in which Odysseus travels to the underworld to meet Teiresias (the blind prophete) in order to take his advice on how tore turn to Ithaki. So, they adapted the lyrics of Odyssey in order to create the imaginary story. The story played in the 3D simulation of Nekromanteion combining the myth of the descent of Odysseus in Hades with the historical hypothesis of the operation of the Necromantion.

4. Evaluation

At the end of the project, students of one country evaluated the digital story of the other

country using an assessment tool based on a digital storytelling rubric [2]. The purpose of this evaluation was to highlight how well students applied the Seven Elements of Center of Digital Storytelling in Berkley, California [13] as described below:

1. Point of View	If there were a clear point of view in each part of the whole story
2. A Dramatic Question	If there was a central dramatic question and if it was answered.
3. Emotional Content	If there was content that contributed to creating an atmosphere
4. The Gift of Your Voice	The quality of voice in narration of the story.
5. The Soundtrack	If the music and soundtrack was fitting with graphic and the story.
6. Economy	The balance of details in the story, the right amount is demanded.
7. Pacing	How the rhythm of voice and punctuation helps or bother the audience.

For each one element, Turkish students were asked to evaluate Greek students' digital story by using the evaluation rubric. They rated Greek students' work in scale from one (worse,) to 4 points (best) using an online questionnaire created in Google Forms. In order to present an example of the evaluation rubric the questions-criteria were formulated as follows:

Point of view

- The point of view is well developed (4 points)
- The point of view is stated but does not connect with each part of the story. (3 points)
- The point of view is stated but no attempt is made to connect it to the overall meaning of the story. (2 points)
- The point of view is only hinted at or is difficult to discern. (1 point)

	Min	Max	Mean	Stdev
The point of view is well developed.	1	4	3.05	0.79
A meaningful dramatic question is asked and answered within the context of the story.	2	4	3.45	0.67
Content create a distinct atmosphere or tone that matches all parts of the story.	2	4	2.82	0.85
Voice quality is clear and consistently audible throughout the presentation.	1	4	2.36	1.00
Music stirs a rich emotional response that matches the story line well. Graphics coordinated with the music.	2	4	3.05	0.65
Economy: The story is told with exactly the right amount of detail throughout.	1	4	3.09	0.87
The pace (rhythm and voice punctuation) fits the story line.	1	4	2.50	0.74

Table 1: The evaluation of the DST-machinima animation film (1:worse – 4:best)

Relating to the question if students followed successfully the seven elements of DST the results of evaluation rubric are in general satisfactory. Results indicate that Turkish students evaluate the 1st, 2nd, 5th and 6th element with high rates.

More specifically "The point of view" was considered as well developed (3.05), which means that (audience) students understood explicitly the (authors') students' perspective. "The dramatic question" also was rated with 3.45 meaning that a key question was clear and answered by the end of the story. In our case the dramatic question was "how Odysseus and his partners can return back to their country Ithaki". Music and soundtrack were rated with 3.05 indicating that music supported the DST and contributed to make the corresponding atmosphere. Finally, "Economy «was rated with 3.09 showing that the digital story was presented with adequate details without overloading the audience.

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On the other hand, the elements 3, 4,7 had a total score less than 3 points indicating a slight weakness. The "Emotional Content" was evaluated as the content didn't match all parts of the story. The "Voice Quality" was considered to be not so clear with the lowest score of 2.36 points. Obviously, the pronunciation of English and the narration skills of Greek students wasn't clear throughout the story and could be improved in another attempt. Finally, the pace was rated with 2.5 indicating that rhythm and voice punctuation could be further improved.

The learning outcomes of our project indicate that the students expressed their creativity and completed the learning objectives, although we confronted many difficulties (performance, connectivity, familiarity with the platform).The majority of Turkish students evaluated Greeks' machinima film mostly with 3 to 4 points based on DST rubric, which satisfied our students as their effort was recognized. Turkish students confronted more difficulties because they were less familiar with this technology.

5. Acknowledgements

This article presented our first attempt to combine 3D virtual worlds, with digital storytelling and machinima in order to develop a learning activity for high school students, introduce them to the tools and have them evaluate their own result. For this, they developed the Virtual Tour in Ancient Worlds project in which they worked on a standalone Opensim virtual world, practiced with the Seven Elements of Digital Storytelling and employed the machinima technique for presenting their collaborative project.

The results of the evaluation rubric, that the Turkish students completed for the work of their Greek teammates showed a general success. The main objective was for students to attain knowledge for their local history by constructing a simulation of a local monument using historical facts and information they gathered both online and from local authorities. They recorded the whole process as an animation movie and presented the result to their peers in a short film that demonstrated the monument, its history and its role in local community.

Despite the difficulties, we would state that it was a successful project, or a success (digital) story, but it wasn't a success due to the quality of 3D content or the artistic level of the film, the success was about the communication and collaboration. Turkish and Greek partners worked together distantly, became virtual friends and they realized that we are not so different, we are close enough to work together

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Nikos Konstantinou is an ICT teacher at the Kanalaki High School, Preveza. He previously worked as a Microsoft Certified Systems Engineer in the private sector concerning the design and installation of network systems. He received his MSc in Virtual Communities from Panteion University. He holds a PhD in the field of Virtual Worlds and Game Based Learning. His research interests vary from educational technology, game-based learning and gamification to virtual Communities and their application to education. He has published some articles in international journals and conferences concerning the use of 3D virtual learning environments in the learning process, serious games as an educational tool and teaching programming through digital games.

Andreas Giannakoulopoulos is an Associate Professor at the department of Audio and Visual Arts of the Ionian University, where he teaches courses related to Internet Communication, New Media and the Web Technologies. He holds a BA (Ptychio) in Economics from the University of Athens (UoA), a BA (Ptychio) and a Master of Arts in Communication and Media Studies from UoA, and a Master of Science in Logic from the University of Amsterdam. His doctoral dissertation, approved by the University of Athens, was in the field of web accessibility. The main areas of his academic activities are computer mediated communication, web technologies and e-learning systems as means of effective online communication.

Iraklis Varlamis is an Assistant Professor at the Department of Informatics and Telematics of the Harokopio University of Athens. He holds a PhD in Informatics from Athens University of Economics and Business, Greece and an MSc in Information Systems Engineering from UMIST, UK. He has been involved as a technical coordinator in a number of EU funded projects concerning knowledge management, data mining and Machine Learning. He has also coordinated several national R&D projects concerning data management and personalized delivery of information. He has authored more than 100 articles concerning text and graph mining and intelligent applications in social networks and the web and received more than 1600 citations. For more information visit:http://www.dit.hua.gr/~varlamis

DCAC

Session 3

Art and Technology

Contemporary Internet activism and its artistic perspectives

Vasileios Bouzas[1]

[1]Associate Professor, School of Fine Arts, University of Western Macedonia, Greece

Abstract

Nowadays, social movements are usually about narratives promoting radical changes that target social changes of a much smaller scale rather than narratives promoting radical changes of society. Thus, we are facing a series of movements that develop practices relate to consumers' identity, rights and obligations, national, gender, civil liberties, environmental, waste management issues. Within such an environment, the present paper explores forms of social interference, as they are being developed today and in particular through the use of Internet. It examines the categories, the historical continuity, the characteristics as well as the artistic identity of online practices that aim at changing and reforming the existing social structures.

Keywords

Art, alternative, internet, activism

The view of art as a field that is not separated from social life is as old as its history. For example two paintings of the 19th century reveal the artists' intention to get involved in some way with the social situation and criticize the social structures. Both have been created shortly after the French Revolution, the one on the left just one-year after the revolution and the right one a few years later.

Figure1: Left: The Stone Breakers, Gustave Courbet. Right: Gleaners, Jean-François Millet 1857.

On the left (Figure1) you can see "The Stone Breakers" a painting (1849) of social realism by the French painter Gustave Courbet depicting two peasants, a young man and an old breaking rocks. On the right (Figure1) "The Cleaners" an oil painting (1857) by Jean-François Millet presenting a realistic view of poverty and the working class, it immediately drew negative criticism from the middle and upper classes who perceived in it as an alarming intimation of "the scaffolds of 1793"[1].

If we look at the history of art of the last century, we can definitely recognize critical thinking and resistance to dominant ideologies at a series of movements such as cubism, conceptual art, pop art and others. We will definitely conclude that movements like Dada and the Situationists are the cultural precursors of the online alternative and activist movements aiming contradicting the

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1   https://en.wikipedia.org/wiki/The_Gleaners

dominant ideology. As Kellner states: "The Situationist project, by contrast, involved an overcoming of all forms of separation, in which individuals would directly produce their own life and modes of selfactivity and collective practice"[2]. Debord wrote [5]: "People's creativity and participation can only be awakened by a collective project explicitly concerned with all aspects of lived experience."

A transition became evident in the last century and especially from the 60s to the 80s concerning the objectives of social movements. There was a gradual shift of the objectives of collective actions from issues concerning society as a whole, such as the position of the labor movement within the society, the anti-war practices and the protection of civil rights, to issues concerning relatively smaller scale themes related to fields such as local ecology, gender issues, identity movements, animal rights nutrition habits etc.

"Tactical media", a new term coined in 1996 describes interventionist media art practices that engage and criticize the dominant political and economic order. In addition, the "subversive form of populist remixing" of media practices as McIntosh states over time has been given many names over time including: "appropriation art, media jamming, détournement, found footage filmmaking, avantgarde film, television hacking, guerrilla television, telejusting, political remix, subversive remix, scratch video and fan viding along with more stagy designations such as cultural terrorism or cybernetic guerrilla warfare [6][3]. The classification of the online and more generally the media alternative practices beyond the characteristics of the actions as constituted by the use of the new medium is definitely associated with earlier forms of resistance.

2. The classification of different types of alternative activities

Some of the mayor categories based on the classification provided by Leah Lievrouw at her book "Alternative and Activist New Media" are analyzed below [5]:

-The interpolation, distraction and transformation of meanings contained in the dominant aesthetic forms of the communication methods of corporate as well as of the folk culture. This tactic usually refers to a practice called cultural jamming with origins in movements such as dada, situationists and pop art. The aim of this tactic is the harassment and distortion of pictures logos of commercial products, promotional posters, billboards, later TV spots or other corresponding phrases of the advertising field in order to alter their messages and create conditions fostering critical thinking. By the use of new media and particularly of the Internet, this tactic of harassment and reversal of consumer contents is gaining in momentum and enjoys an unprecedented scale of spreading of their messages. A recent example of this category is "The Yes Men" group which is a culture jamming activist duo and network of supporters created by Jacques Servin and Igor Vamos[4]. As they mention in their website "The Yes Men" primarily aim to raise awareness about what they consider problematic social issues. We could imagine a future development of such a practice in the engagement and variation of online advertising practices. In his article "The New Culture Jamming: How Activists Will Respond to Online Advertising" the author Alexis Madrigal rightly predicts that activists will find the best way "to disrupt corporate power on the Internet" by interacting with the ads they appear and "muddying the data that's being collected"[5].

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2   https://pages.gseis.ucla.edu/faculty/kellner/papers/medculturespectacle.html
3   https://journal.transformativeworks.org/index.php/twc/article%C2%AD/view/371/299
4   https://www.youtube.com/watch?v=TeDTg0zOPGI
5   https://www.theatlantic.com/technology/archive/2012/05/the-new-culture-jamming-how-activists-will-re-spond-to-onlineadvertising/257176/

-Participatory journalism and the subsequent enrichment and extension of the information, which is provided to the public in different directions including marginal communities. It is important to mention that in this way we can have the empowerment and the possibility of expressing and communicating socially excluded groups on matters relating to social conditions such as dislocated groups, gender issues, etc. This category includes all online actions aimed at informing citizens through different channels and sources that differ from the dominant media (mainstream media). It concerns participatory online practices in which the public is called in most cases to interact and participate. It includes blogs and social media sites where writers and readers express their opinions and are discuss events and contemporary issues. In this category we can include the empowerment of the expression and the communication of socially excluded groups on matters relating to social conditions such as dislocated groups, gender issues, etc. An example of this category is the Indy media and its Internet-based services that adopt the open source practices and the philosophy of participatory journalism by citizens in order to provide alternatives to prevailing news and opinions [5].

-The developed self-organization and management practices through the creation of open-source communities as well as the use of code as a force to reveal the imposition of the sovereignty of the media, the corporate and the state and as a tool of resistance reaching the limits of sabotage. This category refers to the open source community and the developed practices that promote collaborative and participatory environments where passive users become active by their involvement in software development. Thus, the applications' development may have far different targets than the ones created by corporate entities. The priorities may be based on creating applications according to essential social needs and not on increasing corporate' profits as they are usually orientated. In this section we also refer to self-proclaimed hackers who believe that information technology is a force of progressive social transformation as well as of personal expression. There are many artists and groups of artists that practice artistic online interventions revealing the surveillance status of our contemporary society. Examples range from the group of artists called "Critical Engineers"[6] to "Anonymous" which is a decentralized international hactivist group[7].

-The ways that various web communities are using the medium to develop collective resistance in the real world. Internet and related technologies seem to be the ideal media for triggering and documenting practices of the new social movements of activism. In addition, this category contains the largest number of posts and videos that exist in social networks. We could say that the main feature of all this on line audiovisual material is their hybrid forms. The practice of remix with a series of styles and scriptures has historical references and are synthesized and create new species is the most common practice. Tina Askanius in her article "Online Video Activism and Political Mashup Genres"[8] creates a classification of online videos based to their context[9]: videos that call for demonstrations, videos recording interviews of cases, videos that are in the form of documentaries, videos which take the form of an online archive and- videos that have the remix feature called political mash-ups. Tina Askanius refers to Horwatt [1] who mentions that these remixes in the past (at the analogue era) concerned films of second-class film wastes that the creators could obtain

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6   (https://criticalengineering.org)
7   (https://en.wikipedia.org/wiki/Anonymous_(group))
8   https://portal.research.lu.se/ws/files/4197460/4180639.pdf. As Tina Askanius refers: "These include the mobilisation video, the witness video, the document-ation video, the archived radical video remediating historical work and finally, the political mash-up video."
9   As Tina Askanius refers: "These are hybrid genres within a chaotic and staggeringly abundant sea of online videos. Hence, in the proposed typology, I engage with some, but not all, of the different forms of politically committed video one can encounter on YouTube today."

without violating copyrights. Nowadays, this synthesis and incorporation of audiovisual material often originates from any source available on the Internet and from anyone, usually infringing the intellectual rights that may exist.

3. The characteristics and the aesthetic futures of the online movements

Contemporary on-line movements have certain features they basically acquire through the medium used. Some of the predominant features of these practices are described below:

-Since these movements are created within a de-localized environment (the internet space) their practices are not necessarily linked to people sharing a common geographical origin but have the potential to refer to social groups that are situated far away from the place of the confrontation. Consequently, we are faced with the cultivation of collective identities by subjects without a specific geographic reference. Certain identity features are usually created that are mainly related to a developed solidarity.

-These movements do not usually consist of groups that have the same class reference as it was happening in the past but instead these online movements are constituted by groups of different economical class references. In addition, the educational level of participants is to a large extent fairly high.

-There is an immense ability of these movements to activate the mobilization of the many by the one through the dynamics, which emerge by the capability that new media have for a global distribution of the information as well as for a local dissemination of their messages. For example the Arab spring social networks have triggered the mobilizations and the protests in Egypt. Wael Ghonim who was an "anonymous" who helped spark the Egyptian revolution in the social media, speaking at his TED presentation refers to the power of the design of social media that can lead to real changes. It is just one of the many cases that highlight the power individuals can acquire through the use of Internet.

-The relative disengagement from any discipline and guideline framework of a group of leaders in the way we had seen it in previous offline movements. Online practices involve the participants' subjective experiences, which is definitely of greater importance than the one it had in the classical ways of claiming. The participatory democracy seems to be more apparent and the need for a lifestyle commitment is more stable. As Jeffrey S. Juris mentions in his article "Networked social movements: global movements for global justice" these movements are "building horizontal ties and connections among diverse, autonomous elements" and incorporate "free and open circulation of information;- collaboration through decentralized coordination and directly democratic decision-making; and - selfdirected or self-managed networking"[10]. As Leah_Lievrouw states there is an importance of "the subjective experiences of the individual participants" and "especially to maintain the sense that movement participation is a continuous commitment or lifestyle... instead of being organized into disciplined, goal-directed drives." [5].

-Their reference to mobilization issues concerning both global community for major socio-political decisions (for example the 1999 Seattle WTO protests), and small communities for environmental issues consumer habits, eating habits, etc. There are plenty of online campaigns through applications related to everyday activities habits and cultural codes, trying to shape

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10   https://www.researchgate.net/publication/264623147_Networked_Social_Movements_Global_Movements_for_Global_Justice

critical thinking through elements that contribute to the formation of memory in a different way. For example "The McLibel case" which was "an English lawsuit for libel filed by McDonald's Corporation against environmental activists Helen Steel and David Morris over a factsheet critical of the company" [11].

-The possibilities of overcoming the obstacles that either private interests or government entities create in order to prevent the dissemination or the conciliation of information. For example at Chernobyl, in 1986 activists like Tangens managed a rapid and wide dissemination of the real Chernobyl news across Europe and then the world while the Russian government was claiming that it was just a minor incident [7].

-Despite the apparent anonymity of the Internet, the identities of the individuals that make up the community are more controlled and it is possible that entities may in various ways have a complete record of them. Even though online actions are seemingly invisible, the privacy of the participants is significantly lower. In addition, the potential of total surveillance and control of any online communication is a possible way through which entities that own the social media may trigger confrontations and provoke problems to the on-line movements.

-Finally, these movements usually do not perform continuously but are characterized by a certain discontinuity in the manner of their manifestation. The speeds with which they circulate as well as their ephemeral existence and their low cost production are also some of their characteristics.

It is important to make a distinction among the generated material created by activists for the Internet. This distinction concerns the use of the language of the medium and not the message of the communication. It concerns the material that is apparently produced by users who are not media professionals in relation to the material that is produced by artists' groups. It is obvious that in the cases where professionals of the media were asked to create media material the manipulation of the aesthetic potentials of the medium was completely different from the case in which those with an elementary knowledge of the medium which is used for communication. Most of the times the communication of the message is the dominant target of the creators while the use of the language of the medium is of a secondary importance. There are many sites of self-managing groups that definitely have a fairly poor use of interaction features and a total lack of any kind of playful interaction in their design. On the other hand, the material that is created by artists' groups or individual artists who use the Internet as a field of diverse activism, has a totally different form and incorporates aesthetic values that we usually encounter in contemporary digital art. We could say that the aesthetical issues are transferred from the field of the final output to the field of the process of the organization of the participation and the mobilizaton. "It arises from an observation of the present and from a line of thinking about the fate of artistic activity. Its basic claim-the sphere of human relations as anwork venue-has no prior example in art history..." [2]. It seems that the practices of the contemporary activists are related to Bourriaud relational artists practices as their works "..are relational space-time elements, inter-human experiences trying to rid themselves of the straitjacket of the ideology of mass communications, in a way, of the places where alternative forms of sociability, critical models and moments of constructed conviviality are worked out" [2].

4. Conclusions

The possibility of interference through the Internet in the cultural codes of societies is

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11   https://en.wikipedia.org/wiki/McLibel_case

enormous. "The networked space of flows … More than anything else, it changes the quality and structure of the physical world in which we live" [3]. Thus it could be said that it is a peaceful revolution that can take place and transform cultural codes, creating the right conditions for social change becoming involved in both issues related to everyday life and those concerning wider political events. What might have been the hope for the Internet was the great freedom it gives to the movements' ideas and the great potential for participation. Nevertheless, the Internet has been widely used, like other forms of media have been in the past in a totally different way, essentially aiming at the cultural emancipation and the subjugation of social groups. At the same time although the deep knowledge of the language of the medium often leads to the production of complex and highly aesthetical works, most of the time these works are characterized by an inability to produce critical thinking about social issues, which eventually comes from artists and citizens who do not master the medium. Nicholas Bourriaud mentions in his book "relational aesthetics" describing the "law of relocation" that "Art only exercises its critical duty with regard to technology from the moments when it shifts its challenges. So the main effect of the computer revolution is visible today among artists who do not use the computer" [2]. As time passes, there is an obvious need for a link between the field emerging from the relationship of art and technology, and the social structures in order to interfere, change and shape new cultural codes, especially in the field of everyday life, interventions that eventually are capable of forming collective identities and offer an important social service. Contemporary digital art and in particular internet art could have an active role in shaping social structures, a role that does not necessarily respond to the politicization of its content but to the activation of those characteristics that can produce critical thinking and new cultural codes.

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Bouzas Vasileios studied Fine Arts at the Athens School of Fine Arts and got his MFA at the Pratt Institute of New York (aided by a Fulbright Foundation scholarship and a Greek State Foundation grand). He also holds a Degree in Civil Engineering from the National Technical University of Athens. His work consists mainly of audio-video installations and explorations on web-art. His interests include drawing, painting, photography, audio, video, and interactive media. He is currently an Associate Professor in the Department of Fine and Applied Arts at the University of Western Macedonia, Greece.

Challenges of a Sound Artist: Can we listen without looking?

Jacqueline Simon (Jackie Neon)

Abstract

For most people in developed counties, living in today's tech driven, fast-pasted, newssaturated environments means we experience sensory overload many times each day. Our global modern environments are overstimulated. We are constantly focusing on many things at once multitasking at every turn as well as being preoccupied our thoughts about what's next. Focus and imagination have become redefined as a fragmented approach to the tasks at hand, whether it be having a conversation, working on an assignment, or finding a moment to relax. This hyper environment is forcing us to use all of our senses at once. In doing so, we eliminate the ability to experience one sense at a time and to be fully aware of our surroundings. We are also less able to give ourselves the creative freedom to imagine. A space where our imaginations can experience creative freedom is a safe space where we can transcend the confines of our immediate environments so that we can foster the formation of new ideas in relation to stimuli that may not have been initially present to the senses in the original environment. This paper explores a variety of ways that Jackie Neon has showcased "soundscape". "Soundscape" is defined as: A sound art piece using edited field recordings to create a sonic environment that includes a background or landscape, characters, conflict, chaos, tranquility, and a dramatic arc. The dramatic arc of the audio introduces sounds to the listener, has a climax and sonic denouement at the end. The soundscapes are intended to provoke the listeners to use their imaginations by activating their individual senses of hearing. Given the direction we are going this task continues to become more challenging, as time progresses.

Keywords
Soundscape, audio, visual, experiential art

1. Introduction

As a sound artist, it is an ongoing challenge for me to find ways to create listening environments where people can engage with my audio work, activate their imaginations to interpret the soundscapes, and create their own visuals or mental journey. Overall, the purpose of this work is to explore ways of listening.

Over time, a variety of approaches have been used to allow people to listen to sound art. Some methods have included: a live performance with visual aids; headphones; rooms with controlled lighting; and, high fidelity audio speakers. Sound has the ability to transform our physical space into something else. This is a common practice. In some environments, sound generators have been installed in order to help with sleep, meetings and realization. As an artist, I am asking the question: Why not allow sound to create a fantastical space?

Listening and what we hear is impacted by other people and is influenced by what we see. The reason for this is we are often easily distracted by what we see. By combining art, design and

audio in my artistic projects, I have discovered that it is possible to create a space for imagination to take the sonic input and run with it. In a way, there are three parts to each work: the focus being the soundscape, the second is the mode of transmission and the third is what a person perceives as the relationship they develop to what they are hearing, within the mode of transmission.

In this paper, I discuss my explorations in how the physical design of special audio equipment as a supplement to headphones can aid in the experience of listening. The intension of this discussion is how getting to that point was achieved.

2. Aim of the Study

In this paper, I aim to describe how the sensory experience in this work is focused on listening to "soundscapes". A "soundscape" refers to work created by Jackie Neon, where I used field recordings that are manipulated to create a sonic landscape. The soundscapes that have been tested with this study are created from recordings of daily life. These recordings include sounds that might be otherwise zoned out and ignored once a listener has identified them. My fascination with these ordinary sounds comes from the inspiration of Psychoacoustics - which is the science of how we hear and interpret sounds.

Once the sounds have been recorded, Jackie Neon then edited and altered the audio to create a sonic landscape so that listeners were able to experience an audio journey. The sounds are revitalized and given a life of their own. The sounds become characters in their own world. The audio is a combination of sounds from man-made environments and nature. They are a juxtaposition of natural organic spaces and technology. The intention of each audio piece is so that the listeners will listen to the track and simultaneously use their imagination. By doing so, listeners can create a visual component or emotional experience to the sound that is influenced by their individual interpretation of the sounds as they relate to the listener's past experiences. The work discussed in this paper is sound art but, it can also be considered to be experimental music.

Previous work on the research of soundscapes can be seen in R. Murray Schafer's' book Our Sonic Environment and The Soundscape the Tuning of the World [7]. Schafer explores past and present acoustical environments. He also notes the impact that our environments have on the sound we hear, and the relationship of sound to our environments. It is important to Schafer that we be able to distinguish between sounds that are enriching and free us, as compared to other sounds that are toxic or aurally polluting. Thus, we can create healthier environments. He also speaks of perception and the visual bias over aural stimulus held by Western cultures. In addition he writes gestalt psychology of figure and ground with the later add-on of the field from phenomenal physiologists, reaction to the importance of subject matter relationships [7].

When talking about previous work in the world of sound art it is nearly impossible to not mention the works of John Cage. Several of his works combined audio and visual elements such as performance or dance. Not only does Cage integrate various forms of art, he also touches upon the use of noise, music and organization of sound (Cage, The future of music: credo, Wesleyan, 1961) The writing of Bob Snyder represents another general reference to previous research that is relevant to Jackie Neon's artistic pursuits. His book Music and Memory shows how human memory influences music. The book touches upon ideas about perception and memory within cognitive psychology and also discusses how those concepts are seen within music [8].

The work of Janet Cardiff; The Forty Part Motet is a prime example of the power that audio

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speakers in a room can have. The Forty Part Motet is 40 loudspeakers arranged in an oval, each speaker is playing back the voice of different singers singing "Spem in Alium" by Thomas Tallis 1573. Jackie Neon had the opportunity to see The Forty Part Motet when Cardiff's work was on display at MoMA PS1 during a survey of her work that she presented from January 12 - September 10, 2012 [2] Retrieved from https://www.moma.org/calendar/exhibitions/3745. This piece was beautiful and fascinating to experience although several people still wandered in the gallery space talking with friends or on their phones, or taking pictures. Those same people may not have been so chatty or distracted if they were seeing the same work performed live.

The audio speakers, arranged in an oval, allowed the audience to experience the piece from multiple viewpoints, as was her intention. This can be derived from Janet Cardiff's statement on her website:

"While listening to a concert you are normally seated in front of the choir, in traditional audience position. With this piece I want the audience to be able to experience a piece of music from the viewpoint of the singers. Every performer hears a unique mix of the piece of music. Enabling the audience to move throughout the space allows them to be intimately connected with the voices. It also reveals the piece of music as a changing construct. As well I am interested in how sound may physically construct a space in a sculptural way and how a viewer may choose a path through this physical yet virtual space. I placed the speakers around the room in an oval so that the listener would be able to really feel the sculptural construction of the piece by Tallis. You can hear the sound move from one choir to another, jumping back and forth, echoing each other and then experience the overwhelming feeling as the sound waves hit you when all of the singers are singing." [1] Retrieved from https://www.cardiffmiller.com/artworks/inst/motet.html) (see Image 1)

Image 1: Photo of Cardif Miller artwork

Another project that examines perception is a work entitled "Deautamatized" which was created by Pavel Mamontov (see image 2). "Deautamatized" limits participants' use of only two senses and makes them dependent on each other in order to hear, to see and to speak. Doing so forces the participants to view things in an unfamiliar manner, as a way to enhance the ordinary perception of things. Mamontov's design questions were: "What is it like to be you?", "How can I challenge perception?" and "What meaning can be extracted from that challenge to perception?" [6] Retrieved from https://deautomatized.files.wordpress.com/2012/05/deautomatized_mamontov.pdf.

Image 2: Photo of Deautamatized participants

The work of Francisco López also comes to mind. He is a prominent figure in sound art and experimental music. His work has developed a sonic universe based on how he listens to the world. His work uses both sounds from the wilderness and the industrial world in order to invoke a spiritual experience. [5] Retrieved from http://www.franciscolopez.net/pdf/Lopez-TheBigBlur. pdf). López's performance, at Sonar Barcelona in June 2018, part of the Sonar +D line up, was a sound piece in an auditorium where each participant was given a blindfold on their seat. The lights were dimmed. The listeners sat in a theater, López was set up performing in the audience and not on stage. He was set up in the middle of the auditorium seating. People sat blindfolded and listened. The work was powerful and had a transcendent quality. I had the opportunity to attend this performance. During the process of listening to the piece I felt weightless and levitated from my seat. In a way, I also left my body. And, while I knew where I was, I was also lost and forgot for a moment, the reality of this world. Instead, I was transferred to this alternative sonic reality. It was observed after the performance that other people were moved as well, in different ways. Some were wiping away tears while others sought out López to thank him and express their feelings or share their experience about his work (see image 3 & 4).

Image 3: eye mask   Image 4: Francisco Lopez preforming at Sonar

By limiting what a person can see while they are listening they will be able to engage with the sounds they are hearing. In order to have a personalized experience, they use their imagination and create their own visuals. Or, they can have an emotional experience. A similar result could possibly be attained with the use of eye masks. However, eye masks were not considered because they lay directly on the face and also can be uncomfortable. The visors that were created by Jackie Neon, are different from eye masks or blindfolds because they are designed to create a bubble for the listeners' faces, rather than lay directly on the face of the person listening.

3. Materials and Methods

This study was conducted over time. It explores various methods to share soundscapes with listeners. Previously, the use of headphones and audio speakers in a room with controlled lighting

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were used as well as the creation of headgear with integrated speakers. While these options allowed listeners to listen, it did not stop them from becoming easily distracted by their environments; consequently, the experience was passive. The visors were designed to be fitted to headphones. The visors can be modular and allow for the listener to shield their face when listening and thus enable a deeper focus on what they are listening to, while not being distracted by their surroundings.

4. Participants

Several people participated in these works over time. Many participants were attending art exhibits while others were attending a live performance. The general age range was people in their twenties and thirties. Also, occasionally children and people over forty participated as well. The performance attracted a larger range of ages because many people thirty and older also brought their children. It is important to note that the majority of the people who participated in the earliest sound art exhibitions were not formally selected. In addition, they were not compensated for their time. However, participants who tested the design of the visor prior to its exhibition were compensated for their time with food and refreshments (if they chose to accept them as compensation for their time).

5. Design

The designs of these works have taken on a few different embodiments. One of the most common designs has been headphones on display as part of an art exhibit. The more engaging displays of the work have included the integration of physical or sculptural elements. The earliest sound work to include a physical art accompaniment was a painting that included a frame with integrated speakers. Another work included speakers integrated into a disco helmet.

Design for this work takes on two parts. First, there is the design of the soundscape. The second element is the physical design of the listening experience. The visors are layered panels that are retractable and fitted to headphones. They are designed to be removed from the headphones if needed. The design of the audio is evocative. The composition builds upon itself in order to create a sonic landscape that is composed of multi-track audio. Within the audio, there are moments of tranquility and moments of chaos with hints of melody, patterns and occasionally speech.

6. Materials

Materials used in these works included headphones produced by a variety of manufacturers. All headphones supported frequency response of 20 Hz to 20 kHz. The speakers are of unknown manufactures or frequency responsiveness and ranged in size from small two-inch speakers to larger ones suitable for live performances. Physically constructed pieces were made of wire, plaster, mirror, glitter, paper, mylar, and plastic.

The stimuli for these works is sound. More specifically sounds recorded from daily life. Many of which might be considered insignificant. Examples include doors creaking, trains, waiting in lines, and public spaces. Other recorded sounds are from nature, such as: birds, wind or the ocean. With the exception of the first painting with sound integration, it is a general rule that human speech is excluded and if it is included it is a small snippet, not an entire statement.

7. Procedure

The first integration of sound into a visual work, was considered unsuccessful because, the spoken word track was not as compelling as the visual work that accompanied it. This first iteration

had aimed to embrace the inability to separate hearing and seeing. The hope was that the two elements would elevate the overall experience. However, it did not. The physical structure created to join the two was interesting. It curved the painting to hang between the speakers. This work was not continued. The painting lived on separately from the sound work.

A few other exhibitions of sound work included works played on headphones. These works were in galleries where listeners would listen for a bit. Participants were either tethered to a wall or a seat, but did not typically stay for the whole work. It was a similar situation for work played through speakers.

Disco Helmet is a helmet with built-in speakers. When people spent time in the helmet, their attention was split between taking photos and their sudden surprise when they realized the headpiece had speakers (see image 5). The Disco Helmet had been created to accompany a track created with recordings from nightlife and clubs in Chicago. Disco Balls are a prominent icon in clubs so, the pairing of a mirrored helmet with the audio made sense, even if the correlation was not as evident to participants.

Image 5: Disco Helmet   *Image 6: Sound sculpture*

I'd also like to mention a short-lived work that was a sculptural sound piece made of recycled cans varying in sizes, paper, wire mesh, a CD player, together with several small speakers ranging in size from one inch to two and a half inches and speaker wire (see image 6). The work had an organic look and feel to it. Each metal can had a different-sized speaker in it and the wire attached to the cans for the speakers was supported by hanging wires from the ceiling. The entire sculpture was covered in recycled paper pulp and, people were able to listen to each can. Because the cans were of different sizes with different speaker sizes inside them, they all sounded different, even though the same audio was playing among them. The work was lovely and moderately successful because it was difficult to hear in a gallery setting on a small scale. And, people were timid to touch the work, at first.

Performance with visuals was successful as seen in the performance of AbUno Pluribus featuring JACKIE NEON [field recordings + processing], STUNT [custom electronics + synths], CHRIS IANUZZI [modular synths + brainwaves] and brainwave-controlled lasers by SOFY YUDITSKAYA.Ab Uno Pluribuswas Curated by WvS and WvS and Miah Artola in New York City December 2016. The performance was heard in a large room with a stereo sound system. Cushions and chairs were available for people to sit or lay on. In addition, the room was dimly lit so that the projections could be seen. People used the visuals to aid their imagination and their feelings evoked by the soundscape. The visuals gave people something to do while listening (see image 7). After the performance people shared their experiences.
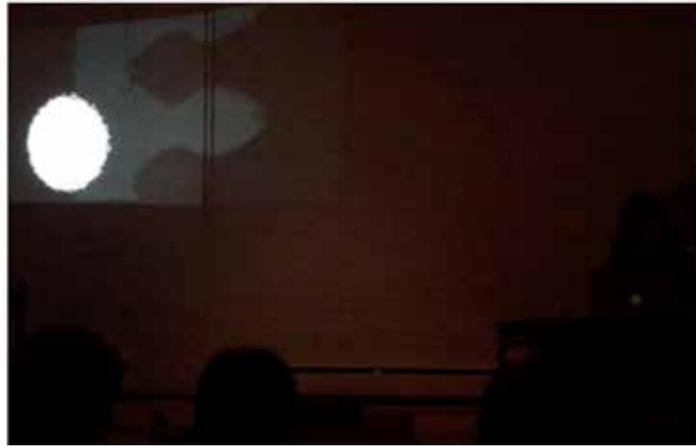
Image 7: Jackie Neon preforming

The most successful device used by the participants were the two visors. They are modular immersive environments. The listener is not able to see their surroundings in detail. As a consequence the listener is allowing to disconnect. Unlike a blindfold, the visors do not apply pressure to the face; instead, the visors connect to headphones. The exterior of one visor is reflective silver so people can see themselves looking at the person wearing the visor (see image 8 & 9). The listener in the silver visor cannot see out because the inside is opaque white. The other visor is white plastic with a hive like a pattern that hides the wearers face from the public (see image 10 & 11).


Image 8: Visor front   *Image 9: Visor side*   *Image 10: Virso front*   *Image 11: Visor side*

8. Results

In the end, it seemed clear that while people wanted to wear the Disco Helmet, they were not invested enough to stay in long enough to listen to much of the audio. This may be partly due to other people wanting to wear the Disco Helmet or perhaps their relatively short stay can be explained by their general disinterest of the sound they were hearing. However, after watching people take the Disco Helmet off and pass it to the next person, letting them know there was sound makes me believe that it was the first reason and not the second reason. Some people reported hearing some party type sounds. With headphones or speakers in a room, listeners would often talk or wander around. However, not many participants stayed long because often times there was more to see elsewhere. Headphones tethered to a wall or suspended from a ceiling was a challenging situation, especially when the start and endpoints are unclear. To expect a listener to stand for an entire sonic experience is unrealistic.

By contrast, the live performance was successful in ensuring people stayed for the whole

piece. The live performance resulted in several listeners reporting feeling like they were floating in space. One listener reported that they felt like an amoeba floating in a petri dish. Attendees would describe the sound and visuals that provoked those feelings for them as well. The visors created a safe, cocoon-like space to experience the soundscape. Some people used their imagination to create their own interpretation of the soundscape. The visors had a moment of adjustment, followed by a focus on the soundscape and then a sonic journey into their imagination. It was reported by users that they felt like they were in their own little bubble. They knew where they were and they also knew that other people could see them; however, they did not care. For participants who wore the silver visor, many said they liked that light was still able to leak in. The visor also created a barrier between them and their surroundings. The response was similar to the white visor with a pattern but people said they were able to see general shapes or shadows of their surroundings; however, they were not very distracted or interested in what has happened on the other side of the visor.

Some comments from the user testing of the visors included:

"I felt like I was reborn and then nothing, I'm not sure."

"felt like I was at the beach and that there was talking or something behind me."

"It had a pillow fort effect, there was something reassuring about knowing that other people could not see my face. Unlike if I had been wearing a blindfold. I was looking at the pattern then closed my eyes it was kind of meditative. The physical and the audio seem disconnected. It might be better if it were a longer audio track."

"Am I supposed to do anything?"

"that was intense"

"got warm inside"

"mechanical part is nice"

"sounded like beach, traffic, bus, street"

"Felt like I was hearing traffic and a hurricane and wind and beach"

"space triply part like a SciFi movie seen"

"It's like being underground because you are enclosed in a space"

"that was cool"

"I could focus on the sounds and close my eyes. It was like very calming to have that on,.Itwas like good white noise."

"Mediative I was focused on the sound only."

"What I liked about it is that it just played and I could tune out the rest of the world. I didn't even have to think about it."

"It's like looking at the clouds with your ears."

"That's so cool. That so relaxing, I like the material. It gives me a headache when I'm looking at it."

9. Conclusions

Participants reacted best to the soundscapes when they were in a controlled quiet environment with some sensory deprivation like that of the visors. The least successful showcasing of the sound work was when listeners were easily distracted by their environments. If they had too many other things to look at, then they had difficulty listening to the soundscapes and engaging with what they were hearing. The most successful examples were where listeners were given the ability to shut out busy environments. The performance and visors were successful in allowing people to be in a space guided mostly by their sense of hearing. The performance was overall successful, yet, it

was difficult to distinguish the individuals' reaction to the soundscape as a stand-alone because the viewer's interpretation of the sounds into their visuals was able to influence the audience as well. The visors were successful because they created a visual barrier for the listener to focus more on what they are listening to over, what is going on around them.

Future iterations of this work would include the creation of multiple visors. Each visor design would be physically the same; however, the materials would change. The different materials would be linked to a soundscape that plays on the headphones that the visor is attached to. The work would be presented in a manner similar to a performance. Different visors with their corresponding soundscapes would be displayed at different times. So, people would be able to partake in an experience similar to a live performance, with a start and end time. Since the visors are attached to headphones, it would also be possible to have performances occurring simultaneously worldwide as long as the locations had the visors and soundscapes.

Reflecting upon the challenges a sound artists faces, can we listen without looking? What I concluded was yes, if the conditions allow for it. Within a controlled environment it is possible for people to listen and experience sound without visual aids. However, getting to that point where a person is not distracted by visual stimuli requires planning, preparation, foresight, trial and error. In order for this to work effectively it requires listeners to buy in and allow themselves to be vulnerable. If a listener is allowing themselves to be vulnerable it is the responsibility of the sound artist (or curator) to empower the listeners to feel safe. A listener needs to feel safe enough that they are comfortable letting go of sight in exchange for the auditory experience.

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[8] Snyder, B. (2000). Music and memory: An introduction. Cambridge, MA: The MIT Press.Challenges of a Sound Artist: Can we listen without looking?

Jacqueline Simon is artistically known as Jackie Neon, she grew up in New York City in a multiethnic and multicultural family. She is a graduate of The School of the Art Institute with a BFA where she concentrated in sound art and later went on to attend Parsons School of Design where she graduated with an MFA in Design and Technology. She is inspired by identity, perception, psychoacoustics and how we translate what we hear. Fascinated by the juxtaposition of expectations and reality she has found combining common materials, images or sounds in her work creates moments of introspection.

A screen-less approach for visual Augmented Reality through dynamic image projection

Panagiotis Triantafyllidis[1], Fotios Stergiou[1]

[1]Members of the creative group Plastik

Abstract

Augmented Reality (AR) is now maturing as a digital media technology with varying and diverse application fields of remarkable impact, assisted by its broad accessibility through casual devices. But even though being easily deployable and thus accessible is one of its major advantages, there is a common issue described by both users and creators of AR experiences. The compulsory utilization of a screen-enabled, usually portable device, introduces a series of problems of varying nature. In our paper, we propose a different method of content presentation, by integrating systems and procedures in order to overcome these usage difficulties and thus the inefficiency of current Augmented Reality techniques. Our proposed implementation is based on the concept of interactive video portable projection. Omitting the monitor tether is not only possible as presented by our simulations, but it could also improve certain AR interactive experiences for particular augmented content types. On the other hand, the given approach came with several implementation issues that had to be arranged before our proof-of-concept, while in some cases, certain AR content types remain incompatible. In this paper, we firstly go through our method and different technologies integration, then present our solutions to the emerging implementation issues, exhibit our proof-of-concept simulation and finally discuss the limitations of our approach.

Keywords

Augmented Reality, Screen-less, Projection

1. Introduction

Modern AR technologies in their current form typically operate through a display of some kind. On this display, the user is presented with a final digital moving image composition, comprising by a live video feed as a background, augmented by digitally created content interactively and dynamically transformed to be aligned with the video content. This display is quite commonly found in the form of a mobile device screen i.e. a mobile phone or tablet and this is one of the reasons for the ubiquity and broad acceptance of this form of digital media [1].

In other use cases, it could be in the form of a Head-mounted display (HMD), worn by the user in front of his/her field-of-view like wearing a mask/visor, using transparent displays to augment the real world as seen by the user's eyes. Lately this type of devices is emerging to a more compact form of enhanced eye glasses [2] or even contact lenses [3] removing the load of a large cumbersome headset device. This visor like approach though being more natural to use, is still less common or accessible, is usually related to cumbersome, obstructive, complex and expensive devices that keep the "seethrough" principle intact.

It has been repeatedly put forward by users and creators [4] that this general display dependency is practically one of the most distinct weaknesses of AR. For large and important user groups, i.e. preschool children and seniors, AR technologies are neither accessible as they are not typical holders of the required devices, nor can they use them as intuitively as expected from other age groups. Handling a portable device as a visor to see the augmented digital content through requires handling skills that are not yet properly developed for young children or motor capabilities and eye-hand synchronization that are deteriorating for elders [5]. What is more, these aforementioned age-groups are less expected to have proper access to, or be willing to try an HMD or a visor/mask [6].

Apart from the above, technology-capable, typical AR users, face a series of difficulties with their experience too, as it remarked and documented [7]. Regarding AR applications on mobile devices, one first and obvious inconvenience is the need to hold the device with one or even both hands. Other matters are related to the way AR works on mobile devices, and the low reliability in dark environments or poor tracking and calibration performance, affected by specific environmental conditions and real world optical features [8]. There is also an emerging issue with the social acceptance of people wandering with their mobile phone cameras enabled, aiming towards their surroundings [9].

Regarding HMDs and similar implementations, these devices also suffer, being usually bulky, with poor portability and inefficient for outdoor use. These devices also introduce issues like eye strain and fatigue [10]. Finally, typically these headsets are highly priced thus not easily acquired by the public, since they only serve as AR and perhaps VR presentation devices and not as a multi-purpose mobile device.

All the issues mentioned above, remarked by the authors on past projects and also found in relative documentation, have a serious impact on the ease-of-use of the medium. In turn, this is affecting the wide establishment of the technology as a major tool for information presentation and distribution. This was the starting point for our research for a new method to effectively augment the real world. In this paper we present a new approach towards this mean's weakness, practically abolishing the use of displays and screens of any kind, proposing a completely new approach. To achieve this, we utilize interactive portable video projection assisted by a combination of modern proven tools, offered by the latest technology.

2. Materials and Methods

We propose the replacement of displays with a dynamic (moving) image projection onto objects and/or spaces, to augment the view of the real world. Instead of the established techniques, we present the user with a portable device that projects interactively transformed digital content onto the real three-dimensional space and/or objects, on a wide scale to achieve the effect of Augmented Reality perceived naturally with the naked eye.

In particular, we designed a wireless portable device which includes the projection system within its casing. The user holds this device by hand and aims the projection beam towards a real object or space. The digital interactive content is overlay projected onto the real world elements to create the augmented image. The viewer sees this composited image with a bare eye, omitting any type of monitor while the interaction is based on the device position and orientation (aim) in the real world as carried by the user. The experience is meant to resemble the use of a flashlight or torch in a dark room and the details of the room are revealed as the torch throws light on them.

To implement a screen-less AR functionality, a series of challenges emerged, and various problems had to be solved.

Dynamic Interaction:

A first obvious problem was the requirement for a continuous, dynamic 3D transformation of the digital content, so that it is constantly perfectly aligned with the elements of the real world, regardless of the user/device position and thus projection point. This is practically the main factor that differentiates our proposal with the techniques of video projection mapping.

To achieve this effect, it was crucial to be aware of the exact position of the projection device in real space. For this task we decided to re-utilize one of the proven and robust camera location algorithms [11] as used in modern mobile AR APIs, i.e. ARkit, ARcore, Vuforia, etc. This results in the need of integrating a mobile phone in our system, but also allowed us to take advantage of the mobile application development pipeline and ecosystem. The 3D location data and AR image composition is carried by the mobile platform and the visual result is then fed to a portable projector that is contained within the device, rather than the mobile display as usual. The data flow is demonstrated in the diagram below (pic. 1).
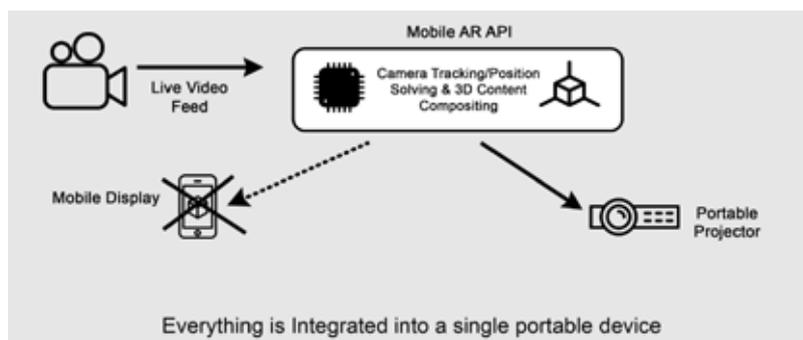
Picture 1: Data Flow

Projection Related Issues:

The utilization and integration of a projector into our device, immediately introduces a series of problems for solution, portability and power source being the most important. Thankfully, a variety of modern, bright nano-projectors is available, coming in very compact sizes, with internal rechargeable batteries and USB power supply. These devices are palm sized and easy to integrate into the system we designed.

Dynamic focusing was also an issue, as the device is meant to be portable and free moving in the real world. To solve this we investigated the use of laser as projection light source. Such projectors that are now widely available, even in compact sizes, replace led lamps with laser sources that are equally bright and energy efficient, but produce sharp, constantly focused images regardless of movement or distance to the reflective surface or the ray's incidence angle [12]. Another advantage, is that because of the low light attenuation, laser projected images are typically brighter per watt of consumption and also perceived as brighter by the human eye.

Finally, since our proposed system is supposed to integrate all the separate parts into one enclosure, we had to take into consideration some parallax issues. This occurs because despite the on board camera's field of view (FOV) and projection point being very close to each other, this

point is far from the user's FOV. To compensate for this offset, at least to a certain degree, software corrections are applied, based on human torso/upper limbs anatomy and the mobile device's inertial sensor readings, as well as with guidance through the application for proper holding of the device during use.

Integration:

Our proposed AR technique strives for improving the current usability situation and has to be comparable with implementations on widely used portable devices like smartphones. This dictates that our device implementation, self-evidently, has to be wireless and portable. It also has to be intuitive to use and accessible. In order to meet these requirements, we had to design and implement a system that integrates various technologies but also fulfills some predefined criteria. According to this concept, we identified the following design challenges:

- User Friendly / Intuitive / Transparent UX
- Compact/Robust
- Wireless
- Low Latency
- Focus Free
- Adequate Low Light Performance
- Affordable
- Upgradeable

Under this scope we examined the available hardware and proceeded with a design built around a portable laser projector, cable-connected directly to a mobile phone, as a camera feed and AR content processing unit. More specifically, we integrated an iOS enabled iPhone, selected for its processing efficiency, quality camera and well documented and tested specifications, broad ecosystem and an established development pipeline, familiar to our team, but also backed with a support community. The running application could be developed within the Unity Platform, backed with ARkit for the AR camera solver. It is important to only project the augmentation digital content, without the backdrop camera feed as the application would show it on a mobile screen. To do so, we used a constant black 3D background in the 3D scene created in Unity, in order to block the camera feed. But the use of a projector has also its benefit for camera low light performance. Until AR interaction in triggered, we project a bright pattern through the application to assist camera tracking. Once the interactive AR projection is initialized, the camera is constantly assisted by the projected digital content.

Next, we designed a portable plastic container/carrier for the comprising systems. To make this compact we arranged the mobile phone laying flat on top of the portable projector and used a basic mirror periscope to direct the iPhone camera FOV to the front of the device, parallel to the projector's FOV(pic.2). The projector and the iPhone are connected directly by a Lightning Port to HDMI adaptor for minimal latency and the system is also backed by a large 2-port battery pack placed underneath the two electronic devices to provide extra power for longer wireless life.
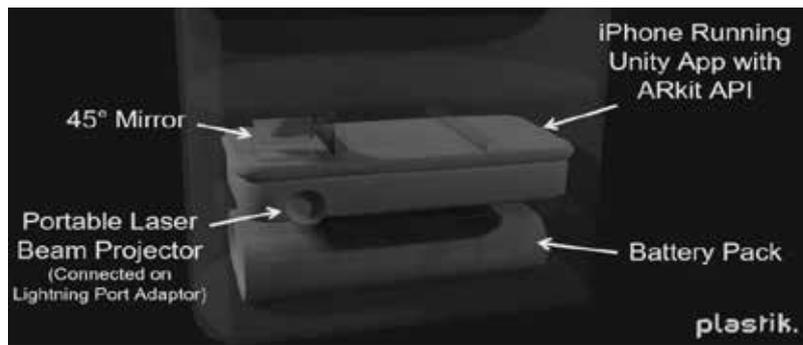
Picture 2: X-Ray View of the complete device concept

Aesthetically, the containing carrier, is designed to resemble a lantern, with a handle above it (pic.3&4). The device was also designed to be efficiently 3D printed, for easy prototyping reasons. Finally, although visually minimal it was also designed to be robust for public use, while special measures were taken to keep the internal systems properly ventilated and safe from accidental drops.

Picture 3: Device concept front view
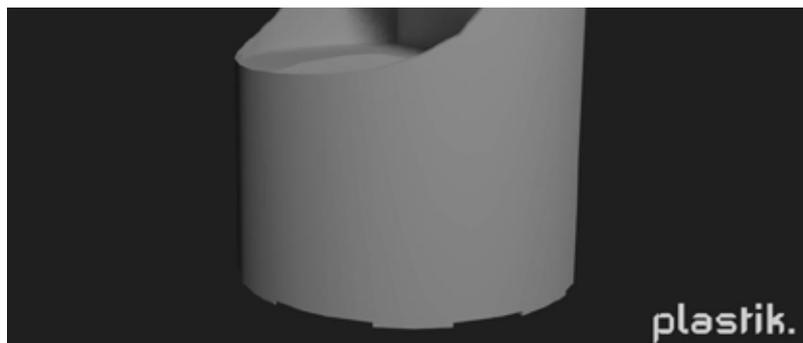
Picture 4: Device concept rear view

Regarding affordability, the final system compared to similar dedicated AR solutions (i.e. Microsoft HoloLens®, Magic Leap®) remains clearly more accessible. The off-the-shelf components selected are relatively easy to find and reasonably priced to acquire but also upgradeable and interchangeable. Using a mobile phone as the main processing unit and application host is restricting at first read, because of its non-open uncustomizable architecture, but the provided dedicated development tools and OS upgrades, eventually remove a serious amount of effort, letting developers focus strictly on application creation.

3. Results

To test our approach on a proof-of-concept level, we came up with a simulated experiment in a 3D animated scene. For this experiment we first recorded (i.e. rendered) some colored objects behind a hole in a wall keeping the camera on a predefined track and speed on a controlled light 3D space. We then used the exact recorded footage as feed for a 3D virtual projection on a wall without a hole, while at the same time we recorded the projection with a new camera, attached to the projector keeping everything moving on the previous track and speed. The two separate footages (renders) were put side by side for comparison as in the video screenshot provided below (pic. 5). Noting that the visual result is almost identical, this experiment demonstrates that an interactive projection can be an equivalent to screen Augmented Reality, provided that the projected image is constantly transforming, in order to adjust to the physical position of the projector.
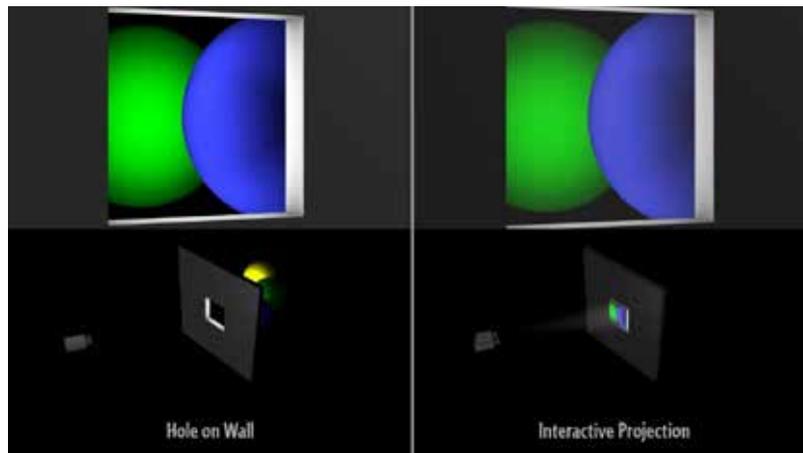
Picture 5: Still frame from the simulated experiment

Our approach initially shows some similarities to the techniques of projection mapping. The major differentiating factor though, is that the multimedia digital content in our case, is interactive. It can retain all the functionalities of AR because it is dynamically created and fed to the projector while performing the required 3D transforms in real-time.

Compared to established interactive projection mapping products (i.e. Lightform®), our concept differentiates itself, firstly because it is portable, and the user can carry it freely and wander around physical space. Apart from that, being designed around an already existing mobile ecosystem, provides developers and content creators with a variety of ready to use tools, like 3D engines, APIs, distribution pipelines, updates, etc. It is also equipped with a reasonable amount of processing power to handle varying types of digital content. Being modular and upgradeable also makes it future-proof and capable to cope with constantly improving graphics features. Finally, because it is required to calculate the actual position of the device in the physical 3D space, we can integrate spatial audio with positional awareness.

Known Limitations

Our proposal does not come without its own limitations as we found out during our research. Firstly, as with most AR implementations, even though it involves the use of a light projector so that the composited image is visible to many viewers, due to a parallax effect caused by the device's and the user's FOV, the experience is only visually correct for one viewer. Next, this approach requires a backdrop surface of some kind for the projection, in the form of an object, a wall or floor,

or combined. This means that there are some difficulties related to 3D perception and recreation leading to the conclusion that this AR technology, although it may be having benefits for some specific cases, is not generally suitable for all scenarios. Lastly, as it is relying on a projection to compose the final augmented image, it is naturally expected that ambient lighting lessens the experience.

Another difficulty that is more than apparent as a result of completely abolishing screens is the fact that our approach practically eliminates the main interface of user interaction with the mobile application, the touch screen. This issue may be trivial for finalized projects as the need for such interaction can be eliminated thanks to alternative methods like voice control or gestures; however it is a serious drawback at the early stages of the application's development and testing.

Some other limitations derive from the components selected to be integrated into the system. The dependency on a mobile phone device means that the processing power is limited, even though as mentioned above it is easily upgradeable. Regarding the use of a portable projector, even if laser as a light source is greatly efficient, bright and sharp, it is still quite dim in relation to a desktop multimedia projector. Lastly, the integration of all the components into a new, easy to use and portable device is still far from the ideal case of finding a way to augment reality without any device, achieving a truly unobtrusive result.

4. Discussion

As a general conclusion, the question that has to be answered is whether our research has actually led to a proof-of-concept for a new type of AR presentation and interaction. Under this strict scope, the results are by all means positive. On top of this, we managed to achieve the majority of our goals for our research providing solutions for our recognized challenges. We have also remarked several limitations on our method and highlighted some improvement points or functionality issues for future research.

We believe that it should be possible and relatively simple to improve our current implementation by providing several enhancements. A first example could be to help the AR tracking mechanism perform better in low light conditions by including in the setup an infrared light source and the corresponding camera filter. This technique is well documented [13] and could be supported from our hardware and software without any special or complicated adjustments. Another option for assisting the efficiency of tracking, especially within a more controlled environment like an indoors space, could be to use visual markers. Current technology allows surface detection even on mobile devices [14, 15], however the usage of markers leads to more robust tracking and can also provide extra spatial information to the system. Moreover, the aforementioned two enhancements can be combined and result in a tracking setup where the markers are invisible to the human eye, as described in the bibliography [16].

During our initial research we also considered an alternative setup where a wireless camera and a wireless projector would be placed in the portable device's housing, while a standalone computer would be connected to these two and perform all the calculations needed, as well as provide the video stream to the projector. This would allow us to take advantage of the extra processing power of a nonportable computer, solving issues related to the expensive calculations needed in order to provide high quality results. However, with this approach we would have to see if the wireless connectivity would cause any serious latency issues and on top of that, current wireless projectors

are bulky and heavy, a fact going against our initial goal of a lightweight, portable setup.

Another area for further research could be the power consumption of all the involved hardware and ways to maximize each device's battery life. At this point, it was not in our scope to perform any kind of quantitative analysis about how each component consumes energy, however finding ways of cleverly saving resources could be a valuable contribution to our setup. For example, the mobile phone's screen could be rendering a plain black canvas or it could even be completely disabled, if the operating system allows to do so. On a similar note, charging the devices could be simplified, for example by making use of the latest technologies offering inductive charging. [17]

Finally, there is a need to develop some sort of debugging interface or a toolset for interaction with the applications under development, since the elimination of screens in our system has also aborted any use of touch interaction. Towards this direction, our initial ideas included the integration of voice commands (i.e. Apple Siri), headset buttons, inertial sensor gesture controls or even temporary external touch screens or keyboards.

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DCAC

Session 4

Digital Culture and Education I

Designing Audio Technology-Oriented Practices for Teaching Art to Primary School Pupils

Emmanouel Rovithis[1], Agnes Papadopoulou[1] and Andreas Floros[1]

[1]Department of Audio & Visual Arts, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece

Abstract

Digital literacy has become a focal topic in modern educational studies. In that context, the Pedagogical and Didactical Sufficiency Program (PDSP) of the Ionian University Department of Audio & Visual Arts is investigating ways to enhance the learning process through the utilization of Information and Communication Technologies (ICT) in teaching practices. This paper presents a learning activity, in which students of Art Education designed educational scenarios that combined a technology-oriented task with the music curriculum of Primary Education. Based on only simple actions, such as highlighting different parts of a sound file in a free, audio editing software, students were able to plan the teaching of audio technology in conjunction with a multitude of different musical subjects. We argue that this approach can foster ICT integration by addressing first-, second-, and third-order barriers, as well as by demonstrating that the teaching of even simple digital literacy skills can serve as the vessel for various learning contexts.

Keywords

Music Education, ICT Integration, Instructional Design, Audio Technology, Primary Education

1. Introduction

Digital media have become dominant in fundamental aspects of modern society, granting users with unprecedented capabilities of accessing, processing and exchanging information. Educators are seeking to respond to the needs posed by this digital revolution by integrating Information and Communication Technologies (ICT) into their teaching practices, in order to include information literacy in modern learners' pallette of skills. Traditional educational means are attempted to converge with hardware and software technologies into novel learning environments that can overcome temporal and spatial limitations. The notion of digital wisdom has emerged to signify the importance of learning how to effectively and beneficially use new technologies. It is the quality of managing digital information that needs to be recognized by parents, learned by educators, and then taught to students to prepare them for facing the challenges of our technology-mediated world [23].

In that direction, addressing technological challenges through educational practices is a challenge per se, since new technologies exhibit features that question traditional schooling: they are customisable and specialised, rely on diverse, interconnected and widely spread sources and require hands-on action besides theoretical knowledge acquisition. [3] New cultural frameworks of learning and socialization have been shaped and resulted in new types of identity for all stakeholders [1]. Educators are no longer rigid experts, but flexible sources; they provide with and guide through contexts on a knowledge-based matrix; they create learning experiences, whose quality they assess

and control. The transformation of the educational status quo has led scholars to compare the impact of digital technologies on the twenty-first century with the impact of the book on the nineteenth [16]. And yet, even though the educational aspects of technology have been attracting research interest for over two decades, the actual embedding of ICT in the classroom is far from being a standard teaching practice, and is kept mostly for specialized courses [3].

The Pedagogical and Didactical Sufficiency Program (PDSP) of the Ionian University Department of Audio & Visual Arts aims to provide prospect teachers of Art [20] with a deep and coherent understanding of learning theories and educational practices, as well as with the necessary technical skills, for the design and implementation of technologically enriched learning environments through the use of appropriate digital resources from the fields of contemporary multimedia audiovisual arts. This paper presents a PDSP learning activity in which students were guided to utilize ICT for the design of an Art Education scenario. Their work served as the main assignment of the Spring Semester 2018-2019 class in the course "Content and Practice in Primary Education". More specifically, students were required to develop an educational scenario based on the use of an audio editing software in terms of opening a sound file and placing markers to highlight regions of its waveform. The sound file itself had to be related with a subject of their choice from the Primary Music Education curriculum. In that way, aspects of digital literacy, in terms of using a computer software, and aspects of audio technology, in terms of recognizing and editing the properties of a waveform, converged with the teaching of a multitude of art subjects. The authors suggest that such projects in the context of pre-teacher education can address some of the barriers to ICT integration in education.

2. ICT integration

2.1. Official directives

The need to include ICT in education has been intensively highlighted on official level. In the educational directives of the European Union the economic aspect is salient:

"One employer in three has difficulty finding people with appropriate skills. This is particularly true in the most innovative sectors of the economy, where there are thousands of job vacancies in the fields of engineering, science and technology. The skills gap is one of the most acute problems facing European countries. Bridges are needed to close the gap. The most solid bridges are education and training." [7].

Focusing on the technology-oriented teaching of Art, the International Baccalaureate, an educational program followed by over 5,000 schools worldwide, states in its "Scope and Sequence" guide for Primary Education:

"The students are stimulated to think and to articulate their thoughts in new ways, and through a variety of media and technologies. Students in the Primary Years Program continually explore imaginative uses of new media tools beyond their basic functional applications, discovering alternative or individual ways to conceptualize the role of digital technologies in their lives. The arts develop innovative thinking and creative use of technologies, and in so doing prepare students to participate fully in this multifaceted world." [13].

On a local level, the Greek Ministry of Education, Lifelong Learning and Religious Affairs has steadily promoted the educational utilization of ICT. In the Cross-Thematic Curriculum Framework

for Compulsory Education formulated by the Pedagogical Institute, the Ministry's former official body responsible for educational planning until 2012, it is stated:

"the role of school ought to be redefined, in order to meet the needs shaped by the modern information and knowledge society, which include (among others) to develop pupils' skills, abilities and interests, and to facilitate them to explore new information and communications technologies" [22].

Similar directives are given by the Ministry's current educational body, the Institute of Educational Policy, whereas the basic priorities of the action plan for 2019 are digital skills in education [17]:

"It is necessary that the educational system promotes the interaction between art and digital technology in order to motivate learners' interest, develop their creative thought, and foster their digital literacy." [32].

2.2. Merits and barriers

The official directives mentioned above are justified by a great amount of research findings reported in literature. The integration of ICT in education facilitates efficient access to multiple layers of information, develops learners' critical thinking, fosters their creative and collaborative skills, enhances their self-esteem, motivation, and self-guidance, overcomes temporal, spatial, and social restrictions, and realizes modern educational theories [10]. Thus, in the course of the last two decades the focus has shifted from asking whether to use technology in the classroom to seeking the appropriate ways to do so. Yet, the dilemma here is: should ICT be used to support and enhance traditional teaching practices or are they the means to a radically different pedagogical vision? [16] Despite the abundance of results, there is still not enough evidence for a clear answer. ICT comprise a variety of media, hardware and software, stand-alone and networked: from audiovisual capture and playback devices, such as radios, cameras, and projectors, to highly interactive devices, including interactive whiteboards, computers, the Internet, video-games, mobile applications, virtual and augmented learning environments. To assume that just because children like technology, all technological media are suitable for enhancing any learning circumstance is an oversimplification. Every case study in literature deals with just one medium examined through a specific combination of factors including subject matter, students' age group and other characteristics, course duration, school's infrastructure and culture, and the country's socio-economic conditions. From such a complexity of factors it is difficult to draw conclusions for general application.

Besides the difficulty to interpret the advantages of ICT integration into a holistic educational approach, there are other difficulties to be dealt with. Early categorizations of these barriers referred mainly to lack of funding and infrastructure (software and hardware) from the side of the institutions, and inadequacy in training and motivation from the side of the teachers. [19] Later approaches added classroom management, technical problems, insufficient ICT-related time during a class period, lack of clear goals in combining technological with pedagogical content, uncertainty, low expectations, and lack of collaboration among the teachers [10]. Focusing on music education, which is the subject of this paper, two barriers are the most notable: paucity of resources, and lack of technology-oriented teaching strategy. Music educators are restricted by a small range of available software, most of them not freeware. Paid software are more difficult to be purchased by the school administration and the students, whereas the user community built around them is less

dynamically and accessibly developed. Even with the software at hand, educators have difficulty in understanding the need, the scope, and the way to use it, and thus sometimes feel more technicians than educators, or even less resourceful than their students, a challenge which stresses the need for technology-oriented educational planning [26].

2.3. First-, second-, and third-order barriers

A systematic reflection upon the challenges in integrating ICT in education can be done through the prism of Ertmer, who distinguished between first-order and second-order barriers. [6] Seen from the teacher's perspective, first-order barriers are exogenous, such as the school administration, the subject, and the available resources, and second-order barriers are endogenous, such as the teacher's own preconceptions, attitudes, and knowledge. Many scholars have based their analysis on this distinction. Whereas in the early years of ICT integration the first-order barrier of resources was identified as the most salient one [12], the increasing access to technology has significantly reduced such limitations [21], shifting the focus to the teachers' beliefs and skills [5]. The viewpoints towards technology are vital for planning an effective technology-oriented lesson, but they are also regarded as the most difficult to change. This poses the risk for the lesson's cultural frame to exclude new media, and deprive students of digital literacy training, as well as inspiring technology-based stimuli. In the work of [18], who investigated the implementation of tablets in secondary education, teachers can be distinguished into two types: the "instrumental" teachers, who exploit the usefulness of technology to enhance their usual educational practices, and the "innovative" teachers, who embrace technology as the means to transform their teaching style and broaden the lesson's horizon. Innovative teachers are more open to change, fascinated by technological progress, and willing to exploit its full potential, whereas instrumental teachers need more convincing to accept that educational technology has more value than just being practically useful. In any case, an approach of teacher development is needed to guide both teaching types to meaningful ICT integration.

Finding ways to effectively combine educational goals and curriculum with relevant ICT tools and resources must be taught and learned. Teachers already have pedagogical content knowledge, and they are becoming increasingly accustomed to technological content knowledge ; what they now need to develop, is the ability to draw upon content and technology, in order to achieve learning [25]. This transcends the distinction between first- and second-order barriers. Even if both are eliminated, if teachers have an abundancy of resources at their disposal and a great amount of eagerness to use them, they would still have to find meaningful ways to link them with their teaching strategies. This challenge has been characterized as the "third-order" barrier for technology integration, [27] and highlights the need for teachers to be taught the skill of designing educational scenarios and lesson activities that use technology to enhance learning. At the PDSP of the AVARTS we guide prospect teachers to educational design by introducing them to learning theories, teaching practices, and technology resources. They are prompted to become teachers and students of themselves in that they design, test, and evaluate their own ideas and strategies in learning activities, such as the one presented in this paper.

3. Technology-oriented Educational Planning

The learning activity is structured in three phases: preparation, implementation, and assessment.

3.1. Preparation

The preparation phase informs students about the scopes and tasks of the learning activity, and provides them with considerations to cope with its challenges. In that process, first-, second-, and third-order ICT integration barriers are addressed.

Regarding first-order barriers, one of the most prohibiting factors to adopting a technologyoriented practice is its cost. We informed our students about the advantages of freeware software in that matter, and suggested the use of the freeware software "Audacity" due to the ease of its installation and use. Of course, any other software would be acceptable, as long as it was free of charge and available online, thus granting teachers with access to a freely distributed set of resources and eliminating any financial restrictions to realizing their educational plan.

In terms of second-order barriers, we focused on students' technical knowledge and confidence. First, a lecture on the physical properties of sound and the way they are captured and represented by digital technology was delivered. This was followed by a technical workshop, in which students familiarized themselves with the software. They were asked to provide a favorite music piece that they feel comfortable working on, and learned to perform editing processes in the computer, such as marking, copying, pasting regions. We clarified all questions and supervised their work until they were all confident that they had mastered the operations, which they would teach in their educational scenario.

To counter the third-order barriers, we sought a thorough approach on shaping the curriculum into clear educational goals and mapping them on a technology-based learning activity. First, we revised and categorized the "technical" curriculum. We limited the operations to be taught to carefully listening to the audio information, observing its graphical representation, and marking points and regions of interest using the "Add Label At Selection" option in Audacity. Then we proceeded to the music curriculum. We pointed to the online resources of the Greek Ministry of Education and asked the students to select a topic they find interesting from the section of Art Education. We discussed about the selections by sharing experiences, naming examples, and defining their properties. We then injected to the discussion some initial thoughts about the design of the educational scenario. What do our prospect teachers want to achieve? What features is the class expected to recognize after the lesson? Are these features easy to locate and analyze? Which actions are needed for introducing the class to the music, as well as the technical curriculum, and how much time will be needed for each part of their lesson?

3.2. Implementation

The deliverables of the assignment are designed to put the students in the place of both the teacher and the pupil. More specifically, they comprise:

- a document that specifies the targeted curriculum, the learning objectives, the order and duration of all involved activities, and the way the learning objectives are addressed by the suggested educational scenario
- an Audacity project that includes the audio file, on which the lesson is based, and the markers, which are placed as needed to complete the requested task

In essence, students had to formulate a lesson plan, which focuses on a technology-oriented learning activity, and then participate in that activity themselves. The task of the activity was the same for all: markers should be placed on an audio file, in order to identify and/or highlight different

musical qualities. But the content was in every case different: every student focused on a different part of the music curriculum. In total, 12 assignments were delivered, dealing with the following subjects:

- Call and response patterns in traditional African music
- Religious elements in melodic and harmonic structure
- Timbre of different musical instrument groups
- Structure of a song
- Animals' sounds in a farm
- Audible similarities between two different school yards
- Identification of sound sources in a soundscape
- Different parts of lyrics progression
- Ambient and narrative sounds in the background of a songs
- Musical parts in response to paintings
- Emotional response to moments in the sound of rain
- Changes in a waveform's dynamic range

It appears that the assignments delivered by the students feature great variety. Four subjects dealt with identifying musical properties, such as structure, melody, harmony, and timbre. Three subjects dealt with listening to a soundscape to find or compare elements. Two subjects focused on the foreground and the background of spoken word. Two subjects connected sound with the listener's emotional response, and one subject concentrated on sound's visual representation in a digital environment.

3.3. Assessment

All assignments were demonstrated and discussed in class. Every student presented their work and argued for the supporting lesson plan. Our approach was largely based on the practice of Lesson Study, which lets teachers collaboratively plan, observe, and reflect on the lesson. [8] More specifically, we adhered to principles from the pre- and post-lesson phases: we discussed about the appropriateness of the task with regard to the goal of the lesson, the anticipated responses from the learners, and the similarities and differences between each student's didactical approach [11].

Consequently, students were given time to optimize their assignment. We wanted to give the opportunity to our prospect teachers to reflect on their teaching strategy as a result not only of the instructor's commentary, but also of a collective sharing of experiences, thoughts and considerations among their peers. The aspects that were revised were mainly the clarity of the task and the appropriateness of the introductory material. The projects themselves had been implemented in a satisfactory way, even though in some the issue of cognitive overload was mentioned and they had to be simplified. The Audacity files were all working –it was emphasized during the learning activity that it is devastating to put effort on technology that for some reason in the end will not work– and the markers clearly put and named to highlight the targeted parts. From the discussion new ideas emerged: using the software's option "Export Multiple" results in exporting all selected ranges into separate files, which can then be re-arranged to form a puzzle for another assignment.

4. Discussion and Future Development

The challenge that we focused on is how can an educator integrate ICT in a music lesson

to enhance learning, but with few resources and low technical requirements. We attempted to address this issue on multiple levels, guided by the distinction between first-, second-, and third-order barriers. In terms of first-order barriers, the software selected for the assignment was downloadable from the Internet for free and easy to install. Furthermore, we limited the required task within the digital environment to simple actions, such as importing a sound file, understanding its waveform, and placing markers to highlight regions. In terms of second-order barriers, the students were gradually introduced to audio technology from basic concepts of sound to standard editing techniques. Furthermore, a practice session took place, followed by a discussion on their questions. In that way, even students who had no previous experience with sound editing in a digital environment felt comfortable with this –new to them– medium. In terms of third-order barriers, we practiced aspects of Lesson Study to elaborate on ways, in which the technology-oriented learning activity can extend beyond digital literacy to concrete subjects from the music curriculum.

The learning activity was overall positively accepted by the students. Even though building on the mechanism of highlighting excerpts from a sound file was a rule that was given to them by the educators, they did not feel restricted. Instead, they became highly engaged, acquired a clear understanding about enhancing a lesson through audio technology, and came up with a great variety of topics, some of which had not been thought of by the authors beforehand. Our goal was not only to demonstrate an example of ICT integration, but also to investigate the richness of applications that can be drawn from a simple idea. In this case, placing markers became the means to teach not only the software per se, but also various aspects of music and sound, from harmonic, melodic, and structural elements to soundscape and acoustic ecology, to lyricism, emotional response, and sound visualization.

There were some considerations about the appropriateness of the software for primary education pupils. However, we must keep in mind that the digital age is responsible for introducing young children to a wide variety of audio experiences in their everyday lives, from small abstract sounds coming from all kinds of devices to multi-layered audio pieces of pop culture, produced and/or heavily influenced by audio technology media and combining music, voice, and sound effects. [30] ; [31] Also, active listening has been suggested as a practice for music education as important as performance and composition. [28]. Focusing on the isolation and analysis of sound properties through a digital medium fosters the understanding that audio technology can result in new approaches to musical notions like time, rhythm, material, and form, whereby every audio stimulus constitutes a commentary on life and a starting point for a composition. [9]

In the future we intend to further develop our approach both horizontally and vertically ; horizontally by suggesting more technology-oriented learning activities based on simple actions, but applied on a multitude of subjects, and vertically by investigating similar ways to integrate ICT in the contexts of secondary and tertiary music education. Digital literacy is a vital component of modern education. The learning activity presented in this paper provides an example of teaching digital literacy combined with various music subjects, suggesting that such practices can enhance the learning process of both.

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"Origami Singing": exploring digital sensors and microprocessors in interactive art and STEAM education

Adamantia Albani[1], Vasilis Pitsilis[2], Vasilis Agiomyrgianakis[1]

[1] Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece
[2] NCSR Demokritos, Greece

Abstract

Digital technologies for collecting and processing data, such as sensors, microcontrollers and wearables, in the interactive art context, can reveal aspects of tangibility. As means for teaching new media art, they can help young people cultivate their creativity and get digital and social skills indispensable for their future, through collaborative, performing and playful ways of learning by accomplishing artistic projects. An interactive installation titled "Origami Singing" and a STEAM education workshop for secondary school students were implemented in 2018, for M. Albani's MA diploma thesis (supervisors: I. Zannos, A. Floros).

Keywords

Interactive art, Sound art, microprocessors, wearables, Internet of Things, STEAM education

1. Introduction

In the context of "post-digital" art, concepts such as presence, embodiment or tangibility, identify qualities which describe a "return" to physical objects, a counter-action to the dematerialization (virtualization) provoked by digital technologies [3] and the ubiquitous computing. Digital computing devices belong to an abstract and intangible world of information carried by "digital symbols" or bits, and processed by operations applied on them, which we experience indirectly, even if they are carried by matter (electrons, electric wires, electronic circuits). The issue of tangibility arises as we apply arbitrarily defined correspondences between the logical / symbolic and the physical / material, so as to achieve a predefined goal [3].

Economic and technological developments require updated educational methods and synergies of different fields which will enable society to cope with challenges such as mass unemployment and its consequential social turbulence. It is believed that two-thirds of today's students will engage in professions that have not yet been invented [20]. Research shows that cultivating creativity, in all educational levels, in addition to the scientific and technological skills, is a crucial issue [20]. Moreover, inventiveness, and capacity to involve all members of a society in the process of innovation are to be included [24]. Through art and technology interaction, creative forces in each person can be unlocked [20].

In some cases, however, a conflict between artistic practices and technological know-how can be observed. Old contrasts seem to assume new forms and prejudices may still remain, such as those between manual labor and intellectual work or between the uniqueness of artistic dexterity and the multiplicity of mechanical reproduction. Artists may find difficult to collaborate with innovators, due to several reasons, such as different working cultures, fear of artists to be instrumentalized,

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legal issues, non-explicit reference to the Arts in calls for submitting proposal texts, financing difficulties, lack of openness, training and meta-competences [24].

Large-scale European projects reveal the European Union's interest in the Internet of Things in order to define technological, economic and social developments. Intelligent systems consisting of portable products (wearables) introduce new functions into clothes or accessories. However, serious concerns are expressed regarding the amount of users' personal data collected by companies trading various service packages. Arts can possibly contribute to sustainable development and innovation in the field of wearables and intelligent objects design, by maintaining a critical attitude and an ecological, social and humanitarian engagement [24].

2. Aim of the Study / Objectives

As digital computing devices belong to an abstract and intangible world of information carried by "digital symbols" or bits, and processed by operations applied on them, even if they are carried by matter (electrons, electric wires, electronic circuits), we experience their function indirectly. The issue of tangibility arises as we apply arbitrarily defined correspondences between the logical / symbolic and the physical / material, so as to achieve a predefined goal [3]. As for our artistic practice, we incorporated into traditional and "tangible" arts, such as painting on paper and origami, digital sensors capable to measure the interaction of the artwork with the environment and enriched it by "translating" this information to sound art (see Pictures 1-2).

Picture 1: "Origami singing", interactive installation, 2018

A primary educational goal in our research has been to facilitate teenagers practice programming and interaction with microcontrollers. Through this process, students should realize that different disciplines, both scientific and artistic, can contribute to exchanges, interdependence and synergies in a democratic environment of equal opportunities. This collaborative, critical and creative way of personal development might lead a "critical mass" of people to get involved with the public sphere. Relating a "hands-on" learning approach to political, social, artistic, scientific, environmental involvement might help people overcome a range of problems concerning their lives.

As a next step we may find creative ways of using the IoT either in arts or in educational projects, such as an interactive, transmedia narrative.

3. Materials and Methods

Originating from participatory culture and "maker" movement, as well as DIY / DIWO (Do

It With Others) / DIT (Do It Together) trends, STEAM (Science + Technology + Engineering + Art + Mathematics) education emerged. More people try to be creative either in independent "maker spaces" or institutions, such as schools, museums, galleries, etc. Through playful and collaborative project-based learning (PBL), students can have a positive experience that they can build on in the future. Artists though, incorporate new materials, means and methods to the body of their work in order to express ideas, trying not to get trapped into a chimeric hunt for novelties, originality or impressiveness.

3.1 Participatory Culture

As H. Jenkins [11] argues, rather than thinking of interactive technologies in isolation, we should think about participatory cultures, the interrelationship among different communication technologies, the cultural communities that grow up around them, and the activities they support. Interaction, as a property of technology, is embedded in the concept of participation, as a property of culture. Concerning literacy, there has been a shift from individual expression to community involvement, which means that social skills developed through collaboration and networking are built upon traditional literacy and research, including technical, and critical-analysis skills learned in the classroom (ibid., p. xiii). The new skills include [11]: Play, Performance, Simulation, Appropriation, Multitasking, Distributed cognition, Collective intelligence, Judgment, Transmedia navigation, Networking, Negotiation.

3.2 Maker movement, DIY, DWO, DIT

Since 1993, when the first computer clubhouse was established in Boston, with the goal of enabling underprivileged youngsters to express themselves through ICT, the principles of collaborative learning and constructivist thinking have been considered essential. Constructivism, according to Papert [19], considers that cognitive structures are implemented through the construction of artifacts [1].

Since 2001, starting year of the first fablab at the Medialab Center for Bits and Atoms (MIT, Boston, USA) [8], numerous places, such as hackerspaces and makerspaces have been developed [14]. The maker movement seems like a digital revival of DIY practices, and brings to mind the Arts and Crafts movement, born in England at the end of the 19th century. Contrary to industrialization, it supported the personalization of objects, creativity and craftsmanship. Many members of French fablabs also have a connection with education (and Scouting), as well as DIY associations (computer clubhouses, model making, creative hobbies etc) [14].

Following that, the DIWO (Do It With Others) and DIT (Do It Together) trends appear as a development and expansion of the DIY movement ('A Vocabulary of Digital Do It Yourself | Digital DIY', n.d.). A paradigm of a DIT project is "Doing It Together Science" (DITOs), focusing on the active involvement of European citizens in "exploring, measuring and experimenting with the world around them", so as to play a major role towards "a sustainable future", by combining the "resources and expertise to raise awareness, build capacity, and innovative lasting solutions grounded in society". In Doing It Together Science, universities and research institutions collaborate with science galleries, museums and art institutions, moving beyond traditional approaches of engagement (e.g. hearings, public meetings or non-interactive exhibits) into direct engagement, such as innovative workshops, exhibitions, and activities. These build upon the hands-on, Do-It-

Yourself (DIY), grassroots, and frugal innovation initiatives [6].

3.3 STEAM Education

"A" for Art transforms the STEM acronym (Science, Technology, Engineering, Mathematics) to STEAM, suggesting that Art (and Design) can play a crucial role in school education, as a subject and a teaching approach which allows children to use their senses and experiment, test their thinking, selfexplore and experience, learn by doing [4], and practice in science [18]. Artistic practices, apart from practical skills and handicraft, require an emotional process engaging play, risk-taking, and imagination, which has often been undermined in teaching academic school subjects, although it is vital for "inventive scholarship". Learning in informal and alternative to formal education contexts, has often been described as critical to tradition, as in Ivan Illich's Deschooling Society [10], although uncategorized, until it gets institutionalized, and creative, as in Gardner's The Unschooled Mind [7]; [22]. The dilemma of the informal creative pedagogy in which novelty and situation motivation play a key role in raising interest, is whether they will be transformed into intrinsic motivation and deeplearning strategy (ibid. p.2).

Furthermore, as A. Mc Lean [16] predicts, programming may become dedicated almost entirely to cultural activities such as music-making and sculpture, augmenting human abilities so as to understand our own data, "breathing computational patterns into our lives". Programming languages could gradually approach natural languages, by developing through use while embedded in culture. A precursor to this may be Live Coding, a practice in which software artists have been developing computer languages for creative coding, live interaction and music-making ('TOPLAP | the home of live coding', [23]. Mc Lean [16] hopes that we will think of code and data in the same way as we do of knitting patterns and weaving block designs, considering that they all are formal languages, with their structures intricately and literally woven into our everyday lives.

3.4 PBL & Transmedia Narrative

Narrative is considered basic in human existence as an essential symbolic process - a shift in space and a dramatic transfer (conflict) - through which people (learn how to) mature [21]. It is thought to be a privileged way of involving people in creative, collective, interactive, and often therapeutic processes. Jenkins [12] described transmedia storytellings as specific forms of stories that extend through different sense systems (verbal, virtual, audiovisual, interactive etc.) and media (cinema, comics, television, video games, theater etc) [21]. Transmedia narrative requires the extension and enrichment of a story and offers readers-viewers-players the opportunity to choose their personal navigation path and participate [15]. In the context of interactive and transmedia storytelling, artistic creativity may be supported by digital technologies, such as sensors, actuators or microcontrollers embedded in tangible, physical objects as wearables.

As an innovative teaching method in all educational levels, Transmedia Narrative is based on Project Based Learning and collaborative processes [21]. Therefore it is based on the works of John Dewey [4] and William Heard Kilpatrick [13] and a constructivist epistemological theory. The PBL method approaches, on the one hand, the individual and social learning, but on the other hand, focuses on the individual and the enhancement of the learning experience. The project is based on a pragmatic philosophy, which states that "concepts are understood through observable consequences" and that "learning occurs because of direct contact with objects" [21]. Technology,

information, multitasking, content, connectivity, interaction and collaboration are key words to the formation of a narrative project and must be present in the classroom to improve the quality of teaching and learning process and to attract today's teenagers [17].

4. Implementation

We finally came up with the idea of a mobile installation which provokes sounds, depending on data collected by an attached to it microcontroller, which checks on the motion and directional / orientation changes. The "Origami singing" has been implemented in two ways, a simple educational and a more sophisticated artistic variant and was presented at Corfu (spring 2018) and Rethymnon (autumn 2018) art festivals. In addition, educational material in an e-book format was created (see Pictures 3-4) for a STEAM educational workshop that was implemented at Corfu "Agros" high school, the results of which were evaluated through questionnaires.

Picture 2: "Origami singing", detail from the educational version, 2018
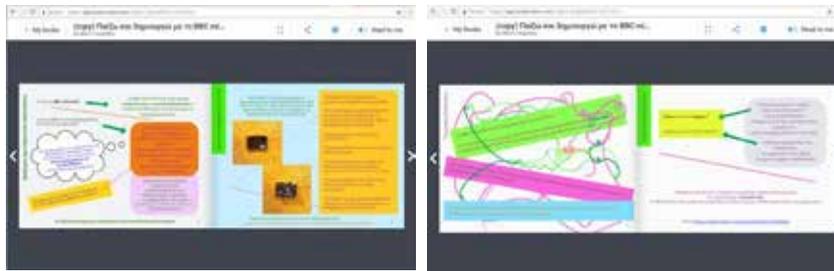
Pictures 3-4: Pages from the e-book created for a STEAM workshop.

In order to develop interactive features within the Origami, we have been using open source hardware and software components. BBC micro:bit, a tiny embedded system is integrated into the Origami, in order to collect data regarding its "state". The fact that there is unlimited valuable documentation for the device, both for teachers and students and also an extensive API documentation for developers is an incentive for its integration within the project.

From a functional point of view, micro:bit is equipped with a powerful microcontroller and also provides a set of sensors, capable to receive and provide information of the surroundings: a magnetometer, an accelerometer, a temperature sensor, a light sensor. Additionally it has two buttons and an LED screen for user input/output and 25 pins where we can connect extra sensors or actuators. Finally, a Bluetooth radio hardware on it, makes it possible to transmit collected data and receive control requests, which is a very important feature regarding our project. In order to receive, process and transform the information transmitted from the micro:bit, a Raspberry Pi microcomputer is connected with the micro:bit via BT. Raspberry Pi is chosen as it is a fully

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fledged, small sized computer with efficient processing power which runs Linux operating system and provides, among others, a set of GPIO (general purpose input/output) pins that allow us to connect components and explore the Internet of Things (IoT) and full networking connectivity capabilities. Linux, a standard and documented development environment on this microcomputer, makes it possible to use a well established server (SuperCollider) appropriate for our project and also develop a custom (Python) program.

In order to produce a functional interactive environment, we have developed and deployed software components on both devices. Initially in the micro:bit we flush a custom "runtime", a hex file, which provides BT connectivity and enables the microcontroller to collect and transmit data, upon request, from the accelerometer and the magnetometer. The information exploited for our project, is the "bearing", that is, the deviation (measured clockwise and in degrees) that the sensor records from the direction of the magnetic north. On the Raspberry Pi side, the custom developed python program initially performs the BT pairing with micro:bit, and then executes on a loop, continuously polling, over the BT connection, its "state" data collected by sensors. At the same time SuperCollider, which is an audio synthesis and algorithmic composition server, is set up and listens on its standard port for input. The collected data are mapped to frequency signals and are sent as input to SuperCollider which, based on the algorithm programmed into it, converts this input to a changing musical motif, which is reproduced by speakers connected to the RPI.

Finally, the actual music produced gives the feeling of interactivity to the audience as it keeps being modified while the Origami is rotating by air currents or by viewers. This site-specific, particularly outdoor and public-space sound installation needs to address issues of unpredictable events. The SuperCollider programming environment receives the processed data and controls all sound generation and specialization by manipulating the arguments of the synth through OSC (Open Sound Control protocol). As a result, sustained notes and, more specifically, clouds of grains have been created. The goal of relating the movement (rotation) of the Origami onto space with its musical output over periods of time has been achieved by creating a granular synthesis generator in which we have bound synth's arguments to a pattern event system. The next and final step has been to map the collected data to the density, duration, volume and panning of the grains using fixed range values, so as to create sustained notes.

The diagram below demonstrates the steps:

1		2		3		4		5
Data recordings by microbit sensors attached to the Origami	☐	RPI connection to Origami-microbit via radio/BT & Polling of data (Python)	☐	Process & Mapping of data to sequences (Python)	☐	Synths generation and data collection through OSC in SuperCollider	☐	Binding synth's arguments using patterns in SuperCollider
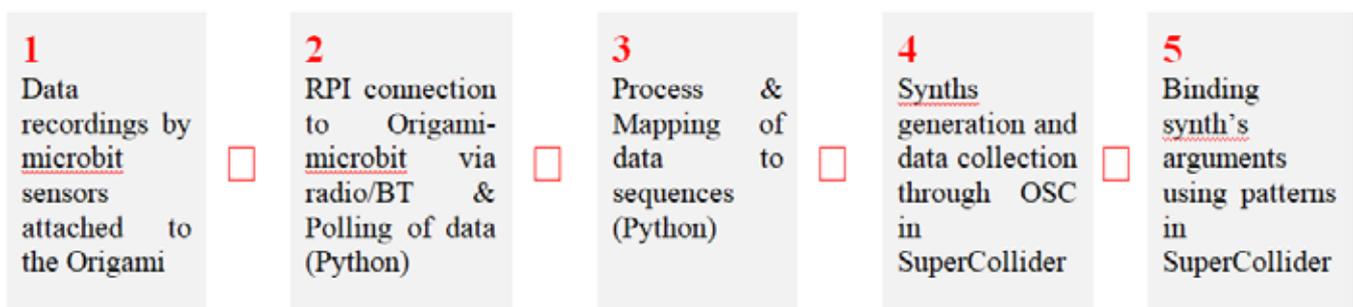
5. Results - Future perspectives

In the context of interactive art, our experimentation with digital technologies such as microcontrollers and microprocessors, aims to bridge various artistic, pedagogical- educational and social-political necessities. We consider the "Origami singing" installation as part of a work in progress, potentially in the frame of a STEAM training scenario inclusive of interactive, transmedia

narrative actions and workshops.

In a "holistic", yet to come project, the groups of participants will be able to interact, experience and compose a narrative through various media and processes, such as texts, pictures, drawings, graphical scores, paintings, sculptures, installations, videos, animations, AR and VR, "found objects" and wearables, among others, in an IoT environment. Our vision is to make a broader use of IoT technologies in order to exploit and share the collected information in a way more collaborative, decentralized and without geographical limits.

More specifically, we may use IoT brokers to communicate the locally collected data to other services, which would listen on information collectively produced from installations potentially located anywhere in the world. These services could produce meaningful transformations and representations of this combined and geographically dispersed information. Instead of locally reproducing the transformed data, we may publish them over the internet using suitable protocols, e.g. MQTT, to brokers' information exchange channels, known as "topics", where interested parts will be able to subscribe and receive the information and subsequently combine, process and transform this information to a new representation which could, in its turn, be re-published to another broker topic where final users would subscribe, receive and locally reproduce it. The final result would be combined and interactive, based on information collected from many installations all over the world. This way, data collected locally will be published and centrally collected, combined and algorithmically transformed and finally reproduced again at the place where the information was initially collected or to any other place where interested parts to this result would exist. Emphasis has been placed on the ethics related to the privacy and controlled use of data. Entities which would make use of this infrastructure should be able to manage and restrict, at will, access to this information. This can be made possible as open source, widely used IoT and messaging brokers implementations (e.g. Mosquitto, RabbitMQ) enable a fine grained management of users permissions on the use of information exchange channels (topics).

6. Conclusions

In the art and education context, interactive technologies such as sensors, microcontrollers, wearables, as well as the IoT, may support people develop their creative potential and emphatically participate in cultural exchanges. The interactive installation "Origami singing" has been implemented in two variants, aiming to explore tangibility, a key-notion in post-digital art. In addition, a participatory work in progress has been conceived and put into action, where both scientific and artistic disciplines contribute to interaction, within a democratic, educational environment of equal opportunities.

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Manty Albani is a visual artist and art teacher. She studied Painting (Athens School of Fine Arts), Archaeology & Art History (University of Athens) and holds a Master's Degree in Audiovisual Arts (Ionian University). Since 2000 she has presented paintings, installations, digital art and multimedia in a solo and numerous group exhibitions in Greece and abroad. She has participated in the "European Art Science Technology Network", in art and theoretical groups ("Omada Philopappou", "The Reading Group") and has translated art theory texts into Greek. She has published her work in more than 20 exhibition catalogues and books.

Vasilis Pitsilis holds a degree in Electrical and Computer Engineering from the University of Patras since 1999. As an external scientific associate with NCSR "Demokritos", in the ground of research projects for more than 12 years, he has been involved in numerous E.U and National funded projects in the fields of IoT, e-Learning, e-Health. His research interests include IoT distributed platform architectures and his professional experience S/W design and development of advanced applications and services, and design and deployment of broadband networks for multimedia applications. He has published more than 15scientific papers in Journals & International Conferences.

Dr.Vasilis Agiomyrgianakis is an audiovisual artist and researcher. He teaches the subject of Algorithmic Sound Composition in the Department of "Ethnomusicology" of the Ionian University. He has enriched his knowledge and skills but also his aesthetic education through the creation of pilot projects that make use of programming for audio and visuals during his work as a postdoc researcher. Furthermore, he has over 10 years experience in programming with SuperCollider and he has performed in several live coding events since 2006. He has completed a PhD thesis developing audiovisual compositions as well as interactive environments.

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Preliminary research on the design of a platform for developing educational applications focused in cultural heritage tourism with the use of augmented reality, mixed reality and gamification

Konstantinos Kotsopoulos[1], Stavros Vlizos[2], Dimitrios Tsolis[3]

[1]University of Patras, Patras University Campus, Rio Achaia, 26504, Greece
[2]Ionian University, Ioannou Theotoki 27, Corfu, 49100, Greece
[3]Omega Technology, Kallithea, Athens, 17676, Greece

Abstract

A preliminary research is presented about an innovative digital platform for the development of educational applications focused in cultural heritage tourism with the use of augmented reality, mixed reality and gamification, using a case study approach to the ongoing excavation of the archaeological site of the Sanctuary of Amyklaion in Amykles, an important political and religious center of ancient Sparta. Real data from the excavation and the monuments of the archaeological site are to be digitized and integrated in an application development platform, the architecture of which is described. Furthermore, the archaeological finds and their documentation format are utilized in educational narratives that improve the visitor's insight through their show by means of augmented and mixed realities. The interdisciplinary of this research is exemplary in setting new ways of collaboration between the broad technological, educational and cultural sectors.

Keywords

Reality, Augmented Reality, Gamification, Education apps, Archaeological Site

1. Introduction

During antiquity, the hill of Hagia Kyriaki, in a distance of about 5 km south of Sparta, was the location of a sanctuary of Apollo, that of Amyklaion. The worldwide exclusivity and importance of this archaeological site is due to the following factors: 1. the unique, in all of ancient Greek architecture, form of the temple of Apollo, the so-called Throne. During the late 6th century BC, the Spartans had invited architect Bathykles of Magnesia, Asia Minor, to construct a monumental (15 x 15 meters) as well as enigmatic building, a form of temple that resembles a high-rise seating structure. 2. the timelessness of the site with evidence of its continued use since the Early Helladic period, ca. 2200 BC. until today. 3. the importance of the sanctuary-related religious events of the Hyacinthia [17].

This multitude of qualities that make the Sanctuary of Amyklaion particularly significant, should be introduced and featured in an immediate way to the current and likely guests of the site. The various difficulties that appear at this location, for example, the absence of unique material because of its reuse in nearby edifices from late roman times onwards, the distinctive characteristics

of its area and continuous archaeological research which prevent the mass travel industry and attendance, as well as the way that the site remains to a great extent obscure to the overall population notwithstanding its significance, present an amazing chance to investigate ongoing and make advanced approaches to settling deterrents that archaeological destinations overall might confront.

In later decades, a near participation has been created between the innovation and culture divisions to form technology tools for the preservation and promotion of cultural heritage. Augmented Reality (AR) has opened up new roads and set out extraordinary new experiencesin the field of culture heritage. Visitors presently have the chance of an interesting and novel involvement with historical centers and, generally, cultural heritage sites can be approached with different views with the use of AR [13]. Along these lines, general society is effectively engaged with history through the submission of virtual stories and data presented by historical centers and organizations to upgrade its insight [20].

Educational experts has likewise fostered a strong fascination with the utilization of technology tools s to additional educational objectives. A three-layered virtual enviroment can be utilized as an instructive tool carrying individuals from various scientific areas to collaboration determined to acquire knowledge. [21]. In addition, gamification makes new ways to deal with authentic experience as the visitor turns out to be effectively involved. Serious games with interesting historical content are one of the most famous types of public history and, in blend with their authentic content, become especially compelling as stories experienced in casual settings. [22]. Gamification applications are basically another type of authentic historical text that offers the potential chance to alter the manners by which history is seen by the overall population, as they have properties that go before their substance and all the while shape it [23].

The presented preliminary research combines all the above mentioned challenges and opportunities in the Sanctuary of Amyklaion(see Figure 1)and approaches the creation of applications of educational cultural tourism which the use of mixed reality techniques, augmented reality and gamification, through an integrated 3D content management system.

Figure 1: 3D rendering of the Sanctuary of Amyklaion

2. Aim of the Study

The main goal of this research is to move the experiential opportunity for growth of the

uncovering of an archeological site exploiting Augmented and Mixed Reality through a focused educational methodology to students and "cultural" tourists. Dynamic Applications will be created and handled by a platform in a 3d environment that will have the following two subsystems: a) a mixed reality (MR) module for developing training stories b) an educational narrative subsystem utilizing AR and gamification. Education-wise, the aim is to restore old Amyklaion as a living historical center, which visitors can enter and comprehend [9]. In this way, the platform will recreate and interpret the historical, archaeological and cultural value of the site.

The central documentation platform will store the findings which were found in the space accompanied by the corresponding descriptive and three-dimensional information. This platform will also render the visualization of the findings in the three-dimensional model of the archaeological site, while it will provide the basic components for the development of an application with educational character. The documentation's main goal is the modeling and interoperation of the findings described, with each other and with other findings. The foreseen documentation must be uniform, including all the information needed for the needs of both the excavation and presentation of the findings, and the project if they don't completely overlap [5]. Standardizing the metadata format used to describe the findings is an important factor for their sustainability, but also for their effective retrieval and use - be it for research, educational, or other purposes [10]. Their design will take into account the interoperability with pre-existing data for the same purpose, interoperability with third-party data for a similar purpose, and the ease of understanding and recording them consistently and without doubt and error.

In the (MR) module for developing training stories, the creator of the applications will select the content that he wishes to appear in the mixed reality application specifying where and when each content will appear and the desired amount of time during which it will be visible (display start, display duration, etc.). The subsystem will be connected to the central documentation platform from which the 3D content will be derived. The creator will be able to select the appearance of more than one type of content in each timeline instant in order to be able to see the excavation work carried out. There will be the possibility for the content to be activated/ deactivated with the interaction modes offered by a mixed reality headset.

The digital applications for students and "excavation" tourists will be developed with the use of the educational narrative apps development subsystem. The subsystem will be connected to the documentation platform so that the creator will connect the content of the applications with real findings and build apps in a narrative form with gamification utilizing AR technology and positioning technologies (GPS and beacons). Each application will adapt to the way the user walks in the archaeological site, without indicating to the user how to advance. Consequently, it should consist of different entities chosen by the app creator with a common gaming context of the experience. A map must be available containing information about what the user has already interacted with and his achievements. An audio file and a virtual character that narrates the information about the content can be linked in each type of content that the creator chooses to import into the application. In some cases, the use of excavation tools will be needed so that the user to be able to discover findings (3D objects). Each content can be linked to games (puzzles, multiple-choice questions, role-playing, treasure hunting) that will be unlocked by the user as he approaches a certain point of the archaeological site.

The holistic approach of the applications combine research about interactive narrative through AR [15], the change of creating fun experience with AR [19], the self-determination of

the visitor via gamification [7], and through new realities to participate in active participation and learning processes [4], the creation of stories and authentic material for the improving of the visitor's experiential learning [11] and the rationale of making alternative narratives in the event that the visitor choose it [12]. There is research which covers portions of the proposed software, for example the Holomuse [13] that offers a total encounter connection with historical centers through MR Headset..

2.1. Materials and Methods

A contextual investigation approach will be utilized in the Sanctuary of Amyklaion and explicitly with respect to the landmarks of the site, for example, the famous Throne of Apollo, that can be without a doubt viewed as the most amazing but perplexing compositional landmark of the late 6th century BC, as confirmed by different recognized researchers since the late 19th century, and the continuous archaeological fieldwork. As indicated by ancient writers (for example Polybius 5.19.3) the Sanctuary comprised the main sacred focus of the Lacedaemonians [17]. The project puts J. Bruner's hypothesis of Discovery Learning [2] in the center of its academic way of thinking. A critical component of this hypothesis is the conviction that for the subject of the growing experience (beginer, scholar, "sightseer") to find new viewpoints in a generally prior type of awareness, having stimuli is essential. Through an exploratory cycle, which will be founded on investigating, tracking down other options and, as a rule, participatory instructive action by the subjects of the educational experience, the fundamental comprehension of new information will be accomplished. As a continuation of the mentioned comprehension of the educational cycle, the constructivist hypothesis of information approach is chosen in the project. As per the hypothesis, learning adequacy is inseparably connected to one's capacity to innovatively comprehend and adapt information, through a course of associating with different boosts [24]. Specifically, advocates of this instructive model accept that subjects of the growing experience, when effectively associated with the receival and development of data and information, are then ready to comprehend it top to bottom as well as keep up with it [25]. More particular, the constructivist educational methodology features as a foundation for the adequacy of learning the game, the revelation, the assembly of the subject's creative mind, the collaboration and interaction with the data and information gave [24]. The parts missing from customary learning conditions are what the project endeavors to cover utilizing mixed reality, augmented reality and gamification strategies through its incorporated application improvement stage. The archaeologists of the excavation participating in the research team, will test a new approach to the study and the offer of focused education in the field of excavation giving them the opportunity, with the use of appropriate mixed-reality devices (e.g. Microsoft HoloLens), to navigate the real space with capabilities of visualization of virtual restorations in the real space, visualization of findings at the point found accompanied with their documentation, simulation in the real space of ritual and other functions of the monument for better understanding of the place and the conditions of its use. This experience will not only be limited to the user of the mixed reality headset, but the visual result and the voice of the instructor will also be live streamed, with the aim of reaching a large number of internet users (archaeologists, students, etc.).

The archaeological site of the excavation will be digitized in 3D with the use of photogrammetric methods from terrestrial photos and UAV's photos taken at regular time intervals (for every level of excavation) during the excavation season and the generated 3D model will be inserted into the integrated 3D CMS. The above descriptive and 3D information that is stored in the findings and

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excavation reports documentation platform will constitute the basic content for the development of digital apps for students and archaeology tourism. These digital virtual excavation applications will be developed for each specific monument and will have the form of a narrative with gamification utilizing augmented reality (AR) and positioning technologies (GPS and beacons). The data of the virtual excavation will be real documented data of the findings throughout time, so the users will experience real moments from the excavation in the same respective locations. There will also be a possibility to develop educational narratives where the methodology of the excavation is presented upon real examples.

The multitier architecture which was selected for the development of the Augmented - Mixed Reality Educational Platform (AMREP) is the three-tier architecture. The proposed solution is based on 3 levels which each performs specific functions and can only communicate with the level that is directly next to it (see Figure 2).

Figure 2: AMREP Architecture

In the Application Layer are the educational mobile application, the mixed reality application and the application content management applications. The mobile app displays information about the archeological site and its findings. The application of mixed reality enables live presentations with the augmentation of 3d models and information in the real space. The two applications via beacons and GPS location services visualize the content based on the user's location. Management applications offer content documentation, user application designing and continuous updating.

In the Business Logic Layer both the processes of managing the components of user applications and content are executed. Through an application programming interface (API) the content and processes are offered to the respective applications.

In the Database Layer, the file system stores multimedia material about all subsystems of the processes level, while the metadata documentation of the findings, the components of the applications (Structure and texts) and data of users are stored in databases.

Following the above described architecture, a flowchart with the system processes is created, showing the steps, users, and subsystems as shapes of various kinds that are linked to each other by arrows (see Figure 3). In the circular shapes the subsystems of the project are represented. In the diamond shapes the basic processes and, in the parallelograms, the different user roles are represented. The interactions between the subsystems are presented with arrows and the documentation platform is the main content provider for the other subsystems. Finally, the diagram shows the interaction of users with the system.
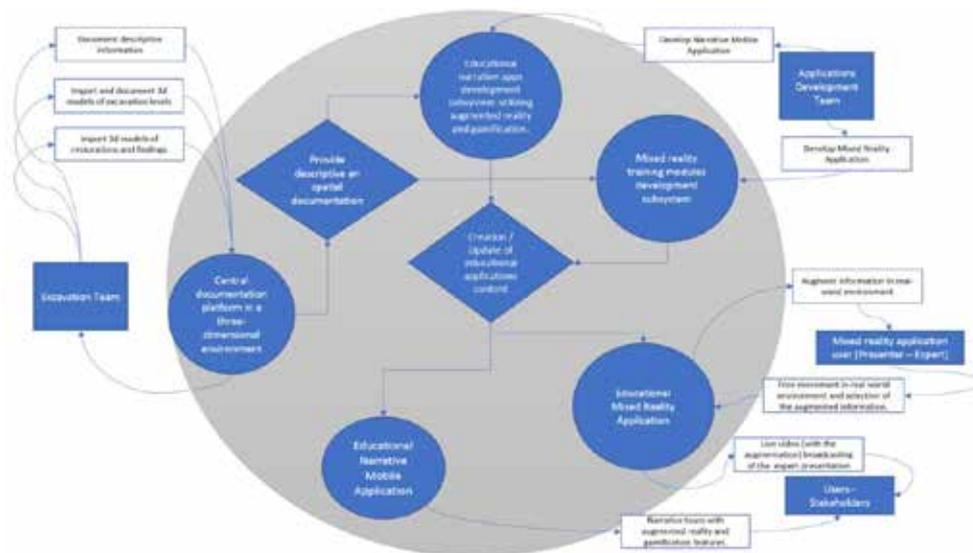
Figure 3: Flowchart of the AMREP Ecosystem

3. Results

The main outcome of the proposed project will be a revolution in the creation of educational applications using innovative mixed reality, augmented reality and gamification methods. Obviously, it ought to be clarified that notwithstanding all innovative applications, the rebuilding of the whole past of the archeological site is unthinkable. Additionally, the arrangement and translation of the past is affected by the philosophical discernments and encounters of the modern age [3]. Indeed, even considering these unavoidable restraints, the documentation format that will be developed in conjunction with the documentation platform will be unique tools that will expand the ability to create simple and great outcomes for unique educational applications. The integrated documentation platform and its resulting applications function as learning tools regarding cultural heritage and its importance, viewing tools of detailed multidimensional models of cultural sites, research and planning tools for the preservation and protection of monuments, as well as a tool to promote sustainable development of cultural heritage.

The research will also result in a direct communication in-between the excavation team and the general public or other cultural and research institutions, with the ability to disseminate the excavation results, findings and research and get feedback of the user interactions, thus optimizing the management of the cultural goods. Finally, the integration of the Sanctuary of Amyklaion into global education programs will facilitate the creation of new partnerships, joint ventures and interoperability with other similar research programs.

4. Conclusions

The digital age of late modern societies is redefining the public uses of historical and archaeological knowledge and the way their subjects approach the past. The 21st century centers around the immediate inclusion of subjects in the creation and utilization of knowledge through digital technology making them the regulators of the new era [26]. Digital environments using augmented reality, mixed reality, gamification and interactive storytelling bring different people and cultures together in a globalized environment and also, gain ever more noteworthy social

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acknowledgment, growing new types of social portrayal, correspondence, articulation and placation with the historical past.. The impact of these new med ia on how subjects perceive, understand and learn about the historical past is proving to be enormous.

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Approaching "Weird Wave". The use of theatrical form in contemporary Greek cinema and the use of these findings at "teaching for new technologies" in Ionian University.

Iakovos Panagopoulos[1,2], Agnes Papadopoulou[3]

[1] Post-doctoral researcher Panteion University Department of Political Science and History, Leoforos Sygrou 136, Athens, Greece
[2] Ionian University, Department of Audio & Visual Arts, Tsirigoti Sq. 7, Corfu, 49100, Greece
[3] Ionian University, Department of Audio & Visual Arts, Tsirigoti Sq. 7, Corfu, 49100, Greece

Abstract

Contemporary Greek cinema from the dawn of Greek Weird Wave (Rose, 2011) with the film Dogtooth (2009) (Lanthimos, 2009) of Yorgos Lanthimos, opened a new chapter in the landscape of global cinema. Greek Weird Wave waslinked with the Greek financial crisis and it was connected with it not only through the topics of their narrations but with the ways of producing their films also. Even though it was never an official avant garde movement with common characteristics and manifesto (like dogma 95), Greek Weird Wave directors share a similar aesthetic in form and style. In mixture of absurdity and raw realism Greek Weird Wave maps a contemporary reality in Greece during the roughest years of the financial crisis. Bradsaw states for Doogtouth that: 'could be read as a superlative example of absurdist cinema, or possibly something entirely the reverse—a clinically, unsparingly intimate piece of psychological realism'(Bradshaw, 2010). Through the directors of Greek Weird Wave one can notice many differences in form and style, especially if we compare directors like Athina Rachel Tsangari and Yannis Economides. On the other hand, there are some very crucial similarities that run throughout most of the directors of the Wave. Metzidakis (2014) in his paper "No Bones to Pick with Lanthimos's Film Dogtooth" talks extensively about four points in Dogtouth (curious language, evocation of cinematic and literary works, confusion of genre, and confusion of species). In the same time, it is also very noticeable in combination with the above four points an extensive use of theatrical form. This theatrical form is noticeable in two ways. The first one is through the approach of acting. This choice gives the creators the opportunity to underline this absurdity in their style. The second way is the use of long shots and the use of the cinematic space in their films. This is noticeable to most of the directors of the Wave from Yorgos Lanthimos to Alexandros Avranas and Argyris Papadimitropoulos. This theatrical approach to acting is used as a tool in the fourth point of Metzidakis, the confusion of species. As Metzidakis says: 'This ultimately postmodern mixing of theatrical genres leads us to consider a fourth and final category of traits important to this film: those which problematize conventional scientific distinctions between human and animal species (Metzidakis, 2014). This presentation will focus in deep research in the use of theatrical techniques in the cinematic work of three directors, Yorgos Lanthimos, Alexandros Avranas and Athina Rachel Tsangari. The findings of this research have been presented in the students of the Pedagogical Sufficiency Program of Audio-Visual Arts department of Ionian University in "teaching for new technologies" module. This module focuses on cinema and in the ways

that this tool can be used in teaching process. Film Studies and cinematic research can be a powerful tool for future teachers in order to approach their students from a new and vibrant point of view.

Keywords

Weird Wave, Education, Theatrical Form, Greek Cinema

1. A Post-modern approach to contemporary Greek politics

Greek Weird Wave was born as noted earlier in the research by the enormous success of Dogtouth (2009) (Yorgos Lanthimos, 2009) underlining some specific elements of contemporary Greek reality. Many scholars like Marios Psaras links Greek Weird Wave existence with the political uprising in Greece 2008. These riots where characterised by many as a crisis of identity. Kornetis says: "…many analysts called December "a crisis of meaning," others an identity crisis, a nihilist outburst, or a collective psychodrama, and juxtaposed it to the euphoric utopianism of 1968' (Kornetis, 2010). This notion also got enriched by the Journalist of the Guardians Steve Rose in his article "Attenberg, Dogtooth and the Weird Wave of Greek Cinema" saying: "Is it just coincidence that the world's most messed-up country is making the world's most messed-up cinema?"(Rose, 2011).

In the same time when film critiques or analysts trying to connect this wave with political influence and a need to underline contemporary Greek reality, the main directors of this wave deny any connection with it. Also, here there is a paradox that many filmmakers that use the same norms in cinema are marked as Greek Weird Wave artists, the filmmakers deny this brand for their selves. I believe that here is the first difference with all the previous so-called avant-garde movements. This wave does not act as a movement. It just happened to exist at a certain period because the first film was a success and the markets wanted a new product that it was convenient that was coming from Greece, since Greece got the attention worldwide because of the political events. When Lanthimos worked for the first time in an un-conventional way with the topic of Greek family, that started raising questions because it was hitting under the belt one of a very crucial and sacred elements of Greek society. As Psaras mentions: "Weird as in idiosyncratic or merely incomprehensible, Lanthimos's film is definitely a distinctive dramatization of the quotidian time and space of a Greek family. However, its uniqueness lies not so much in the film's representation of an unconventional Greek family but in its relentless interrogation of the familiar and national narratives and, most importantly, in its unconventional mode of dismantling them" (Psaras, 2016, p. 65).

After thatsuccess many films with the same form, norm and topic came to the surface like Miss Violence (2013) by Alexandros Avravas, Strella (2009) by Kostas Koutras and many more. Another common characteristic of these film is that the directors didn't care for a final finale or an end in the questions that they raised through their film. In all of Lanthimos films the story never finishes, in Koutras we can see the same pattern and in Athina Rachel Tsangari also. That is also connected with the nihilistic and postmodern nature of these film. That was shown also by the film Hardcore (2004) that for many worked as the arc of the Greek modern cinema to Greek Weird Wave. As Psaras mentions:"Through its postmodern aesthetics the film attempts a formal and thematic deconstruction of, and experimentation with the nation's favorite narratives as well as with Greekness itself. In this way, Hardcore in many ways anticipates the so-called 'Greek Weird Wave', suggesting the prior existence of alternative voices that sought to express the 'weird'

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encounter with the 'crisis of meaning' through the core inscription of a clearly queer content." (Psaras, 2016, p. 22).

In the films of Greek Weird Wave there is a lack of hope for societies future. In the Lobster (2015) we observe a society running with certain rules that reminds our own society. When the protagonist escapes the hotel and moves to a group of radicals that are called "loners" that they also escaped from the same norm we see that this group is more authoritarian than the others. The above filmmakers are trying not to give a fragment of hope in society today raising questions of how effective this work of art can be. Is not important only to underline a problem but also to suggest a way out. That is one of the clearest differences with the modernist approach of the New Wave.

2. Theatrical form in Greek Weird Wave

This presentation will focus in the theatrical elements and their importance in the work of three Weird Wave directors Yorgos Lanthimos, Athina Rachel Tsangari and Alexandros Avranas in his film Miss Violence (2013) (Avranas, 2013). All the above directors are characterised as Weird Wave artists since they share some similar aesthetical characteristics in their form and style. One element that stands out is their use of theatrical form in their mise-en-scene. When Yorgos Lanthimos first introduced the audience with this new approach on filmmaking with Dogtouth (2009) (Yorgos Lanthimos, 2009) the first shock was the way that his actors were performing. Because the narration of the film focuses in the everyday routine of three youngsters isolated to their luxurious house by their family who is giving them wrong information about the outside word, in the begging the audience believe that this weird performance exists because these youngsters are isolated from the outside society and they act as adults/children. When the narration of the film continuous we can observe that the characters outside this house performing in the same way. We are starting to understand that this motive goes far deeper than just a representation of the effects of isolation in three young people but aims in the representation of contemporary Greek society during the first years of the financial crisis.

This theatrical effect as noted earlier is noticed in two elements. In the performing of the actors and the use of cinematic space. This "weird" theatrical performing of the actors is an element that is noticed in all the above three directors. The way that the actors performing seems like a recorded rehearsal that never indented to be screened. This aesthetical choices in addition to the actor's repetition underlines a really specific reality of Contemporary Greek society. The mechanical repetition of actions and words and the social automatons of the characters underlines a specific comment for contemporary Greek society. That ours acts, our relationships, out actions are just a part of a performance, of social repetitions that are attached to our everyday life by the social contracts that run society. If we use Freud's point of view in his essay "Beyond the Pleasure Principle" (1920), where Freud states that humans struggling between two opposing drives Eros (The life instinct); which produces creativity, harmony, sexual connection, reproduction, and self-preservation; and Thanatos (the death instinct), which brings destruction, repetition, aggression, compulsion, and self-destruction. As Freud states for "compulsive repetition":"…is something that the individual is not conscious of, that the compulsive element in this concept is something which is not neurotic at all, or not necessarily, and that it is just as or no more compulsive than breathing or the changing of the seasons" (Freud, 1961, p. 14).

This element is clearly noticed especially in the approach of Yorgos Lanthimos and Alexandros Avranas. Lanthimos in ALPS (2011) (Yorgos Lanthimos, 2011) illustrates exactly that.

He articulates that our existence us human species are our social repetitions and our use of certain expressions and behaviors and nothing more. Avranas also shows that in the way that the family reacts to the death of their young daughter in Miss Violence (2013) (Avranas, 2013). They just use their social accepted expressions and norms in the world outside the house and in the house, they just continue their lives without the same grief and behaviors. This is also illustrated perfectly in the same film when the family eatsthe sandwiches from their young daughters' birthday after her death. This idea of the social contract or of the so called "Common Sense" of society is a topic that seems to trouble these directors. The characters of their films seem to accept fully this so called "Common Sense" and only rebel somewhere in the end, but not successfully. In Yorgos Lanthimos The Lobster (2015) (Yorgos Lanthimos, 2015) the directors illustrate the acceptance of these "unreasonable" rules of this dystopian society by all its members. The difference here from the so-called dystopian films in Hollywood (like Burger, 2014) is that even the groups that rebel against this status quo they become tyrants and worst rulers than the official ones, like the group "Loners" in The Lobster (2015) (Yorgos Lanthimos, 2015). This is also a clear post-modern effect that underlines their critique in modernity and modernity's political connection with the socialist dream. Another element that illustrates thistheatrical approach in acting isthe distance the characters take when they perform an infringing and taboo action. Is like a de-familiarisation effect when they perform a hybris. Like when the father in Miss Violence (2013) (Avranas, 2013) is raping his daughter after her gang raped from people that payed her father to have sex with her. When the father is having sex with his daughter his expressions are in a distance from the scene and the crime he is committing is a combination of Freud's Life and Death instincts in the most raw and animalistic representation. This approach in sex scenes is also illustrated in Giorgos Lanthimos Dogtouth (2009) (Yorgos Lanthimos, 2009). As Psaras mentions: "Sex is presenting as mechanical as driving the car to the family's house, and the scene itself is as boring and annoying asthe squeaks of the bed that dominate the soundtrack" (Psaras, 2016, p. 67).

Commenting on this animalistic representation in acting performances these elements can be found in many films of the chosen three directors. In Yorgos Lanthimos Dogtouth (2009) (Lanthimos, 2009) to Athina Rachels Tsangari Chevalier (2015) (Tsangari, 2015) where the members of the ship decide to play a game of who is going to prevail as the alpha male of the ship. This game is only for the passengers of the ship and not the crew. Of course, this narration has a clear feminist underline and in the same time articulates this class difference between the crew and the passenger. The players are so eager to win this game that really doesn't mean anything that their behavior is becoming completely animalistic until the end. Tsangari underlines that also with the dialogue just right before the beginning of the game regarding what kind of animal each member of the party looks like.

In regards with the cinematic space of the above directors their use is really interesting in addition to their acting and narration. The above directors especially Alexandros Avranas in Miss Violence (2013) (Avranas, 2013) and Yorgos Lanthimos in during his Greek speaking films the prefer the use of slow steady single shots from un conventional angles in order to visually create this new reality this new space. But what is this new space? It contains elements of our own reality but in the same time is much different than that. It is familiar and unfamiliar in the same time. They are familiar because the characters are using norms and social automatisations that we use but in the same time they are unfamiliar because they don't filter these norms, they don't belong to same social contracts us we do and they are all driven by their instincts. It is a different universe, a different reality, a Heterotopia. Let's see how Foucault explained the difference between Utopia

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and Heterotopia in the preface of his book "The Order of Things": "Utopias afford consolation: although they have no real locality there is nevertheless a fantastic, untroubled region in which they are able to unfold; they open up cities with vast avenues, superbly planted gardens, countries where life is easy, even though the road to them is chimerical. Heterotopias are disturbing, probably because they secretly undermine language, because they make it impossible to name this and that, because they shatter or tangle common names, because they destroy "syntax" in advance, and not only the syntax with which we construct sentences but also that less apparent syntax which causes words and things to "hold together" (Foucault, 1994, p. 18). Foucault later lecture regarding heterotopias divided them in two different types. The heterotopias of crisis and the heterotopias of deviation. As he states for deviation heterotopias:"…those in which individuals whose behavior is deviant in relation to the required mean or norm are placed. Cases of this are rest homes and psychiatric hospitals, and of course prisons, and one should perhaps add retirement homes that are, as it were, on the borderline between the heterotopia of crisis and the heterotopia of deviation" (Foucault, 1984, p. 5).

This notions of counter-universes within our own universe are totally articulating the visual universe of the above Weird Wave directors and the way they want to comment on contemporary Greek society through these counter-universes. They use these deviations and they alternate the archetypical reasons of actions like family or the family table with a theatrical rituality. For example, the family table in Alexandros Avranas in Miss Violence (2013) (Avranas, 2013) has a sacrificing ritualistic deviation. The family table is not a place for protection and love any more. Every bite that they take comes from money produced by the sexual sacrifice of the daughters. The archetypical essence of families table breaks and is stained. In the same way the family table or the children dance in Yorgos Lanthimos Dogtouth (2009) (Yorgos Lanthimos, 2009) works in the same way. These children exist in a bubble universe that is created from their parent to protect them from the outside world. This universe breaking once more the archetypical use of family with the incest relationship of the children supported by their parents. In addition to space the use of time in these Heretopias is used quite interestingly. As Foucault states: "Heterotopias are most often linked to slices in time — which is to say that they open onto what might be termed, for the sake of symmetry, heterochronies. The heterotopia begins to function at full capacity when men arrive at a sort of absolute break with their traditional time" (Foucault, 1984, p. 6).

The use of time in these cinematic spaces is really vague. The time frame cannot be determined exactly since it has elements from different period. The costume design in Yorgos Lanthimos and Alexandros Avranas films has also referenced from earlier decades with an obsession to conservative choices in clothes. The set design also comes from earlier period (VHS, vinyl records etc.). These choices map a completely unique time and space that underlines certain issues of contemporary Greek reality, of contemporary Greek humans of the western modern free world. A short of a "human disease", using Roy Andersson's expression. The use of the theatrical form in the acting performance and their use of cinematic space are elements that are really interesting and extremely unique, in this scale, in world cinema.

3. Using these findings as a Pedagogical tool

The findings of this research have been presented in the students of the Pedagogical Sufficiency Program of Audio-Visual Arts department of Ionian University in "teaching for new technologies" module. It was emphasized that the associative thoughts force us to go from a specific impression

to a specific idea and in such a way that the transitions are not a result of choice but it is a necessity. But associative thoughts are not enough to explain relationships. Only make the relationships possible. Associative learning (between a stimulus and response) is affected by the consequence of the response. Students have to be cautious to avoid generalization from one situation to another because of cooccurring events in everyday life. The directors of Greek Weird Wave cinema stylize all the conventions, and totally undermine the seriousness and arbitrariness of the supposedly orderliness. In their films, relationships and acts are just a part of a performance, of social repetitions that are attached to our everyday life by the social contracts that run society. In the next period the above research will go deeper in the use of theatrical form in Greek Weird Wave cinema and especially in the notion of the creation of these heterotopias. We will produce some semistructure video interviews with the university students that will show the impact of this research to young future teachers. Film Studies and cinematic research can be a powerful tool for future teachers in order to approach their students from a new and vibrant point of view.

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Session 5

Digital Culture and Education II

Interactive learning games: the importance of art-based production methodologies and aesthetics for the development of innovative content

Polyxeni Kaimara[1], Georgios Miliotis[1], Marinos Pavlidis[1], Evangelia Koumantsioti[1], Stavros Karakoutis[1], Aris Melachroinos[1], Evangelos Pandis[1], Ioannis Deliyiannis[1]

[1]Department of Audio and Visual Arts, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece

Abstract

Game-based learning is a very active research field within the education debate, although games are not new in the pedagogical research area. The link between learning and educational practice needs to be seen as a process of translating theory into practice, taking into account the context in which the latter is unrolled. The field of Educational Technology performs this role. Educational technology as a complex, integrated process facilitates human learning through the systematic identification, development, organization, utilization and management of a full range of learning resources. Games are one of those learning resources and one of the most ancient forms of designed human interactivity. Interactivity as a field of research and practice concerns both educators and game designers. Within the computerenhanced learning environment, four dimensions of interactivity learning are recognized: the learner, the content, the pedagogy, and the context. This work focuses on the aspect of interactivity related to the development of digital learning game content in the form of a simulation game to improve skills for daily living, which is primarily aimed at children with learning disabilities in inclusive settings, utilizing learning theories that meet the requirements of 21st-century pedagogy. It formulates a new proposal for developing educational games that combine art-based production methodology and game development methodology with programming, both employing cutting-edge technology such as 360o videos, virtual and augmented reality.

Keywords

Activities of Daily Living, art-based production, game development, interactive simulation games, learning disabilities, 360o videos, transmedia

1. Introduction

In the long history of learning theories, fundamental questions about how learning takes place in the human brain and body have been employed by philosophers and educators [1]. Learning is the main research topic of learning psychology with supplementary input from the disciplines of sociology, pedagogy and biology, including modern brain research in the neuroscience field. One of the pioneers of educational psychology, coming from behaviorism, was Edward Thorndike, whose aim was to make the study of teaching scientific and practical, providing the principles of teaching based on the laws of psychology [2,31,34]. Although its objective epistemological approach has been widely disputed in recent years due to weaknesses in interpreting the learning

process as a whole Error! Reference source not found., its contribution has been determinant in shaping instructional programs. Thorndike claimed that the most fundamental type of learning process involves the forming of the connections between stimuli and responses through the rewards to increase the strength of those connections in a trial-and-error behavior procedure. Thorndike's theory named "connectionism" consists of three primary laws of learning: the law of readiness, the law of exercise and the law of effect. Contemporary ideas about the learning process include these three basic laws of learning formulated by Thorndike supplemented by three more laws: primacy, intensity, and recency. These principles of learning have been analyzed into additional structural elements and are referred to in the game design process as well Error! Reference source not found.. Essential elements of game design include seven interconnected and circular techniques so that one is a prerequisite for the other: flow, feedback, simplicity, immersion and engagement, choice, practice and fun. Thus, "flow" that is directly related to the motivation could be revealed as part of the law of readiness. The effective feedback as requirement for flow and the practice are parts of the exercise. As games are supposed to be fun, the positive feelings/emotions are parts of the law of effect. Additionally, games use a combination of immersion and engagement to create intense experiences, thus intensity improves learning due to increased interest and heightened focus. Learner choice and involvement are sub-parts of the laws of effect, readiness, and intensity and consequently of motivation. Finally, the simplicity offered by games which is a core aspect to game design has a direct impact on feedback and flow, and in turn, are associated with positive feelings and motivation. For game designers, simplicity applies to all aspects of game design: user interface, goals of the game, feedback loops, game mechanics, user input, screen layout, story narrative, rules and instructions. Many of the principles that are crucial for effective learning are also a fundamental part of games. It is assumed that there is a gap between game designers and instructors. However, the differences between learning and game design are mostly a matter of perspective, not of fundamentals Error! Reference source not found.. In fact, the connection between learning and game design is so strong because learning and games are based on the same laws and present similarities.

Games are one of the most ancient forms of designed human interactivity Error! Reference source not found.. The role of interactivity in digital educational games renews interest in learning theories and their impact on understanding computer-based interactivity and its potential for enhancing the learning process Error! Reference source not found.. Behaviorism, cognitivism, and constructivism are the three learning theories most often utilized in creating learning environments, providing structured foundations for planning and conducting instructional design activities Error! Reference source not found.. For behaviorism the goal of instruction was to elicit the desired response from the learner focusing on the importance of the association between the stimulus and response followed by reinforcement of the "correct" behavior. Cognitive theories stressed the conceptualization of students' learning processes and addressed the issues of how information is received, organized, stored, and retrieved by the mind. Even though constructivism is considered to be a branch of cognitivism, constructivists do not share with cognitivists and behaviorists the belief that knowledge is mind-independent and can be "mapped" onto a learner. Learners build personal interpretations of the world based on individual experiences and interactions. Learning to be successful, meaningful and lasting requires three key factors: activity (practice), concept (knowledge), and culture (context). Despite their differences, the learning theories present the basic pedagogical principles that should be taken into account by digital game designers. The link between learning and educational practice needs to be seen as a transformation of theory into practice taking

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into account the context in which the latter is unrolled Error! Reference source not found...

However, it should be noted that most of these learning theories developed at a time when learning was not influenced by digital technology. Towards the end of the 20th century, a new field in education emerged as a branch of the educational theory. Initially, in 1963, called "Audiovisual Communication", which was primarily concerned with the design and use of messages that control the learning process, at a time of intense influence by behaviorism as recorded by the use of the term "control" Error! Reference source not found.. Educational technology is the new term for a theory, a field and a profession. According to the Association for Educational Communications and Technology Error! Reference source not found., educational technology is a complex, integrated process, involving people, procedures, ideas, devices and organization, for analyzing problems and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning. The rapid development of the computer in schools has brought about the emergence of a new group of specialists who were calling themselves "educational technologists". However, as Ely pointed out Error! Reference source not found., the self-called educational technologists "have embraced the label but not the concepts of the field" because of their belief that they "have discovered a device or medium which will engage the learners as no teacher has ever done", revolutionizing education. 21st-century rapid technological evolution and the development of complex interactive multimedia require skills such as critical thinking, communication, collaboration, and creativity Error! Reference source not found.. At the same time, these multimedia facilitate the cultivation of these skills by highlighting the human's leading role through cooperative processes that are influenced by the community, culture and social knowledge [7,25].

In the case of educational learning games, their design is an extremely complicated activity and a team process which, beyond game designers, computer and interface specialists, requires subject matter experts in the domain, instructional systems design experts, cognitive task analysis and in-game research Error! Reference source not found.. Keys to a successful digital game include the finding of balance between entertainment, principles of fun and engagement, instructional design and learning. This task demands building an effective design team to create common teaching/ learning models and processes, ultimately developing innovative games that can revolutionize learning Error! Reference source not found.. Thus, learning games' development requires a significant allocation of resources and expertise, as their production cycle is similar to that of entertainment computer games; yet the former's development is more complex as it additionally involves the collaboration of teaching/learning experts. There are many genres of computer games and simulations are among them Error! Reference source not found..

Educational games and simulations, unlike direct forms of instruction, are experiential exercises Error! Reference source not found.. For games the objective among others is to win; simulations, in contrast, are adequate models of the complex real-world situation with which the player/student interacts (referred to as fidelity) taking on roles with well-defined responsibilities and constraints. Thus, there are two key differences between games and simulations: one is that most video games have a win state, and the other is that players don't just run a simulation, they microcontrol elements inside the simulation. Microcontrol has well-known cognitive effects Error! Reference source not found.. Additionally, simulations include empathy to some degree, i.e., mechanisms that put the player's affective state with the state of the game character/avatar. In other words, when a player simulates the avatars, he/she do not become them, but he/she process

certain predicates in as-if mode, imagining how he/she would feel or react in the same situation Error! Reference source not found..Adding some or all of the formal structural elements of games such as fun, play, rules, goals, winning, competition, a simulation turns into a simulation game[8]. Many contemporary games employ filmic methods, such as cut scenes, voice-overs, and third-person point of view. Through these, the game depicts the character and the character's expressions to the player. An important issue for both design and research is to examine whether discovery learning environments, such as simulation environments, lead to knowledge that is qualitatively different from knowledge acquired from more traditional instruction. In addition, the still persistent important goal of current research is to identify the characteristics of the games and simulations that improve learning and which kinds of knowledge and for which kinds of learners [9,10]. The state-of-the-art brings back to the forefront Dede's Error! Reference source not found. statement about the historical controversy between pedagogy and technology for the necessity or not of a universal educational method that is best for all types of content, students, and educational goals based on the composition of the different principles of learning theories. The key components of the learning process remain the same and the synthesis of the theories proposes four dimensions of interactive learning within the computer-enhanced learning environment Error! Reference source not found.:

i. the learner as the "who" of the learning process,
ii. the content as the "what" of the learning process,
iii. the pedagogy as the "how" of the learning process, and
iv. the context as the "when" and "where" of the learning process.

These dimensions also formed the basis of the four-dimensional framework outlined by De Freitas and Oliver [5]which can be used both in the evaluation and in the design and development process of digital learning games and simulations. The four-dimensional framework encompasses i. Context (where play/learning takes place), ii. Learner specification (age and level, learning background, styles, and preferences), iii. Pedagogic considerations (methods, theories, models and frameworks) and iv. Mode of representation (tools for use/level of immersion, fidelity, and interactivity).

Contemporary digital environments have features that can afford important learning opportunities for users Error! Reference source not found.: interactivity, adaptivity, feedback, choice, non-linear access, linked representations, open-ended learner input and communication with other people. Interactivity, as one of the most important features of learning technologies, is a research field and practice for both educators and game designers. Games-based learning and simulation-based learning are innovative forms of interactive content [11,12]. To design an effective educational game/simulation it is not enough just to count on strong educational content. Moreover, not any game could be considered successful even if it motivates students based on its gamification techniques. The question is whether, ultimately, educational games/simulations improve learning outcomes. What are the characteristics of a game/simulation to achieve its learning objectives? A game/simulation design aims to consider those elements that lead to a fun, engaging, and educational game experience. Instructional strategies and learning theories must be included in these formal methods Error! Reference source not found..

Within this framework, our cross-disciplinary research team designs and develops game-like digital learning materials by receiving content from real-life scenarios, employing art-based production methodologies, determining from the beginning the four dimensions of interactivity. Our ongoing project is an interactive simulation with gamification techniques called "Waking-up in

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the Morning" addressed to typically developing preschoolers and children with learning difficulties of similar mental age. The main goal is to give an alternative way to cultivate important life skills in the domain of Activities of Daily Living as people with developmental disorders often have difficulties while performing tasks in their daily living. The project is based on the conviction that everyone can learn according to his/her interests, personal characteristics and pace in an adaptive and personalized interactive environment.

2. Aim of the Study

This work presents the process of interactive content development in contrast to traditional media production workflows. To describe the steps that were taken to design and develop the interactive learning game, which is actually a simulation game, we built on film production and game development methodologies.

3. Method and Materials

Digital learning content comes in many forms including interactive tutorials, games and simulations, e-assessments, streaming media, web pages, digital writing and presentations, podcasts, screen casts, videos, slideshows, quizzes, etc. Error! Reference source not found.. Our simulation prototype was designed and developed, having in mind the De Freitas and Oliver Error! Reference source not found. checklist, which involves the four dimensions of interactivity Error! Reference source not found. and it is integrated into a wider range of skill learning options through transmedia learning activities, which share the same content in a virtual environment. This work is strongly related to game development phases mixed with art-based production methodologies: concept, pre-production phase, production, alpha-phase, beta-phase and post-production, and filmic methods, as cut scenes, voice-overs, and third-person point of view [20,29]. Dalgarno and Lee [3] argued that representational fidelity and learner interaction are the two unique characteristics of 3-D virtual reality learning environments. Representational fidelity refers to the quality of the display to reproduce the content in the most realistic way possible, while learner interaction refers mainly to the dynamic embodiment experience through the use of an avatar. The avatar functions as the user's representation, thus the user can communicate with and control the environment through the avatar as if he/she was actually in the 3D environment simulation [17,18]. To ensure representational fidelity and better transfer of taught skills to real-world conditions, we chose 360o video technology. In the film, an actor, that is a real 9- year-old child, functions as an avatar. A third-person perspective is adopted, as the player can see the character/actor moving into the screen, allowing more viewing environment when playing. The player interacts with the actor/avatar by choosing what is the next avatar's move according to the guidance of a pedagogical agent. There is also a secondary actor, the child's mother, who interacts with her child in the film but does not interact with the player. The produced digital material is utilized both in a virtual reality learning environment (VRLE) as well as in an augmented reality learning environment enriched with symbols/communication cards. VR-enabled headsets, laptops, tablets, smartphones or interactive whiteboards will be used, depending on the player-learner's profile/characteristics. The symbols/ communication cards function as buttons for the VR version of the game and as triggers for the AR version. The symbols were downloaded from the Boardmaker collection after obtaining permission from TobiiDynavox Picture Communication Symbols® that designed them. We deliberately chose pre-existing pictures because these symbols are readily recognizable by children with educational

needs as many special educators and therapists already use them.

4. Results

As the simulation game was designed to receive content from the real world, the steps for its development were parallel to the design and development of 360o videos with shared elements:

1. Concept/Design:

- the idea originated from the ascertainment that the degree of child independence in Activities of Daily Living (ADLs) is crucial for parents, caregivers, educators and therapists
- target group, game's genre, learning theories approaches, technology and hardware platforms, gameplay description and mechanics, i.e., the steps a player takes to achieve the goals of the game and finally the schedule

2. Development

◊ Pre-production:

• scripting   • storyboard

Image 1:developed with Fade In Professional Screenwriting Software

• shotlist   • breakdown(casting, props, etc)

◊ Production:
• shooting

• diagram
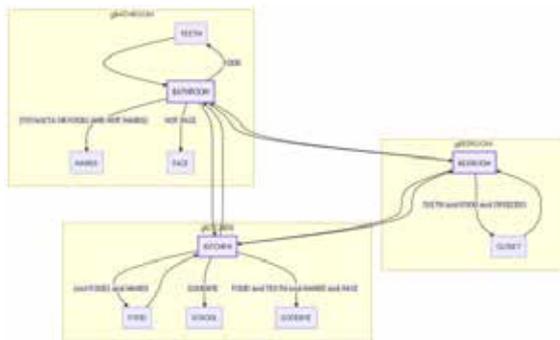
• overview
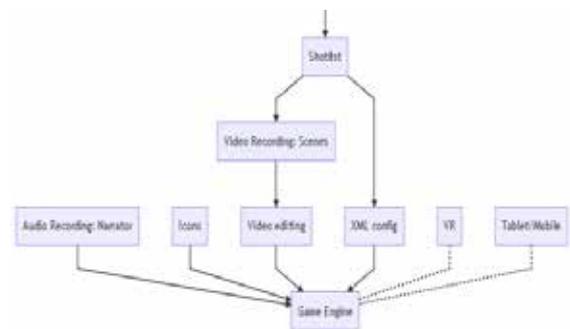
• coding, programming and software development

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◊ Post-Production (post-production of the 360o videos is integrated into the production of the game)

• montage   • convert pictures to vector

• voiceover

• sound design

Alpha phase: internal testing methods with criteria on each prototype stage

Beta phase: testing cycle conducted by third parties (user and expert evaluation)

Post-Production (game): release to public and game package

5. Conclusion-future work

The field of education is always influenced by the technological achievements of each era. Undoubtedly, in a digital era flooded by a wide range of devices and applications that aim to make our lives easier, it is a common perception that those who are technologically illiterate find it difficult to engage with current challenges. Certainly, young people do not belong to this category. However, they are often called upon to be taught by teachers who are not keen on using the capabilities of modern devices like smartphones and are far more ignorant of the actual content supported by these mobiles, for example, digital games, and thus often condemn all games, under the umbrella of "violent" play, "wasted time", or "trifle". Educational technology is the education sector that combines pedagogy and innovative technology. A paradigm of educational technology could be digital games. However, each digital game is not considered educational even if the content is

educational. Utilizing the games' elements that make them fun, attractive and ultimately engaging in conjunction with gameplay, educational objectives and pedagogy is the foundation of game-based learning. Games are one of the most ancient forms of designed human interactivity. Interactivity is a field of research and practice for both educators and game designers. The purpose of this work focused on this aspect of interactivity relating to digital learning game content development. It is a new proposal for developing educational games that combine the art-based production methodology and game development methodology with programming, both employing cutting-edge technology. To design and develop an interactive learning game that delivers content from the real world and at the same time affords image fidelity to ensure natural representation it was necessary to take into account both the methodologies for the design and development of video games as well as the production process of a 360o video. In conclusion, pre-production (scripting/storyboard, etc.) occurs before and during the Alpha phase of game development, production during the Alpha phase and post-production before and during the Beta phase of game development. This mixed video and game production leads us to a complex model of game development that showcases the importance of art-based production methodologies and aesthetics for the development of innovative game content. Following the authors will proceed to evaluate the simulation learning game, both for game design and educational purposes. The assessment methodology carried out is closely linked to the game development phases: concept, preproduction, prototype, production, tracking, alpha, beta, gold, and post-production. Evaluators will be users of focus groups consisting of students with and without learning disabilities and experts.

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You have the tablet, I have the cards, let's play together! Combining card-based games, puzzles, multimedia applications and learning content that support inclusive education scenarios

Polyxeni Kaimara[1] , Stavros Karakoutis[1] , Aris Melachroinos[1] , Marinos Pavlidis[1] , Evangelia Koumantsioti[1] , Evangelos Pandis[1] , Georgios Miliotis[1] , Ioannis Deliyannis[1]

[1] Department of Audio and Visual Arts, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece

Abstract

Working with students with learning difficulties is challenging because even though they share common features according to their diagnosis, personalized learning approaches are also required. Personalized learning is the new trend in many learning environments that requires not just technological support but also the transformation of teaching methods. Personalized learning builds on learning theories that meet the requirements of 21st-century pedagogy and the principles of Universal Design for Learning. Teachers are seen here as levers of innovation in the field. As a result, they need to have access to affordable equipment, such as smartphones and tablets, and easy-to-use applications, which can support their students anywhere and anytime. Taking into account teachers' views on what they perceive as obstacles to the integration of digital learning materials in the classroom, i.e. resources, lack of training, attitudes about traditional and modern teaching, lack of equipment and support from policy-makers, our research team is designing and developing applications utilizing cutting-edge technology such as augmented reality employing gamification techniques. Specifically, the main purpose is to perform these applications, which deliver content from everyday life skills, in conditions of inclusive education, focusing on facilitating teachers to overcome the barriers they encounter in the implementation of "a school for all" and providing opportunities to students for collaboration.

Keywords

Augmented reality, everyday life skills, game development, learning difficulties, personalized learning

1. Introduction

Personalized learning is the new focus on many learning environments that requires not only support but also the transformation of teaching techniques and practices by the teachers. This transformation is based on the contemporary framework of the learning theories and meets the requirements of the 21st-century pedagogy and the principles of Universal Design for Learning (UDL) [4]. In the ever-evolving 21st century characterized by the rapid development of digital technology, speedy transfer of information and knowledge management require critical thinking,

communication, collaboration and creativity [28]; [30].The usage of technology in every area of life shifts the role of the educator, between the one who teaches and the one who learns at the same time with his/her learners. Thus, although the so-called 4Cs super skills (i.e. critical thinking, communication, collaboration and creativity) of the 21st century are not new in the field of personal development theory their cultivation is considered more compelling than ever due to the abundance of data which every person is called to handle with. Thus, others' people experiences could become a substitute for knowledge [24]. The framework for developing learners' super-skills is inspired by the principles of UDL. Assuming that every learner is unique and differs markedly in the ways that he/she can be engaged or motivated to learn, perceives and comprehends information, navigates a learning environment and expresses what he/she knows, it is concluded that there are not only one means of representation, of expression and of engagement that will be optimal for all learners in all contexts [7].The theory of UDL indicates that learners need to have access to information in different ways so that each learner can learn in the way that is best for him/her. UDL provides the guidelines to develop a flexible and adaptable learning program that allows equal opportunity for all learners and the principles to implement inclusionary practices in the classroom. Because of the diversity in the classrooms, i.e., different ages, cultures or disabilities at the physical or cognitive level, etc., the aim is to design multi-modal systems/materials. Multi-modal systems use more than one human input channel in the interaction, that could be used by as many users as possible, regardless of their sensory, physical or cognitive impairment and in any technological platform and devices [13].

As mobile devices are lightweight, portable and intuitive to use thanks to touch screens, they are preferred over laptops or desktops [45]. Devices, such as tablets and smartphones, are useful in education as they permit users to have unparalleled access to communication and information, facilitating what has been termed "anytime, anywhere learning" or seamless learning, because of their increased affordability, functionality, small size and portability [8] . Tablets also represent a space for entertainment, a space of freedom and escapism from the "world of adults" [12]. Nowadays, most children are familiar with digital technology, tools and applications and exploit almost all of the possibilities provided by their mobile devices every day. Mobile devices can support both individual and social construction of knowledge simultaneously, so learners should be given opportunities for more control over their own learning [10]. In formal educational settings, teaching students inside and outside the classroom employing their own devices is engaging and motivating, promotes personalized learning, collaboration and communication among peers [21]. Technologies are getting more powerful, more mobile, more pervasive, more adaptive and less expensive [41]. Such as technology is Augmented Reality (AR).

AR as an emerging interactive technology allows the reproduction of computer-generated imaging information, including detailed information about locations, events or activities from the real world by combining sounds, pictures, videos and animation, the fusion of virtual and real objects and allows applying mobile technologies in collaborative learning, revolutionizing the educational experience [26]. AR technology and its supporting devices can recognize and present information to the users even if they are far apart. It provides interaction, physical experience and a flexible environment. It is especially suitable for teaching risky, complex or abstract concepts and for presenting objects and locations that students can't see or visit. It also improves understanding, problem-solving, creative thinking and motivation [46]. Unlike VR, AR interfaces allow users to see the real world at the same time as the virtual images that are associated with real sites and objects [47]. In a smart classroom environment, students collaborate in a common workplace respecting the

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individual pace and learning profiles. This is a difficult task to implement at a desktop-based lecture. Students working on separate computers do not easily interact even though they sit next to each other. On the converse using mobile devices, new opportunities for a highly interesting interactive learning experience are promising. An experience like that enhances collaborative learning since students can sit together and have eye contact. Moreover, when students work together, the space between them is used for non-verbal communication, such as glances and gestures, even touches. These interfaces let users see each other, along with virtual objects, allowing communication behaviors much more like face-to-face than like screen-based collaboration [5].This significant contribution of mobile devices is also related to their utility in the field of education of people with special educational needs and especially of students in the autism spectrum disorder (ASD), which face difficulties on eye contact and touching, and of students with specific reading disability (dyslexia). Innovative potentiality has emerged with touch screens and compensatory assistive technologies by facilitating the handling and enhancing self-communication and message composition [38].

Designing and developing educational material for teaching activities addressed to students with different learning profiles is a necessity as a result of the diversity of the population in most classrooms. Educational settings premise equity by providing the same learning opportunities, valuing all pupils equally and celebrating diversity. Schools with an inclusive orientation define "differentness" as an ordinary part of the human experience [1]. In such settings, equity of opportunity becomes a reality only when students receive instruction adapted to their readiness levels, interests and learning preferences [43]. The case of students with special educational needs is challenging because even though they share common features according to their diagnosis, most of them need individual approaches. However, the classic individualized approach provided in a resource room (integration class) or a class with parallel support to the struggling student in the mainstream school, as applied in Greece, is far apart from personalized learning and could lead to isolation or even stigmatization. A personalized learning approach utilizing technology has the potential to reduce the stigma of special education and enable students to meet high standards [35]. There is a debate among academics and practitioners, whether personalized learning is about isolation or inclusion. According to all of the above, personalized learning could lead to isolation only if it is implemented inadequately. Using personal desktops lacking differentiating content, that is based just on the individualized education plan (IEP) and without promoting the collaboration conditions among peers, really isolates students. Technology is not a panacea. We cannot use computers in classrooms keeping the same conventional teaching strategies [25]. As Mary Ann Wolf stated, integrating technology for instruction is "much more than putting a piece of software into a classroom" (as cited in Robin, [36]. Once again there is a question of definitions and techniques. At first glance, personalization, differentiation and individualization have similarities, the terms are often used interchangeably and so there is a confusion in the education world. In fact, they differ, as personalization is student-centered, while differentiation and individualization are teacher-centered. In an environment that is fully personalized, the learning objectives and content, as well as the method and pace, may all vary so personalization encompasses differentiation and individualization [6]. A particularly important noting is that of Spector's. Spector [41] underlined the difference between "personal" and "personalized" and stressed that the "personal learning environment" constructed and controlled by the learner is completely different from the "personalized learning environment" that automatically adapts to the interests and needs of individual learners.

Regarding inclusive education, the cornerstone of which is a school without exclusions and segregations, teaching methods become more complex as each student, with or without disabilities

has his/her own personal pace. Personalized learning inspires teachers to design ways to approach students individually in an inclusive environment, adjusting to a particular learner's interests, goals, focus, progress and problems following the principles of differentiated instruction [41]. Most teachers state that they want to differentiate the content of their courses but they disquiet regarding classroom management, they are pressured by the necessity to cover a wide range of content in a short, by lacking the right equipment and know-how. Even when they can use technology, they declare that it is a costly process in both time and money [19]. Recently, smart education provides the guidelines to overcome these problems because it is based on technologies and devices that are available to anyone, and can be used anytime and anywhere [20]. Moreover, cutting-edge technology emerges the creativity and the interactivity of both teachers and students. In the literature review of interactivity, it is stated that games are one of the most ancient forms of designed human interactivity [37]. Digital game-based learning is the innovative form of interactive content thanks to the combination of technology, game and learning [9]. Furthermore, the best method to carry out a task is to turn it into a playful activity using gamification techniques and through it to gain experience for future goals [3].

Gamification refers to the use of game design elements to motivate and increase user activity and retention [11]. Thus, employing gamification techniques in AR applications exploits the dynamic elements of games, namely goals, rules, challenges, achievements, etc. and cutting-edge technology capabilities transforming a simple application to more attractive, challenging, less boring and motivating. However, integrating those applications into a learning environment is not just about entertainment but mainly about learning. Alongside, putting educational content into game-like applications with the expectation of motivating children is not enough to convert them to education games [17]. Although motivation is a good starting point these applications should be aligned with the principles of pedagogy and educational methodology.

Gamification is a word that has become synonymous with rewards as most gamification systems focus on adding points, levels, leader boards, achievements, or badges to a real-world setting [32]. If the goal is to teach a skill with real-world value, reward-based gamification can be effective. As the student learns the skill, he/she is rewarded and then when performing that skill in the real world, he/she recognizes its value. So, the rewards are no longer needed, as the student will continue to use the skill for real-world benefits instead of the gamification rewards. However, the risk with rewardbased gamification appears when the goal is to create long-term change in the student's behavior. Instead of using game design elements to increase external motivation through rewards, game designers can use them to increase internal motivation and, therefore, meaning in non-game settings. The rewards should quickly be replaced with more meaningful elements, such as a narrative, freedom to choose paths to explore, playful activities and opportunities to reflect. This process is known as meaningful gamification. "Meaningful gamification is the integration of user-centred game design elements into non-game contexts" [31]. The term "meaningful" is based on Mezirow's model of "transformative learning" [29] where the challenge of creating something meaningful is to connect it to the learner's life, providing a variety of experiences and ways of engaging. The goal is to raise the chances that each learner find something meaningful to the connected non-game activity that meets his/her needs and interests. Transformative learning theory fits the concept of UDL where the learners have access to the content in different means allowing to choose the means they prefer. Focusing on the possibilities that technology furnishes to special and inclusive education and taking into account the principles of the learning theories that utilizing by game design as well and the principles of UDL, we created educational content familiar to students.

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2. Aim of the Study

One of the principles of UDL is considered to be the "why" and encompasses the ideas of motivation, building on the interests of the students, providing multiple means of engagement and reasons why they should learn what they're learning [18]. Digital educational games allow teachers and students to connect meaningful real-world scenarios with school content, thus responding to the old question "Why do I need to know this?" [2]. Besides the "why", the four dimensions of interactive learning are also examined, i.e. the "who" (learner), the "what" (content), the "how" (pedagogy), the "when" and the "where" (context) (see [23]. In this paper, our work as part of a larger project is presented. The purpose is to give teachers alternative ways of teaching through the possibilities of transmedia learning, that is a storytelling technique, in which educators and learners can expand a core knowledge or experience across different media platforms [15] with content derived from everyday life of children, such as the Activities of Daily Living Skills (ADLs). By utilizing paper cards, which are a classic method of symbol-based communication and visual support among children with developmental difficulties, we developed AR applications with gamification techniques, following filmic methods and using mobile devices such as tablets and smartphones. The aim is to employ every day devices thanks to their affordability as indicated by the results of our recent research [22].This research about the pre-service teachers' attitudes towards the use of digital games for collaborative learning in schools resulted that the 99.2% of the 264 undergraduate students and future teachers of various scientific backgrounds responded that they have a personal computer or a laptop and the 96.2% smart phone or tablet.

3. Method and Materials

Regarding the four dimensions of interactivity, this application focus on:

- Learners: students with special educational needs and their peers, mental age around 5 to 7 years old
- Content: the morning routine, i.e. what a person does from the time he/she wakes up to get out of his/her house to go to work (for students at school)
- Pedagogy: a combination of the principles of the learning theories, i.e. behaviorism and constructivism, with contemporary theories for special education
- Context: the material could be used either at school, mainstream or special, or at home but the main goal is to be used in inclusive classes as a good tool/practice for typically developing children and their peers with learning disabilities, taking advantage of the potential of technology at both software and devices level

Concerning the special educational needs, the theoretical documentation was based on the principles of Universal Design for Learning and of Personalized Learning in a collaborative environment, such as inclusive education settings. To create the AR application which was developed using Vuforia and Unity3D Engines, we followed concrete steps:

Initially, employing the script/storyboard of the whole transmedia project "Waking up in the morning" (see, [23]),we chose those parts from the material created to content production that best fits an AR application: pictures for triggers, videos for tutorial and gaming overlays, and gamification process.

For the pictures, we used ready-made pictures from Boardmaker collection under obtaining permission from Tobii Dynavox Picture Communication Symbols® (Figure 1). We deliberately

chose ready-made pictures and we did not design our own because these pictures are easily and readily recognizable by most of the children with educational needs as many special educators and therapists use them, and therefore there is no need to teach or demonstrate new visual material. Additionally, the usability and availability of the images were taken into account as the availability of the images will also affect the availability and the functionality of our application. To have an overall AR application experience, the pictures need to be easily accessible, as they're used for triggers. Furthermore, another reason for choosing these cards, in addition to their availability and recognizability, was the way people and objects are depicted. Considering research about the effect of the amount of physical detail in images on picture recognition memory, Boardmaker collection is simple pictures/symbols, servicing the lower cognitive load and on the avoidance of disruptions [33]. Moreover, regarding technical issues, as those images have to act as image targets recognizable by the system, guidelines provided by Vuforia Engine about strong key features, such as sharp edges, optimal image dimensions, aspect ratio, image contrast, distributed textured areas, etc. were taken into account.

1   2   3   4   5   6   7   8
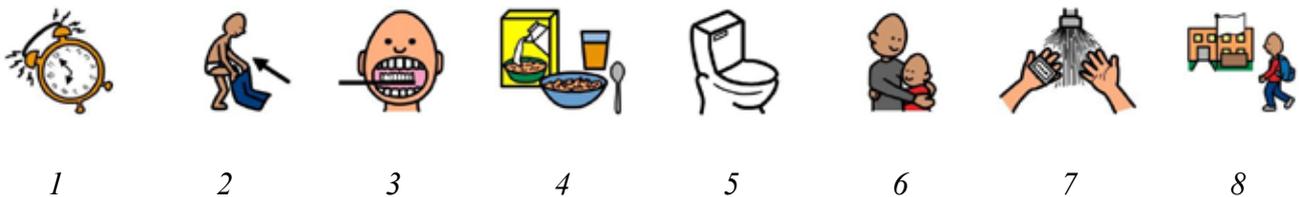
Figure 1

For the application to work, the student-player must put the images in accurate order, following a sequence of activities, e.g. first we eat and then we brush our teeth (Figure 2). Our application uses 8 images, with the 1st image being the start and the 8th the end of the story. The 1st and 8th image are placed on a board from the beginning and students are asked to place the other 6, which are given in mixed sequence, but fixed for all students.

Figure 2

Pictures could be also used as a storyboard giving the opportunities to both teachers and students to create their own story-generating those conditions to further develop the content by adding extra activities/images, e.g. making the bed, hair brushing, wearing shoes, etc. (Figure 3).

Figure 3

For the videos, we proceeded to the appropriate converts and video processing to be compatible with the AR platform. The videos have been selected from a series of videos that provide an integrated separate routine, e.g. tooth brushing, so they could function independently and be used

for other learning activities. It is also filmed a pedagogical agent who is welcoming the student-player and "tutoring" him/her for using the AR application, giving directions to the game flow, as well as oral rewards when the student-player finds the appropriate image or additional information when the player finds a different image than expected. If children are not yet able to make card combinations to create the story according to the AR gamified application, the pedagogical agent provides "help". Finally, they see the content of the video and thus benefit from the whole process.

As mentioned above, for gamification, to give a complete sense of game experience, application users need to follow a specific process by placing the pictures in the appropriate order on board. When the cards are put in the precise order, their unique combination acts as a trigger for the emergence of a suitable video. If the cards have inaccurate order, then the pedagogical agent appears to prompt him/her to try again. The purpose of this game is the students-players learn the steps in a particular order, not by punishing but by showing that nothing will happen if they make the wrong choice, as the game flow stops. This process does not discourage the students and is one of the most effective ways to keep playing, trying to discover the accurate image combination. The ultimate goal of the game is to students transfer skills to real life.

4. Conclusion

According to the literature review, AR applications give motivation, perceived enjoyment and collaboration among learners and can provide the benefits of an effective and engaging learning experience. Our research team is working to give teachers the expertise to approach any content through easy AR applications that they will design and develop with their students. This process involves the whole class, students and teachers, and therefore the family, to create their own videos and with simple programming, recording familiar characters and environments to children. Thus, it will be made easier for students, especially in ASD, to identify with the avatar and take advantage of video self-modelling capabilities as a form of video-based intervention (VBI). Our expectation is also to give teachers ideas to overcome the obstacles they face both for the differentiation of their educational material and for the implementation of inclusive education, exploiting the possibilities of technology. Further work focuses on the evaluation of the application by teachers and students, either as material that could promote cognitive tasks or as a chance for collaboration between students with educational needs and their peers.

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Undergraduate students' attitudes towards collaborative digital learning games

Polyxeni Kaimara[1], Emmanuel Fokides[2], Andreas Oikonomou[3], Ioannis Deliyannis[1]

[1]Department of Audio and Visual Arts, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece
[2]Department of Primary School Education, University of the Aegean
[3]School of Pedagogical and Technological Education (ASPETE)

Abstract

Digital game-based learning is considered a smart learning environment and has been recognized as an effective approach thanks to the ability of games to motivate and engage students, improving students' learning performance. Digital learning games are the new paradigm for education, based on the idea that children learn more effectively by solving problems in playful activities than by traditional materials that focus on reading, writing, spelling, arithmetic and listening. Whatever changes are made in teaching and learning, teachers remain the levers of the educational process, because they are the ones who will be called upon to implement innovations in the classroom. In this work, the authors' team aimed to investigate undergraduate students' attitudes to the utilization of collaborative digital games in the learning process. The results provided a basic understanding of the students' attitudes. In general, students were slightly positive regarding digital games implementation. This finding allows many interpretations, including the view that students seem reluctant to adopt technology in teaching and learning despite their extensive exposure to digital media. Therefore, a more in-depth investigation of pre-service teacher attitudes, as well as the philosophy and curricula of the Greek Higher Education Pedagogical Departments, their readiness to adapt to the demands of the 21st century and their willingness to accommodate the international trend of transforming educational systems is required.

Keywords

Digital games and higher education pedagogical departments, digital learning games, preservice teachers, students' attitudes

1. Introduction

Digital game-based learning has been recognized as an effective approach thanks to the game dynamics to enhance motivation and to stimulate students' curiosity and learning interest through activities that make sense to them [6]. Games are important for the development of children's cognition and social processes, by engaging and allowing them to have control, providing a more interesting and challenging learning environment, thereby effortlessly improving their learning performance [6] . Digital learning games could be considered as the new paradigm for education, based on the idea that children learn by problem-solving in playful activities rather than traditional based material focusing on reading, writing, spelling, arithmetic, and listening [7].The pedagogical approach that is implemented in many of these games relates to their potential to function as the

hook to connect the learning objectives and activities defined by the curriculum [16]. The less conservative approaches consider digital learning games as powerful learning tools and part of the overall educational technology. However, digital learning games are more an educational approach rather than just educational tools [4]. In the 21st century, digital games, among others, cultivate learners' skills such as critical thinking, collaboration, communication, creativity, and information seeking [26]. Digital games empower teachers and learners to connect scenarios through the real world with school content, thus responding to the old question "Why should I know this?" [3] In a learning society, flooded with data, the discovery of real information that will lead to knowledge requires complex skills and the transformation of the educational system into a system that is characterized by a readiness to integrate new challenges. Traditional teaching methods cannot provide convincing answers to this old question as they simply reproduce knowledge. Skills that are far from the model "read, write, arithmetic" is demanded. In this educational system, undoubtedly, learners are at the heart of the learning that is, the "who" of education, with teachers being at the heart of system change. No changes in the educational system can happen without teachers. They are both the pedagogues in the classroom and pivotal agents of change in [33].

Even if, the majority of the teachers recognize that digital games support students to develop a wide range of strategies that can be very important for learning such as the resolution of problems, the learning of sequences, deductive reasoning, and memorization, and they have positive attitudes towards their use, few teachers have decided to implement videogames in their classes, partially due to the lack of experience [2]. Several studies have been conducted to examine those factors that lead teachers to utilize or not digital games in education. Numerous researches associated teachers' intention to use games with Keller's [27] ARCS-V Motivation Model [8]. ARCS-V model proposed five key principles associated with motivation in the educational technology context:i) attention, ii) relevance, iii) confidence (iv) satisfaction, and v) self-regulation (volition). Although Keller himself [28] indicated that for students to become fully motivated, teachers need to discover the relevance of games to their specific content areas, [36], surprisingly, concluded that perceived relevance was not found to affect teachers' attitudes toward educational video games or their intention to use them. The explanation given by the researchers was that teachers found it easier to value digital games as an attention driver than as a relevant teaching methodology for students learning the process. This finding is consonant with the view that the key part of the problem regarding the integration of digital games into the classroom related to the perception of technology as a tool rather than a system or set of affordances [4].

Digital game-based learning as part of technology-enhanced learning [19] could be studied in the broader context of technology acceptance in education. Although, according to [40], the first large step has been made: "we have largely overcome the stigma that games are play and thus the opposite of work"(p.2), however, putting educational content on games with the expectation of motivating children is not enough to call a digital game as an educational one. If so, it is just the replacement of the medium, instead of paper/book/whiteboard. It is very important to acknowledge the attitudes of teachers, both in-service and pre-service, that are shaped throughout their lives, both within the wider social environment and during their studies into the school and later into the university [32]. In addition to the teachers' own experiences, the characteristics that encourage or discourage them from using digital games are related to the games per se. There are many features of digital games that will challenge teachers to use them in their educational work. Perceived usefulness, perceived ease of use, computer self-efficacy, and attitude toward computer use were found as significant determinants of the intention to use computers by pre-service teachers [11]. Pre-service teachers

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concluded that perceived usefulness and perceived ease of use were the most influential factors to their intention to use 3D multi-user virtual environments (MUVEs) when they become teachers [12]. Similarly, in the case of educational video games, perceived usefulness influences directly and positively teachers' behavioral intention while perceived ease of use indirectly influences intention through perceived usefulness [37]. Kenny and McDaniel [28] regarding the undergraduate students' (pre-service teachers) perceptions about games and their usefulness in education, found that a small minority played video games regularly and this lack of experience may explain why most of the pre-service teachers admitted that they consider video games as too complicated. The impact of game design experience had a positive influence on teachers' attitudes, self-efficacy, and perceptions regarding the use of digital games in the classroom [1].Therefore, it is proposed several changes to pre-service and in-service teacher training curricula and professional development programs that should provide opportunities for teachers to design their own gaming environment, to explore ways to incorporate game design activities into the classroom or informal learning environments, and thus to become more actively involved in game selection and integration that will allow them to reach games' full potential [29]. Hence, technology can shape, and reshape, who is the learner and who is the teacher [16].

In this context, the authors' research team examines the factors associated with the implementation of digital games in education. Previous authors' research studied players/students' views on serious games [13], In the current research, the authors have focused on teachers' views as one of the key factors in the successful implementation of digital games in the classroom. The survey instrument was a combination of the qualitative and quantitative approaches. This paper analyzes preservice teachers' attitudes (as future teachers) about their intention to use collaborative digital games in the learning process, providing information from the quantitative part of the research. Pre-service teachers will soon start working in the real educational context and at the same time have a dual identity as both students and teachers. The authors considered that is necessary to identify students' (pre-service teachers) views, as games are a common form of entertainment for their generation [32].

2. Aim of the Study

The main aim of this study was to examine undergraduate students' perceptions (preparing to become teachers) towards digital educational games and their implementation into the classroom especially digital educational games, which are designed for collaborative learning. The purpose was to record the general prevailing atmosphere in the University Departments that prepare future primary and secondary education teachers. Following, the hypotheses, the participants/sample size, the onlinebased survey questionnaire, and our data collection process are described.

3. Materials and Methods

The general attitude of pre-service teachers was examined in correlation to demographic items that served as independent variables (IVs) of the research, which shaped the hypotheses of this work:

3.1. Hypotheses

H1. Undergraduate students' attitude toward collaborative digital learning games is positive.

H2. Scientific background significantly and positively influences undergraduate students' views towards collaborative digital learning games.

H3. Gender significantly and positively influences undergraduate students' views on collaborative digital learning games.

H4. Age significantly and positively influences undergraduate students' views on collaborative digital learning games.

H5. Additional ICT training significantly and positively influences undergraduate students' views on collaborative digital learning games.

H6. Undergraduate students who play games for more years have more positive views on collaborative digital learning games.

H7. Undergraduate students who play games more frequently have more positive views on collaborative digital learning games.

3.2. Participants, procedure and duration of the survey

The undergraduate students of the target group were 263students coming from twenty-five University Departments in Greece, which are preparing students to become teachers of Primary and Secondary Education. The research also included students from the Departments of Special Education. An invitation was sent to the Department's secretariats and Facebook student groups to inform students about the research. Students were also informed that the research will be conducted voluntarily, that the consent of his participation is considered to have been given by completing the online questionnaire and that the researchers committed to keeping their anonymity. The questionnaire was available for about one month and a half, from the beginning of February to the mid of March 2019.

3.3. Questionnaire

The survey instrument was an online questionnaire that combined qualitative and quantitative approaches and contained three sections. In the first section, participants were required to answer questions about their demographic data, as the department, gender, age, additional training in ICT, and information about their game-playing experience. About the university department, the students recorded the department in which they were studying so then be coded according to the subject of their studies/scientific background. Age was divided into 4 groups: 18-23, 24-30, 31-40 and over 40 years old. To confirm students' experience of playing games, multiple-choice questions were created considering the years they have played and their frequency, as follows about the number of years: never, less than 2 years, 2-8 years, 9-15 years and over 15 years and about their frequency: never, occasionally i.e. 1-3 days a month, frequently i.e. 1-3 days a week and every day.

The questions in the second section of the questionnaire were about participants' attitudes towards digital games and their opinion regarding the usefulness of the games or not in the context of collaborative learning. The questions were based on the scale employed by Martín-del-Pozo et al., [32]. The quantitative approach was formulated based on33multiple-choice questions and participants were simply selecting the answer that fitted them in a five-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). At the end of the questionnaire (third section), participants were given the opportunity, if they wanted, to provide additional comments as an open-ended question: "What do you think is the biggest barrier to integrating collaborative digital

learning games into the learning process?"[1] For this paper, only the answers to 33multiple-choice questions are analyzed, that is the quantitative approach.

3.4. Data screening and transformations

Data from the "Undergraduate students' attitudes towards collaborative digital learning games" questionnaire were imputed into SPSS 25 and they were checked for missing or unengaged responses (none was found). A new variable was computed which was the average of the questionnaire's 33 items, which served as an indicator of participants' beliefs for undergraduate students' attitudes towards collaborative digital learning games. The preliminary analysis revealed that the data in this variable were not normally distributed. The issue was addressed by computing a new variable using the two-step transformation to normality technique described by [39].This transformed to normality variable, served as the study's dependent variable (DV).The questionnaire's demographic items, namely: scientific background, gender, age, additional training in ICT, and information about their years and frequency of game-playing experience, served as the study's independent variables (IVs).

As regressions analysis was to follow to find the relationship between the predictors and the outcome variable, an analysis was conducted for examining whether the assumptions for this type of testing were met. The rule of thumb for at least 20 participants per IV [18], was satisfied since there were 263 participants and six IVs. An analysis of standard residuals was carried out, which showed that the data contained no outliers since no values were exceeding the |3| limit [10]. The data also met the assumption of independent errors (Durbin-Watson statistic 2.01). Variance Inflation Factor (VIF) and tolerance were used for checking multicollinearity. It was concluded that multicollinearity was not an issue, as there were no cases in which VIF was above the value of 4. Moreover, tolerance was, in all cases, well above the recommended minimum of .25 [18]. Finally, heteroscedasticity was not an issue as assessed using the Breusch-Pagan test [5].

4. Results

The data were imputed into SPSS 25 for statistical analysis. The questionnaire's reliability was examined using Cronbach's alpha [9], and was found to be acceptable (α = .806). As the questionnaire examined the overall attitude toward collaborative digital learning games, an average was calculated for each participant's responses to all items, which served as the study's dependent variable (DV). The DV's mean was slightly above the mid-point (M = 3.44, SD = 0.34). This indicates that participants' attitude toward collaborative digital learning games was positive (but not remarkably positive). Thus, H1"Undergraduate students' attitude toward collaborative digital learning games is positive" is accepted.

In particular, to accept or reject the additional hypotheses, the sample description is given. The total sample of 263 students, 78 males, and 185 females, was divided into 3 categories of scientific background, according to the main body of the courses being taught in their departments. Thus, three categories emerged UNI1 which included 106 students of theoretical scientific background, UNI2 which included 111 students of technological scientific background, and UNI3 with 46 students of special education departments. The third category emerged because, according to the literature, special education teachers seem to be more positive regarding digital games utilization in the classroom and especially in inclusive settings (Istenic Starcic & Bagon, 2014).According to

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1　　The results and conclusions of the qualitative research that emerged from the answers to the open-ended question were published after its presentation at the DCAC2019 conference(Kaimara et al., 2021).

age, four groups were created: (1) 18-23 years old, (2) 24-30 years old, (3) 31-40 years old, and (4) over 40 years old. 180 students were found in the age group 18-23, 51 students had an age between 18 and 23 years old, 24 students were found in the age group31-40, and 8 students were over 40 years old. Considering the additional ICT training, 163 students did not attend additional training, while 100 students attended additional training programs.

The following was recorded about the students' experience in playing games: Table 1 shows the Experience of playing games regarding the years, and Table 2 shows the frequency of playing games.

Level	Years spent playing	N	%
0	never	58	22.1
1	less than 2 years	51	19.4
2	2-8 years	59	22.4
3	9-15 years	54	20.5
4	over 15 years	41	15.6

Table 1: Experience of playing games regarding the years

Level	Frequency of playing	N	%
0	never	58	22.1
1	occasionally: 1-3 days/month	51	19.4
2	frequently: 1-3 days/week	59	22.4
3	every day	54	20.5

Table 2: Experience of playing games regarding the frequency

For examining whether the IVs had an impact on the DV, a series of One-way ANOVA tests were to be conducted. Given that the data in the DV deviated slightly from being normally distributed and given that there was not an equal number of participants in each IV's levels, it was decided to proceed using non-parametric tests, namely the Mann-Whitney and Kruskal-Wallis tests (depending on whether there were the two or more levels in the IV).

It was found that:

- The different groups of scientific background i.e. theoretical, technological and special education did not have an effect on the DV [$H(2, 260) = 1.73$, $p = .422$]. Thus, H2 is rejected; the scientific background does not significantly influence undergraduate students' views towards collaborative digital learning games.
- Gender did not have an effect on the DV ($U = 6455.00$, $p = .177$). Consequently, H3 is rejected; gender does not significantly influence undergraduate students' views on collaborative digital learning games.
- Age did not have an effect on the DV [$H(3, 259) = 1.16$, $p = .762$]. As a result, H4 is also rejected; age does not significantly influence undergraduate students' views on collaborative digital learning games.
- Additional training in ICT did not have an effect on the DV ($U = 7073.00$, $p = .072$). Thus, H5 is rejected; additional training in ICT does not significantly influence undergraduate students' views on collaborative digital learning games.

- The years spent playing digital games had an effect on the DV [H(4, 258) = 15.68, p = .003]. Thus, H6 is accepted, the more years undergraduate students played games the more positive views have towards collaborative digital learning games.
- The frequency of playing digital games had an effect on the DV [H(3, 259) = 12.46, p = .006]. Thus, H7 is accepted, undergraduate students who play games more frequently have more positive views towards collaborative digital learning games.

In the last two IVs, in which statistically significant differences were noted, post-hoc pairwise comparisons were conducted to examine the differences between the levels of these IVs (Tables 3and 4).

| | **Group pairs** | | | | |
Levels	0-1	0-2	0-3	0-4	1-2
N	58 51	58 59	58 54	58 41	51 59
Mean rank	52.56 57.77	47.81 70.00	52.61 60.68	44.30 58.06	47.08 62.78
U	1337.50	1062.00	1340.50	858.50	1075.00
Z	-.860	-3.541	-1.314	-2.350	-2.576
p	.390	< .001	.189	.019	.010

Table 3: Pairwise comparisons for years spent playing digital games

| | **Group pairs** | | | | |
Levels	1-3	1-4	2-3	2-4	3-4
N	51 54	51 54	59 54	59 41	54 41
Mean rank	51.75 54.19	42.82 51.07	63.75 49.63	53.31 46.46	44.93 52.05
U	1313.00	858.00	1195.00	1044.00	941.00
Z	-.411	-1.474	-2.290	-1.161	-1.248
p	.681	.140	.022	.246	.212

Table 3: Pairwise comparisons for years spent playing digital games (continued)

| | **Group pairs** | | | | |
Levels	0-1	0-2	0-3	1-2	1-3	2-3
N	70 101	70 63	70 29	101 63	101 29	63 29
Mean rank	71.63 95.96	60.04 74.73	45.19 61.62	84.97 78.54	64.69 68.31	44.45 50.95
U	2529.00	1718.00	678.00	2932.00	1383.00	784.50
Z	-3.163	-2.196	-2.593	-.844	-.456	1.085
p	.002	028	.010	.399	.648	.278

Table 4: Pairwise comparisons for the frequency of playing digital games

From the above tables, it can be inferred that:

- Participants with the lowest frequency, i.e. never played digital games gave a lower rating to the DV compared with the other groups. Simply put, students who never played games or who played at a lower frequency gave the lowest average to the overall attitude toward collaborative digital learning games.

- The results that correlate the years that students have played with their attitude towards digital games in the learning process are not so clear. There seems to be a statistically significant difference between those who have never played games compared to those who have played more than 2 years and especially over 15 years, but this gaming experience is not able to explain a possible positive or negative attitude for learning games.

Generally, pre-service students' attitudes are slightly positive, a mean of 3.44 (out of 5), nearly to the option "Agree". Similar was Martín-del-Pozo et al., [32] finding with an averaging of 3.65. The additional analyzes showed that no independent variable, such as scientific background, gender or age, even the years spent playing, has an impact on the attitudes towards collaborative digital learning games. From the above, it can be concluded that the only factor that could influence a positive attitude is the frequency with which someone is playing games. These findings are consistent with findings of other contemporary surveys in which the correlation of the demographic variables and their attitudes or intention to use educational video games has not shown statistically significant differences among groups of teachers formed by the gender, age, teaching experience, type of school (primary or secondary school) where the teachers were employed [30]. These results are particularly promising, as previous research has shown that age and gender are predictive variables of attitude formation [32]. Sánchez-Mena, Martí-Parreño & Aldás-Manzano [35] found that age moderated teachers' perceived ease of use on perceived usefulness, i.e. the effect of teachers' perceived ease of use on teachers' perceived usefulness of educational video games is moderated by this factor (age). In other words, older teachers found difficulties in the implementation of educational video games due to the lack of experience and familiarity with video games compared to younger teachers. Alongside, in the case of pre-service teachers the most powerful factor that affects their attitudes towards ICT, generally, was the viewpoint of their university professors who teach ICT-related courses [42]. The impact of game design experience had a positive influence on teachers' attitudes, self-efficacy, and perceptions regarding the use of digital games in the classroom [1]. Therefore, pre-service and in-service teacher training curricula and professional development programs should provide opportunities for teachers to design their own gaming environment, focusing on teachers' age as older and younger teachers' perceptions, familiarity and competence. Training programs should showcase the perceived usefulness of educational games to encourage teachers to adopt this educational innovation in their courses.

5. Conclusion – future work

The notion that prevails is that the young generation has positive attitudes towards digital educational games. However, our research pointed out that although there are no strong resistance and negative beliefs by the students, they seem a little bit reluctant to adopt the technology in teaching and learning despite their extensive exposure to digital media[2]. The results provide a basic understanding of the undergraduate students' attitudes and views on collaborative digital learning games. Our research suggested that the concern of the attitudes of future teachers of all educational levels, Primary, Secondary and Higher Education is fundamental as in some years almost the majority of the teachers will be called upon using digital learning materials. This evidence is very important especially for the educational system of higher education level which prepares the future teachers and should be under consideration for educational policy-making. Therefore, a more in-depth investigation of pre-service teacher attitudes, as well as the philosophy and curricula of

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2   A different statistical approach highlighted the factors that shape student attitudes, which was published shortly after the first results of the present study(Kaimara et al., 2022).

the Greek Higher Education Pedagogical Departments, their readiness to adapt to the demands of the 21st century and their willingness to accommodate the international trend of transforming educational systems is required. If the learners are at the heart of the learning and the teachers of any educational level are at the heart of system change, the cornerstone of any change is teacher education. Following, the researchers' further work has relied on the qualitative approach of the questionnaire that was employed in the current work, analyzing the barriers regarding digital learning integration in the classroom as they were referred by the pre-service teachers.

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Polyxeni Kaimara, MSc Developmental and Educational Psychologist, holds a PhD in educational technology for inclusive learning environments (Department of Audio and Visual Arts of the Ionian University in Corfu, Greece). She also holds a Master's Degree in Public Health, a Degree in Counselling and Guidance, a Certification of Adult Training and a Certification of Qualifications & Vocational Guidance. She has teaching experience at Western Macedonia University and Ionian University. She is working as a psychologist at an Educational Centre for People with Disabilities in Florina, Greece. She is a co-author of several papers and chapters. Her research interests focus on the design and evaluation of educational systems for special education and training, and the implementation of digital games aimed at designing programs for inclusive education. https://scholar.google.com/citations?user=rVcJ1mUAAAAJ&hl=el

Dr Emmanuel Fokides is an Assistant Professor at the Department of Primary School Education, University of the Aegean, Greece. His courses focus on the educational uses of emerging technologies, virtual reality, digital storytelling, augmented reality, and serious games. Since 1994, he is involved in several research projects regarding distance and lifelong learning and the educational uses of virtual and augmented reality. His work is published in several conference proceedings, chapters in edited books, and journals. He is also the co-author of several books. https://scholar.google.com/citations?user=byq8N_EAAAAJ&hl=el

Dr Andreas Oikonomou is an Associate Professor at the Department of Education (discipline: Developmental Psychology, Educational Psychology: Theory and Practice) at the Pedagogical and Technological School of Education, in Thessaloniki. During his 30-year academic career in the field of Psychology, Pedagogy, Didactic of Science and Environmental Education, he has been involved in many national and European projects and has published numerous papers in peer-review journals and conferences. For years Dr Oikonomou worked on political education and training of young people giving to them tools about citizenship (theories, methods and techniques) to work with people, engaging and aware others in social problems to resolve. https://scholar.google.com/citations?user=4aLOaqAAAAAJ&hl=el

Dr Ioannis Deliyannis is an Associate Professor in the field of "Analog and Digital Technologies of Interactive Multimedia" at the Department of Audiovisual Arts at Ionian University, Corfu, Greece. He holds a Computer Science Degree and a PhD in the field of Interactive Multimedia (University of Wales, Swansea). His research work is largely related to multi-media applications, visualisation and web-based technologies applied to complex scientific fields such as Computational Rheology and the development of Educational Systems for Research and Interactive Learning. https://scholar.google.com/citations?user=ppxYJLEAAAAJ&hl=el

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Escape Room as Learning Environment: Combining Technology, Theater and Creative Writing in Education

Zoi Karageorgiou[1], Eirini Mavrommati[1], Eleni Christopoulou[2], Panagiotis Fotaris[3]

[1]School of Applied Arts, Hellenic Open University, Patras, Greece
[2]Department of Informatics, Ionian University, Tsirigoti Sq. 7, Corfu, 49 100, Greece
[3]School of Computing, Engineering and Mathematics, University of Brighton, UK

Abstract

Meaningful learning activities can challenge pupils to work, cooperate, face appropriate and contextualized challenges and help them understand problems and different situations. Learners need to develop cognitive, emotive and scientific objectives and highly thinking and metacognitive skills relating to analysis, synthesis and evaluation. Creativity in schools needs fresh ideas and students that have communication and collaboration skills and are highly interested and motivated in order to fully participate in a project. This paper reveals how escape rooms can be used as a learning environment even at the stage of design. It presents the outcomes of a questionnaire that students answered at the beginning, concerning their opinions about the school and escape rooms. It highlights the design steps and the difficulties that arouse during this procedure that took place in a Vocational School in Greece. It reports on the benefits of a project about an escape room that challenges students to use different tools such as new technologies, theater and creative writing. Finally it provides a new insight into a multilevel cooperation between teachers and pupils of different Specialties and argues that these capabilities can be understood, learned and applied by others engaged in same projects, in order to contribute to future studies of school innovation and success.

Keywords

Escape room, theatre, technology, creative writing, vocational school, design

1. Introduction

A learning environment at school, in order to offer the building blocks of design, improvement and innovation, should follow certain fundamental principles [17]:

- Learners are the core participants, with active engagement and understanding of their own activity as learners.
- It is based on the social nature of learning and it stimulates well-organised co-operative learning.
- The learning professionals are highly attuned to the learners' motivations and the key role of emotions in achievement.
- It is extremely sensitive to the individual differences among the learners in it, including their prior knowledge.
- It devises programs that demand hard work and challenge from all without excessive

overload.

- It operates with clarity of expectations and emphasis on formative feedback to support learning.
- It strongly promotes "horizontal connectedness" across areas of knowledge and subjects, as well as to the community and the wider world.

Creativity is brought into schools, in such environments, not only in the way of doing but also in the way of thinking. The acceleration of school life in digital world demands innovation, redesign, flexibility and abilities to manage and disseminate knowledge [10]. Teachers as experiential beings seek out opportunities for tactile and embodied experiences of the new [10]. A considerable challenge for them is the use of synthetic approaches by which creativity can thrive [10].

One area of concern is arts, where collaboration, imagination, and out-of-the-box thinking are expected. They can impact powerfully on accomplishment of multiple areas of the syllabus, provide experiences to students that line up with "real world" expectations, enhance their achievements and influence their wellbeing [9]; [4]. Arts integration helps school people to reach out community resources, transfer knowledge between different areas and connect them to the school curriculum [3].

Another area of concern is technology, which supports students' developments with multiple tools and empowers them (consciously and unconsciously) to take advantage and shape those tools in order to help them in their daily practices [13]. It also enables learners to be educated on their own terms [7], to connect, interact and communicate with the other students, with the educators and cooperating institutes in order to ease joint learning, cooperative projects, product prototyping [12].

Theater elements help educators to implement interactive theatre practices into their school life, to improve and widen their educational experiences and to increase their communication skills [5]. Very important is the opportunity of having reflections in action, which means playing and failing within the secure world of the fiction [1]. Meaningful learning activities that challenge pupils to work in roles, make them face appropriate and contextualized challenges and help them understand problems and different situations [14]. According to Dorion [8] role-plays can enhance the nature of interaction between learners to develop cognitive, emotive and scientific objectives and highly thinking skills relating to analysis, synthesis and evaluation.

The teaching of personal development skills helps students to develop self-awareness, selfdiscovery, and self-actualization [2]. Helping them conquer skills of literacy leads taking control of their own life [6]. It is noted that "…what a writer does during composing is best understood in relationship to the social event that he or she is in the process of accomplishing" [19]. During dramatization creative thinking, cognitive and metacognitive skills are cultivated, since children assume, identify, improvise and evaluate the dramatic situations. They are involved in the dialogue, control the information and look for logical reasoning. Through critical thinking they deal with problems and multiple fantastic situations and conditions [20].

Students desire learning and projects that are more active, more social, and more applicable to the real world. Creativity is defined as the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others and entertaining ourselves and others [11]. Escape rooms are live-action team-based games where players discover clues, solve puzzles and accomplish tasks in one or more rooms, in a limited amount of time trying to accomplish a specific goal, usually escape from the room [16]. By their nature they provoke creativity in education and provide people with opportunities to practice a range of communication

and collaboration skills [18].

This paper presents the design steps of an action plan that took place on a Secondary Education Vocational School in Greece. This project included the transformation of a classroom into an escape room using a rare combination of tools such as creative writing, theater and technology. A survey was conducted before the design, in order to explore students' opinion and knowledge about the whole idea.

The program "New beginning at EPAL" (started experimentally in October of 2017) included co-financing from Greece and European Union for this Vocational School project, since it linked (Vocational Education Training) VET with local community and established cooperation with the greater educational and scientific society [15].

This paper offers a different context of an escape room that was co-designed by students of different ages and specialties.

2. Foundations -Aims

This study supports the thesis that students' capacities to learn should expand mostly from the view that learning and teaching systems must be designed to cultivate their potentiality. Such learning environments can empower and stimulate students' balanced thinking, capacities and mentality evolving them to out-of-the-box thinkers. Each of them should collect a lifelong lasting knowledge base and skills needed, to utilize them in order to become flexible and adaptive thinkers, who can find out creative solutions in the challenges that emerge, and deal with complexities that lie ahead successfully.

The basic aim of the paper is to examine students' perceptions, abilities and interest about the use of their creativity in a project that comprises the design of an escape room including the transformation of a laboratory using technology, creative writing and theatre elements. It investigates how a multimodal form of education consisting of multitudinous tools. Simultaneously, can act as a differentiating factor in students' school life. Finally this paper wants to present an original action plan that focuses on exploring school innovation and provides a new insight into a multilevel cooperation between teachers and students of Vocational Education. It highlights the steps and difficulties at the design, before the stage of implementation and argues that these capabilities can be understood, learned and applied by others engaged in same projects, in order to contribute to future studies of school innovation and success.

3. Pro-evaluation and Design Methods

Vocational School of Aiginio (EPAL Aiginiou) consists of 29 teachers and 120 students. Its Sectors and Specialties are:
- Administration and Economy - Administrator and Financial Officer
- Electronics, Electronics and Automation - Technician of Electrical Systems, Installations and Networks, Technician of Electronics and Computing Systems, Installations, Networks and Telecommunications
- Health, Welfare & Wellness - Assistant to Nurses
- Agriculture, Food and the Environment - Plant Production Technician

The school's mainstream discussed and finally agreed to support the idea of an escape room

as a learning environment. The Lead Author of this paper was appointed as the coordinator of the action plan. After sending the proposed schedule and budget to Noesis (Thessaloniki Science Center and Technology Museum), the project was approved and co-financed from Greece and the European Union with the amount that was requested.

4. The questionnaire

Students from the school were asked to answer an online questionnaire in order to gather information according school and escape rooms. The results came out from Excel and online Google Forms. A total of 70 pupils volunteered to do so, at the beginning of the project. The sample represents 64% of 110 students that attend to lessons, from which 38.6% (27) are female and 61.4% (43) are male. About 24.3% of the sample are A' class students (almost all of them), 41.4% are B' Class and 34.3% are C' class students. Only 11.4% (8) of the sample knows well escape rooms and have played the game. All of the rest (62) have heard about it but never played. Half of the students have heard about escape rooms from school, most of them when they were filling out the questionnaire. The rest heard about it from their friends, from the internet and other sources. About 31.4% of the sample (an interesting number of 22 pupils) didn't believe that such a game can be created at school. From those only 1 is student of A' class. 21.4% of the sample (15) disagrees that escape room should be based on school courses. From those all are male and only 1 is student of C' class. About 22.9% of the sample (16 students) didn't want to participate neither in the design nor in the whole project.

Cost is the most significant factor for not creating an escape room, according to the opinion of 35 students (50%), 26 (37.1%) of them believe that time is a negative factor, 21 (30%) that it's students' refusal and 16 (22.9%) teachers' refusal. From 69 students that answered the question about school and how interesting seems to them 8 (11.6%) don't like it and the same number likes it, 10 (14.5%) students like it a lot, 19 (27.5%) a little and 24 (34.8) enough. Only 8 (11.6%) of the 69 students don't think that cooperation between school students in creating an escape room won't be successful.

In terms of differentiation and actions that make school stand out from others, 52 (74.3%) students agree that such actions are done, 50 (71.4%) believe that actions that make it more interesting to them are done and 54 (77.1%) believe that actions that open school to the community are done too. The basic courses that pupils believe that could be used for the creation of an escape room are Language, Mathematics, Anatomy, Physical Education and IT.

As far as theater in escape room is concerned, 50 students (71.4%) answered that it's very interesting and only 39 (55.7%) would play a role in it. Regarding their own creativity 57 (81.4%) students have participated in a play (not necessarily at EPAL Aiginiou) and 47 (67.1%) have written a poem, a play, a fairytale or a story at school, at home or anywhere else.

It seems very logical for students living in a small village, not to be aware of the existence of this live-action team-based game. This is why most of them learned about it in school. It is interesting that 21 students from B' and C' Classes, that had already taken part in school projects the former years, believed that this game couldn't become a reality in EPAL Aiginiou. Considering the answers to the courses that can be used as puzzles it seems that robotics, virtual reality and informatics, in general, were not taken into account entirely by the pupils, perhaps because they are only taught in C' Class.

Cost for many of the pupils was the most inhibiting factor in the creation of the game, since none of them new about the founding. Over 50% percent of the sample find school interesting and over 70% agrees that it's open to community, does exciting projects and that cooperation for the game would be successful.

5. The design

Based on the results of the inquiry 9 students from 4 specialties of the school where selected to use their knowledge, their fantasy and their abilities in order to design an escape room in EPAL Aiginiou. They should be prepared and positive to cooperate with the 21 students of A' Class, as tutors, in order to show them how a knowledge gained from each field can be used enriched and linked to personal experiences, so to create a project that can potentially be a future professional goal. Also, 10 teachers from different specialties discussed about the subject and agreed to help this project to be implemented. The students of A' Class were separated in groups such as actors, programmers, cookers, marketing managers, electricians, writers and designers.

Two teams of 12 students were finally defined as the designers. Only 3 of them were from A' Class. With the escort of two teachers, they visited and played in professional escape rooms of different scenarios and one of them had an actor inside, who played three different roles (Figure 1). It was important to play in such a game, because theater elements would be used in the new escape room. In the next meeting they recorded all the puzzles that they could remember, discussed about their experience and they agreed that it revealed to them a meaningful experience.

Figure 1: Real life escape room-visit with students

Since game master's role, actor's role and rules of escape room where defined, the work-team decided that the theme should be based on the Spanish heist television series "La Casa de Papel", which includes crime and mystery, in order to satisfy players' expectations with new offerings. Online research, at that time, showed that no escape room with such subject existed in Greece. The theme was unique and helped to create the context of the room. Since role plays would exist and immersion should be enhanced, relative customs were necessary. Students made a market research and bought 8 thief uniforms with Dali's masks (Figure 2). The game would concern players from the age of 15 and over.

Figure 2: Buying costumes "La casa de Papel"

For the preparation of the act, school cooperated with the theater company "ΜΩ", which sent a volunteer actor to play theatrical games with the students (Figure 3). "EL GRECO", School of Fine Arts accepted to collaborate and help students create Dali paintings for the decoration of the room, in order to motivate students and keep their interests at high levels.

Figure 3: Theatrical games

The next step considered the design of the room. It was decided that Computer and Network Laboratory is the best place for the designers to meet, since members of the group had for many hours relevant lessons in there and the other teachers wouldn't be bothered. Students used the trial version of Roomsketcher Software (Figure 5) and after three phases of comments, evaluations and amendments they ended up to the final, most easy to use, design. Final photos where printed in order to be used in the future at the implementation stage.

Figure 4: Designing the escape room before & after

The settings of the riddles would be based on the design of the room and students used a

variety of them, after taking into consideration the types of puzzles Nicholson [16] records. Taste riddles (Figure 5), out-of-the-box thinking, robotics, VR and 360o videos and QR codes, team communication, observation, blue light, hidden objects, creative writing, improvisation, puzzles, physical experiments and music riddles were suggested, other simple and easy and other more difficult. Each puzzle would be created from the corresponding team, should have a purpose and add a substance to the narrative of the room and should be evaluated from the whole team. Students preferred to put them in sequence. This meant that each puzzle should be connected with the previous one. According Nicholson [16] this type of puzzle organization fits best for small rooms, like the Laboratory. A storyline was created along with the placement of the puzzles to help them during this procedure.

Figure 5: Taste and VR puzzles

The scenario had two specific roles. Two of the thieves should interact with the players in an engaging way, helping them or not, instead of the game master, who should give instructions at the beginning, and get them dressed, with their eyes closed. Team thought that the engagement of the players with the actors was very important. They suggested that the actors would have to define which role they would play from the series and that the writers should write down phrases for each puzzle that would be helpful to players. The game master in the entry would try to engage groups in the story, to make it real and believable to them and create positive emotions. It was finally decided that each player would respond, after the game, to an online inquiry in the matter of all of the above.

Marketing managers in order to awake the interest of the target group, suggested to make big posters, invitations and informative triptych and show a presentation about the design and the idea of the escape room in an open event on May. At the same period during the informing of high school students, another presentation of the whole procedure should be shown. They proposed that the scenario based on "La casa de papel" and the use of combined elements of writing, theatre and technology would make the marketing message clear, interesting and unique.

Electricians in cooperation with the designers should search the internet, in order to find out equipment for proper illumination of the room. After that with the help of their teachers-instructors they would complete the installation. By this time the design was completed.

6. Conclusions

This paper presents the framework that was followed from the beginning of the idea until the phase of design. EPAL Aiginiou is a very creative and active school. This year for example it run an ERASMUS+ A01 program in Barcelona and a twinning program with a school in Italy. The fact that many of the students and teachers were missing because of their trips abroad, bureaucratic work and

preparation, evaluation and many other tasks took a great deal of time. The actual implementation of the two projects started in February, in the same period with the design of the escape room. All these factors could have become a barrier throughout the process, but fortunately this didn't happen.

During the courses, each team recorded, tested and evaluated every information, in order to decide if and how it could be used as a puzzler in the escape room. Students' observation during their dialogues showed that they enjoyed the procedure and they were constantly trying to combine knowledge to implement a remarkable and unique escape room. It was impressing that they were looking for the teachers in order to meet and go on with the design of the room and they participated full of interest, suggestions (each one from his specialty), tastes, fun and fantasy. Snapshots of the "La casa de Papel" gave them many ideas for clues, such as the use of mobile phones and the accounts of money.

Some students, on their own initiative, searched about software (Roomsketcher) that learned to use by themselves. They found out VR videos and encourage other classmates to use VR glasses, they proposed to create led electronic systems and automatic door lock. The experience in real life escape room was so intense, that rouse students' interest from other classes.

The results of this project until now showed that, even from the stage of design, escape room follows many of the fundamental principles of learning environments. It also motivates students, gives them opportunities for out-of-the-box thinking and the chance to combine different type of learning. It's crucial the guidance from the beginning to be strong and the goals to be clear. This was achievable since the coordinator of the project had great experience as a player in real-life escape rooms.

The difficulties that revealed during the design stage are the following:

- Groups could not meet in the afternoon, because pupils come from neighboring areas and their moving is difficult.
- The basic team consisted of students of the C' Class, which means they had many examination and specialties lessons.
- Many teachers come from distant regions.
- The approval process was time consuming.

The results of those difficulties were the above:

- Physics experiments were not implemented because of the lack of time, although the corresponding professor and project coordinator met twice, searched for experiments and selected those that would be easy to implement by the students and to be chosen, by the design team, as riddles.
- There was no time to meet the painter for painting lessons, so the design group decided to use printable Dali's paintings.
- Tutoring never took place, so most of the students of A' Class didn't have the opportunity to use experiential learn into courses of the sectors and specialties, in order to decide what is best to follow for next year.

In the near future students and teachers have to co-operate in order to implement the outcomes of the design stage and transform the Computer and Network Laboratory into an attractive escape room. Final riddles should be chosen and put in the correct order, locks, special lenses, lighting and blackout systems should be bought, evaluations and tests should run from experts, target groups should be informed and impressions and comments of players should be recorded.

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Zoi Karageorgiou: PhD candidate of the School of Applied Arts (Hellenic Open University-HOU) and IT Professor at Vocational School. She studied Applied Informatics (University of Macedonia) and graduated the Master Program of Graphic Arts and Multimedia (HOU). She was awarded for "Best digital teaching scenario" by the Greek Ministry of Education, as Distinguished Member of the Scientific Association for the Promotion of Educational Innovation and took the 1st prize in a national creative writing competition. She deals with website management, teachers' training and eLearning courses. She is actively involved in national and international conferences, creative writing and narratives and participates in radio shows and in theater groups as an actor/animator.

Irene Mavrommati: Associate Professor, School of Applied Arts, Hellenic Open University (2009– present). She has worked for Philips Design, the Netherlands (1995–2000) as a senior interaction designer/project manager and as an interaction design researcher/FET research project coordinator with CTI (2000–09). She has a Ph.D. in Interaction Design and MAs in Interactive Multimedia (RCA, UK) and Graphic Design (Birmingham, UK). She has organized, and participated in, several art exhibitions, books, journal and research articles, with a focus on experience and interaction design and IoT environments. She has over twenty years of experience in design and research and has led several EU FET research projects.

Eleni Christopoulou: Lecturer at the Department of Informatics, Ionian University, Greece and a tutor at the Hellenic Open University, Greece. She holds a PhD on Computer Science with focus on ontologies in context-aware mobile and ubiquitous computing systems from the Department of Computer Engineering and Informatics, University of Patras, Greece. Her research interests include knowledge representation and management in mobile and ubiquitous computing systems, contextawareness in smart systems and smart cities as well as big data in IoT environments. She has received a scholarship from the John S. Latsis Public Benefit Foundation, Greece, and a visiting researcher scholarship from the University of Oulu, Finland.

Panagiotis Fotaris: Principal Lecturer and Course Leader for BSc (Hons) Digital Games Development & BSc (Hons) Computer Science for Games at the University of Brighton. He has a diverse background in computing, digital media, and e-learning, and demonstrates a deep understanding of the pedagogical, social and cultural issues affecting the adoption of new learning technologies. His research interests include Gamification, Augmented/Virtual Reality, Internet of Things, Technology Enhanced Learning, HCI and UX Design.

Promoting Cultural Heritage via Gamification and Augmented Reality

Marios Magioladitis[1], Dimitrios Ringas[1], Eleni Christopoulou[1]

[1]Department of Informatics, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece

Abstract

We present our experience applying a gamification methodology and exploiting augmented reality in order to motivate learners to become actively engaged in researching their cultural heritage and exploring local history, monuments and pieces of art via their engagement in playful yet educational activities. Past and current research demonstrates that students engage themselves more actively in learning activities when these involve socializing, self-guided discovery and teamwork and latest technology trends promote learning outside of the classroom in informal settings. In this context, we have invited learners to re-discover familiar urban spaces, collect information on people commemorated on street names, statues and other landmarks and then design a technology based activity that others could follow in an educational yet playful manner. On all cases, participants responded positively on both the process and the learning outcome, reported feeling more confident on their coding skills, gaining better understanding of the IT terminology and tools involved as well as better familiarizing urban spaces that they frequently used.

Keywords

Gamification, augmented reality, urban games, cultural heritage, outdoor learning

1. Introduction

The paper presents a methodology that we followed and which aims to motivate learners to become actively engaged in researching their cultural heritage and exploring local history, monuments and pieces of art via their engagement in playful yet educational activities. The proposed methodology has been applied and evaluated in diverse educational environments and settings.

Numerous past research has demonstrated that students engage themselves more actively in learning activities when these involve socializing, discovering and teamwork. Current trends in technology enhanced learning explore how learning can be achieved outside the classroom, in informal settings, leveraging spontaneous interactions, interacting with locals and collecting their local knowledge. In addition to that, research examines how latest technology can enable novel interactions among both people and people and the urban scape.

The participants in our research participated actively; they traversed the selected urban landscape, selected points of particular interest and then retrieved information from various open sources, like Wikipedia and its sister projects. Then participants designed a game, using techniques that exploit cloud-based platforms and the application of augmented reality, aiming to blend digital content and physical landscape. In this paper two distinct applications of our methodology are presented; in the first one the group consisted of University students and in the second of adult

learns.

The first implementation was carried out at Corfu Tech Lab as part of a workshop series called "Girls Just Wanna Hack" aiming to enhance the IT skills of young female University students. The meetings were at the National Historic Library of Corfu. Approximately 10 females participated in the project. The students implemented a treasure hunt. The program was supported by the Public Affairs office of the U.S. Embassy of Athens.

The second implementation was at Second Chance School of Corfu were adult learners who haven't completed secondary education participated in a school project under the guidance of a mathematician with the aid of an informatics teacher.

We evaluated the learning process by interviewing participants. In both implementations they gave positive feedback on both the process and the learning outcome, reported feeling more confident on their coding skills, improved understanding of the IT terminology and tools and also reported enhanced familiarization with their hometown.

2. Background

Mobile learning is "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies" [16]. Ubiquitous learning on the other hand means something more than mobility, a ubiquitous learning environment is any setting in which students can become totally immersed in the learning process [22]; it is a setting of pervasive learning that is happening all around the student but the student may not even be conscious of the learning process. In extension, smart city learning leverages the infrastructure and services that modern smart cities offer in order to transform them into open learning environments.

A number of mobile learning applications have been used in various contexts, like schools, and universities. In [14] various examples of teaching and learning with mobile technologies are categorized under the perspective of the learning theory that each follows. In [10] mobile learning and training projects are described under the prism of selected features, like context, aims, technology and outcomes. In [15] mobile education projects, applied both in high schools and universities, are analyzed regarding infrastructure, devices and educational processes.

Ubiquitous learning is based on the idea of "always on" education that is available anywhere, at anytime [2]. A key concept of ubiquitous learning is the social interactions that occur wherever and whenever [21]. A number of context-aware ubiquitous learning systems and applications, like ActiveCampus and ActiveClass, Ubi-campus, JAPELES, Oxygen, etc., have been evaluated [11] exhibiting the benefits of ubiquitous learning.

Teachers acknowledge the value of learning outside the classroom exploiting novel methods and technologies [1]. Ubiquitous and pervasive learning enable students to build learning experiences in places and learn everywhere together via a socio-cognitive process, which promotes cooperation and teamwork. Additionally, the learning environment can be blended with the real environment.

Augmented Reality is a new medium, combining aspects from ubiquitous computing, tangible computing, and social computing and it can be harnessed to inspire, motivate and engage learners and transform their learning experiences [20]. It allows students to retrain easily new information and is applicable to any level of age/education/schooling [12].Teachers are already using AR in the

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classroom via various forms like:

- Digital puzzle boxes: teachers configure a set of challenges on a computer and students engage with these challenges via a smartphone, tablet, etc.
- Scavenger hunts: AR experiences can be attached to physical locations by attaching QR codes to various physical objects in the room or outdoors.
- Augmented field trips: AR experiences may also be placed at physical locations by using GPS coordinates.
- Student creations: students can also create their own augmented reality experiences to demonstrate learning. Students find this creative activity fun and they can also play and share with friends the final product.

Meanwhile significant developments have been made in gamification in recent years. Gamification itself as a concept refers to adding gaming elements to activities that are not originally about gaming. Ideas found in games such as the reward system, points and credits, etc. are used in non-gaming activities to make them more challenging and to encourage participation. The Cambridge Lexicon describes gamification as "the practice of making activities more like games in order to make them more interesting or enjoyable" while Merrian-Webster Lexicon comments that "Gamification is about making something potentially tedious into a game". Thus the idea in gamification of activities such as learning is to use game design elements to improve user engagement, organizational productivity, information retrieval, ease of use, and even physical fitness. A series of studies demonstrate that it has positive effects on individuals [6] and in many cases gamification principles have been used as a facilitator of the citizen engagement process. Furthermore, recent studies show that gamification is really suitable for decision-making processes and during the co-design of new services and products in order to motivate citizen to actively participate [17].

Modern smart cities offer the necessary infrastructure and services to foster a number of formal or informal and gamificated learning activities in the city landscape. They can accommodate urban games exploiting ubiquitous and mobile computing as well augmented reality technologies. Following we present how students can design and create their own urban games, which make the boundaries of the magic circle [8] blurry and permeable, transformed into a membrane that allows "the game to become intense by the reality of life and life to be charged with the importance of the game".

3. Methodology

Research has demonstrated that students engage themselves more actively in learning activities when these involve socializing, discovering and teamwork. Current trends in technology enhanced learning explore how learning can be achieved outside the classroom, in informal settings, leveraging spontaneous interactions, interacting with locals and collecting their local knowledge. In addition to that, research examines how latest technology can enable novel interactions among both people and people and the urban landscape.

3.1 Inspiration and Aim

Our inspiration emerged from the definition of a sociable smart city [3]:

"A Sociable Smart City is one rich in infrastructure, which combines and exploits both people and artificial intelligence, empowering and engaging people in activities where urban social

interactions thrive aiming to advance the quality of life and culture."

The first attempt to apply our research outdoors was in Corfu, selecting to tag city landmarks with QR codes transforming them to points of reference that acted as gateways to the collective city memory and invite users to experience the interaction with digital layers of content embedded into their familiar urban space [4]. Users were invited to perform a tag-based outdoor exploration and with personal smart devices equipped with a camera and a decoding software application they could scan such a code and be transferred to CLIO in order to interact with the Collective City Memory.

The encouraging and positive feedback from our first work led us to work on how we can motivate our learners to be more creative and challenge them to design and create their own urban game. We propose a methodology that uses synthetic approaches by which creativity can thrive [5] regarding creativity as the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others and entertaining ourselves and others [7].

So, the aim of our methodology is to exploit gamification and augmented reality in order to motivate learners to be actively engaged in exploring and learning about their cultural heritage, local history, city monuments and art pieces via playful yet educational activities.

3.2 Description and Applications

Initially, we invited our participants to traverse the selected urban landscape and select points of particular interest. At the next step we engaged them to retrieve information from various open sources, like Wikipedia () and its sister projects. Next, they were motivated to work on teams and collaborate targeting to design an urban game. Their goal was to blend digital content and physical landscape, exploiting cloud-based platforms and augmented reality technologies. Finally, they invited friends and schoolmates to play with their urban game.

In this paper, we present two distinct applications of our methodology; in the first one the group is consisted of University students and in the second of adult learns.

The first implementation was carried out at Corfu Tech Lab as part of a workshop series called "Girls Just Wanna Hack" aiming to enhance the IT skills of young female University students. The meetings were at the National Historic Library of Corfu. Approximately 10 females participated in the project. The students implemented a treasure hunt.

The second implementation was at Second Chance School of Corfu were adult learners who haven't completed secondary education participated in a school project under the guidance of an informatics teacher and a mathematician.

We have selected these two distinct applications in order to get feedback from both a formal setting, like the Second Chance School of Corfu, and an informal setting, like the workshop series in a public library. Additionally, the age of students varied, as we had grown-up adult learners and young university students, as well as their skills level and previous knowledge.

4. Results

Following, we present the various steps and the outcome of our methodology in these two different settings.

4.1 Corfu Tech Lab

Corfu Tech Lab (American Space) is hosted at the National Historic Library of Corfu and it is financed by the Public Affairs office of the U.S. Embassy of Athens. We ran a series of workshops aimed at female students, aged between 12 and 29 years old, with the goal of developing digital skills and alleviating racial inequalities in technology.

Initially, we gave lectures on Urban Games and Smart Cities and we hold workshops to give some basic foundations in programming. We mainly focused in organizing meetings with the University students in order to an augmented reality game that would take place inside the old town of Corfu. The group chose the theme of the game by themselves. We created a Dungeons and Dragons game where the players could play via mobile phones.

Question	5	4	3	2	1
I feel more confident on my coding skills	58%	25%	17%	0%	0%
I have a better understanding of the IT terminology and tools involved	67%	17%	17%	0%	0%
I have understanding of the geography of Corfu	33%	33%	17%	8%	8%

5= A lot, 4 = Some, 3 = Neutral, 2 = Not much, 1 = Not at all

The participants joined the project by filling up an online form. We evaluated our work with questionnaires at the end of the project. In general we got a positive feedback for both the process and the learning outcome. The vast majority of the participants said that: felt more confident on their coding skills, thinks that after the end of the project they have a better understanding of the IT terminology and tools involved and that the process enhanced the understanding of the geography city.

4.2 Second Chance School of Corfu

Learners were invited to traverse the old city of Corfu and select points of particular interest. They realized that they walk around their city everyday and in order to orient they use the landmarks and street names. However, most of the times they do not know who was the person after whom a street or landmark is named, what the person contributed and why he or she is commemorated. People can see a statue and read its name, but even then they don't know what the actual person did and why the statue was raised. So, their motivation was their wish to gain a deeper knowledge of the street names and statues around the city. They set the goal to collect more information on these people, beyond their name, and to upload this information to an application so that it can accessible to anyone who shared this interest.

Initially, in the context of the research work they had to select which people to look for and where. Via brainstorming and group work they selected popular streets and several statues scattered around the city. However, during the follow up meetings learners enriched their list, as this process proved to be quite intriguing.

Figure 1: Phase one – Select people of interest

Figure 2: Phase two – Collect information

The next step was to put together the data that was collected from various open sources and books during the survey and to write for each person a comprehensive summary, which would be presented via the application to users who want to see more detailed facts.

Then these data had to become geo-located, by relating them to specific coordinates somehow related to the life of each person. This geo-location of data later allowed to display it on online maps, like Google maps, and GPS-aware devices and applications.
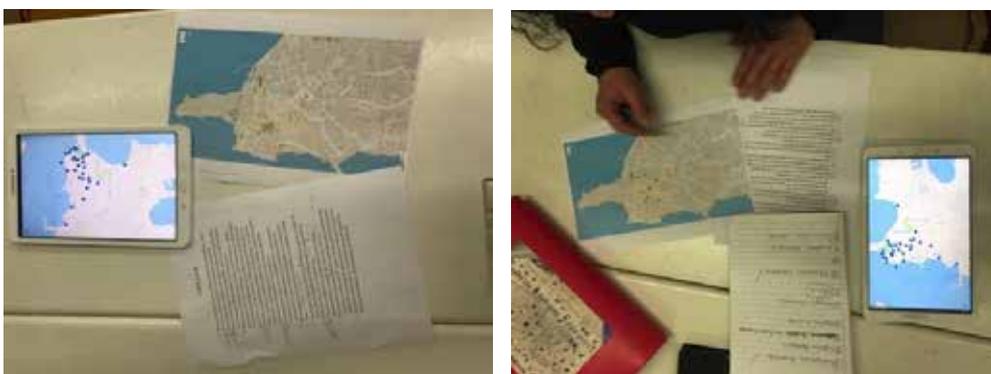

Figure 3: Phase three – Locate coordinates

A particular augmented reality technology that the learners used was the Layar Augmented Reality App, a smart mobile device application that allows one via a relatively simple technical API to overlay custom content on the view of the device's camera. This application allowed the students

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to attach their geo-located content to specific city locations and to access it via two distinct views; a typical web map view suitable for "in classroom" learning activities and an augmented reality based one for outside learning activities.
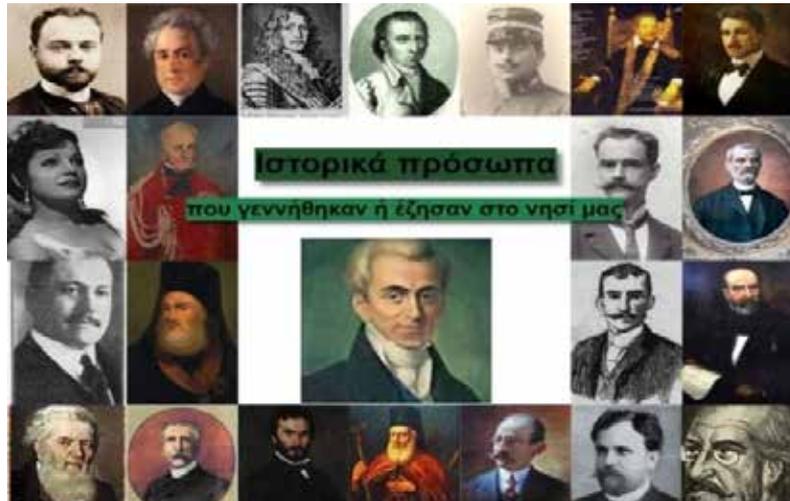
Figure 4: Phase four – The treasure hunt game

Working on the information that they had gathered on each person, a sub-group of the learners were assigned the task of extracting treasure hunt like questions, for instance "What did our national anthem poet view from his window?";players of the treasure hunt were expected to consider who the poet is, where his house is, locate it on map and visit it in order to take a picture. The learners were able to deliver 17 such questions.

These 17 questions were divided in 3 sets and a game for two teams was designed; the questions were distributed in 2 distinct sets of 6 questions and a common set of 5 questions. The sets of distinct questions were selected so that difficulty and distance that was required to be traversed would be similar for the two teams. The initial distinct sets were meant to separate the two teams on the kickoff of the activity avoiding interaction; the last shared set of questions would spark competition as only the first team which would capture a shared landmark would be assigned it. The winner team was the one with the most correct pictures, keeping in mind that in the shared set only the earliest correct attempt would be awarded a point.
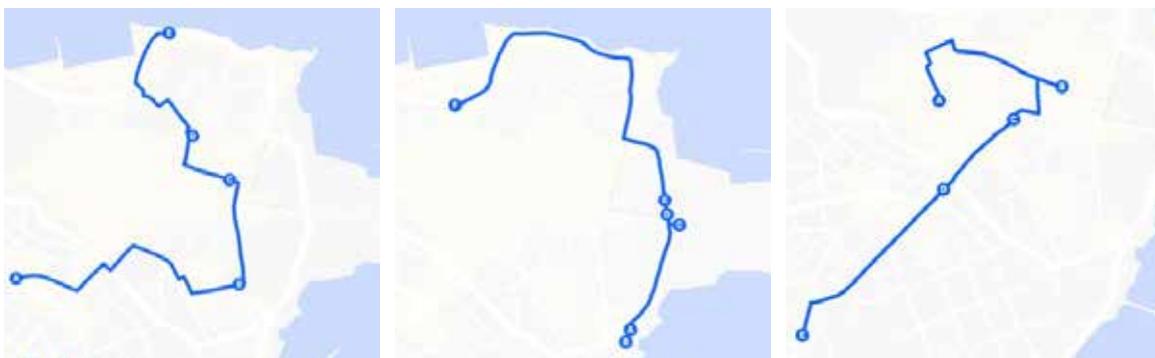

Figure 5: Phase five – The two distinct and common route of questions

5. Conclusions

Evaluation was mainly based on follow-up interviews with the participants. The main

conclusions and responses provided are summarized bellow. All participants reported that they felt that both the learning process and the outcome were very positive and that they engaged in a novel learning activity.

Working on the implementation of a real world application aimed to be used by other users motivated them to focus on the involved technologies, further develop their knowledge and enhance the required skills. A sense of creativity is always fostered on project-based learning; working in our case on a novel interface as augmented reality further motivated learners initially to experiment, play with and later to share with others and demonstrate their work and achievements. Setting a goal and timeline, as well the expected the use of the outcome by other users helped coordinate the whole team and motivated all members to take up roles that would contribute to the overall work, of course not without usual group dynamics friction. Yet, it was also clearly noted that the application of this methodology on a formal learning group performed far better than in the case of the informal one; conceivable reasons include the pre-existing strong team binds in the former case as opposed to the intermitted and less committed participation in the latter.

Learners less apt with technology who worked more on data collection and game design reported developing an enhanced familiarization with urban spaces that they routinely traversed. Augmented reality, as perceived from the end-users perspective, has proved to be a particular motivator and a tool that inspired users to re-visit familiar spaces and explore them through a novel technology enhanced lens. Finally, all users reported that they particularly appreciated the fact that the exploitation of ubiquitous computing allowed them to engage in learning activities outside of the usual formal settings and that it encouraged social interaction in the learning process.

6. Acknowledgments

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Marios Magioladitis: Mathematician and PhD Candidate at the Department of Informatics, Ionian University, Greece. He hold a MSc. in Mathematic Foundations of Computers and Applications from the Department of Mathematics of the University of Crete. He worked as scientific fellow at the Universities of Duisburg-Essen and Oldenburg in Germany. He currently works at the Corfu Tech Lab (American Space) where he organises STEM workshops. He has published scientific works on gamificiation and applying new technologies in education in numerous conferences. In 2016, he received a Wikimedia Foundation grant and in 2018 an IP - American Spaces Project Grant for organising IT workshops.

Dimitrios Ringas: Teaching staff at the Department of Informatics, Ionian University, Greece. He holds a PhD on Computer Science with focus on how ubiquitous computing affects the urban landscape from the Department of Informatics, Ionian University, Greece. He holds a Diploma in Computer and Informatics Engineering from the University of Patras, Greece, and an MSc on Computer Science from the University of Manchester Institute of Science and Technology (UMIST), UK. His research interests include ubiquitous and urban computing, human-computer interaction, smart city applications as well as urban learning applications. He has received a scholarship from the John S. Latsis Public Benefit Foundation, Greece, and a visiting researcher scholarship from the University of Oulu, Finland.

Eleni Christopoulou: Teaching staffat the Department of Informatics, Ionian University, Greece and a tutor at the Hellenic Open University, Greece. She holds a PhD on Computer Science with focus on ontologies in context-aware mobile and ubiquitous computing systems from the Department of Computer Engineering and Informatics, University of Patras, Greece. Her research interests include knowledge representation and management in mobile and ubiquitous computing systems, contextawareness in smart systems and smart cities as well as big data in IoT environments. She has received a scholarship from the John S. Latsis Public Benefit Foundation, Greece, and a visiting researcher scholarship from the University of Oulu, Finland.

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Session 6

Cultural Facets - Augmented Reality in Art

Augmented objects interacting with social media activity

Caterina Antonopoulou[1]

[1]Department of Cultural Technology and Communication, Social Sciences Faculty, University of the Aegean, Greece

Abstract

This paper discusses issues related to the technological mediation of communication, through the presentation of a series of data-driven media art installations. The installations consist of augmented artifacts that interact with data received from social media platforms and dynamically change parameters of their functionality or appearance according to the retrieved information. They critically approach behaviors that appear on social media networks, such as the divergence between real and digital identities, dataveillance, and the unawareness of internet materiality. The paper presents the concept of each installation and briefly describes their technical implementation.

Keywords

Augmented objects, data-driven installation, media art, physical computing, social media platforms

1. Introducing the Social Things media art installations

The Social Things series consists of three media art data-driven installations: inflated_ego, #freePrometheus, and Social Thing#3. All three installations share some common characteristics. They consist of common everyday objects which are technologically augmented with actuating, processing and networking capabilities. Moreover, they use custom software and hardware built with open source technologies, such as the Processing Integrated Development Environment (IDE)[1] and the Arduino platform[2].The software of each installation accesses the Application Programming Interface (API) of a social media platform, such as Facebook and Twitter, to retrieve real-time data and processes these data to detect certain users' interactions. According to the processed information, it activates an actuator or an output device which is connected to an electronic circuit and is controlled by a microcontroller.

2. Social Thing #1: inflated_ego

2.1. Concept

The installation inflated_egoreflects on the rift between the real and the idealidentity of social media users. It criticizes the (over)exposition of a curated view of the self and the promotion of a carefully crafted virtual life. In the digital world, a 'like' is often considered valuable by social media users, who perceive it as a reward of their virtual achievements. The installation provocatively

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1   https://processing.org/
2   https://www.arduino.cc/

ponders: "What would be the value of a 'like' in the material world?"In order to provide an answer to this question, it maps the digital entity (a Facebook 'like')to a physical one (an amount of air). In concrete, a small amount of air is pumped into the inflated_ego balloon, whenever a social media user likes the Facebook page of the virtual public figure SoThi. Thus, Facebook 'likes' inflate SoThi's ego, however, multiple successive 'likes' can drive the inflated ego to an explosion.

2.2. Installation

The installation contains a technologically augmented balloon that dynamically increases its volume according to data retrieved from the social media platform Facebook. It consists of a Do It Yourself (DIY) construction, a custom software and a custom electronic circuit (Figure 1). The installation uses an air pump connected to an Arduino board attached to the balloon. The software is built with Processing and runs on a microprocessor with internet connectivity. It accesses the Facebook API to retrieve real-time data concerning the number of likes of a certain Facebook page. Whenever a new 'like' is detected, the Arduino microcontroller activates the pump for a few seconds. A Liquid Crystal Display (LCD), which is also controlled by the Arduino, displays information about the current number of fans of the SoThi Facebook page.

Figure 1: inflated_ego installation view

2.3. Social media page

SoThi is a page of a fictitious public figure on the social media platform Facebook, created for the demands of the project. The posts of the page are results of a simple algorithm, that performs internet searches of generic keywords (such as freedom, beauty, balance, happiness, peace, friendship) in databases of Public Domain images and famous quotes. Every post is created by the combination of one image with one quote (Figure 2). The content of the retrieved images further highlights the excessive online fabrication of an illustrated virtual happiness. SoThi's page is edited by multiple authors, which turns SoThi into a plural identity.
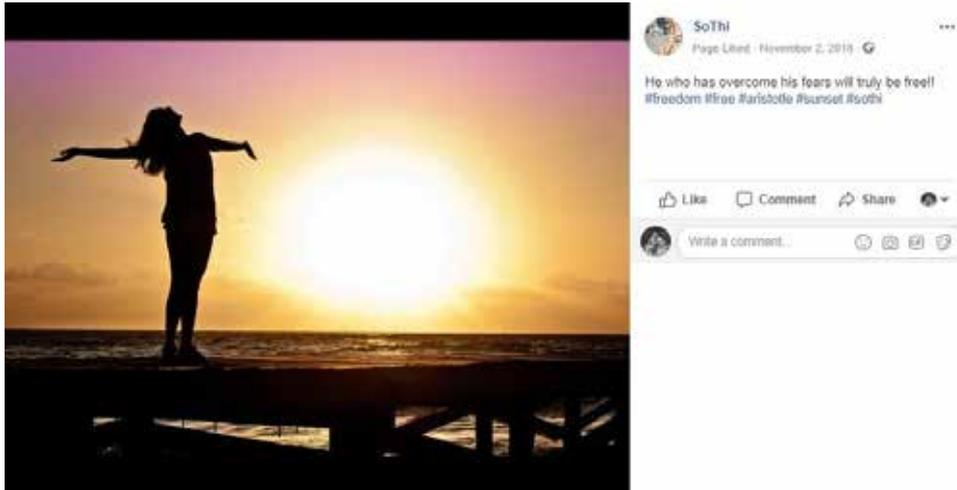
Figure 2: Sample post on SoThi's Facebook page

3. Social Thing #2: #freePrometheus

3.1. Concept

The #freePrometheus installation reflects on the dataveillance of digital information. It was developed in the context of Tragedy 2.0_Athens 2018, Research and Arts Program for the Ancient Drama and the Digital Age and was premiered during the Prometheus 2.0 group exhibition at Michael Cacoyannis Foundation in Athens (Prometheus 2.0exhibition catalogue, 2018). The project transfers the figure of Prometheus Bound to the current hybrid reality of continuous internet connectivity and restless social media presence. Under this context, a campaign in favor of the political prisoner Prometheus appears on social media with the distinctive hashtag #freePrometheus. However, the data flow is surveilled and controlled by an algorithm, that uses this information against Prometheus, gradually destroying the gift that he offered to humanity: the fire.

3.2. Installation

The installation consists of an augmented DIY lamp which dynamically changes its luminosity according to real-time data retrieved from the social media platform Twitter. The lamp is made of plexiglass tubes and addressable Light Emitting Diodes (LEDs) strips and is controlled by a custom software and a custom electronic circuit (Figure 3). The LED strips are connected to an Arduino board. The software is built with Processing and it runs on a microprocessor with internet connectivity. The algorithm accesses the Twitter API and retrieves data from Twitter in order to detect tweets tagged with the hashtag #freePrometheus. Whenever a new tweet is detected, the Arduino microcontroller switches off one LED light from each strip and the luminosity of the lamp decreases. The light simulates the fire of Prometheus and the plexiglass tubes simulate the plant narthex (a kind of cane), where Prometheus hid the fire when he stole it from Hephaestus, according to the myth. An LCD provides information about the Twitter users that recently used the hashtag #freePrometheus.
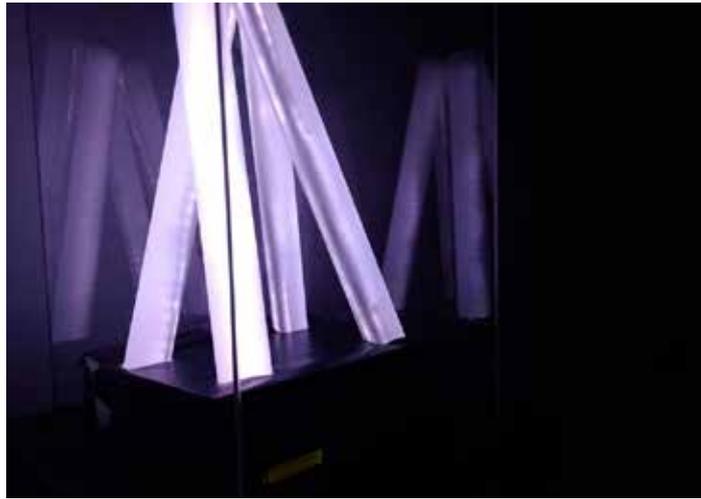
Figure 3: #freePrometheus installation view

4. Social Thing #3

4.1. Concept

The operation of internet presupposes a physical infrastructure that consumes natural resources and pollutes the environment. Daily online activity harms the environment, despite the ecological awareness users may promote on social networks. Social media platforms are among the most visited sites worldwide [4] and their use contributes to the increase of CO_2 emissions. Social Thing #3 aims at revealing the contradiction between our digital activity and its material impact on the physical world. It consists of an aquarium containing a micro-scale ecosystem of fish. The parameters of the ecosystem are affected by social activity related to climate change and global warming. The activity that promotes climate change awareness deteriorates the conditions of the ecosystem, thus drawing attention to internet materiality and the physical consequences of our digital actions.

4.2. Installation

Social Thing #3 consists of an aquarium that dynamically decreases the amount of its containing water according to real-time data received from the social media platform Twitter. The aquarium is augmented with a peristaltic pump which is controlled by an Arduino microcontroller (Figure 4). The software is built with Processing and runs on a microprocessor with internet connectivity. A custom algorithm detects tweets tagged with hashtags that promote climate change awareness. Whenever a new tweet is detected, the peristaltic pump is activated and it pumps water from the aquarium to an auxiliary water container (the quantity of water cannot be decreased under a certain level to ensure that the eco-system will not be damaged). An LCD displays the username of the social media user that posted the most recent tweet.
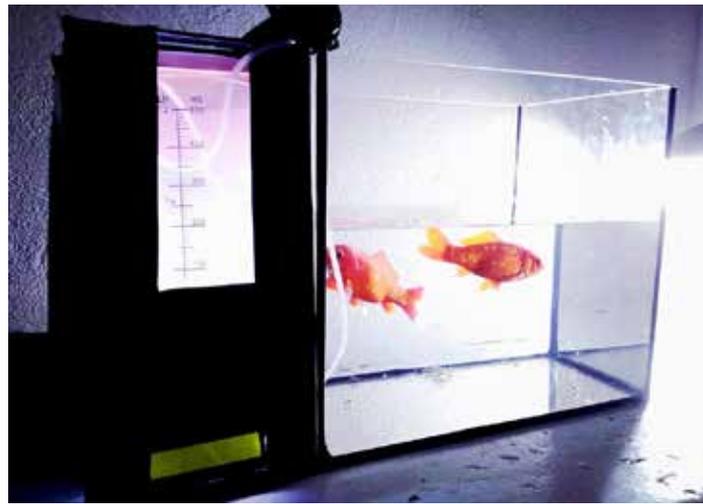
Figure 3: #freePrometheus installation view

5. Discussion

Critical media artworks often problematize and break with dominant discourses around technological advances, which are usually extremely positive, preventing users from understanding their social consequences. Social Things installations reflect on three issues related to the technological mediation of communication through social media platforms.

The first issue focuses on the rift between the real self and ideal self of social media users, and related phenomena, such as the increasing narcissism and the fear of missing out (FOMO). Researchers investigate the interrelation between narcissistic behavior and the use of social media. Various models are proposed to describe the ways that social media interactions bolster the narcissist's positive self-views and encourage further narcissistic self-enhancement [2]. This behavior, facilitated by the disembodied character of online communication, results in the fabrication of a false digital identity. Moreover, the over-exposed virtual happiness provokes the fear of missing out to peer social media users. The abbreviation FOMO, which was added to the Oxford English Dictionary[3], refers to a feeling of anxiety that one may miss exciting events that other people are going to, especially aroused by posts seen on social media.

The second issue is related to the implications of privacy, security, and dataveillance on users' online communication. Users' personal data and usage behavior are collected, stored, assessed and commodified for economic purposes, with or without users' consent. Social media platforms are large advertising-based capital accumulation machines that achieve their economic aims by economic surveillance [3]. Data mining processes feed and train algorithms that predict and modify human behavior in the context of "surveillance capitalism" [11]. Users unwillingly agree with abusive terms of use in order to gain free access to corporate platforms. In other cases, they willingly share their data to receive personalized services or they invoke the "nothing to hide" argument [10]. However, apart from providing customized user experience, massive data collection serves third party interests [1]. Corporations and governments illegally purchase users' data or monitor information that users share publicly. The emerging field of digital listening describes how users' interactions on social media platforms are monitored and analyzed [6]. Both the behavior (retweeting, liking, sharing, commenting) and the content (hashtags, tweets, posts, and comments)

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3   https://public.oed.com/updates/new-words-list-june-2015/

are processed by companies that offer their services to political entities, helping them to design more efficient political campaigns and address certain target groups or to improve their public image and focus their discourse on trending discussions. According to Fuchs [4], social media facilitate an integrated form of surveillance, as users' profiles hold a complex networked multitude of data about individuals, providing information about different and partly converging activities and social roles [4].

The third issue critically approached by Social Thing#3 is internet materiality and the environmental implications of online activity, which are usually overlooked by internet users. Trevor Paglen, an artist whose work spans image-making, sculpture, investigative journalism, writing, and engineering, highlight the misleading way that immaterial metaphors, such as the 'Cloud' or 'cyberspace', are used to describe the internet. These metaphors deliberately conceal the fact that infrastructures of power are material things and that "the Cloud is nothing more than buildings with servers in them" [5]. This tactic aims at obfuscating power relationships and hide them from perception and control. Especially the term 'Cloud' conceals "the means of networked publication and communication (including energy consumption), from view and access."[9]. Moreover, these metaphors tend to conceal the vulnerability of data networks, which depend on material infrastructure such as underwater internet cables [5]. This way, the seamless functioning of the internet, that users take for granted, can be limited or suspended by the authorities controlling this infrastructure.

6. Conclusion

The paper introduced the Social Things series of media art installations. The three artworks – inflated_ego, #freePrometheus, and Social Thing #3–aim at addressing technological advances such as online communication and social media platforms in a critical way. The users of such technologies tend to disregard the social consequences of their technologically mediated actions in the name of seamless performance, usability, and convenience. Moreover, technological artifacts or applications conceal, underneath their transparent interface, the unpleasant conventions that their use implies. In contrary, several critical media artworks draw attention to the social impact of technologies that intrude everyday life and shape many of its aspects. Social Things reflect on issues related to the distortion of self-perception during disembodied online communication, privacy and dataveillance of personal information and the implications of the materiality of internet infrastructure. The paper discussed the consequences of these issues and the ways that authorities benefit from users' unawareness or indifference on such issues in order to establish power relations or increase their economic profit. However, despite the repressive way that technologies are often used by authorities, the same technologies can also be appropriated, used and hacked by "open source communities, activists, makers, and artists who can anticipate both technology's potential opportunities and the potential risks and dangers which techno-evangelists have not yet realized" [7] or they deliberately overlook.

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Caterina Antonopoulou is an engineer, media artist, and researcher. She has been a lecturer & workshop instructor of interactive arts (Athens School of Fine Arts, National Technical University of Athens, e.t.c.). She is co-founder of the artistic collective 'Once upon a Byte' and co-curator of the 11th& 12th Athens Digital Arts Festival. She currently pursues a PhD on media art at the University of the Aegean. She has collaborated with numerous R&D labs and artistic groups. Caterina holds a master in Digital Arts (Pompeu Fabra University, Barcelona 2009) and a diploma in Computer Engineering (National Technical University of Athens, 2006). Her work has been presented at international exhibitions & conferences. [https://peqpez.net/]

DCAC

Session 7

Digital Culture and Technologies II

Orders of the heard. The sacramental order

Loukas Messinezis[1], Apostolos Loufopoulos[1]

[1] Department of Audio and Visual Arts, Ionian University, Tsirigoti Sq. 7, Corfu, 49100, Greece

Abstract

Postmodernist thinkers and scholars have elaborated extensively on the fact that reality seems to start being preceded by things that are not real. Consequently what applies for the tangible world of appearances, should apply as well to the immaterial realm of the heard. So what about aural reality in relation to what has been called the precession of the simulacra? With our recent research, we attempt to define 'aural simulacra' and investigate their role within a contemporary arts context. In perfect analogy, what Jean Baudrillard calls 'the orders of the image', corresponds to what we call the 'Orders of the heard'. All we need is to read the audio signal as a sign and the sacramental order, the order of maleficence, the order of sorcery and that of pure aural simulacra unveil their existence within our field of study. With this article, we initiate a practice based research series of all These orders of the heard. Wer first stumble upon the sacramental order. These simulations are an exact reflection of a profound acoustic reality. However, what is it exactly? Which signals claim their placement in it and why? Through practice and scholarly research, we embark on a journey of exploration, investigating processes and trying to identify and utilize the attributes of the sacramental order. We attempt to unleash its potential in favor of the production of an original artwork and through creative processes, to observe the effect These realizations have on sound arts practice and research.

Keywords

Sound art, acoustic reality, authenticity, simulation, hyper-reality

1. Introduction

Our journey through the world of simulacra and simulations in auditory arts, starts from the hypothesis that the audio signal possesses all the qualities to be read as a sign. According to the Oxford Dictionary of English, a sign is 'an object, quality, or event whose presence or occurrence indicates the probable presence or occurrence of something else'[8]. If we observe the audio signal and the way it is being perceived either in everyday life but also in the field of sound arts, we can see a similarity with the lingustic signs and more specifically as Ferdinand de Saussure indicatesa sign is '[…] of dual nature comprising two elements' [3]. The one part is the signifier and the other the signified. We initiate our investigation from this starting point as post modern philosophers who elaborated on the notions of hyper-reality and simulations, also started their stream of thought and stochastic explorations by the same observation. Yet these philosophers mostly explore things tangible. Following their steps we start our investigation regarding the intangible ethereal realm of the heard. The signifier – signified construction of the audio signal (see Figure 1.) allows us to start thinking and talking about'aural simulacra'[6] and observing the different qualities of various signals depending on specific characteristics. Following the bibliography and through practice research we try to identify the analogy between the world of the tangible and that of the aural. Our

ultimate goal is to observe the possible consequences these variations have on the sound artwork. In order to achieve that though, we need to identify and verify if – based in our assumption – there is a true analogy between these two worlds.
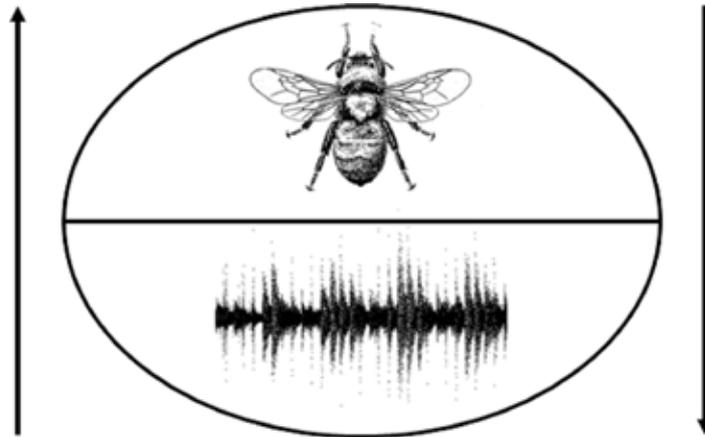

Figure 1: The signal as a signifier-signified construction

2. The orders of the heard

Jean Baudrillard is one of the key figures of post modern philosophers who also initiatied his thought from the observation that signs and symbols are a signifier – signified construction. Taking of hyper-reality, simulacra and simulations he calims that the image has four successive evolutionary stages. In particular he states that the image:

> […] is the reflection of a profound reality;it masks and denatures a profound reality; it masks the absence of a profound reality; it has no relation to any reality whatsoever; it is its own pure simulacrum [2].

These stages of the image are named accordingly as the sacramental order, the order of maleficence, the order of sorcery and that of pure simulacra. If we observe these definitions and try to think of things audible, we may see a perfect analogy. This becomes even more evident if we start thinking of specific examples. Therefore, a reflection of a profound reality in the acoustic field would be a recording. Something that masks a profound reality, thus mimicking it purposefully sounding as a fake, it would be something like the sound of violins in Korsakov's piece 'flight of the bumblebee'[7]. Something that masks the absence of a profound reality, thus something that sounds real without having an original would be the sound of wind simulated using white noise and physical modeling. Finally, as pure simulacrum, thus something that has no connection to any reality yet we perceive as real would be the sound of a lightsaber which we identify as real but is not related to any reality.

Within our research, we adopt these definitions and titles as provided by Baudrillard. The mystical naming corresponds perfectly to the mystery these intangible simulations enclose. Our effort is try and journey through all these phases of the signal in the realm of the aural via creative practice. What we are trying to do is identify which characteristics place a signal to a specific order of the heard and through practice to see how the sound artwork and its narrative or aesthetics affectsto which of these orders of the heard a signal belongs. This article focuses on the first order of the heard, the sacramental order.

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3. The sacramental order of the heard

As we mentioned before regarding both the image and the audio signal, the sacramental order refers to signs – and thus signals – that are an exact reflection of a profound reality. In the world of the visual, an accurate example would be the art of photography. In the world of the aural, it is rather obvious that the exact representation of a reality – to the level that it is perceived as its reflection – would be phonography. Such signals have extensively been used within important artworks with a characteristic example being Luc Ferrari's composition 'Presque Rien No.1'[4]. There are a few factors though that are worth mentioning and complicate our stream of thought, yet provide us the foundation for further research. What is the relationship of the signal of the sacramental order with media of capture, reproductive media and the listener? This is the main question we attempt to answer through practice. For example, if we record and reproduce acoustic reality using vintage equipment such as a gramophone on one hand and digital equipment on the other, does that affect the order of the heard to which the signal belongs? What is the relationship between media of capture, reproductive media and this particular type of acoustic simulation? Finally, except the media and the signal itself, what is the role of the listener when placed within a field of the same acoustic reality reproduced within various contexts and from different media? These are the main questions that through our creative practice, we try to elaborate on. Yet before we start, we need to choose a suitable acoustic territory to work on.

3.1.1. The field

Before we initiated the creative process through which we aimed answering the above questions, we needed to ensure that the chosen area and its aural reality fulfilled some important criteria. We identified these criteria as the follows:
- Sociopolitical and anthropological context
- Soundscape diversity
- Historical data
- Seasonal variations
- Ease of access

After reviewing various locations, we finally chose as field of research the area around the cargo port of Piraeus. This particular area fulfilled all of the above requirements. For example, the recent purchase of a big percentage of the port from the Chinese shipping company COSCO, has a huge sociological and environmental impact across the region, while the plurality of sounds due to the activities taking place across the coastline is immense. Additionally, as one moves from one location to another across the entire area may observe that the soundscape changes dramatically, including a variety of elements such as leisure marinas, shipyards and ferry docks. Another factor that we took onto account had to do with the concept we wanted the final artwork to communicate. This refers to the relationship between the old and the new; something that as a notion across our chosen location is evident and had to be reflected by the composition element of the artwork.

4. The Idea and Methodology

We based the idea behind the artwork on the research question of how media of capture and of reproduction alter the attributes of the signal and possibly affect the sacramental order. Therefore, we aimed to start capturing soundscapes and sounds using new digital media, while at the same

time and in parallel, an old reel-to-reel portable tape recorder and vintage electret microphones would perform the same recording at the same moment. The methodology we followed is inspired by Barry Truax's approach to soundscape study who proposes as best way of approaching a soundscape, the soundwalk without a recorder [10]. With this method the artist - researcher may have a better understanding of the actual aural reality of the location, including its weather and time dependent variations, and therefore be more precise on the desired captured outcome at the time of the field recording. After performing these initial soundwalks, we initiated a series of recording sessions as described above in the desired locations and conditions.

We performed three different types of recordings. The first one referred to capturing the sound of a specific sonorous object we had identified. The second referred to capturing the soundscape of a specific location while finally the third one referred to sound interventions that would produce aesthetically interesting elements but also would give us the opportunity to enhance the narrative aspect of the composition. All the recordings were performed as stated with both the digital and the analogue equipment and we did not try to eliminate any sound artefacts that resulted due to special characteristics of the used media of capture. The second phase of the creative process was studio / laboratory work. We created one single soundscape composition in stereo format. Each channel of the stereo spectrum had the parallel recordings. Therefore, on the left channel we placed the digital version of the composition while on the right, the one based on the recordings performed by the reel-to-reel equipment. During the compositional process, again, we tried to keep any artefacts that occurred because of the medium intact, yet we always had to keep in mind the aesthetic and narrative nature of the work so in some cases we edited out some material. The last part of the creative process was to follow the sound art cannon and communicate our concept to a wider audience.

5. New Gods / Old Gods

The artwork attempts to communicate the relationship between the notion of the new versus the old in a broader sense, using recordings performed with new and old media of capture. The recordings are both of the sacramental order and through creative practice, we explored the differences between them and tried to identify if the medium plays any part regarding the particular order of the heard.To enhance the narrative of the work we needed to find a suitable diffusion platform. Additionally we needed to ensure that the quality of the diffusion is optimal and therefore we chose to use headphones for that purpose. This way the audience also had the possibility to use only the left or the right channel in order to listen to each one as a standalone or in stereo, which was communicating the audio conclusion. The visual aspect of the work enhanced even more the message as we used the media of capture that we used for the recordings in an installation format. The portable digital recorder was positioned face to face with the reel-to-reel tape recorder. The way they were positioned implied a battle which would also enhance our concept but additionally the digital recorder was positioned on the left side corresponding to the left channel of the diffusion while the vintage recorder on the right (see Figure 2.). The media player that was used to playback the audio part of the work was giving the opportunity to the visitors to choose which part of the work to listen. The visitors couldstop it, rewind it and start it at their own will at any point they wished, thus enabling the audience to have a control over the artwork and feel free to explore any aspect of the work the desired.

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Figure 2: 'New Gods / Old Gods' installation

6. Conclusions

During the creative process and the presentation of the artwork, we were able to make some important observations relating to our research. If we listen to the vintage recording as a standalone composition, it is evident that what we hear is a composition of a concrete audible reality and – as an actual reflection – it is composed from signals of the sacramental order. Similarly, when we listen to the digital part as a standalone composition, it is again an actual reflection of the acoustic reality, which is even better defined. If we listen to both of the compositions synchronized, they give us again the impression of an actual reflection of a profound reality and therefore we conclude that the audible result is composed of signals of the sacramental order. As its seems then the medium does not affect the order of the signal. However, it is a fact that we can hear some differences between these three versions of the work. What is then the impact of the medium? Marshal McLuhan claimed that 'the medium is the message'[5] and in this particular piece of work it seems that this is the case. McLuhan also divided media into two categories depending on the effort that the receiver of the message needs to make, in order to understand it. These two categories are hot and cool media and in particular, he states:

> Any hot medium allows of less participation than a cool one, as a lecture makes for less participation than a seminar, and a book for less than dialogue [5].

In our case, the analogue recording when listened to as a standalone version needs more participation from the audience due to some artefacts and the quality of the sound. What the medium does in that case is adding narrative and aesthetic value to the work but regarding the order of the signal that has been captured and reproduced as a simulacrum, seems irrelevant. What is interesting enough is that if a medium 'cools down' enough, which means that the quality of sound and the amount of artefacts merit the recording very hard to identify, then the situation changes and the signal may pass over to some other order of the heard. It seems that there is something like an aural uncanny valley where the signal can suddenly drop in and be perceived differently.

'New Gods / Old Gods' is the first of a series of artworks that are going to be produced as we try to journey and explore all of the orders of the heard. The methodology we employed for such an endeavor is what Franziska Schroeder defines as 'Practice research', instead of the traditional

'practice based research'.Schroeder in particular argues that:

> [P]ractitioners have a duty to intimately join practice and research. I want to suggest that we refer more resolutely to Practice Research (abstaining from '…as if') and in that way deny elevating research over practice [9].

Therefore, with our tools being the aural simulacra themselves and with the use of any relevant mediawe search for what has been called an embodied knowing. As Barbara bolt observes, in such a practice:

> [T]he materials are not just passive objects to be used instrumentally by the artist, but rather the materials and processes of production have their own intelligence that comes into play in interaction with the artist's creative intelligence [1].

We align with this approach and set to explore all of the orders of the heard. We have just scratched the surface but with 'New Gods / Old Gods' we already set forth to journey from aural reality to the sacramental order we will continue to the order of maleficence and the order of sorcery until the point that we lose any reference to anything real and we enter the world of pure simulacra.

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Live coding and Poetry: A text driven synthesis technique in musical live coding

Vasilis Agiomyrgianakis[1]

[1]Ionian University, Tsirigoti sq.7, Corfu, 49100, Greece

Abstract

The objective of this proposal is to investigate the aesthetic potential of incorporating a textdriven sound synthesis technique in musical live coding. The purpose of this research is to use Homer's The Odyssey and the dactylic hexameter as a musical score in order to drive the creative flow of improvisation in live coding performances and provide rhythmic events derived from epic poetry and at the same time to project both the code and the poem's scansion system onto the screen. Both the projection of the code and the results of its execution can be used as an event score for the performer and as a blueprint which the audience can easily read during the live coding, as it is difficult for the audience to read and understand and people may lose contact with the performers. Poetry, on the other hand, is an easily understood medium and, in my opinion, it makes a connection with the musical output during the live coding performance. This project will also contribute to reproducible research by testing several cases from related but distinct research areas of musical live coding and data sonification

Keywords

Dactylic hexameter, data sonification, live coding, micro-montage, text-driven technique

1. Introduction

The idea of mapping text to compose music can be found back in the Medieval period and more precisely in Guido d'Arezzo's works (around 991-1031)who not only developed the 'solfeggio' but also invented systems for algorithmic composition amongst others. An example of his algorithmic ideas is the "Micrologus" in which he invented a method of creating melodies deriving from syllables in the text [10]. Additionally, nowadays there is a notable development in linguistics and theories of verse structure. For instance, Halle's and Keyser's "English Stress: Its Forms, Its Growth, and Its Role in Verse", Chomsky's and Halle's "The sound Patterns of English" as well as Kiparsky's "IndoEuropean Origins of the Greek Hexameter" are good examples the aim of some of which being to formulate rules that will recognize and generate a specific meter, such as, for example, the iambic pentameter [3].

Additionally, during the last few decades, live coding has become very popular amongst artists because of the flexibility and power that interactive programming languages can offer in making music on the fly. There are lots of paradigms and researches in live coding era especially in IDEs and frameworks such as ixi, SChacks, Tidal, Sonic Pi and Gibberin the Web.

Moreover, data-driven sonification and visualization have increased their popularity amongst interdisciplinary research teams such as artists and scientists. Kramer defines sonification as "the use of non speech audio to convey information." More specifically, "sonification is the transformation

of data relations into perceived relations in an acoustic signal for the purposes of facilitating communication or interpretation" [7]. Apis, such as DTM API, can do real-time data processing and mapping for creating complex audio expressions [14], amongst others. Since then there have been many other examples that make use of data as a score which can be derived from many sources such as text, numbers as well as symbols and gestures. There are many ways to retrieve and use data and to map them to values that can be used to manipulate sound characteristics as well as musical structures. These can be found on recent researches using machine learning to identifying rhythmic patterns in poetry written in English [2]. However, in my research I have experimented with parameter mapping sonification [5] in which I have mapped data to auditory parameters. This research focuses on the partial use of the rhythmic patterns of epic poetry in live coding rather than attempting to present a definitive and exhaustive study of generative metrics.

In other words, my research is focused on real-time manipulation of audio events by using data from poetry. More specifically, it aims at collecting symbols through a data-set of dactylic hexameter's scansion system so as to drive the rhythmic events in live-coding performances. The term 'scansion' denotes the discovery of the particular pattern of the metrical system of the verse [13]. In this study the data set with the scansion system has been created by means of using the University of Vilnius' online Greek Hexameter Analysis[1] as shown in figure 1.

Metrical analysis

#1 Ἄνδρα μοι ἔννεπε, Μοῦσα, || πολύτροπον, ὃς μάλα πολλὰ

Figure 1: Metrical analysis of an Ancient Greek Hexameter (Retrieved from:
http://www.thesaurus.flf.vu.lt/eiledara/index.php).

2. Related Work

There are plenty of projects that use sonification techniques to describe text, such as "Making music from text" which uses the text with ASCII and MIDI notation to sonify d'Arezzo's "Word Music" [9]. Another research is the "It will discourse most eloquent music": Sonifying Variants of Hamlet of Emsley and De Roure which have created a "software, using the ChucK9 language, which ingests the file or the data stream" [6]. However, I have created a code in SuperCollider environment in which I have made dictionaries mapping symbols to numerical values, in my attempt touse the sonification of diverse verses from The Odyssey using the scansion of the ancient Greek text, ancient Greek and Latin texts so as to insert rhythmic and melodic events in my effort to manipulate sound characteristics so as to extend the creative process of live coding performance at the same time.

2.1. Aim of the Study/ Objectives

My research on using text to manipulate sound and graphics started when I was a PhD student. Back then I had sonified The Odyssey to create audiovisual materials which I had used inside my fixed media compositions [1]. My aim in this project is to extend my research in sonification of text materials and to create a library for Text-driven sonification in live coding performance. The goal is to incorporate sonification events in live coding and to investigate the aesthetic potential

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1   Online Greek Hexameter Analysis: http://www.thesaurus.flf.vu.lt/eiledara/index.php

of using dactylic hexameter's metric systems as a rhythmical pattern generator. In my opinion, the combination of metric systems can produce interesting alternations to the overall performance.

My aim is to encapsulate the code of the sonification mechanism into classes in SuperCollider so as to create an easier way of evaluating the code for live coding performance purposes. Furthermore, another feature of my live coding library is that which gives the performers the ability to be more flexible during their performances while manipulating data. For instance, it is possible for the performer to choose to sonify only a letter or a word or a verse of the poem.

2.2. Hexameter Metric System in live coding improvisation

The roots of dactylic hexameter[2] can be traced back to Hesiod, Homer's Iliad and The Odyssey, as well as Ovid's works, to name but a few. Dactylic hexameter is a form of meter or rhythmic scheme in poetry. In this research 8 verses from The Odyssey are used as those found in Rhapsody L or the Book XI[3].

Magnusson in his research "Algorithms as scores: coding live music" stated that "the score in its various forms is a mnemonic device that enhances more complex compositional thinking patterns than those we find in pure oral tradition. In his research he suggested a new path in the evolution of the musical score in live coding, where the score is written in the form of an algorithm, either graphically or textually" [8]. Also, McLean states that computer programming code is the music notation of live coding performances [11].

However, in my research the visualization of the scansion followed by the text in the ancient Greek language is used as the event score which is posted onto the SuperCollider post window after the execution of the code which is responsible for the sonification of the poem. This has happened because I wanted to make it possible for the audience to locate the rhythmic events onto the screen and at the same time listen to them. Coding is difficult to read and understand by most people and as a result the audience might lose contact with the overall performance. Poetry on the other hand is a medium that people can easily understand and, in my opinion, make a connection with the musical output during the live coding performance. Another part of this research has been the creation of the visualization of the audio output as abstract graphics. To achieve that I have used the length of the syllables to drive a sequence of shapes. These shapes are long and short circles which symbolize the rhythmic events of the hexameter and its sonic events, for example, the sounds of grains and sustained notes.

2.3. Mapping the data

The mapping of data to numerical values could then be easily used to determine the parameters of sound and music, such as rhythm, pitch succession as well as the timbre and the shape of the sound amongst others. In my effort to represent the ancient Greek and English versions of The Odyssey I have built three lists of collected characters-symbols. Firstly, I have converted the Ancient Greek text into numeric values using ASCII code. I used this method to create sustained notes (drones) in live coding performance. Secondly, I used dactylic hexameter's scansion system which I have mapped into numeric values and thirdly, I have mapped the Latin characters of the text to numeric

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2   Oxford Dictionary: A verse of six metrical feet, which in the Greek form consists of five dactyls and a trochee or spondee. Retrieved at: https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095934628

3   Ancient Greek text of The Odyssey retrieved at: http://www.perseus.tufts.edu/hopper/text?doc=Perseus:-text:1999.01.0135

values.

2.4. Mapping the Scansion

The scansion system of dactylic Hexameter, as shown in Figure 2 contains the symbols "-", "u",",|" and "x" where "-" is a long syllable, "u" is a short "|" is a break and "x" is an anceps syllable which is either long or short (mostly long) i.e."-uu|–|-uu|–|-uu|-x|". "The feet can be of two types only; the trisyllabic dactyl (-UU) and the dissyllabic spondee (- -)" [13]. The Dactyl (-uu) is a metrical pattern known as a "foot" which comprises one long syllable followed by two short syllables [15]. It is estimated that an average long syllable has between 1.6 and 1.8 times the duration of a short one [15].

Furthermore, the symbols in the scansion have been mapped using numbers in the MIDI (Musical Instrument Digital Interface), and in the frequency domain and other numerical values which are specified by other parameters of the synth such as amplitude, density and duration of the grains amongst others.

Symbol	Characterisation
–	long
∪	short
×	anceps
|	break

Figure 2: Metrical Symbols.

Theoretically, if we play the rhythmic patterns of a paragraph of the original text, we can retrieve the rhythmical structure of the ancient Greek version of The Odyssey which, in this case, is the dactylic hexameter. One more tool in this library is the creation of a dictionary that converts the Latin alphabet to numeric values. This can be used both for the rhythmic and melodic part. An example of the metrical analysis of 3 verses from the Odyssey can be seen in figure 3.

```
-uu|--|-uu|-uu|-uu|-x|--|-uu|--|--|--|-x|-uu|-uu|-uu|-uu|-uu|-x|--|-uu|-uu|-uu|-uu|-x|-
uu|-uu|-uu|--|-uu|-x|-uu|-uu|-uu|--|--|-x|-uu|-uu|-uu|-uu|-uu|-x|-uu|-uu|-uu|-uu|-uu|-
x|--|-uu|-uu|-uu|--|-x|-uu|-uu|--|--|-uu|-x|-uu|-uu|-uu|-uu|-uu|-x|-uu|-uu|-uu|-uu|--|-x|-
uu|--|-uu|-uu|-uu|-x|-uu|-uu|-uu|-uu|-uu|-x|-uu|-uu|-uu|--|-uu|-x|-uu|--|-uu|-uu|-uu|-x|-
uu|--|-uu|-uu|--|-x|-uu|--|-uu|-uu|-uu|-x|-uu|-uu|--|--|-uu|-x|-uu|-uu|-uu|-uu|-uu|-x|
```

Figure 3: Scansion system of 3 verses/stanzas from The Odyssey.

With the resulting algorithm it is possible to use a large quantity of values which result from encoding the text serially or from choosing the exact verse or line from within the poem. According to the encoded text the quality of the output can produce dynamic expressions with rhythmic, melodic, or chaotic sequences with audio events. Figure 4 demonstrates the mapping of the symbols from the scansion system to numerical values.

```
/*long*/      $--> [2.1,2.3].choose,
/*short*/     $u->0.5,
/*break*/     $|->Rest(1),
/*anceps*/    $x->[2.1,0.5].choose
```

Figure 4: Mapping symbols to values in SuperCollider programming language.

2.5. Mapping the Latin Alphabet

As an extension of my text-driven synthesis technique I have also used the Latin alphabet as the data with which I have manipulated the arguments of a synth. In this case, I have mapped the letters of the Latin alphabet from a to z as numbers from 1 to 26 respectively as it is shown in figure 5. I have also mapped punctuation as the musical rests with diverse values. For instance, dot has a rest value of a quarter, comma of an eighth and so on.

Figure 5: Mapping the Latin Alphabet

Below is an example with the SuperCollider code as it is written in Emacs org-modeand it shows how the parameter mapping has been implemented.

```
#+BEGIN_SRC sclang :results remove
//Granular synthesis example
~grains = Pbindef(\grain, \carfreq, Pseq(~dr2.linlin(-5, 5, 0, 2000)),
 \modfreq, Pseq(~dr2.linlin(-5, 5, 0, 800)), \ind, Pseq(~dr2.linlin(-5, 5,
 0, 1000)), \trig, Pseq(~dr2.linlin(-5, 5, 0, 25)), \shape,
 Pseq(~dr2.linlin(-5, 5, 0.1, 1)), \dur, Pseq(~dr2.linlin(-5, 5,
 0.0, 1)), \amp, Pseq(~dr2.linlin(-5, 5, 0.6, 0.6)), \rate,
 Pseq(~dr2.linlin(-5, 5, 0.0, 1)), \vol, Pseq(~dr2.linlin(-5, 5, 0.5, 0.5)),
 \pan, Pseq(~dr2.linlin(-5, 5, -0.7, 0.7)), \pos, Pseq(~dr2.linlin(-5, 5,
 0.1, 0.7)), \envbuf, Pseq(~dr2.linlin(-5, 5, 9, 0.01))
#+END_SRC
```

In this case, it is possible to use the data sets to create cloud of grains and to create ambient and drone music on the fly. I have chosen to use as editor for this research the GNU Emacs because in my opinion Emacs and org-mode are suitable and flexible tools for the case of reproducible research. Org-mode is a fast and effective plain text system which provides tools such as code blocks which enhance the evaluation of code of various programming language such as the SuperCollider language.

2.6. Synthesizer Implementation

I have built various synthesizers for live coding performances. Some of them have been made of Granular, additive and modulation synthesis. In the granular synthesiser I use the data to control the density of the grains, the playback rate of the sampled sound, the playback position and the duration of the grains. In Granular synthesis the produced grains typically have a duration between one thousandth of a second and one tenth of a second (from 1 to 100 ms) [12]. In other techniques such as modulation synthesis I used the data to control the carrier, the modulation frequency and the shape (envelope) of the synth so as to emphasize both the alternation of the timbre and its rhythmic

events. The aim is to manipulate the rhythm, the timbre and the shape of a sound by controlling the envelope of the sound amongst others. Thus, I use hexameter's scansion system (symbolic notation) as the array of values with which the characteristics of the sound are controlled.

Furthermore, I have used the Event types and parameters' mechanism of SuperCollider in which a key/value pair is used. The key determines which action is taken while the significant parameters depend on the event type. For example, the key can be the arguments of the synth and the value can be a number which is mapped to match the values of a specific characteristic of the sound generator. For instance, if we want to map values to the frequency domain these must be between 20 and 20000.

Additionally, the range of values for the amplitude must be between 0 and 1. Figure 6shows an example of how I use Pattern-Event system using data from text in SuperCollider and how the text can be mapped to numerical values depending on the diverse arguments of the synth.

```
Patterns(\midiNote, Pseq(~hexameter.mapTo(0.0, 2.1, 60, 80)),
\envelopShape, Pseq(~hexameter.mapTo(0.0, 2.1, 1, 30)),
\duration, Pseq(~hexameter.mapTo(0.0, 2.1, 0.01, 3)),
\volume, Pseq(~hexameter.mapTo(0.0, 2.1, 0.1, 1.0))
).play;
```

Figure 6: Pattern-Events mechanism pseudocode

By using methods such as linlin (maps a linear range of values to another linear range of values), it is possible to parameterize the range of values to match the range of parameter values of each unit of measurement, such as Hz for the frequency of the sound with the arguments of the UGENs I used in SuperCollider. A good example is that of the UGEN Grain Buf with arguments such as trigger, duration, playback rate, position, panning, amplitude and envbuf.

In the argument trigger (density of grains) the linlin method is used with values ranging from 1 to 200. Another example is the mapping of the duration of the sound sample of the grain generator which uses the range between 0.001and 4 seconds.

3. Results

These experiments have given me the opportunity to make the listening of the ancient Greek rhythmical structures, and more specifically that of dactylic hexameter, as those found in Homer's The Odyssey and Iliad amongst others, possible. Moreover, in my opinion, I have found it interesting to use these rhythmic events inside my live coding performances and to combine them with other audio materials such as those found in ambient and noise music genres.

4. Conclusions

This research not only focuses on data manipulation and its symbolic representation onto the screen so as to create rhythmic and musical expressions based on dactylic hexameter in live coding performances but also, at the same time, to create a feedback related to the data the events of which unfold in time and space. In the future I plan to experiment with the combinations between meters such as iambic (Dimeter, Trimeter, etc.), trochaic, anapestic, and dactylic, amongst others, as well as other linguistic properties to the sonification paradigms. Moreover, another future research I would like to carry out would be to build a mechanism that allows mapping of the ancient Greek characters to numerical values in the place of ASCII character encoding standard.

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5.1. Sites

• Online The Odyssey in ancient Greek http://www.perseus.tufts.edu/hopper/text?doc=Perseus:text:1999.01.0135

• Online Ancient Greek Metrical SystemAnalysis

Dr. Vasilis Agiomyrgianakis is an audiovisual artist and researcher. He teaches the subject of Algorithmic Sound Composition in the Department of "Ethnomusicology" of the Ionian University. He has enriched his knowledge, skills and aesthetic education through the creation of pilot projects that make use of programming for audio and visuals during his work as a postdoc researcher. Furthermore, he has over 10 years of experience in programming with SuperCollider and has performed in several live coding events since 2006. He has completed a PhD thesis developing audiovisual compositions as well as interactive environments.

Greek Cinema and Representations of Disabled People – Autism

Maria Papadopoulou[1]

[1]PhD Candidate of the Department of Cinema AUTH, Greece

Abstract

This research is part of an extensive research that studies the way in which Greek cinema represents disabled people in general. Specifically people with autism, in relation to the cinematic representations of Hollywood, as well as studying the way in which these representations affect the public. In particular, this research begins with the disabilities representations, and then focuses on cinematic representations of people with Autism Spectrum Disorders. The bibliographic review shows that from the beginning of its creation, the cinema dealt with cinematic representations of people with disabilities. In addition to American cinema, and the Greek cinema at the very earliest it dealt with mental illnesses and disabilities. These cinematic representations at that point had a negative impact on the public in relation to these people, reflecting the society of that time. Through this research, the power of cinema is perceived to create social representations that arise through cinematic representations. Taking as a starting point the cinematic representations of people with autism in 1988, an attempt was made to explore the films, Rain Man (1988) and Life with Alki (I Zoi me ton Alki) (1988). Some of the main findings of this research were the different approach of disability and autism within the same artistic context at the same time period and the abundance of research on the subject in relation to Hollywood cinema and the lack of references in Greek cinema.

Keywords

Cinematic Representations, Social Representations, Autism (Autism Spectrum Disorders).

1. Introduction

The cinema from its first steps follows two trends: a) copy the reality with the Limier brothers as the main leaders of that trend and b) develop the imagination and artistic thought with Melies being the leader of that trend [17].However, in both cases, viewers of a cinematographic work expect cinema characters to behave in a natural way [17]while the actor must look like he really is the character he is playing, either by presenting some of its specific properties, or by departing significantly from a photographic illustration [2]. Bazin (1986) suggests that Cinema is a player of realism and seeks to put the viewer as deep as possible into an illusion that he sees it as a reality, while due to the unusual cinema communication between the viewer the message of the film holds a position of authority [7]. As a result, cinematic representations are transformed into social representations. Social representations refer to the processes of collective importance that result in common attitudes that generate social ties that bring together societies, organizations and groups [14].

Considering the above, through this research an attempt is being made to explore the way in

which the person with disabilities is represented in Greek cinema and how Greek cinema is been influenced by Hollywood cinematic representations. In particular, this research begins with the disabilities representations, and then focuses on cinematic representations of people with Pervasive Developmental Disorders (for reasons of brevity, it will be refer as autism).The present research is not only aimed at recording a series of films that have incorporated into their myths a character with autism, but also it sets two main goals: a) the in-depth study of the way in which the cinematic representation of the character is built as well as b) the study of social representations created through the cinematic representations of people with special needs in general and with autism in particular. Based on the stated objectives, the following research questions have been investigated: 1) According to the literature how the film character of the person with autism is been portrayed in a Hollywood movie? 2) How the cinematic character of the autistic person is been portrayed in Greek cinema? 3) What kinds of social representations are created from these cinematic representations?

In order for this bibliographic research to work flawlessly it was divided into six sections.

- The first section deals with the definitions of social representations and their connection to cinema.
- The second section presents the history of representation of disability in cinema.
- The third section deals with the definition of the person with Pervasive Developmental Disorders (Autistic person) and examines some of its characteristics.
- The fourth section deals with the cinematic character of the autistic person linking Greek cinema to Hollywood.
- In the fifth section presents the conclusions of the analysis of the two main films Rain Man (1988) and Life with Alki (I Zoi me ton Alki) (1988).
- Finally, the sixth section refers to the objects that were dealt with in the present research, and presents the conclusions that arise.

2. Representations

It is very difficult to define social representations, while entities are almost tangible and easy to perceive as a reality while they are difficult to perceive as concepts [22]. Representation is defined as an organized and structured set of elements, a set of opinions, attitudes, relationships, beliefs and information in relation to an object [1]. Representation defines the nature of the stimuli that surrounds the individuals of a community while at the same time generating and defining behaviors [22].

The cinema creates character representations due to its peculiarity as a mass media and due to its great resonance that was used early for national or social propaganda purposes [19]. As a branch, cinema is governed by a framework of institutional rules with direct effect on political affiliation [7]. As a result of this, cinema contributes to the creation of social representations and to the spreading of stereotypes. Which stereotypes are a popular technique used by cinematographers who represent disability [10].

2.1. Disability in cinema

By making a historical review of the films, we come across to two findings. First the cinema was concerned in its early steps with the issue of people with disabilities. Already in 1898, the first film dealing with the issue of disability, by Tomas Edison Fake Bagger, was released. In this

fifty-fivesecond film the protagonist is a beggar who pretends to be blind. It is a film in which "disability" is ridiculed and is a source of humor and fun for the public [24]. Secondly, there is a multifaced cinematic depiction of disability that reflects changes in society and social behaviors, and on the basis of which cinematographic attitudes to disability can be divided into four periods up to the 1960s [9]. In the first period, before the First World War, cinema depicted disability as a withdrawal from the normal. In the second period, after World War II, cinematic representations of characters with disabilities are improved mainly as a direct response to the return of wounded and veterans from the battlefield, who struggle to overcome their difficulties. In the third period, 1950 the entertainment industry returns to a negative image (representation) of disability. Finally, in the fourth period, 1960 and onwards cinema presents through its films a more tolerant attitude towards disability, adopting the values of the 1960s that proclaimed equal rights for people with disabilities[9]. In the following decades, the way that the issue was addressed is not so clear. Several Hollywood films have been unable to eliminate the logic of being trapped in regret [13]. A basic example is the film My Left Foot (1989).

Also, the position that cinema has cultivated the negative representations of a certain disability strengthens the films about mental disorders. People with psychiatric illnesses in fiction films are depicted either as victims (melodrama) or as objects of mockery (comedy). As a rule, they are represented as violent characters, with the result that this stereotype contributes more to the stigmatization and marginalization of these individuals [6]. Then the cultural tendency of society to treat disability and illness as an experience requiring deliverance rather than support, in the sense that deliverance being in this case synonymous with suicide [26]. So, disability is associated with death. Also, Avatar (2009) links disability to the sexuality of the person, as the protagonist as a wheelchairimpaired person loses the status of soldier (which is also directly related to male sexuality) and is forced to redefine his own identity and sexuality through science and medicine [21].

However, Hollywood, in some cases is more accurate in his representations. An example reinforcing this view is the film King's Speech (2010), which was believed to have exerted a positive influence on the public and the researchers, towards people with stuttering problems, and is a good example of a good response to a human problem [32]. However, it should be noted that even when cinematographic representations of people with a disability show the character to the public, especially when it is a serious disability, it becomes almost impossible for them to be socially integrated [18].

As far as Greek Cinema is concerned, the first Greek film was Golfo (1915) which was based on the homonymous play [28]. Love leads a young girl to madness and then to death. Similarly, Astero (1929) follows the footsteps of Golfo, even though in this case the madness of love is cured by the power of love. The miracle that brings the healing is a feature that was later adopted in many melodramas by KLAK FILM, in which the mother, child or poor girl suffers an accident stays paralyzed or blind has no hope of recovery but in the end a miraculous doctor from America or love or faith will lead to complete healing of the patient.

Another example of a cinematic representation of disability is the film The Counterfeit Coin (I Kalpiki Lira) (1955), in which the character of the disabled person is a beggar who represents the disabled (blind) in order to earn a living. A pattern that it is also founded in Hollywood's first films. Then, the comedy introduced the character of marginal intelligence to the Greek cinema that offered generously laugh. The character of the fool (idiot). A classic fool of Greek cinema is

Yannis Gionakis [28], with an unforgettable interpretation in film The Yellow Groves (Ta Kitrina Gantia) (1960). Also, the comedy introduced the character of the fake madman who tries through his situation to achieve his goals My Wife went Crazy (I Gynaika mou Trelathike) (1966) is a prime example of a similar cinematic character of Greek cinema. There is also another type of madness, the madness in the movie A Crazy Crazy Family,(Mia Treli Treli Oikogenia) (1965). In this case the madness becomes synonymous with the broken family [8]. A different, poetic approach of the sick mind and body in Greek cinema is presented later through the film Byron the Ballad of a Demon (Byron I Mpalanta enos Daimonismenou) (1992) [30].

A newer approach to disability for Greek cinema is the 80s, in which a series of films have been created that deal with the concept of disability in their fiction under the realm of realism. Stigma (To Stigma) (1982) presents the relationship of a couple through the problem of their child's disability (down syndrome) and the solution of drama by killing the child and breaking the relationship [29]. Subsequently, Dimitris Kollatos made two films with the central character of an autistic child with low functionality, Life with Alki (I Zoi me ton Alki) (1988) where he represents the father and son relationship and their relationship with the society [29]and the film Red Rose (Kokkino Triantafyllo sou Ekopsa) (1993). In the second film, the death of the child seems to be the only solution to the drama. A similar choice of death (father and son) is given as a solution to the problem in the short film Gas (Igraerio) (2006). In conjuction to severe disabilities, Greek cinema has rarely dealt with special educational needs. A typical example is the film The Kanary Yellow Bicycle (To Kanarini Podilato) (1999). A film of low tone but high social message showing the reintegration into society as a continuous fight against prejudice and discrimination [30].

2.1.1. Autism Spectrum Disorders

Today, according to the American Psychiatric Association [3], the name that is used to describe (scientific consensus), autism is "Autism Spectrum Disorders" these disorders represent a single continuum of mild to severe impairments in the two domains of social communication (persistent deficits in social communication and social interaction across multiple contexts) and restrictive repetitive behaviors/interests rather than being distinct disorders (Restricted, repetitive patterns of behavior, interests, or activities) [3].

It should be noted that people with autism present mental disability. 23% of these individuals have an IQ greater than normal, 77% of them have mental disability, and from them a 50% has moderate to mild mental retardation and a 27% has a heavy mental disability [15]. According to National Research Council [23], the main difficulties faced by people with autism from the very moment Kanner described it until today, are a) the management of social relations and b) the interaction with other people, difficulties that have led researchers, clinicians and educators to study in depth over the last 40 years, techniques that will help these people overcome these basic problems. [23].

A rare and unusual condition, which occurs primarily in people within the autism spectrum and states a situation in which a person with intellectual disability manifests excellent mental abilities, is the Autistic Savant [16]. These outstanding abilities are presented mainly in the fields of music, design, mathematical calculations and calendar computations, and 1 in 10 autistic people have one of these skills [12].

The cinema has exploited the character of the autistic savant. Typical examples of films where

the character was savant autistics with particular abilities are films Rain Man (1988) and Mercury Rising (1998).

3. Autistic character in Greek cinema and Hollywood

The state of autism is a special situation. While these individuals have some common features they are very different from each other. The classification of the autism spectrum and differentiation makes it impossible to portray perfectly every aspect of autism through television and cinema characters [27]. Autism, like many other disabilities, as early as 1988 was not understood by society, as a result, many movie producers felt they would not be potential commercial successes. However, the change came with the film Rain Man (1988), which is seen as the first film in which autism is represented in an accurate way [31].

Since the first appearance of the autistic character on the big screen, this character has been categorized. The most common categories for cinema and television are four a) the magic / savant, β) the "different"/ peculiar, c) the character with undiagnosed behaviors and d) the autistic character whose imagination is more realistic or based on a real person [27] .

Hannam (2014) through her research identified seven features in relation to the construction of autistic character in cinema. Specifically: 1). usually the autistic cinematographic character is not the protagonist of the film, but is there to serve the plot around the central character, which evolves through his contact with the autistic character. 2) The autistic character is determined - described by other characters (usually doctors) based on its condition and the consequences of this condition. 3) Autistic character usually appears as an obstacle to the basic character. 4) Usually the autistic character is presented as sweet and innocent without sexuality (asexual character). 5) The autistic character is usually presented with special abilities that help the basic characters but these special abilities are not used to the benefit of the autistic character. 6) Many times the autistic character is isolated from the other characters and from the audience and 7) the life of the character with autism remains relatively unchanged at the end of the film (Hannam, 2014). This is the basic model, the basic recipe for the success of a film that deals with an autistic character.

The literature on these films of American Cinema is enormous and did not cease to be of interest to researchers. As for Greek cinema, few films use in their myth an autistic character, for example the films Life with Alki (I Zoi me ton Alki) (1988), Red Rose (Kokkino Triantafyllo sou Ekopsa) (1993), The Routine (2015) και ο Eteros Ego (2016). Also, there is no organized reference or list of these films and no such bibliography exists.

4. Two main films in 1988

The appearance, of Rain Man (1988) introduces to the general public the problem of autism and some people used the term "Rain Man" to describe people in the autism spectrum [4]. Wing [33]reports that this film helped make Autism known to the general public. Hollywood because of the film Rain Man adopted the stereotype of the cinematic character of the autistic savant person [25].

Although the character of Raymond (Dustin Hoffman) is also the title of the film, his brother Charlie (Tom Cruise) is the protagonist [27]. The length of the movie is about 130 minutes. At these 130 minutes the viewer watches Charlie a car dealer. Charlie learns about the father's death and discovers that he is not the only beneficiary, so he is trying to find the other one. Then he discovers

that this money is controlled by the director of an institution for people with disabilities, pay a visits to the institute and he learns that he has a bigger brother for whom he did not know. His brother Raymond is an autistic person and lives in the institute. Charlie then kidnaps Raymond and goes to a doctor to be evaluated. The conversation between the doctor and Charlie is unnecessarily deceptive for Charlie, (and afterwards) partly politically incorrect from the point of view of the doctor, although it was appropriate for 1988 [27]. After Charlie learns that his brother is autistic savant they start a trip by car. During this time, Charlie uses Raymond for his unique abilities, especially at a casino in Las Vegas, as well as trying to get his custody to be able to control their father's money. During the journey, character dynamics change as well as Charlie's character. In the end, although Charlie does not manage to earn his brother's care, he tries to explain to the courts that he has a real relationship with Raymond and really cares for him. But the court and the doctors are trying to explain to him that Raymond is "unable to have a relationship" (Rain Man, 1988, [27]).

It is obvious that Raymond displays numerous features of autism and certainly matches the criteria of diffuse developmental disorders, even today, but the added skills are not realistic or the accurate depiction of autism as a whole [27]. Through the scene with the kiss of Raymond and Charlie's girl it is more than obvious, that it concerns Raymond's sexual desires is a field in which the film prefers to be silent and present a character without sexuality (asexual character).But people with autism have sexuality, preferences and desires. A major role in the sexual behavior of these individuals is the lack of social skills that can affect a person's behavior [5].

As it is perceived, the film carries all the features mentioned in her research Hannam (2014) perhaps because this film has set the standards and created the recipe for success. As mentioned above the film was politically correct for the period it was created and helped to make autism known in society. The film followed a somewhat realistic course of filmmaking representation but did not touch issues deeply such as the sexuality of people with autism and their freedom. While their encroachment in institutions is presented as the most appropriate solution for their situation.

At the same time Kollatos approached the matter differently. He creates an autobiographical film as a scriptwriter, director and actor, starring his son Alexandros who embodies for the cinema his autistic low-functioning brother Alkis.

"Is an autobiographical film about an eleven-year-old autistic boy, Alkis, who remains completely enclosed in himself and denies any communication with the environment. His French mother did not stand the stress because of her son's situation and left her family, returning to France. His father, the director of the film, Dimitris Kollatos, recognizes the child every right to live in one's own world, and stands constantly beside him with the support of a psychologist. Among them is a strange communication, with codes that are not recognizable by third parties, which nevertheless works in a redemptive way "[11]. This film is a valuable documentary about an almost unknown aspect of the Greek society of autism and the inhumane organization of the mental health sector[29]. The film does not follow any of the Hollywood formulas or recipes as reported by Hannam's (2014) research. Kollatos tries to convey his personal message through the film, the value of this document is such that it degrades what public demand for aesthetic beauty [29].

The film at 121 minutes presents the life of an autistic character named Alkis through the life and eyes of his father. The father confronts his wife, science (the family psychiatrist) and society, trying to keep his autistic son near him happy and free instead of as he is been proposed to close him in an institution. An option imposed by the Greek society of the time. It is an autobiographical film with a strong realistic element, who is not afraid to touch issues regarding the sexuality of

people with autism, the ignorance (that time) of doctors in dealing with the problem, to the break up of the family when it faces serious problems and the lack of welfare structures for people with autism and their families not only in Greece but also in France.

Kollatos touches all the taboo issues that Rain Man did not dare to touch. The film was not accepted by the festivals and, as he says in an interview he gave for the purposes of this research to accept him at foreign festivals he had to change the scenes from the 'house of tolerance' where the father went with his son.

5. Conclusion

This research has focused on Greek cinema in conjunction with Hollywood cinema. The following two films were selected as prime examples a) Rain Man (1988) by Barry Levinson and b Life with Alki (I Zoi me ton Alki) (1988) by Dimitris Kollatos, because Rain Man is Hollywood's first film to deal clearly with the issue of autism and Life with Alki (I Zoi me ton Alki)is the first Greek film in which myth is knit around an autistic character. Coincidentally, both films were screened at the same time in order to determine how they have influenced the audience who watched them.

In many cases cinema gives the characters that represents a distorted identity which is either positive or negative. Unavoidably, poses the question of whether cinema actually reflects society, its wishes and beliefs or whether society tends to borrow (human) attitudes and behaviors from it.

Although both films initially give a sense of how they deal with the state of autism with respect and realism, however, you observe a different approach. Rain Man (1988) presents as a solution the confinement of people with autism in an institution (represents the autistic character as a person who is functional, has residual speech and special skills) while the film Life with Alki (I Zoi me ton Alki) (1988) presents as a tragic solution the incarceration of the person with autism in the institution, representing a character that is in a worse mental and functional situation than the one presented by Rain Man (with low functionality, without speech and without special abilities). Also, in Levinsons film the character is asexual avoiding the issue of sexuality. While Kollatos film deals with the subject of sexuality. Also, through his film, Kollatos challenges the medical community, the society and the welfare state highlighting the problem, as opposed to Levinson's film in which the doctor possesses absolute knowledge and authority.

It should be noted that there is a rich literature on Hollywood about the social representations produced through the cinematic representations of people with autism as opposed to the similar research in Greek Cinema which is minimal; therefore, it is an unknown field that needs to be more thoroughly investigated.

The present study presented bibliographic analysis and examination of the representation of autistic character in cinema. As a follow-up to this issue, quantitative research will be carried out to investigate whether the bibliographic findings are consistent with the quantitative data that will be obtained through a questionnaire addressed to a) special educators and training specialists, b) students of the cinema department AUTH, as well as qualitative findings from a focus group.

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Cinematography

Fake Bagger, Tomas Edison, 1898

Rain man, Barry Levinson, 1988

My Left Foot, Jim Sheridan, 1989

Avatar, James Cameron, 2009

King's Speech, Tom Hooper, 2010

Golfo, Konstantinos Bachatoris, 1915

Astero, Dimitris Gaziadis, 1929

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My Wife went Crazy (I Gynaika mou Trelathike), Dimitris Nikolaidis, 1966

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Gas (Igraerio), Bujar Alimani, 2006

The Routine, Dilitris Antzous, 2015

Eteros Ego, Sotiris Tsafoulias, 2016

Storytelling Technology: Design, Usability and Performativity

George Metaxiotis[1]

[1] Aristotle University of Thessaloniki, Thessaloniki, Greece

Abstract

Storytelling technology is a research field intertwined with media, information and computer technology but is also a distinct field with unique properties. The concepts of usability, design that come from these relative fields, acquire new meaning and scope through their associations with storytelling performativity. The most prominent digital storytelling methodology that I explored in my research is a hybrid methodology that was established by J. Lampert and D. Atchley [15] and developed as a genre through major projects[1] numerous conferences and publications [18]. The selection of the specific Digital Storytelling Workshop format was based on a) its unique adaptability to a wide range of different technologies during the last 30 years, b) the algorithmic structure of its methodology that render it repeatable and versatile, and c) the multimodal participatory methodology that allows researchers to "follow technologies around" as participants design and perform their stories.

1. ICT and storytelling: design and usability

Most of the media and ICT storytelling projects designed by technicians, developers and ICT experts, look obsolete, almost 2 or 3 years after their introduction, as their design tend to overemphasize the technological innovation, development and progress: the media as the message. Storytelling technology has always been associated with newness but the design of innovative software doesn't span more than a few years. Any article that is 5 to 10 years old, with references on the subject of "digital storytelling" software, will include about 80-90% inactive links. This absence of market efficacy is even more evident in state funded academic and educational investments. Many school ICT labs remain inactive because their hardware and software become obsolete very quickly and students prefer to use their tablets, laptops and smartphones instead. Media convergence is moving faster than institutions' adaptability. Another example of this problem are the ICT teachers: they do not teach code, computer engineering or any other information technology they studied at the university, but they become 'warm experts' (Lehtonen, 2003) they just facilitate narrative software utilities. On the other hand, language teachers who, most of the time, make use of storytelling technologies have not a single technological lesson in their university curriculum and they are too preoccupied with grammatical and idiosyncratic rules to deal with the technological associations of language.

Researchers and designers tried to tackle these problems by shifting their focus from expert's design of technologies to real users and their uses of technologies. The most prominent concept that was introduced to bridge the gap between designers and user-performances was the concept of

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1   http://www.bbc.co.uk/wales/audiovideo/sites/galleries/pages/digitalstorytelling.shtml, b) https://www.storycenter.org/, c) www.digem.eu

usability. Some definitions of usability include flexibility, usefulness, effectiveness, learnability or ease of use, and attitude or likeability [2]. Butler [3] suggested that a system is considered usable if the users can complete a given task within a predetermined amount of time. Lecerof et al. [17] provided usability definition by addressing relevance of a system to users' needs, efficiency, users' subjective feelings, learnability, and system's safety feature, such as granting users the right to undo actions that may lead to errors. [5] explicitly stated that usability refers to the relationships between tools and their users [14].

2. The Digital Storytelling Workshop methodology

The digital storytelling tradition shifted the focus from designing or finding better technological tools, with higher usability, to a) increase the participation and the ownership of the technology, by giving the tools to the users and b) expand the idea of the media and information tools, to include not only technologies, but also techniques and practices. According to Daniel Meadows [19] a digital storytelling scholar and artistic director of the biggest BBC digital storytelling project: the aim of the journalists and the media professionals, should be to give the tools to the everyday people, so that they learn how do their own media and not be done by the big media. This approach reflects the definition of convivial tools by Ivan Illich "People need new tools that will work with them and not tools that will work for them" [10]. According to Illich tools are decisive for social relations. In practice an individual is related to society through the tools they can control or through which they become controlled objects. To the degree they control their tools they can invest the world with their own meaning. This approach is not another version of the question between technological determinism and its opposite (does technology affect people or people determine technology?). Giving people the tools is not another version of social inclusion or an attempt of bridging the digital gap. The most important tools for Meadows are the tools of editing, the tools of research. Unlike social media, or any other DIY direct application of information tools in use by the people, the question is about the importance of personal narrative practices, techniques and grammars that are embedded in technologies.

Digital storytelling format instead of focusing on either narrative structures, or technological structures produced mixed algorithm, a set of macros that include both (some of these macros are presented in table 1).

"speak in first person"/"write up to 250 words"/"find an object that is an index of a personal experience"/"produce a dozen pictures connected to this object"/"make sounds or narrate this story with your own voice"/"tell the story to 8-10 people"/"rewrite the initial story"/"edit the elements in a computer software"/"show your story in the public"/"follow a strict timeline of 3 days"/

Table 1: Macros from the Digital Storytelling Workshop Algorithm

The result of this mixed methodology was that for 30 years, thousands of digital stories are produced worldwide with a standardized quality: no sexist, racist or undocumented and unscientific discourses were ever produced through this algorithm. Besides this methodology was never affected by the changes and the evolution of software, hardware, or even older electric and evenbrick and mortar technologies.

According to Meadows [8] "when we started [doing digital stories] there was no YouTube, there was no broadband, if you wanted to watch a story of the webpage you needed ten minutes to download it first through dial-up connection! After 8 years we kept on doing digital stories using our mobile phones". This versatility was already inscribed, embedded in the form from its

inception. The first Digital Storytelling Workshop was produced by Dana Atchley at the request of the American Film Association and was inspired by his multimedia performance called "Next Exit". This show was an interactive storytelling performance with a unique and versatile use of technology. Unlike most of the multimedia performances even today, Atchley never "showed off" the technological elements but integrated them seamlessly in the storytelling. Initially he used slide projectors during the show, later he used video projections or screenings and finally he integrated all the elements of his performance in an interactive desktop interface. This interface was finally used as a web page and his webpage was functional many years after his death (still functional in 2009, offline today). Despite Atchley claiming to be a video person he never presented a video work in an autonomous way, his digitales were always part of a major interactive performance.

This new algorithm /methodology for the study of storytelling technologies presented a major shift by moving the focus away from the major issues in bibliography: the digital gap, the direct relation between class and technology, the gendered stereotypes on technology, or the domestication of gender through technologies.

The role of technology as a class indicator and the production of a digital underclass according to [1] was based on the multiplicity of technological artifacts Rojek 2001, Brunsdon 1997 in [1] and on the differential access to the Internet and computers, their distribution, price, usability and their design. Both researchers and governmens' intervention policies had as their priority to flatten these hierarchies but avoided more significant questions like: if people get access to computers, media, the internet, will it be for the benefit of the people? Is it what happened with the social media and all the DIY technologies?

On the contrary, the very structure of the storytelling workshop starts from the premises that these theoretical issues are very easily solved by either the convergence of media or the minimal use of technology. With a single laptop, or a few laptops and the use of smartphones everybody could have equal access to technological facilities. In more than 12 different workshops that I have performed since 2009, there was evidence a completely different access to media technologies and the internet (image 1) but this huge digital gap (which widens even more if we add the brick and mortar gap, the difference in the facilities and the venues of these workshops) didn't play any important role in the quality and structure of storytelling. In many cases students needed their computers to finish their stories, but most of the tasks were made on the laptop, the mobile, and whenever there was no access to an advanced technology the storytelling turned more theatrical, performative, minimal and funny.

Image 1: The participants always preferred the simplest, minimal way to produce their stories[2]

Not only a direct relation between class and technology was supported by little or no evidence but also the relation between gender and technology showed that despite existing stereotypes women

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2   The maximalist urge was evident in many cases but always drove directly to failure and frustration, and easily abandoned

were more involved in learning media technology software and skills. These findings allowed us to focus on more structural issues of the relation between technology and storytelling.

The most common media practices I facilitated and tested through my research were: blue screen, photography and video techniques, Photoshop, non-linear editing, animation, clay making, stop motion. These practices and technologies were tested, compared and related to more traditional practices like drawing, drama and writing exercises.

One of the main findings resulting from the analysis of the produced stories and their production process [22], was that no specific technological skill, the participants already had, or ICT design practice I facilitated, had any significant correlation to the successful multimedia meaning production: In any number of different stories the use of the same technique, technological practice (grammar, aesthetic rule, or protocol), was leading to completely different results. The initial professional design of the technological format of the workshop was challenged and sometimes completely altered by the individual user-experience, media skills/ knowledge and vernacular creativity of the participants.

Besides, the emphasis on any specific ICT or technological skill was counter-productive against the overall digital storytelling process. Whenever someone invested a lot of time on learning an animation, or a non-linear video editing software, for example, the result was that there was no time left to tell the story. Best results always came with a theatrical use of technology, or as Artaud would say "a poor technology". The most successful digital stories did not depend on how many photographs, animations were used or what specific interactive, 3D, or other software was employed, but on how these available visual technologies were coherent with verbal images and performance images to create functional representations.

3. Multimodal Analysis

In this context, it is difficult to apply traditional linguistic or mathematical interpretative methodologies to the numerous technological elements involved in digital storytelling production. Most of these approaches while acknowledging the heterogeneity of the field, offer no insight on how technological issues are intertwined with social or scientific research issues. Despite the several antiessentialist approaches that attempted to capture the performative and the representative structure of multimedia texts, there was no concrete methodological approach. Bourdieu's habitus, William's structure of feeling, Derrida's deconstruction, or Foucault's discourse analysis, didn't replace traditional logocentric approaches in methodology: the interview, the questionnaire, the diary, the transcript, the discourse analysis etc.

Some prominent attempts to construct new methodological tools, included social semiotics with a focus on social representations and performance studies with a focus on speech acts and performativity. In both cases "representations" and "performativity" are applied to very different data (individual experiences, image reproductions, discourse tautologies) and however brilliant and rational they lack any descriptive value. The biggest issue in all these traditional and current approaches to storytelling technologies is their inability to specifically describe how language relates to technology. According to Kress and social semiotics there is a possibility to transfer meaning from one mode or medium to another, a process called transduction (and echoes the older concept of isomorphism), but each medium is considered fundamentally different.

On the contrary all the data from my research show that all different media, all different modes

and semiotic materials share the same minimal internal structural modalities, despite the degree of their external multimodality or multimediality Hull &Nelson 2005; [22]. Photography, video, animation, communicate with traditional techniques of painting, universal practices of gestures and performance and verbal storytelling because all of them share the three basic semiotic modalities described by Peirce's semiotic triad "symbol – icon – index". These modalities can be defined as A) the symbol according to Jacobson's[3] definition of "the verbal sign is always distinct" something that was later thoroughly described by Saussure as langue or arbitrary linguistic constructions. Martinet described this process more technically as alphabetical double articulation. B) On the other hand Jacobson defined "the icon sign" as "always hierarchical" and hence always a measurement through numerical systems. This is a structural definition of icon when most of the scholars are still trying to give typologies of icons as a form of definition (Eco, Peirce, Foucault, Soneson). C) The indexical modality is best described by Latour and Callon's Actor Network Theory an approach of Science and Technology Studies that describes all social and semiotic relations as associations between agencies.

In order to study the "technology" as an independent variable associated to storytelling the research process was formulated through three steps: a thematic analysis to explore the symbolic/alphabetical modality, a comparative iconometry to describe the iconicity/numerical modality, and indexicality as a mapping of agencies and their associations. Through these three basic, minimal, structural modalities, we can have a multimodal analysis instead of just logocentric analysis of multimodal and multimedia texts:

I. Thematic analysis: The first part of the analysis of both the stories and the workshop process was to identify technology as a distinct (alphabetical) category. According to this approach "technology" as a semantic seme is nothing different than "gender" "nationality" "job" "school" or any other semantic isotypy, seme. Through this method no aspect of "technology" should be excluded from the study of thematic associations: technology can be an object, a process, information technology, media, communication technology, hardware, software, broadcasting, engineering technology, a skill applied in the making of the story, a verbal discourse, ideology, a representation in the participants' stories etc. The simple theme "technology" is connecting all the different representations. In this approach I don't get to decide which are the important variables, anything the participants say, draw, perform are important variables.

II. Comparative iconologyor iconometry: All these themes, tags, isotopies can be used by different media, different modalities, different icons so that many different measurements can be produced for a single theme.
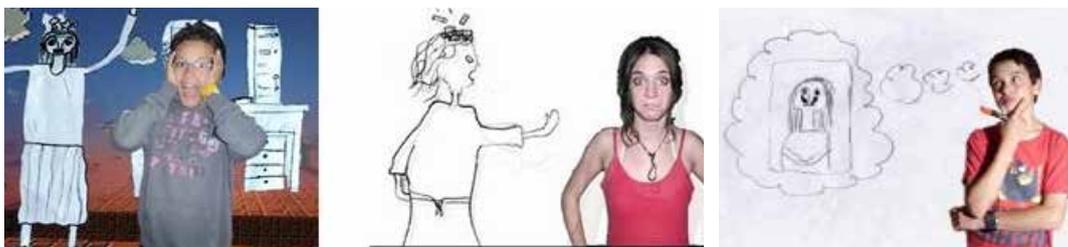

Image 2. Different technologies used to produce different measurements (photography=younger age, more real, closer to technology, painting= female gender here combined with older age, unfamiliar to technology)

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3   Instead of Peirce's philosophical dense and often contradicting definitions of the triad I applied a more concrete and accurate definition by Jacobson

The most successful use of technologies was to represent different measurements and therefore produce a dynamic hierarchical and antagonistic system (images 2, 3) instead of a static system of langue substitutions. The combination of photography and painting was a particularly successful use of storytelling technologies along with blue screen techniques combined with background removal software technologies. They all presented clear actors and there for agencies [21].

Image 3. For example the above image was accompanying the phrase "women drivers are dangerous" (=more dangerous than men). The measurement produced by the grammatical level in language is compared to the measurement produced by the collage, where the man looks more dangerous than the woman. So the initial verbal measurement is reversed with the use of media and information technologies.

The contribution of media and information technology to storytelling practices was multifold: not only new explicit layers were added so that the meaning could become clearer but also more complicate realities could be reflected and conceptualized. The most important function of media and storytelling technologies presenting new measurements was translation: the conflicting initial measurements, usually presented as grammatical elements of verbal statements/discourses were given new meaning by new objects and new measurements of old, transformed or deconstructed objects. It is not by accident that foreign language books are full of icons and multimedia. In regard to individual experiences and sensory data we are all foreigners in need of better translations.

3.1. Indexicality mapping and the designation of agency:

Indexicality is a process that describes agency. The use of themes/symbols and icons/measurements has only one purpose: to describe which actor is active and doing the translation, the measurements, and which actor is stabilized as a black box, as an object. The process that I find always evident in the storytelling, is that different measurements of different media or modes are always used to objectify, combine categories with hierarchies as we can see in image 2 but also in image 3.

Traditionally, Marxist and feminist approaches gave only negative connotations to objectification but only because they were considering meaning construction as interpretation with a final interpretant. But the analysis of the objectification function in the stories of my research (Metaxiotis 2018a, 2018b) is mainly a translation process. Through this process it was evident that we can identify two major distinct functions of storytelling technologies. a) Technology that is being used for the purposes of interpretation (induction, deduction), where objects are exploited as black boxes and b) Technology that was used for the purposes of translation networks (as abductions) where black boxes are opened and objects are transformed.

3.2. Technology as an agent of interpretation and propaganda

When technology is used as a black box, a closed system, it doesn't seem to affect the storytelling at all. In one specific and representative example a student used about 30 to 40

photographs, pictures, video extracts and maps, combined with composition effects and music but the result was more generic and abstract than a biblical or a blatant propaganda narrative. The script was talking for the whole duration of the story (4min.) about God, Friendship, Trust and there was no pragmatic reference to connect the verbal to the visual representations, we look at photographs but we recognize nobody, no single place or event.

Most of the existing information technology projects support discourses that imitate essays, documentary and third person narratives that have an argumentary, objectivist style of language. Throughout the research this was proven to be the most important impediment to the validity and reliability of the participants' stories. Even though participants were explicitly told to avoid generalizations, a 30-40% percent of the stories were written on third person narrative style with many abstract generalizations. The technology used in these discourses is minimal, redundant, decorative with little or no usability.

3.2. Technology as an agent of interpretation

The most positive correlation between technology and storytelling was that minority and disempowered groups (ethnic minorities, gender being the most prominent cases emerging from the research) were systematically presenting higher use and involvement in learning of media and information technologies, but also higher semantic connectivity between the technological media and the visual and verbal content.

For example, women used this objectification, translation process to reverse the process of ideological objectification and domestication. While women verbally express negative stereotypes about the computer as an object and support ideas of domesticity, they are more eager than the boys to learn new software and new skills during the workshop. The use of the "computer technology" is best exemplified with the parallel use of another technological object the "car". The car that is a recurring theme in many girls stories is connected to the stereotype of a girl confined in a private space but also allows girls to control the public space through the private space of the car. The same reversal of domesticity happens with the use of media skills as the PC transforms the private space of the house to the most important today public sphere, the world-wide web. For boys the car is an object, a closed black box that can be used to travel or exhibit their money power. The car in many of the women's stories is a vehicle of liberation, but also a reclaim of public space without losing their domestic, private space. It was Virginia Wolf in "A room of one's own" who spoke about domesticity and objectification not as something evil but as an empowering tool. The use of a different modality, a different medium, increase the possibility of a different translation, a presentation of different categories and different measurement of reality and black box transformations.

4. Conclusion

Concluding, the relation between multimedia technologies and storytelling may be relatively recent in human history but reflects the fact that story production was always a multimodal and multisensory human process. The methodology of Digital Storytelling Workshop is designed as a set of valid, reliable, repeatable macros, that are part human and part technological, that allow the participants to effectively make use, reflect and project their individual experiences to the public domain, the domain of general learning and communication.

The main difference between the information technology and the storytelling technology is that the first originates from engineering and focus on functioning and usability. An engineer has to build a bridge and make it function so well that it will never collapse. On the contrary, storytelling is always about the beauty or terror of collapsed bridges, mistakes, fatalities, impossibilities, unpredictability, games, chaos, experimenting, assumptions, desiring and trusting to mention only a few different storytelling scopes. All these logical 'abductions' can be epistemologically described as Popper's "black swan". To paraphrase Popper the best storytelling would be the story of a black swan: when everybody believes that all swans are white, and all the information technologies, scientists, educators, institutions are supporting this claim, the most powerful story would be to tell your personal story of meeting a black swan, with images, audiovisual documents, selfies with the swan to prove its existence. These new measurements are to translate the yet incomprehensible experience. The black swan is the singularity that deconstructs with a single blow the black box of white swan theory. Media and storytelling technologies are the answer to all the information technologies' malfunctions, they are the individual experiences, that once in a while and sometimes too often, become critical for the public sphere.

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