

MULTIMEDIA AND VIRTUAL REALITY INTO COMMUNICATION PRACTICES OF SCIENCE CENTERS: A SOCIAL REPRESENTATIONS PERSPECTIVE

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Abstract

The goal of this paper is to understand the way multimedia and virtual reality are being integrated into the communication practices of science centers and represented by their directors or responsible personnel, from the perspective of the social representations theory. Through a three-phase, mixed-methods approach, we focused on the 21 institutions of the Portuguese network of science centers (Rede de Centros Ciência Viva). Phase I consisted of a documentary analysis of the science centers websites and Facebook pages, in order to draw a preliminary map of the activities, scientific areas, multimedia and virtual reality devices of the centers. In phase II, we surveyed 16 directors or responsible personnel of the science centers via an online questionnaire, to corroborate the results obtained in the documentary analysis and also to identify the role of multimedia in science centers and which of them had virtual reality activities. Phase III consisted of semi-structured interviews with six directors or responsible personnel of six science centers from North to South of Portugal to explore their social representations, as well as to obtain in-depth information about the role of multimedia, virtual reality and visitors in the science communication strategy of the centers. Data were analyzed with the support of Excel, SPSS, and NVivo. Results showed that exhibitions are the most common kind of activities, followed by laboratories and workshops. Physical-natural sciences were represented in more than 75% of the science centers; mathematics, robotics, and informatics were present in less than 50% of the centers; social sciences and arts were underrepresented. Whereas projection devices and computers were used in more than 80% of the centers, virtual reality devices, tablets, and touch screens were used in less than 15%. Results of phase II, besides corroborating data from phase I, showed that the integration of multimedia seems to be associated with different degrees of interactivity allowed for the visitor. Virtual reality devices were mainly used to demonstrate their immersive capability rather than to explore the specificities of the science contents. As for the social representations, we found that multimedia was associated with the integration of image and sound and anchored to learning purposes and young audiences. Virtual reality was defined as “simulation” and “reality that does not exist”, therefore objectifying the concept of interactivity. It was perceived as a means to attract more audience. Though a central role was assigned to the visitor, contextualization seemed to be the more frequently adopted model of science communication. The findings suggest that, though multimedia plays a central role in the centers, it does not meet up the promise of allowing for higher levels of interactivity and public engagement and that virtual reality became the ultimate technology for making sense of interactivity and extension of reality. This study urges for a framework to promote a balanced integration of the multimedia with the activities of science centers to support the adoption of bidirectional models of science communication, in which evaluation is essential. This line of research is being explored in a science communication project (I SEA) by a multidisciplinary team. Based on the affordances and social representations of virtual reality, the main goal is to develop a non-obtrusive method of evaluation of science communication in non-formal spaces.

Keywords: Multimedia, virtual reality, science centers, social representations.

1 SCIENCE CENTERS, MULTIMEDIA, AND REPRESENTATIONS

Given the technological changes of the last decades, the main question of this research is to understand the way multimedia and virtual reality are being integrated into the communication practices of science centers and represented by their directors or responsible personnel, from the perspective of the social representations theory, as a theory of communication.

In our case, we interested in understanding the way the directors of the science centers represent multimedia and virtual reality because representations are not only about meanings but interconnected with practices.

1.1 “Ciência Viva”: An inspiring idea for science communication

In the decade of 1990, the Portuguese Minister for Science and Technology launched a program for democratizing access to science. Besides funding experimental sciences at schools and campaigns of science communication, the program supported the establishment of a national network of science centers [1].

More than 20 years later, the Portuguese network of science centers “Rede de Centros Ciência Viva” comprehends 21 centers dispersed by the Portuguese territory, from the Azores archipelago to the inland districts [2]. Despite the thematic diversity and characteristics of the centers, the guiding idea is still the one lighted up by Mariano Gago: to make science accessible by asking people to put their hands-on [3], serving schools, families, tourists, and individuals [4].

The concern with the democratization of science is not new. Since the decade of 1970, different models of science communication were constructed [5]. The deficit model tried to fill the gap of scientific knowledge in the target audience; the contextual model implied attention to the audience’s environment in order to facilitate the transmission of scientific information. The laymen expertize model revalues the knowledge heritage that the audience uses to solve problems. Finally, public participation models try to engage laypeople in the scientific process.

Regardless of the models, every message needs a medium. In the Portuguese Science Centers, multimedia devices and systems are used to convey messages and to engage the audience in the activities. This paper will try to show how the integration of multimedia in science communication is represented, but before we need to focus our attention on multimedia and virtual reality.

1.2 Multimedia and virtual reality

For Mayer [6] multimedia corresponds to the presentation of materials using words and images. Nowadays, it usually corresponds to digital information conveyed in more than one form, combining the elements of the multimedia array in a multiplicity of solutions. Because of the horizons multimedia opens, it has attracted scholars to study its relation with education [7], science education [8], and science communication [9].

Virtual reality is the ultimate type of multimedia system, although it is possible to locate its origins around the decade of 1960, with the multi-sensorial simulator *Sensorama* or with the *Ultimate Display* [10]. Virtual reality eloquently expresses the tension between, on the one hand, transparent immediacy and, on the other, visible mediation [11].

Despite virtual reality is not a new technology, in recent years we have been witnessing an increment of the interest and investment on the part of the game industry and a lowering of the price of the devices [12]. For understanding how is it that science centers in Portugal are integrating multimedia and virtual reality we need to understand how their directors or responsible personnel are making sense of these technological systems, reason why we will, briefly, review the theory of social representations.

1.3 Social representations

The theory of social representations is especially suited for the study of the transformation of scientific and technological knowledge into common sense [13, 14], even if for one reason or another this original vocation is very often neglected [15].

Social representations are the common ground that results from the symbolic exchange of social groups about things, and, vice versa, the ground that breed ideas and discussion with a plethora of meanings [13]. In a nutshell, it about the way knowledge is constructed and changes in time, by making novelty familiar [16].

Coping with novelty involves two processes: anchoring and objectification. People search for similarities between new things and their previous knowledge about other, more familiar objects, imputing a sort of equivalence between the old and the new: for example, computers initial were reduced to a typewriter [17]. However, once their distinctive feature, i.e., programmability was integrated into common sense, computers become things in their own right, serving as symbols in turn for the human brain [16]: they are objectified. Objectification is the process of render what abstract an almost if not material and tangible image.

Communicability between scientific language and common sense is what makes the study of social representations of science and technology relevant. For example, we now may use the word robot to characterize an athlete or the word virus to name an informatics malfunction [18]. Contrasting with areas such as natural science, metaphors used in Greek newspapers about engineering and informatics topics were located within a promise-scare axis [19].

2 METHODOLOGY

The mixed-methods approach was three-phase (a documentary analysis, an inquiry by questionnaire, and an inquiry by interview) and focused on the 21 institutions of the Portuguese network of science centers (Rede Ciência Viva). As the study narrows in the number of objects of analysis and/or participants, it grows in focus and detail, reflecting an intentional trade-off between the representativeness and deepness of results. The research was conducted as part of the Master in Multimedia dissertation of the first author [20] and was part of the Project I SEA [21].

2.1 Phase I – Documentary analysis of the science centers websites

Phase I consisted of a documentary analysis of the science centers websites and Facebook pages, in order to draw a preliminary map of the activities, scientific areas, multimedia and virtual reality devices of the centers. Websites and Facebook pages were identified by searching the web for the name of each one of the science centers; the authenticity of the online sites was checked. The content analysis grid focused on the typology and characterization of the activities (type, scientific area, multimedia) and the general characterization of the center. Data were analyzed with the support of Microsoft Excel.

2.2 Phase II – Inquiry by questionnaire of science centers responsible personnel

In phase II, we surveyed 16 directors or responsible personnel of the science centers via an online questionnaire, to corroborate the results obtained in the documentary analysis and also to identify the role of multimedia in science centers and which of them had virtual reality activities. The questionnaire was constructed on the criteria used in Phase I, including 12 questions. After a pilot test with responsible personnel from three science centers, the questionnaire was improved and made available in the LimeSurvey platform of the University of Porto. An invitation was sent to the email contacts of the science centers, and some personal contacts were also activated to increase the response rate. Data were analyzed with the support of Microsoft Excel and IBM SPSS Statistics 25.

2.3 Phase III – Inquiry by interview science centers responsible personnel

Phase III consisted of semi-structured interviews with six directors or responsible personnel of six science centers from North to South of Portugal to explore their social representations, as well as to obtain in-depth information about the role of multimedia, virtual reality and visitors in the science communication strategy of the centers. While four of the science centers did not have experience of virtual reality available for visitors, other two have or have had such experiences available. Participants were contacted after declaring their availability in the previous phase. The recruitment was guided by the interest in listening to directors of science centers with and without virtual reality activities but was also constrained by the research schedule. Interviews were fully transcribed and analyzed in NVIVO 12, according to a two-level analysis: in the first level, we used emergent categories resulting from iterative readings and, in the second level, a priori categories, based on the processes of the theory of social representations (objectification and anchoring).

3 RESULTS

Results from the documentary analysis of the Internet sites and Facebook pages of the science centers showed that exhibitions are the most common kind of activities, available in 19 of 21 centers, followed by laboratories and workshops. It is worth noting that the rest of the activities, such as lectures, conferences, movies, or field trips, are only available in less than 20% of the science centers.

Physical-natural sciences were represented in more than 75% of the science centers; mathematics, robotics, and informatics were present in less than 50% of the centers; social sciences and arts were underrepresented, which is coherent with the fact that only recently the Museu de Foz Côa, dedicated to archaeology, was included in the Ciência Viva network of science centers.

As for the multimedia available, whereas projection devices and computers were used in more than 80% of the centers, virtual reality devices, tablets, and touch screens were used in less than 15%.

Results of phase II, besides corroborating data from phase I, showed that the integration of multimedia seems to be associated with different degrees of interactivity allowed for the visitor. Virtual reality devices were mainly used to demonstrate their immersive capability rather than to explore the specificities of the science contents. Available in three science centers, it is used to allow the visitor to visualize and navigate by natural landscapes or to experiment free applications, only to promote a first contact with the technology

Phase III allowed exploring the social representations of the directors or responsible personnel of six science centers. Multimedia was associated with the integration of image and sound and anchored to learning purposes and young audiences. Virtual reality was defined as “simulation” and “reality that does not exist”, therefore objectifying the concept of interactivity. It was perceived as a means to attract more audience.

From the comparison of the cluster analysis in Figure 1 (Science Centers with experience in virtual reality) with the one in Figure 2 (Science Centers without experience in virtual reality) significant differences emerge. Interviewees of the centers with virtual reality experiences seem to connect the word virtual with activities, in the inferior branch of the figure, where we can find references to the exhibitions and the visitors. In the other branch, which has two major divisions, it is worth noting that multimedia is associated with concern. Participants are concerned with the purposes of the multimedia, wanting it to be more than attractive. In valuing the learning role of the multimedia, they express an anchoring of multimedia to education. In Figure 2, reality and virtual still appear in the same branch (inferior branch), together with multimedia, activities, resources, and world. Multimedia may be working in this case as an anchor to make sense of virtual reality. In other words, the degree of integration of multimedia seems to be lower.

The analysis of the mentions to the drawbacks or disadvantages of virtual reality corroborates the idea that practices are interplayed with representations. In the centers that have experienced virtual reality, concerns revolve around the secondary effects such as sickness, and that the continued use of the system might have adverse effects on the long-term. On the other hand, in the centers that never have had experiences of virtual reality concerns are about the usability of the equipment (uncomfortable and not practical), doubts concerning their efficacy and the costs.

The headset, thus, seems to objectify virtual reality, making them visible and tangible. In this case, it seems to help centers without virtual reality to address the topic. Another evidence is the association of virtual and augmented reality. When the participants mention augmented reality, in 8 out of 25 times, they also mention virtual reality.

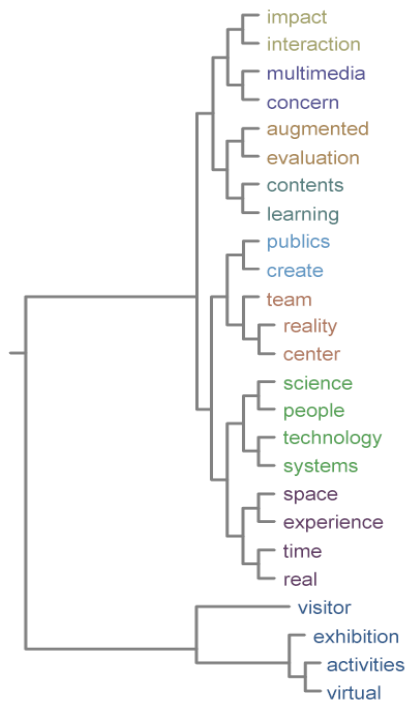


Figure 1. Cluster analysis of the interviews (Science Centers with virtual reality experience).

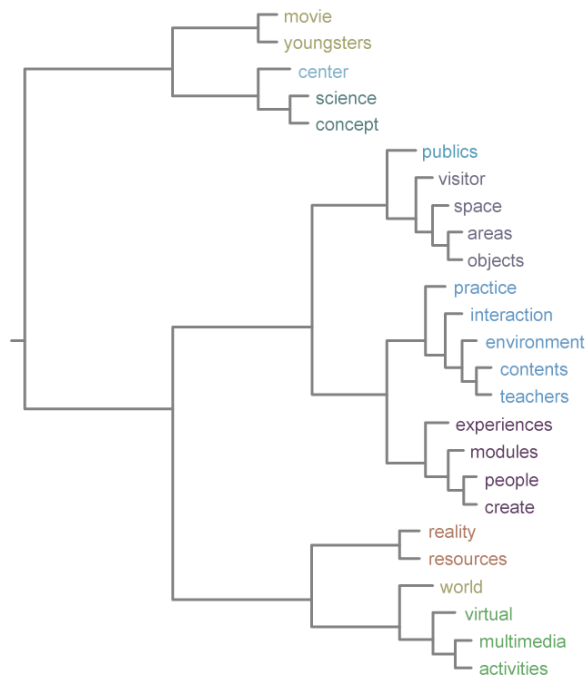


Figure 2. Cluster analysis of the interviews (Science Centers without virtual reality experience).

Multimedia seems to be anchored to young audiences, due to their supposed familiarity with interactive technologies, although some concern with the possibility of saturation effects are reported. Interactivity is an essential topic of the interviews, as participants stress that the centers should engage visitors by stimulating the dialogue with the monitors and by interacting with the science modules. Some types of multimedia, such as films, are questioned because they seem to promote one-way strategies of communication, assuming that all the visitors are equal. Virtual reality seems to cover this gap, allowing for interactive, immersive experiences that enhance or extend the world of the visitor. Technology itself almost become the center of the experience, because it is new for most visitors and also because there is a deficit of science contents for virtual reality.

Though a central role was assigned to the visitor, contextualization seemed to be the more frequently adopted model of science communication. Evaluation is mostly informal, consisting of feedback collected from the visitors.

4 DISCUSSION

In this study, investigated the way social representations of multimedia and virtual reality through a three-stage mixed methods approach, conducting a documentary analysis of the webpages and Facebook pages of the Portuguese Science Center “Ciência Viva, a questionnaire and finally interviews with directors or responsible personnel.

The prevalence of computers, sound systems, screens, and projectors is in line with the idea of multimedia as a combination of sound and images [6, 7]. Novel technologies need to be tamed [22-24]. The degree of integration of multimedia as a combination of sound and image suggests that the process of domestication for science communication is finished. However, if we think of media as remediation [11] and premediation [25], it seems that science centers are being quite conservative in the way their curatorial approaches and representations of the role of multimedia.

The findings suggest that, though multimedia plays a central role in the centers, it does not meet up the promise of allowing for higher levels of interactivity and public engagement. Virtual reality became the latest technology for making sense of interactivity and extension of reality, but the promise is not without danger or feelings of fear [19, 26]. Previous experiences with virtual reality seem to change the representation, showing the inseparability between representation and action [27]. In the present study, the discourse becomes more specific: actors are more knowledgeable in the sense of the practical knowledge referred by Jodelet [28]

This study urges for a framework to promote a balanced integration of the multimedia with the activities of science centers to support the adoption of bidirectional models of science communication, in which evaluation is essential. This line of research is being explored in a science communication project (I SEA) by a multidisciplinary team. Based on the affordances and social representations of virtual reality, the main goal is to develop a non-obtrusive method of evaluation of science communication in non-formal spaces.

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