



MUSÉUM NATIONAL D'HISTOIRE NATURELLE, PARIS, FRANCE

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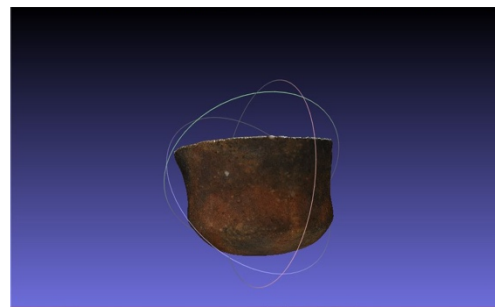
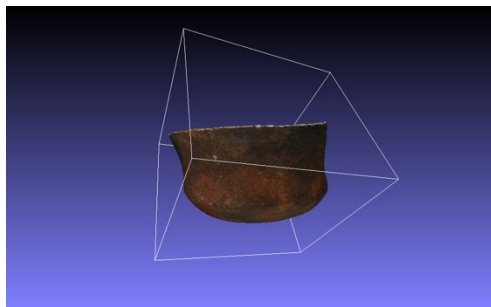
INSTITUTO POLITÉCNICO DE TOMAR, PORTUGAL

INTERNATIONAL MASTER IN QUATERNARY AND PREHISTORY (IMQP)

THE DIDACTICS OF GESTURE THROUGH LATER PREHISTORIC COLLECTIONS OF PREHISTORIC ART MUSEUM IN MAÇÃO, PORTUGAL. INTEGRATING ANALOG AND DIGITAL TECHNOLOGY.

Memory submitted for public discussion as part of the Master degree, by

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ABSTRACT:

The current main exhibition of the Prehistoric Art Museum of Mação is about gesture and its transformative, communicational and creative dimensions. A core component of the exhibition is the focus on transformation of landscapes. The exhibition is entitled ‘From gesture to art: create, make, and communicate’. It builds by stressing that gesture starts to relate the functional uses of understanding, supporting and holding. Gesture is presented as a foreshadowing of the created object, or even the landscape, and as the first materialization of the idea. To understand the human gesture and the transformation of raw materials and landscapes, the exhibition evidences physical, chemical and recycling transformations through lithic, organic, ceramic and metal work artifacts and experiments. The Museum stresses the relevance of tangibility in shaping human reasoning. Introducing digital technology in the museum exhibition is another component of this study: the intension is to integrate the collection with digital technology based on an interaction between real objects and virtual object, reinforcing the tangible interaction of visitors. To implement the augmented reality in the museum exhibition the data for the creation of digital content has been collected from the archaeological experiment and study of museum collection. Moreover, a survey was conducted to support the integration of the museum with society, fostering knowledge socialization.

Keywords: Gesture, Prehistory, Museology, Experimental Archaeology, Digital technology, Digital Exhibition, Notions of time and space.

RESUMO

A actual exposição principal do Museu de Arte Pré-Histórica de Mação é sobre a gestualidade e as suas dimensões transformativas, comunicacionais e criativas. Uma componente nuclear desta exposição é o foco na transformação das paisagens. A exposição intitula-se “Do gesto à arte: criar, fazer e comunicar”. Ela constrói-se enfatizando que a gestualidade começa por relacionar os usos funcionais da compreensão, apoio e retenção. A gestualidade é apresentada como um prenúncio do objecto criado, ou até da paisagem e como a primeira materialização da ideia. Para compreender a gestualidade humana e a transformação de matérias-primas e paisagens, a exposição retrata transformações físicas, químicas e de reciclagem através de artefactos líticos, orgânicos, cerâmicos e metálicos, assim como experiências. O Museu salienta a relevância da tangibilidade na formação do raciocínio humano. Introduzir tecnologia digital na exposição é uma outra componente deste estudo: a intenção é integrar a colecção com tecnologia digital baseada na interação entre objectos reais e virtuais, reforçando a interação tangível com visitantes. Para implementar a realidade aumentada na exposição do museu, os dados para a criação de conteúdos digitais foram recolhidos da experimentação arqueológica e do estudo da colecção do museu. Além disso, foi realizado um inquérito para apoiar a integração do museu na sociedade, promovendo a socialização do conhecimento.

Palavras-chave: Gestualidade, Pré-histórica, Museologia, Arqueologia Experimental, Tecnologia Digital, Exposição Digital, Noções de tempo e espaço.

CHAPTER 1: INTRODUCTION

The Prehistoric Art Museum of Mação is situated in the Alto Ribatejo region of central Portugal. The museum presents the region and the territory, through local collections, with a main focus on the origins of agriculture and on prehistoric art. The current exhibition is “From gesture to art: Create, Make and Communicate” discussing the role of the gesture for human societies and human evolution, namely in the processes of transforming materials and landscapes, as well as on solving needs, create artistic work and communicate. The Mação Museum project has begun in 1943, with a local archaeologist and humanist, João Calado Rodrigues, who gathered together the original collection. However, he did not see the establishment of the Museum, which would occur only in 1986, under the initiative of Maria Amélia Horta Pereira. Between 2002 and 2005, the museum was reorganized, focusing on Prehistoric Art and on symbolic and religious human behavior, and also became home for a national research center on Geosciences and Humanities, after a proposal of Luiz Oosterbeek, its current director. Taking research at its core, the museum pursues a threefold aim: cultural, economic and social.

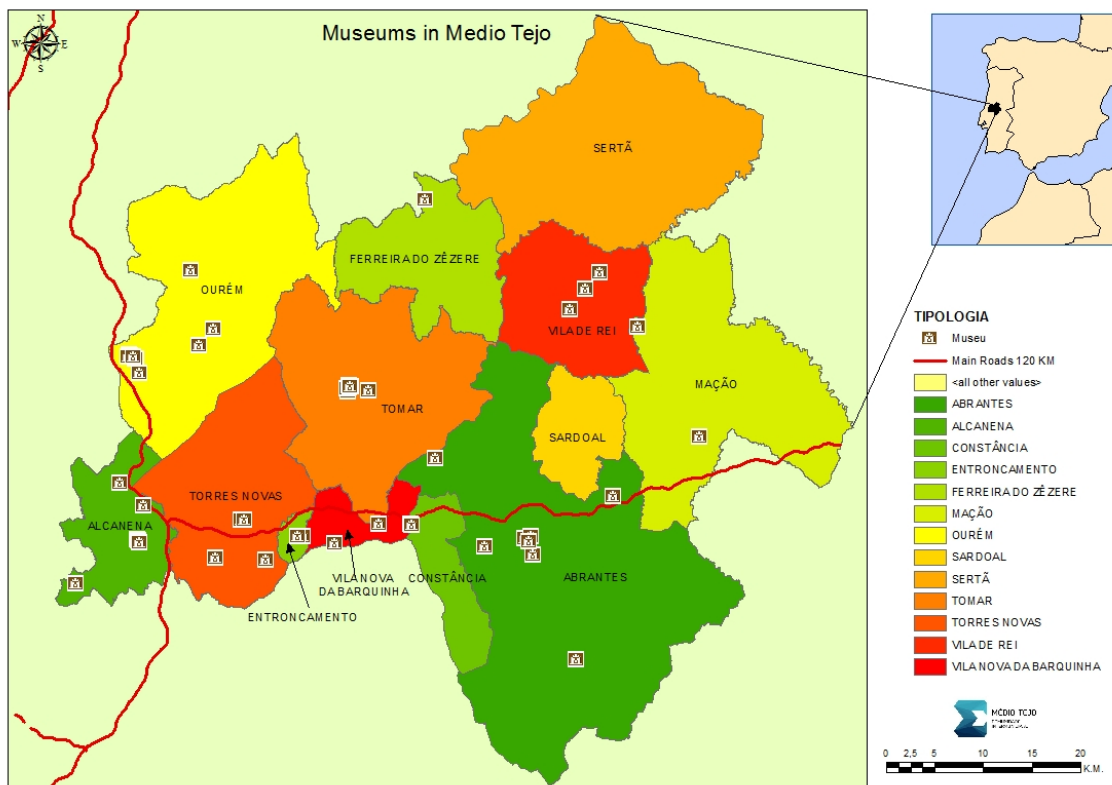


Figure 1: Location of Mação and the Prehistoric Art Museum (IPT archive collection)

1.1 Theme of the study

This research focuses on the current central exhibition of the Mação Museum, on the gesture and the anthropogenic transformations of raw materials and landscapes. From the late prehistory the massive changes have happened in the way of people living. It started by domestication, agriculture, development of lithic tool industry and ceramics became widespread.

Crop agriculture was a basic resource among the first farming communities in Europe. Soil tilling and crop sowing, harvesting, processing and stocking were strategic technical activities for these communities. The spread of new crops, brought from the East into Europe, was surely accompanied by the parallel spread of new technologies associated with them. Agriculture was carried out all along Europe in a considerable variability of ecological, economic and social contexts existing among the Neolithic groups. (IBÁÑEZ et al 2008).

1.2. Objectives and aims of study:

The study aims to highlight the importance of human gesture in the construction of the landscape in Alto Ribatejo Area. Besides, the research is to understand the later prehistoric economy, technology and social system, agriculture, in order to help with an understanding of the transition to contemporary techniques. To analyse and understand the transformation and gesture of this region, arrange an archaeological experimental work. The main objective is to introduce the digital technology by practical learning and use of augmented reality, preparing texts, videos and images for complement the understanding of prehistoric objects that are observable in the exposure. The intention is to integrate the collection with digital technology. Moreover, working on the integration of time and space it will be a connection of the museum with society to combat alienation, and socializing knowledge. To fulfill the action a survey work will make an assistance to collaborate with community of this area.

1.3. Question of departure:

How can digital technologies be integrated in the Museum of Prehistoric Art of Mação, enhancing the understanding of the relevance of gesture for human reasoning and, because of this, fostering the use of tangible processes?

1.4. Thesis structure:

In the introduction section, the main objectives and aims of the study is briefly discussed, following the theme on the next. In the second chapter, an initiative has been taken to characterize the area and long history of the human occupation in the alto Ribatejo region. This chapter will help to understand the context of the area and transformation of human behaviors in later prehistoric time period. All the information is based on previous research of Alto Ribatejo area.

Chapter three discusses the museum communication in the present world based on the bibliographic research which synthesizes state of art of the current knowledge.

The fourth chapter is focusing on the program, activities and the exhibition of the Prehistoric Art museum of Mação pre-eminently.

The method used in the development of the work appears in fifth chapter, where the archaeological experiments, visualization of museum process and museum integration with the local society (by survey work) are presented.

The sixth chapter presents the analyses and result obtained from the experimental, digital and survey work.

The last chapter is a discussion and conclusion where the research question will be discussed gradually and make an interpretation of this work.

In the annex, the survey form is attached which is both in Portuguese and English language, designed for this research.

CHAPTER 2: THE PREHISTORIC CONTEXT: FROM THE DAWN OF FOOD PRODUCTION TO THE EMERGENCE OF WARFARE SOCIETIES IN THE ALTO RIBATEJO AREA

2.1. Area of study:

Alto Ribatejo is a sub-region of Central Portugal (western Iberian Peninsula) with an area of about 2,500 km² (5% of Portuguese territory) mostly in the district of Santarem, located along the banks of the lower Tagus. It extends West-East from the municipalities of Alcanena and Torres Novas to the municipality of Mação and South-North from the municipality of Vila Nova da Barquinha to the municipality of Alvaiázere.

The hydrographic system is controlled by tectonics, so the Tagus River dominates the hydrographical system in this area (east west), followed by the Zêzere River, which flows into the Tagus from the north east, and the Nabão River, which flows into the Zêzere from the northwest. Natural springs of fresh water are numerous, and archaeological sites often are close to either or both of these two sources of water. (OOSTERBEEK 1997). The study area of this thesis within the Alto Ribatejo is specifically the municipality of Mação. The demarcation of the Alto Ribatejo region stems from both the physical and human. On a physical level, the skeleton of this territory consists of the hydrographic basin of the Middle Tagus, encompassing the lower Zêzere, the Almonda, Nabão, Alviela and Ocreza rivers, and the Atalaia, Boas Eiras and Rio Frio streams. (OOSTERBEEK *et al.*, 2002)

The Alto-Ribatejo region is characterized by the merging of three geological units (Rosina *et al.*, 2005): (i) Ancient massif of the east (ii) Estremadura Limestone to the west and (iii) Tagus basin to the south (CRUZ AND OOSTERBEEK, 1998; OOSTERBEEK *et al.*, 2002). In the east and northeast, the ancient relieves from the Pre-Cambrian and Paleozoic outcrops, composed by schist's and gneiss from the Beiras; to the west and northwest arises the limestone massif of the Portuguese Estremadura, essentially Mesozoic; these formations mark out a third unit constituted by the Tagus and Sado Tertiary Basin. In this area geological diversity is well presented. On the west we find the plain formed by the Cenozoic sedimentary complexes, on the east arise the modest schist relieves of the Pre-Cambrian and Paleozoic shelf, while at the center we find a small outcrop of highly altered granite (ROSINA *et al.*, 2005).

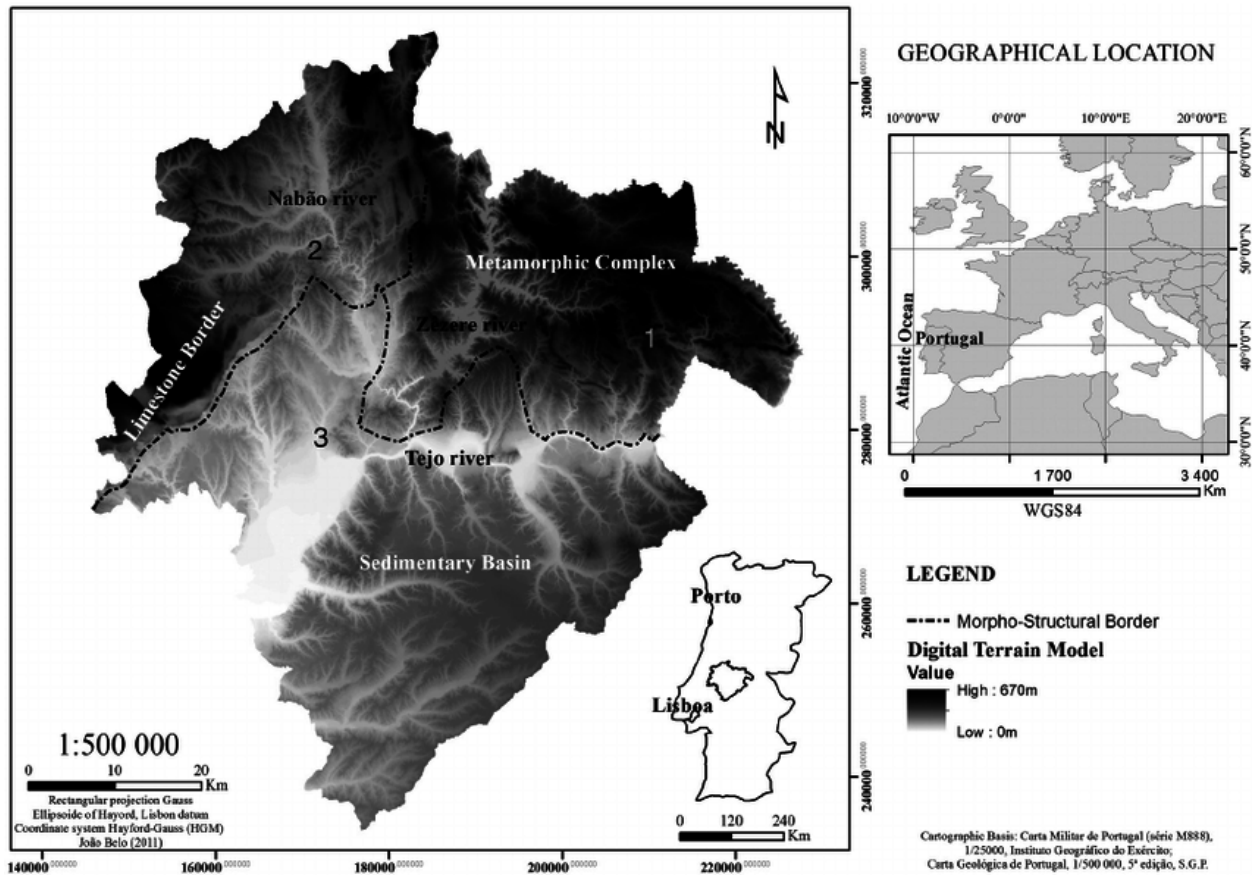


Figure 2: Geographical location of the Alto Ribatejo region, with an indication of the main rivers and of the three geomorphological units that converge in it. (Gomes et al 2012: 225)

The Ancient massif is composed of metamorphic, sedimentary and magmatic rocks deformed by Hercynian orogeny, with ages including between the Pre-Cambrian and the upper Paleozoic, namely: shales, clay shales and micaceous shales, quartzite, amphibolite, gneiss, granite, granitoid and carbonated rock. Geomorphologically, it presents some of the presence of quartzite ridges, the presence of fracture valleys or the existence of a model with different characteristics between granite and schist areas (RIBEIRO *et al.*, 2010).

The Estremadura Limestone Massif also known as the Western Rim or Meso-Cenozoic is a geomorphological unit inserted in the central sector of the Basin. Lusitaniana, an oceanic

sedimentary basin located in the Iberian West Bank, originated from during the Mesozoic by the fragmentation of the Pangaea at the opening of the North Atlantic (KULBERG *et al.*, 2006).

The Tagus Basin is formed by a set of more recent formations, such as terrace deposits, alluvial deposits, dunes and detritus roofing deposits. This catchment area, orientated in accordance with NE-SW, comprises the southern part of the central mountain range and the Estremadura Limestone massif. It is draining a large part of the southern part of this mountain range and most of the courses of water coming from the massif. The group of archetypal formations that document the Cenozoic and witness a vast river drainage in the Palaeogene due to reactivation of NE-SW fractures on the western edge of the Hercynian Massif, which enabled the opening of the of this basin and the Mondego basin. The area displays clay and sandstone formations on the shore to the right of the River Tagus as 'outcrops of the Miocene series' (GONÇALVES *et al.*, 1979).

This Tagus Basin is formed by sands and coarse plateau gravel with Pliocene pebbles. The series of conglomerates and sandstones are deposits of the Pre-Tagus, which correspond on the left bank of the Tagus to plateaus cut by lines of water originating a continuous and regular mantle, composed by reddish and brownish clay sandstones with pebbles and clay of the same color. These deposits of typically fluvial nature crown the tops of residual reliefs, having the action of erosion on these lands has led to the formation of debris that fed the quaternary terraces (GONÇALVES *et al.*, 1979).

Lithologically, this units also three main sediment complexes (MOUTERDE ET AL. 1971; ZBYSZEWSKI 1971A, 1971B; ROUSSET AND MOUTERDE 1971; RUGET-PEROT 1961; apud OOSTERBEEK, 1997) there are limestone and marls (with weak presence of flint) in the 'Estremenho' Massif. Schist, greywacke, quartzite and granite are the more abundant rocks in the Ancient Massif. Finally, clay, silts, sands, and pebbles make up the detritic drainage basin. The Holocene alluvial sediments, the Pleistocene wide fluvial terraces, the karstic cave fillings (Limestone Massif), and the detritic coverings represent the regional Quaternary deposits. The Holocene alluvial sediments arrive at a depth of more than 9 meters in the Tagus sedimentary basin (OOSTERBEEK, 1994).

2.2. Environment:

Climate is a key factor in landscape formation, determining hydrological regimes, influencing soil formation and erosion, and consequently vegetation mosaics. Climate has long been recognized as the environmental factor that most strongly affects the life and distribution of living things on earth (FERREIRA, 2017).

The climate undergoes a significant change around 14,000 years BP. Over the late period, the impact of progressive warming has less severe cold oscillations in the southern latitudes. These oscillations were less violent in the south of the Europe, favoring the development of deciduous forests and the replacement of the cold season megafauna by species that will characterize the Holocene (OOSTERBEEK *et al.*, 2012). These changes will have favored a broad continuity of adaptation strategies on the part of the hunter-gatherer groups of the beginning of the Holocene, in relation to the average and final Magdalenian. The lithic industry is marked by development of tools to facilitate remote hunting and access to marine resources. According to archaeological records in caves, hunter-gatherer groups faced with the changing environment had to define new strategies, which would naturally; this has led to perplexities, doubts, contradictions and various solutions. It is this diversity that will characterize the ancient and medium Holocene (OOSTERBEEK *et al.*, 2012).

The region of North Ribatejo is presently defined as a zone of sub-Mediterranean polyculture, with sub- Atlantic elements. The climate is characterized by a very clear difference of seasons, with high thermic amplitude (from about 5 or less °C maximum temperature in January, to over 40°C in July-August, and an annual average of 16°C). Associated to a reasonably high rainfall (over 700 mm of annual average) (OOSTERBEEK 1997). The Mediterranean climatic area is characterized by two types of extreme temperature seasons. The extreme seasons correspond to winter (cold and humid) and summer (hot and dry), while the temperate seasons correspond to autumn and spring. It can describe as" summer without rain, sunny and hot, and a cool season during which they follow each other the rainy and cold days being the only climatic type (DAVEAU, 1995; FERREIRA, 2017).

Precipitation is a climatic element that influences the water availability of a territory and consequently influence in the landscape. Figure 4 shows the rainfall data annual average (mm)

for the Tagus Valley (Alto Ribatejo Area), which clearly suffers from the influence of the proximity of the sea and altitude. North of the Tagus valley, the precipitation values are higher, and can reach the 1 600 mm per year, corresponding to an area of higher altitudes plus and accentuated orography as found in the Ancient Massif and in the Extremadura Limestone Massif (FERRIERA, 2017).

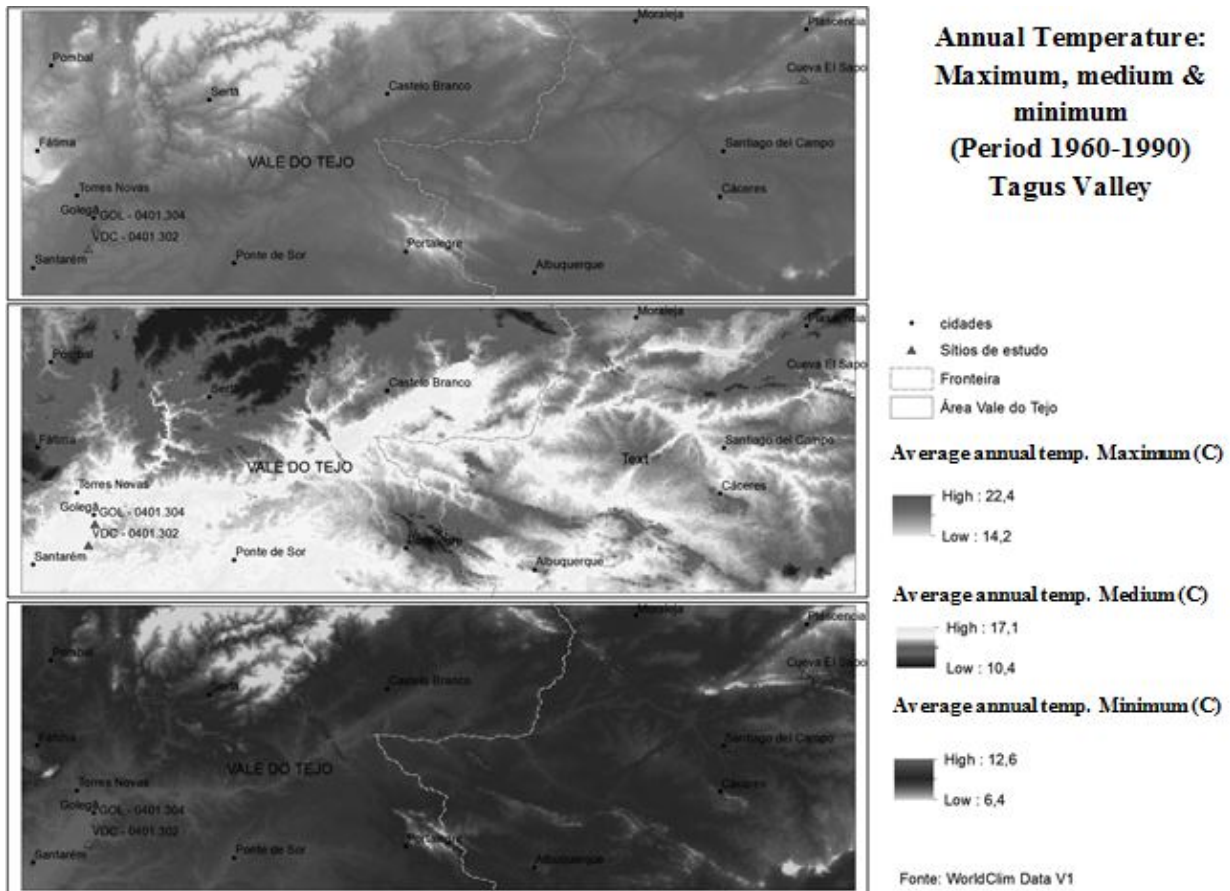


Figure 3: Climate of Alto Ribatejo Area. (Ferreira, 2017:23)

The eastern area of the Tagus Valley demonstrates a low precipitation rainfall occurrence <500 mm per year, mainly influenced by the distance from the sea. In South and Southwest quadrants of the Tagus valley, the precipitations are also less abundant, ranging from approximately 600 mm to 700 mm. Being a consequence of the low altitudes of the sedimentary basin of the Tagus River and the barrier effect that the Extremadura Limestone Massif provokes, preventing the wet air from reaching the Atlantic Ocean. The higher rainfall occurrences for the

Tagus Valley correspond to the autumn (October/November to December) and winter months (March/April).

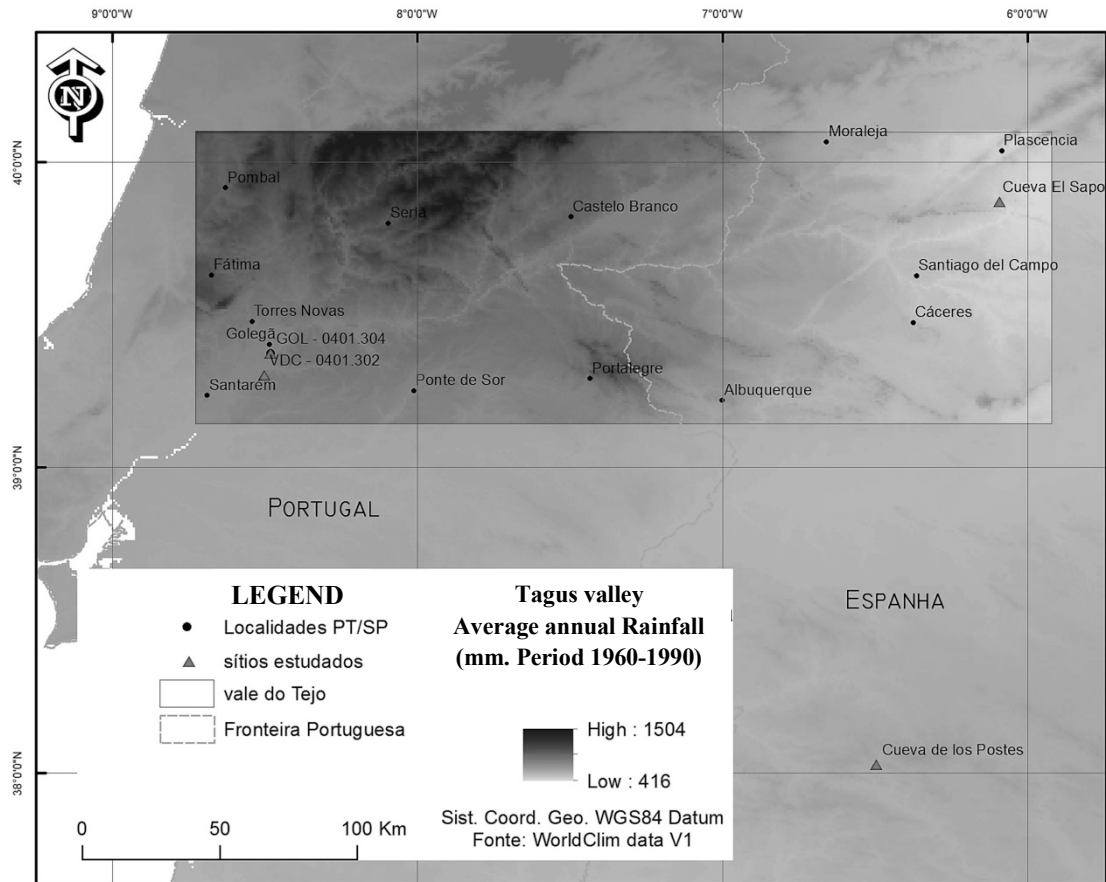


Figure 4: Rainfall data annual average (mm) for the Tagus Valley (Ferreira, 2017: 24)

2.3. The dawn of food production:

Around 6,000 BC, the Upper Ribatejo was the stage for a mosaic of human groups which have developed more durable or seasonal adaptation strategies, in a number of countries directions (not necessarily conflicting, but complementary): the hunting of fauna of medium size (cervids and wild boar), fishing and occasional collection of terrestrial mollusks, and It is in this context that the process of neolitization in this territory, when there are material cultural innovations - ceramics, polished stone utensils and bones that indicate that animals have already been domesticated. In at least two traditions seem to exist, which have maintained their dichotomy in spite of the exchanges indicated by the raw materials (TOMÉ & OOSTERBEEK,

2011). The most relevant archaeological sites for the study of the process of neolitization are the Povoado da Amoreira and the Gruta do Caldeirão for the ancient Neolithic evolved, the Gruta do Cadaval and the Anta 1 of Val da Laje, for the middle Neolithic of ancient tradition and the Gruta dos Ossos and the Megalithic Complex of Rego da Murta for the transition to the Chalcolithic.

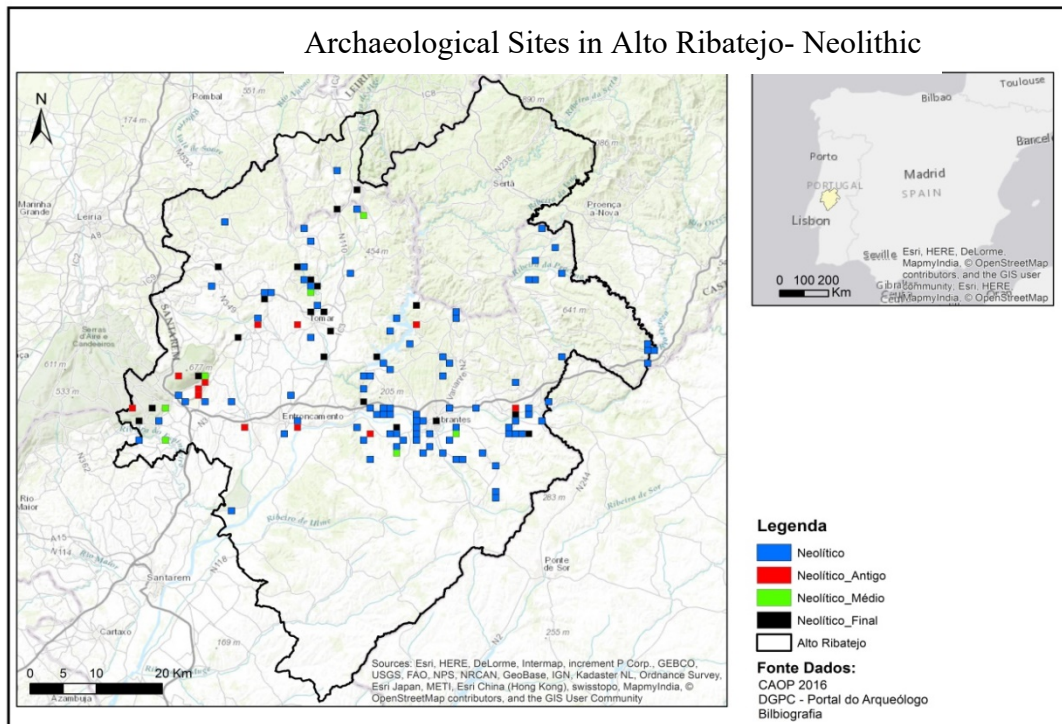


Figure 5: Neolithic sites in Alto Ribatejo Area (Jorge Cristóvão, ITM archive collection)

The process of Neolithisation, associated with the presence of Cardial Ware, occurred during the middle of the 6000 BC in the area of the Limestone Massif, the earliest chronometric data available for sites in the Estremadura region that are located outside of this area are two to three centuries more recent, that is, dating to circa 5200 cal. BC (CARDOSO, 2006).

In the region of the Estremadura with the arrival of unknown communities remains a coastal tradition with printed ceramics and incise cardial and epi-cardial, axes and hoes fully polished, scarce microliths and arrowheads, abundant blades and flaps without retouching, and buried in a cave. This input is represented in the Gallery of the Cistern (Gruta do Almonda) and in the Pena d'Água Shelter (ALMEIDA & OOSTERBEEK, 2013). The caves of the Nabão valley, especially the Cave of Caldeirão, show around 5,400 years BC, a Neolithic package

horizon, where ceramics were found and printed noncardial, incised and printed ceramics, globular vases, and high lap. No traces of cereals or legumes were found on this horizon. On the other hand, pig bones, bovine bones and *ovi-caprine* bones have already been found there, associated with cave burials (OOSTERBEEK *et al*, 2012) which reveals the domestication.

The early to mid-Neolithic has been dated between circa 4500- -3500 cal. BC in the Lower and Middle Tagus (CARVALHO, 2012). For the territory of the center and south of Portugal was suggested a division within this period, with the Initial Neolithic corresponding to approximately 4500-3800 cal. BC, when individual burial still continues to be the norm to the detriment of collective burials (ALMEIDA *et al*, 2011). During this period, spherical and smooth ceramics stand out in funerary contexts, being rarely present in contexts housing, industries follow the previous patterns, but in the segments are replaced by trapezoids; the industry is more abundant and the adornment elements include bracelets in shell or stone (CARVALHO, 2012).

The emergence of megalithism is associated with the Carapito/Pramelas Horizon, which has been dated to between the end of the 5000 BC and the first quarter of the 4000 BC, based on the absolute chronologies of some of the monuments (VALERA, 2006).

The local traditional area was established essentially during the first half of the 3000 BC and seems to have been characterized by a significant autarchy (closed economy) of a relatively small territory, in stark contrast with contemporary situations developing in the south of the Iberian Peninsula (where processes of territorial aggregation are well documented). In this period the paradigmatic change is in the settlement which accordance with communication and moderate consolidation of an agricultural economy. In the pottery, they add some motifs (VALERA, 2006).

It is also in 3000 BC that in the Tagus Valley the Chalcolithic and the processing of products was born. Evidence discovered in layer B of the village of Santa Margarida da Coutada, in Povoado do Maxial and in Povoado da Cova dos Castanheiros (CRUZ *et al*, 2014). The late 4000 BC and the 3000 BC correspond to the copper age. This is the period of the emergence of the metallurgy and social implication. Finally, in the late Neolithic or, at least, the early chalcolithic, a series of stone-built settlement have been found all through the region. This is called 'Hillforts' settlement known as chalcolithic settlement (OOSTERBEEK, 1997).

2.4. The emergence of warrior societies:

The birth of warrior societies is a crucial moment in history, as it generated deep and lasting changes in human culture through the affirmation of a specific social actor the warrior and through the introduction of new myths and new form of social, political and economic organization. The impact of warrior societies has been made tangible, above other things, in strongholds, colonies and open mines: the remnants of these artifacts are the long-lasting testimony of the specific social and technological features of these peculiar societies. Warrior societies could not exist without the practice of war, and the emergence of human collective violent confrontation is, in itself, a significant area of study in archaeology, anthropology and history (REDMOND 1994; REYNA & DOWNS 1994; MARTIN & FRAYER 1997; CARMAN & HARDING 1999; DELFINO 2016). As pointed out by Leroi-Gourhan and Lorenz, the birth of war, as a social practice, has its foundations in hunter-gatherer societies. In European context, to discuss about warfare society there are some way to describe. Cognitive archaeology, funerary archaeology, and the study of artifacts build a European scenario of a warrior society with its symbols (COIMBRA AND DELFINO, 2016).

From the late chalcolithic period, bronze age artifacts found in the archaeological site in Alto Ribatejo Area. In the beginning of 1700 BC to 1300 BC, consider as middle bronze age in the region.

This study is focusing on the time period of European Bronze age warrior societies. In order to expose the rationales that brought to this development, it is first considered the presence of war in hunter-gatherers societies through the analysis of skeletal remains, pictures and through the use of actuals. This last method allows to statistically show that larger societies (agricultural, sedentary ones) are better at granting the survival of individuals and of the whole group in the face of military threats than smaller ones (those made of hunter-gatherers) (BERRUTI & RUZZA, 2016). The fact that larger agricultural societies were born in response to a demand for security also helps in explaining why the capability to wage war became socially important, as it was a mean to acquire security for the group. A prominent role was thus attributed to warriors and warrior values, making these sedentary cultures warrior societies proper: a form of social organization that interested all of Europe in the Bronze Age. This claim is proved by archaeological evidence in burials, graves and art (KRISTIANSEN AND LARSSON 2005),

In European context, Bronze Age rock art in Valcamonica includes several portrayals of weapons: swords of different kinds, halberds, axes and shields. Dueling scenes are also present, interpreted as rituals involving the most important members of society. Bronze Age male burials including weapons have been found all throughout Europe and this kind of finding is so widespread that is considered a standard element of European Proto-History (de'MARINIS & FOSSATI 2004 apud BERRUTI &RUZZA, 2016).

During this time period, in Tagus river basin in Portugal, so many metal weapons has been discovered, some of them are collected in Prehistoric art museum in Mação. Three bronze hideouts are known in the region: one small hideout in rock pit (Porto do Concelho) and two big hideouts inside a pot (Senhora da Moita and Barreiras do Tejo). Unfortunately, only the hideout of Porto does Concelho has survived, and the other two are only known through oral information. Porto do Concelho (Mação), discovered in 1943 and Castelo Velho do Caratão (DELFINO *et al.*, 2013; DELFINO, 2014), are very important site in Portugal for the Bronze Age settlement site. Some of the artifacts are (Figure: 6) – Axes, swords, spearhead, knives, Sickle etc. where most of the objects are used some are never used.



Figure 6: Bronze Age artifacts collection of Prehistoric Art Museum of Mação. Object from Porto do Concelho (Mação) (DELFINO, 2016:95.)

Moreover, the sites from Senhora da Moita (Carvoeiro-Mação), Barreiras do Tejo (Abrantes), Castelo Velho do Caratão, Quinta da Pedreira (Rio de Moinhos – Abrantes), Cerro do Castelo, (Vila de Rei) where one found a fragment of an armlet and a stone mould of a probable sword in Castelo de Abrantes, hilltop walled settlement in a hill directly near of the Tagus, in 1988, has been found (DELFINO, 2016)

During Iron Age that many of the examples of pentagrams associated with warriors can be observed. The pentagram was also used on a barbarian piece of armor found at Conimbriga (Portugal), dated from the 5th century and appears on iconography depicting several Muslim warriors with pentagrams on their shields. Despite being out the time frame, some examples of pentagrams deserve to be mentioned, because they contribute to the better understanding of their association with warriors or with knights. It's the case of several funerary tombstones from the 12th century, belonging to the Knights Templar from Tomar, in Portugal and the 14th century English romance Sir Gawain and the Green Knight, which considers the pentagram to be represented on this knight's shield (COIMBRA, 2011).

With the analyses of the association of three symbols with weapons and warriors, since about 1000 BC till 1000 AD, which are: the pentagram (or five-pointed star), and swastika. The examples come from a very diverse range of iconography and artifacts such as rock art, pottery, fibulae, funerary tombstones, helmets, shields, spears, axes and swords, among other cases, with different chronologies (COIMBRA, 2016). There are several examples of pentagrams in this context in Portugal, Spain, France and Italy (MASCARÓ PASARIUS, 1953-54: apud COIMBRA, 2016).

War is a peculiarly human cultural practice. Pointed out by Leroi-Gourhan and Lorenz, the birth of war, as a social practice, has its foundations in hunter-gatherer societies. The advent of agriculture provided the means to sustain larger societies and, since those are less prone to war-related deaths, the quest for security could with good reason be considered an incentive (among others) that made humans favor of the development of Neolithic over hunter-gatherer societies. The major propensity to battle-losses of hunter-gatherer society can account for their progressive loss of ground in the face of agricultural warrior societies, in a violent process of social adaptation and evolution. Larger agricultural societies were born in response to a demand for security helps in explaining why warriors became central figures in European Bronze age societies (BERRUTI & RUZZA,2016)., making them as develop in warrior societies.

CHAPTER 3: THE THEORETICAL FRAMEWORK: COMMUNICATION IN MUSEUMS AND THE BUILDING OF CONCEPTS AND REASONING

3.1. Role of the museums:

According to the ICOM definition museums are non-profit institutions which operate in the service of society and its development for the purposes of education, study, and enjoyment (ICOM Statutes, 2007). Existing for the public benefit and utility, in the 21st century they have to face a double challenge, on the one hand, they must reach a wider and more diversified audience, reflecting the complex demographic composition of contemporary society. Moreover, they must ensure that the value of cultural heritage is understood and that cultural capital increases (CERQUETTI & MONTELA, 2015). Museums are spaces in which identities are understood, formed and shared. They provide a stimulating public space in which people can come together and be inspired (NMDC, 2010).

The museum as an institution tells the story of man the world over. It holds the cultural wealth of the nation in trust for all generations and by its function and unique position, it has become the cultural conscience of the nation (CERQUETTI & MONTELA, 2015). Museums hold the knowledge of cultural origins and the meaning of societies' transformations. Based on the historical time assumption, museums have already chosen the criteria which qualify objects to enter history. Thus, museums turn the object into a cultural past worthy of preservation as a symbol of the origins of its time.

Museums are using their unique collections and services to address social issues. They are striving to be places where all sections of the community can have a voice and be reflected in a museum's collections and displays. Through volunteering programs, internships, apprenticeships and work placements they are proving to be a valuable resource for the development of basic and specialist job skills.

The role of museums has changed over time and never more so than in the last 10–15 years. As well as their traditional role of collecting, preserving and sharing rich collections, museums now find that they play an increasing role in supporting the development of communities. Museums can be a place to help shape community identity and bring different community groups together, a catalyst for regeneration through the creation of new venues and

civic spaces, and a resource for developing the skills and confidence of members of those communities. Museums are using their unique collections and services to address social issues. They are striving to be places where all sections of the community can have a voice and be reflected in a museum's collections and displays. Through volunteering programs, internships, apprenticeships and work placements they are proving to be a valuable resource for the development of basic and specialist job skills (<https://www.scribd.com/document/385374343/21072010-Communities-Love-Museums>).

The museum keeps the role in various ways in the societies, community, and territory, development of knowledge socialization, education, and cultural heritage, especially make a link between the community and the culture. We can discuss as-

- Museums and heritage bring people together: Museum building a society for all age's people. On the other way, arranging different types of activity of the museum can bring all ages people together. All ages' people can be benefited from museum, libraries and archives(<https://www.ne-mo.org/reading-corner/museums-as-social-agents.html>). Identify the current and potential role of museums, libraries and archives in delivering the wider benefits of learning to older people in England. (ALDRIDGE *et al.*, 2009)
- Museums support regeneration and the development of the local economy: Culture is at the heart of public places and museums can help raise the profile and quality. The museum sector is supporting a large workforce. As example, there are around 2000 museums in England, employing over 27,600 people, with over 4300 employed in local authority museums of life in urban centers. (LISU,2006)
- Museums support the development of community cohesion (NMDC 2010): From a survey work, 45% of museum-goers agree they feel more positive towards other people and their cultures as a result of a visit to a museum, on the other hand 81% of teachers think it either 'likely' or 'very likely that pupils had learned more about other people and communities as a result of visits to museums (HOLDEN, 2006)
- Museum keeps the role in Education sector: One of the fundamental objectives of the museum is to educate, and it is only the museum that has the capacity and the ability to impart cultural education effectively as it houses the tools and materials for doing so in its collections. In modern society, the museums enrich the educational process by

exposing children and indeed the public to their history in a positive way; they assist our future generations to understand and appreciate their history and culture and take pride in the achievements of their forbearers (ARINZE, 1999).

- Museums and the Promotion of Unity: For a people to live in peace and happiness there must be unity. Museums do promote unity in the society by using their resources to ensure understanding and appreciation for the various groups and cultures that exist in that society. (ARINZE, 1999). On a broader perspective, museums can promote cultural diplomacy that will engender greater understanding between peoples and nations.

Moreover, the *mise en valeur* (enhancement) of cultural heritage should identify and explicate its complex value – historical, artistic, aesthetic, etc. (THROSBY, 2001).

Finally, considering the role of addiction and increasing marginal utility in cultural consumptions from a marketing point of view we should remember that the appreciation of a museum does not damage other cultural institutions, but rather involves the visit of other museums (CERQUETTI & MONTELA, 2015).

3.2. Knowledge and tourism

A museum is a cultural institution. The tourism industry is one of the fastest growing industries in the world and is becoming increasingly important. This importance is as a result of immense benefits derived from the industry (OKPOKO, 2006). Tourism connotes the mobilization of people's cultural and natural resources especially those aspects which made people unique from the other people (ANDAH, 1990; ADENIJI & EKANEM, 2013).

This presents the extent that sustainable cultural tourism issues affect the preservation of overloaded big cultural cities, as well as the survival of local cultural heritage. As far as local cultural destinations are concerned, it is argued here that research has neglected the possibility of preserving local cultural heritage through – not against – enhancement. Rather, relationships between local museums should be promoted in order to achieve economies of scale, scope and learning, to then provide the necessary cultural facilities and improve museum service quality for local tourism development (CERQUETTI & MONTELA, 2015).

Museums, museum-like institutions and cultural heritage objects preserved by them occupy the key place among the objects of tourist interest. They can be regarded an independent aim or the main goal of a tour. Or they may be included into a tourist route as one of the sites. They can also be catalyst to the development and implementation of a tourist product (TSYREMPILOVA & BILDUEVA, 2018)

Knowledge and tourism are interconnected with the museum. A museum carries all the information of the touristic knowledge of the region. Museums hold the knowledge of cultural origins and the meaning of societies' transformations. Based on the historical time assumption, museums have already chosen the criteria which qualify objects to enter History. Hence museums turn the object into a cultural past worthy of preserving as a symbol of its time.

Museums have been intimately linked with the leisure sector, especially in studies related to marketing of museums (HARKIN, 1995; CRANG, 1996; LYNCH ET AL., 2000; MASBERG & SILVERMAN, 1996; PRENTICE, *et al*, 1998; RYAN & GLENDON, 1998; SCOTT & BURTON, 2000; TIAN *et al* , 1996; PACKER & BALLANTYNE, 2002; BURTON & SCOTT, 2003; WITCOMB, 2003; APUD KELLY, 2009).

Therefore, “variable geometry networks” could be developed to overcome local museum weaknesses. The scale of museum networks should be appropriate to the efficient margin of different service supplies (each museum could participate in one museum network for one type of supplies and in a wider network for other supplies) (CERQUETTI, 2008: CERQUETTI & MONTELA, 2015). In summary, the application of this strategy would allow: (1) an increase in the level of museum facilities and services; (2) local museums to become pivots of a cultural itinerary rather than just unknown destinations; (3) the museums to take advantage of the opportunity of new and increased cultural experience-based tourism demand in search of authenticity; (4) reducing negative externalities and diseconomies due to a flow concentration towards just a few cultural cities; (5) opening new possibilities for local entrepreneurship in tourism and the industry and (6) promoting the sustainable development of local destinations.

Finally, the development of cultural tourism through cultural heritage enhancement could promote new economic and environmental planning tools, stimulating people’s awareness and participation in the maintenance and management of cultural and historical sites and developing

a joint interest of tourism participants and local authorities in inter-sector policies and programming.

3.3. Communicating in the digital society:

Emerging technologies, such as virtual and augmented reality (AR), wearable computing, and digital fabrication, have improved the engagement and experiences of learners in a wide range of content domains (loy, 2014, Bacca *et al.*, 2014, Johnson *et al.*,2016, Pollalis *et al.*,2018). In particular, these technologies pose unique opportunities for enhancing object-based learning. Object-based learning places interaction with physical artifacts in a central position in the learning process (UCL. 2017).

Digital technologies are being used in museums worldwide for day to day activities and provide information on exhibitions, museum products, events, opening hours, ticket availability and prices etc. Some museums use social media tools such as blogs, portals, Twitter, Facebook, YouTube etc. to interact with their audiences. Social media tools help museum professionals to provide efficient service to their customers and at the same time attract more visitors. The museums that are maintaining websites interact more time with their audiences and with the whole world. They are networked not just within a geographical area or community but globally through international contacts, special interests, different cultural communities, and social networks. In brief, museum websites provide facilities to global connectivity. In this way visitors come to know world heritage sites and they can plan their physical visits (PERERA, 2015).

Digital technologies have the potential to allow museums to achieve a step increase in the access of their collections and, in some cases, become major broadcasters of cultural content. Digitization of cultural collections has strengthened the quality and quantity of available object images and cataloging information so that images could be quickly located and processed for distribution and licensing to both internal and external customers. This is likely to enhance museum image-licensing models as well as to improve traditional activities such as collection management, curatorial practices and scholarly research (ENRICO AND FEDERICO, 2011)

Now-a-days, the influence of New Media Technologies has a strong impact on the Success of Museum Exhibitions. With the development of technology, new media evolved into a decisive tool in promoting exhibitions and reaching out to audiences. In addition, new media

became an integral part of exhibition spaces, and – in some cases – even artworks themselves. Yet, despite the significant potential of new media to change the way exhibitions are conceived and organized, academia and practice alike lag behind in understanding the influence of new media on exhibitions (WIDMAN, 2017).

Visual exhibition, the online access to digital images on museum websites is generally free, museums only indirectly appropriate the benefits of their investment in such a model, especially by promoting museum collection and augmenting their visibility so to generate revenues from the increased number of visitors, public funding and donations. Mobile application is really popular in the museum digital activity. In this application it is possible to have access to check the museum data from different pdf, audio, video, 3d modeling.

New media tools will help museums to become attractive to various, partially new target audiences, by offering new ways of interaction with the museum visitor. Thus, museums will be better prepared in their quest to attract visitors and to be noticed in a marketplace which is increasingly shaped by the private sector (which offers more and more personalized, interactive and innovative services. Wearable devices, digitalization, user-centered design, augmented & virtual reality, digital identity, the internet of things and robots/drones will be of particular significance for museums in future.

CHAPTER 4: THE PREHISTORIC ART MUSEUM OF MAÇÃO

The museum of prehistoric art initiated a strategy, as from 2001, to intervene in the heritage management as part of an integrated approach to landscape and societal challenges. Conservation of the heritage became a priority not only to protect it, but to consolidate territorial identity (archaeological features being the backbone that remains once major fires destroy the landscape), to generate debates on a landscape in transition amidst a world in transition (on adaptation challenges, but also on the relevance of gesture and the implications of the tangible/intangible relation for cognitive development) and to structure a space of experimentation of new museographic and educational experiments (from the design of a new digital communication programme).



Figure 7: Façade of the Museum of Mação (Image By: Istiake Manik 2019).

The current preparations of digital and analogic based exhibition are on the issue of massive extinctions and the debates on the so-called anthropocene). This approach focuses on using digital humanities as a tool for preservation, research and knowledge socialization (e.g. archiving, image processing and contents discussions dissemination), but also for questioning the limitations and risks associated to digital processing and replacement. The museum strategy drove the attention of visitors and became the basis for an advanced studies research Centre, for projects with the European Commission, the Council of Europe and the International Council for

the Philosophy and Human Sciences, but also for a significant economic growth in the region, generating income and jobs.

4.1. History of Establishment

The idealization of the Museum arose in 1943 following the important archaeological finding of the Port of the County, on the initiative of João Calado Rodrigues and counting with the support of the City Hall. On March 6, 1943, was found in the place of Porto do Concelho, parish of Mação, a set of pieces of "bronze artifacts", collected by Dr. João Calado Rodrigues. Those objects became the first point of reference for the knowledge of the Bronze Age in a vast region of Beira Baixa.

With the discovery on March 6, 1943 of the set of pieces from the Bronze Age known as the Treasure of Porto do Concelho, the history of the Museum of Mação begins, which in 1946 would have a second nuclear moment in the Castelo Velho do Caratão. In 1944, the remains of the prehistoric funerary monument of Chãs do Casal da Barba Pouca were collected. In 1946, Dr. João Calado Rodrigues discovered the Castelo Velho do Caratão. In 1947, some artifacts were found from another archaeological site which was directed by Mrs Moita, Galega Carvoeiro. After this excavation municipality take an initiative to establish a museum (PEREIRA, 1973).

João Calado Rodrigues was an intellectual of many vocations and had in his vision of archaeology, to understand notion of the importance of this science and human occupations of the past. This concern had guided all of his archaeological activity in Mação. In an improved rigor at the base of his Museum project, and never forget the community as the foundation of its sense of purpose archaeological vocation. On the other hand, his project was one of civic education and anchored in the state, with an unequivocal Patrimonialist vocation. All its activity in Mação aimed to create a space of socio-cultural integration (CURA & OOSTERBEEK, 2017).



Figure 8: The first sketch of Mação Museum (Museum of Mação archive collection)

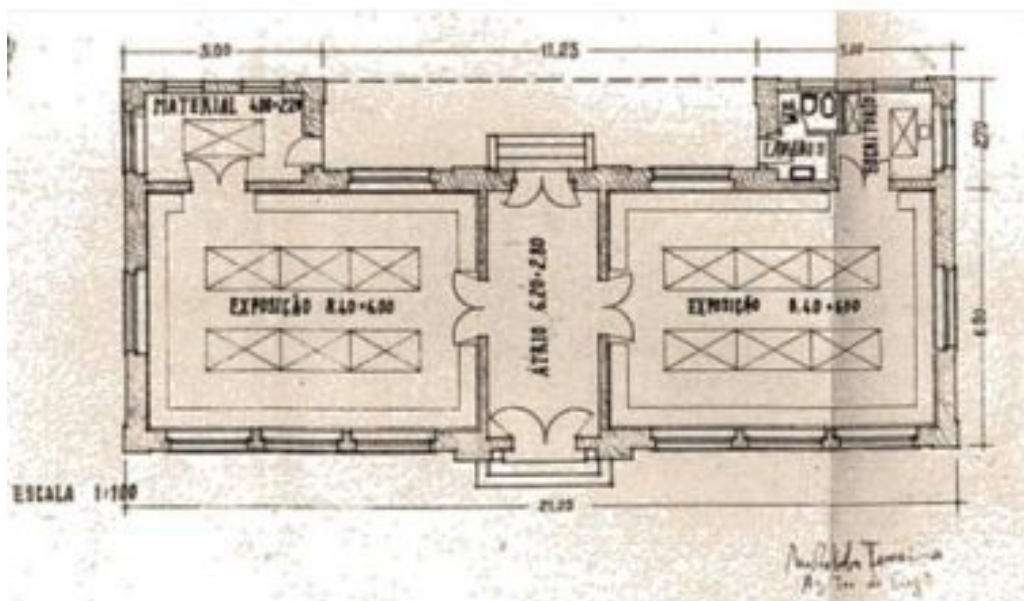


Figure 9: The first sketch of Mação Museum exhibition plan by João Calado Rodrigues. (Museum of Mação archive collection)

In 1961, the administration of Paisana Joaquim found out some problem and demanded to the President of the National Board of Education to send a specialist to classify and inventory the collections of Mação museum. Antonio Pimenta Mendes was the conservator, as nephew of João Calado Rodrigues, whom the Municipality wants to recover. Such a specialist is not sent, but the collections chamber was recovered. After that the legacy was taken over by Dr. Maria Amélia Horta Pereira, who would come to guide the conception and inauguration of the Municipal Museum. The museological project follow always with the concern of the community and research, which it coordinates, and during which it carries out new archaeological interventions that consolidate an integrated vision of the cultural and natural heritage of the municipality (in the old exhibition), and recognition of the archaeological importance of the territory for research (PEREIRA, 1973).

In 1967, Dr. Maria Amélia Horta Pereira took the responsibility of the museum and studied all the collection about ethnological, archaeological perspective. On that moment she directed an excavation in Alto Ribatejo area. From the excavation the collection elaborated. Dr. Maria Amélia Horta Pereira always had the concern systematic organization of historical and archaeological knowledge, expressed in the inventory of the Museum's collection and in its great work "Monuments History of Mação", 1970. In its intense activity the following were expanded archaeological works and the ethnographic and artistic collections always in a logic of institutionalization of research. His concern was to create a museum anchored in the rigor of the Inventory and Preservation and focused on Research and education (CURA & OOSTERBEEK, 2017)

Finally, in 1986, the permanent exhibition of the Municipal Museum opened to the public, totally innovative, in accordance with the current European concept applied to the region's monographic museums from Dr. João Calado Rodrigues collection, proposed by Maria Amélia Horta-Pereira Bubner (CURA & OOSTERBEEK, 2017).



Figure 10: Prehistoric Art Museum Exhibition in 1986. (Perreira 2009:22)

The new cycle of the Museum began in 2000 with the discovery of rock engravings in the Ocreza River valley on 6 September. The central theme of the museum became rock art and the themes of the symbolic and the sacred over time, articulated with the idea of risk and landscape (OOSTERBEEK et al, 2009). The survey was directed by Luiz Oosterbeek. The new cycle of the Museum was accompanied by the celebration of several protocols between the City Hall and several national and international entities such as the Polytechnic Institute of Tomar, CEIPHAR, the Portuguese Institute of Archeology and the International Federation of Rock Art Organizations. These agreements established a network of partnerships, with emphasis on the agreement with IFRAO (International Federation of Rock Art Organizations) for the creation, in Mação, of an International Library of Rock Art. (<http://museumacao.pt.vu/>).

The extension of the museum as a global territory starting in 2001, is part of the same logic of research and social involvement as the previous ones, now looking at the international dimension and incorporating components such as experimentation, higher education and

internationalization In this new cycle, three fundamental foundations have been laid: the collections of archaeological and historical sites of Mação and the region, the relationship with the community of Mação and the close articulation with higher education and the international dimension, privileging the relationship with the Polytechnic Institute of Tomar (CURA *et al.*, 2011).

On 3 October 2002, the Director of the Museum, Luiz Oosterbeek, a proposal for the program of reorganization and dynamization of the Museum of Mação, which is now known as the Museum of Prehistoric Art and the Sacred of the Tagus Valley. On 6 April 2003, a declaration of the reorganization program of the Municipal Museum of Mação was signed. Between August 2003 and March 2005, the entire building was restructured and the exhibition (<http://museumacao.pt.vu/>).

In 2013, the Museum began a new stage, with the Gesture, Risk and Landscape project. The permanent exhibition was reorganized around the theme of gesture in the construction of the landscape and objects and works of art.

4.2. Programme and Activities:

The prehistoric art museum of Mação and Institute of Terra Memoria are well connected. With the collaboration of these two organizations all the Programme and archaeological activities has arranged. The responsibility of the museum had taken is social involvement and interaction.

From the outset, the connection with the population was reflected in the co-construction of the museological Programme, with the direct participation of more than 10% of the population, as well as in the strategy for defining the exhibition content that articulates the concerns of the local population, the cultural heritage and the global processes (CURA & OOSTERBEEK, 2017).

The Museum of Mação has been the protagonist of several European and some National projects, which make it possible to affirm Mação, as the research and heritage management center in Portugal with a truly international dimension. Within the ongoing research and higher education projects, research lies at the heart of the Museum's priorities, comprising specialists

from the following fields. European centers of excellence, as well as a network of national (IPT, UTAD, CPH, CEIPHAR, PAAMT and CIAAR) and international partnerships. It should be noted that, within the framework of these partnerships, the Museum integrates, as partner or coordinator, a wide range of projects, mostly financed by the European Commission in several countries such as Spain, Brazil, Senegal, Colombia, and Angola. The common example for all projects is the link between archaeological research, the creation of a museum or heritage center and the organization of educational programs (the Andakatu workshops) that socialize knowledge as it is built in the investigation units. Some of the research based and international programs are-

- ✓ Integrated landscape management (UNESCO chair)
- ✓ Heritage Quality Management (HERITY)
- ✓ Erasmus + programme (Master programmes)
- ✓ International Seminars and network (APHELEIA)
- ✓ Cultural tourism programme (MOVTOUR)
- ✓ Andakatu Project

The master's and doctoral projects (recognized under the Erasmus Mundus / Erasmus+ Programme), articulated with the creation of a center of the Centre for Geosciences of the University of Coimbra (focused on the sphere of Humanities and supervised by IPT and the Instituto Terra e Memória- ITM) and with several international projects (namely with UNESCO), prove this insertion, illustrated by the association of ITM with the edition of the minutes of the World Conference of Humanities (2017) or by the creation of the UNESCO-IPT Chair for Humanities and Integrated Cultural Management of the Territory (UNESCO-IPT) (CURA & OOSTERBEEK 2017).

In addition to the training already mentioned at postgraduate level, the Museum hosts intensive programs of strong academic expression and has created an educational service that is directly emerging from the research projects, which integrates the users of the Museum in the logic of research on technologies and human behavior (CURA *et al* 2011).



Figure 11: DYCLAM and IMQP student in cultural heritage management fieldwork (Image by: Istiake Manik 2018)



Figure 12: IMQP student on Ethnoarchaeology course field work (2017-18 session) (Image by: Istiake Manik 2018.)

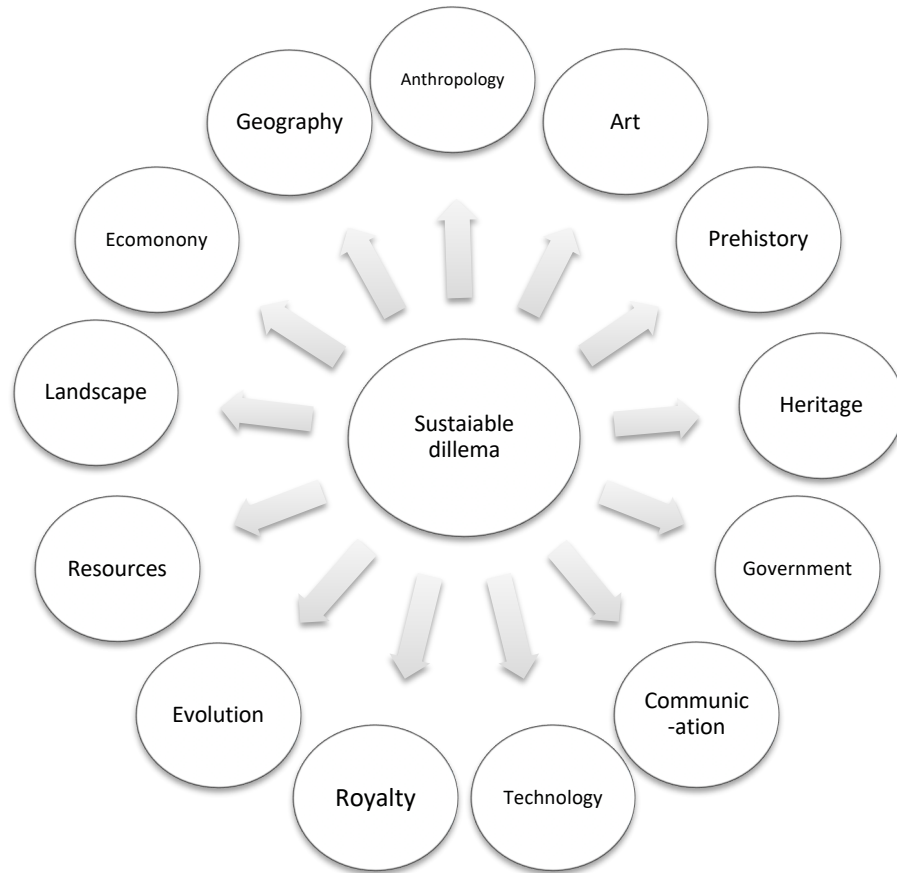


Figure 13: Diagram of Sustainable dilemma. Source: Oosterbeek 2016.

Deductive activity of the museum: The Prehistoric Art Museum of Mação acts in different areas, from research to heritage management, but its main role is to be a space for meeting, reflection and building of critical knowledge and concepts (OOSTERBEEK, 2009; OOSTERBEEK, 2010). The main focus of the museum is on the meaning of the human interaction with the landscape and territory, transition of hunter gatherer along with prehistoric art. Based on this theme, the educational services of the Museum of Prehistoric Art developed a didactic project of Archaeological activity.

The activity is based on presentation of archaeology to the public of the area. It makes a systematic contact from past to the present. These are based on direct experience. On the other hand, Technological experimentation is different material with Lithic, bones, pigments, etc. It assumes a central role of the understanding of the theme (CURA *et al.*, 2008).

The Museum of Prehistoric Art of Mação operates in different areas, from research to integrated territory management, but their main role is to be a space for meetings, for reflection and for the construction of knowledge and critical concepts (OOSTERBEEK, 2009; OOSTERBEEK, 2010). Some of the archaeological experiment activities are Rock art, ceramic production, lithic technology etc.



Figure 14: Deductive activities (Prehistoric painting).(Cura *et al.*, 2013:371)



Figure 15: History of human evolution through experimentation. (Cura *et al.*, 2013.372)

The museum taking research at its core, and pursues a threefold aim: cultural, economic and social. The museographic programs are to identify study and preserve heritage remains, with special attention dedicated to the prehistoric art complex of the Tagus basin. To enhance the value of this heritage, by integrating it within educational and touristic programs, also fostering a cultural identification with current populations (OOSTERBEEK *et al.*, 2006). To create jobs in research and in cultural industries, also improving the global regional income essentially in the territory sector.

4.3. Existing Exhibition

The exposition is basically is a combined gest of actual gest and prehistoric gest. It has designed with some archaeological material and some experimental materials. The importance of the Tagus Valley rock complex (which was a research priority, culminating in the full publication of its corpus in 2018) justified its valorization within the museum, going through major thematic cycles: hunter-gatherer societies (2002-2004), human adaptations in the Holocene and the origins of the agricultural economy model (2005-2014) and the anthropological interpretation of the gesture, in its multiple technological, communication and artistic dimensions 2014-present (CURA & OOSTERBEEK, 2017).

The Museum is focused on the meaning of human interaction with the landscape, but also in its transformation during the prehistory, especially in the transition from the last hunter-gatherers to the first communities of farmers, studying their habitats, burial sites and art. These being the main themes the practical and cryptic education are a major component of all the activities, bearing in mind that a synesthetic stimulus is the best way to educate and deliver a message (GONÇALVES *et al.* 2002).



Figure 16: Museum exhibition at a glance.

The museum exhibition is integrated by landscape. Transformation of landscape, shaping of landscape, megalithic is diversity of the materials. In the exhibition 3 important information's are: (i) shaping the landscape (ii) diversity of materials (iii) notion of recycling. To discuss about the museum exhibition, first we can discuss on the exposition plan. The plan is describing here with the number of showcase-

1. Shaping Landscape (Figure 18)
2. Organize the Countryside (Figure 19)
3. Beyond death-The cyclic time (Figure 20)
4. To build Extension of our body (Figure 21)
5. Diversity of the material (Figure 22)
6. Metal Work: Recycling (Figure 23)
7. Creation of the others (Figure 24)
8. Segregation of the art (Figure 25)
9. Gesture (Figure 26 and 27)

The first showcase of the museum is displaying the landscape of the agriculture and domestication. The objective of this display is to present the human evolution, to make a change of landscape, deforesting and create a farming and pastures area. The objectives of this specific showcase are: Animal bones with cut marks, Seeds (agriculture evidence), Stone tools (Adzes, Axe,) and Ploughshare (Use in farming). All the artifacts are collected from Conheira do Penhascoso, Mação and Gruta de Cadaval of Alto Ribatejo Area.

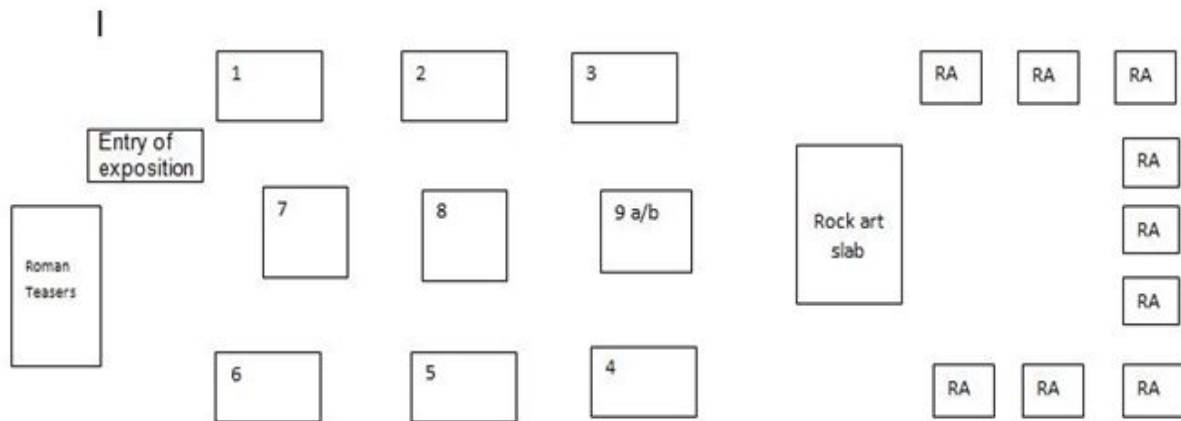


Figure 17: The Exhibition ground plan of the Museum. (Mação Museum archive Collection)



Figure 18: Exhibition of Shaping Landscape.

In the second showcase is presenting building or construction material, woodwork and ceramics. These objects are collected from the different parish of Mação. The exhibited objects are (1) Ceramic pot (2) Wall blocks (Construction) (3) Gauze, Adze (4) Ceramics (daily uses in different purpose, especially to make the lamp). The artifact comes from, Povoado da Zimbreira, Mação, Anta da Foz do Rio Frio, Mação and Conheira do Penhascoso, Mação.



Figure 19: Exhibition of Arrange the countryside.

Showcase three is containing Bone object, shell object, flint object over all cyclic object. They are- 1. Bone Object- Idols, spatulas, beads, rabbit sculpture, 2. Shell and antler 3. Flint object are Blade-bladelets, Arrowhead. 4. Burial of hunter- quartz blade, Arrowhead 5. Decorated slate plaques-several design and size. These objects are collected from the archaeological site of Gruta do Morgado Superior, Tomar, Gruta do Cadaval, Tomar, Gruta do Morgado Superior, Tomar, Anta da Foz do Rio Frio, Mação and Anta dos Pendentes, Mação. Some of the object are presented here from the exhibition.



Figure 20: Exhibition of 'Beyond death-The cyclic time.'

Showcase Four to show the technology of lithic and ceramic production. The full process of the lithic from acquisition, prepare, reduce and use of the tools. On the other hand, the same process for the ceramics work. The display is giving the information through the time the techniques changed but the gesture is preserved. The display is-

1. Work on stone- Quartzite pebble, Flint blades from, Halberd, Arrowhead, Flint blades and bladelets core, Sickle in construction, with flint burin and bee wax, Sickle
2. Work on Ceramics- Clay, ceramics pot, ceramic fragment, loom weight.



Figure 21: Exhibition of ‘To build Extension of our body’.

The objects are collected around Mação region (Anta da Mincova, Conheira do Penhascoso, Casal da Barba Pouca, Anta dos Pendentos, Mação, Casal da Barba Pouca, Mação, and some of them are experimental on the basis of Neolithic and iron age period founded in Tagus basin.

In the showcase five, is displaying the object of the organic elements made. It shows the diversity of the material. They are- 1. Organic objects are- Raffia basketry (handicraft). 2. Cork spoon (handicraft). 3. Leather bag (replica). 4. Horn and cork recipient (Mação). 5. Bobbins (Mação).

Showcase Six is all about recycling. Metal is the introduction of ideal of recycle. All the process of the recycling has displayed. The objects are- 1. To smelt the metals- Malachite, charcoal, 2. Copper objects are- Axe, Arrowhead 3. To recover used metals- Axes, Spearheads, Sickles, Daggers, Swords. 4. To recycle the metals: Bronze fusions, Bracelets, Rings, Bronze ingots.



Figure 22: Exhibition of Diversity of Material.



Figure 23: Exhibition of Metal Work: Recycling.

The collection sites are Gruta de N^a. Sr^a. das Lapas, Tomar, Anta da Foz do Rio Frio, Mação, Porto do Concelho, Mação, Castelo Velho do Caratão, Mação

Showcase Seven: Gesture of making art. With the hand of Chinese shadow is telling gesture. In Portuguese the word is 'GESTO'. Title is 'Creation of others-Shadow of gesture'.



Figure 24: Exhibition of Creation of the others

Showcase eight: The way of making clay to interpretation of art. The basis and the gesture are to creation/ is the gesture to form of Idea. Title is Segregation of the art.



Figure 25: Exhibition of Segregation of the art.

Showcase nine: Hand gesture. Reconstructed hand image, from the bones of several individuals from the Neolithic necropolis of Gruta dos Ossos, Tomar. The display is of some hand gesture are presenting motifs of (i) Using of stone tool (Axe) (ii) carrying a stone (iii) slate plaques engraving (iv) Using blower for melting (v) working with clay (vi) making baskets.



Figure 26: Hand Gesture.

In the other part of this showcase is displaying the hand gesture. is language expressing of the word of 'PARTUM' which is to create, the other one is 'FACERE' is to make (OOSTERBEEK, 2014).



Figure 27:1. Left: language expression of hand gesture. 2. Right: The concept of the museum exhibition (OOSTERBEEK 2014:115).

CHAPTER 5. METHODOLOGY:

5.1. The main exhibition of Mação museum

Introducing digital technology is a new addition and it's a new dimension for the museum. All the work has been done based on the museum's collection and exhibition. The main exhibition of the museum is about gesture and it's transformative, communicational and creative dimensions. A core component of the exhibition is the focus on transformation of landscapes (deforestation, architecture) and of raw materials (physical transformation with lithic technology and basketry, chemical transformation with ceramics and recycling with metals). This part of the exhibition is complemented by the experimentation workshops of the museum. Communication (including gestural language) and Creativity (including decoration and rock art) are the other dimensions focused in the exhibition.

The purpose of the exhibition is to raise a reflection about human behavior, its transformation and recurrences and the relevance of tangibility (gesture) in developing and transforming intelligence. The purpose of introducing digital resources in the exhibition is not so much to attract visitors, but to enhance their understanding of the interactions between the tangible and intangible dimensions of knowledge, acknowledging the irreplaceable role of tangibility. All the work of experimentation has been done with help of Pedro Cura.

The actions taken to complete the objective were-

- Archaeological Experimental work for getting the gesture of the Ceramics, Lithic and Metal work
- The use of different types of digital technology in the museum collection
- An enquiry work with the Mação local people to make an integration with the society and museum

5.1.1. Experimentation of lithic technology

Experimentation of lithic technology is means of study, by human behavior can partially understand. With this research some of the other archaeological research is connected. Paleoanthropological research has focused on diverse aspect of the technology of lithic. By these experiments it's possible to gather the information on human behavior such as procurement of raw material, manufacture of the tools, strategy of using tools, and action of the tool. In lithic technology the most popular terminology is called-

- (i) Use of Techniques (nature of gesture): Technical procedures are short systematic sequences of actions involved in any kind of preparation, such as: the abrasion of an overhang, the preparation of an edge prior to removal by a burin blow, the faceting of a striking or pressure platform (INIZIAN *et al.*, 1999).
- (ii) Methods (Operational Steps): Method refers to any carefully thought out sequence of interrelated actions, each of which is carried out according to one or more techniques. More often the term method implies an elaborate conceptual scheme leading to the manufacture of predetermined products, whether by shaping or by flaking (INIZIAN *et al.*, 1999).

As the research is about gesture, we tried to use technical behavior of the technology. For the work we follow several steps. There are- Raw material collection, Reduction, Use. To make a lithic tool there are some steps to work and for the different material, different types of tools. The chain operation of lithic technology is-



Figure 28: Chain operation of lithic technology.

(https://en.wikipedia.org/wiki/Cha%C3%A9ne_op%C3%A9ratoire)

5.2.2. Experiment of Ceramic Manufacture: For the ceramic experimentation there are some steps to complete the full procedure.

To complete the full process of ceramics making, the necessary elements are-Clay, Water, Color material, Objects for design and Firing system. For the experiment the first step of the work is to collect the raw material. In this research we collected the raw material from local site. After collecting the raw material, it is crucial part of the work is to make a composition of clay paste. Then the process is pot making. In later prehistory time all the pottery is hand made from the region of the alto Ribatejo. In this experiment we tried to make handmade pottery. After getting the expectant shape and design of the pottery, the final step is firing. For the firing method we used the open firing method. All the experiments are describing below.

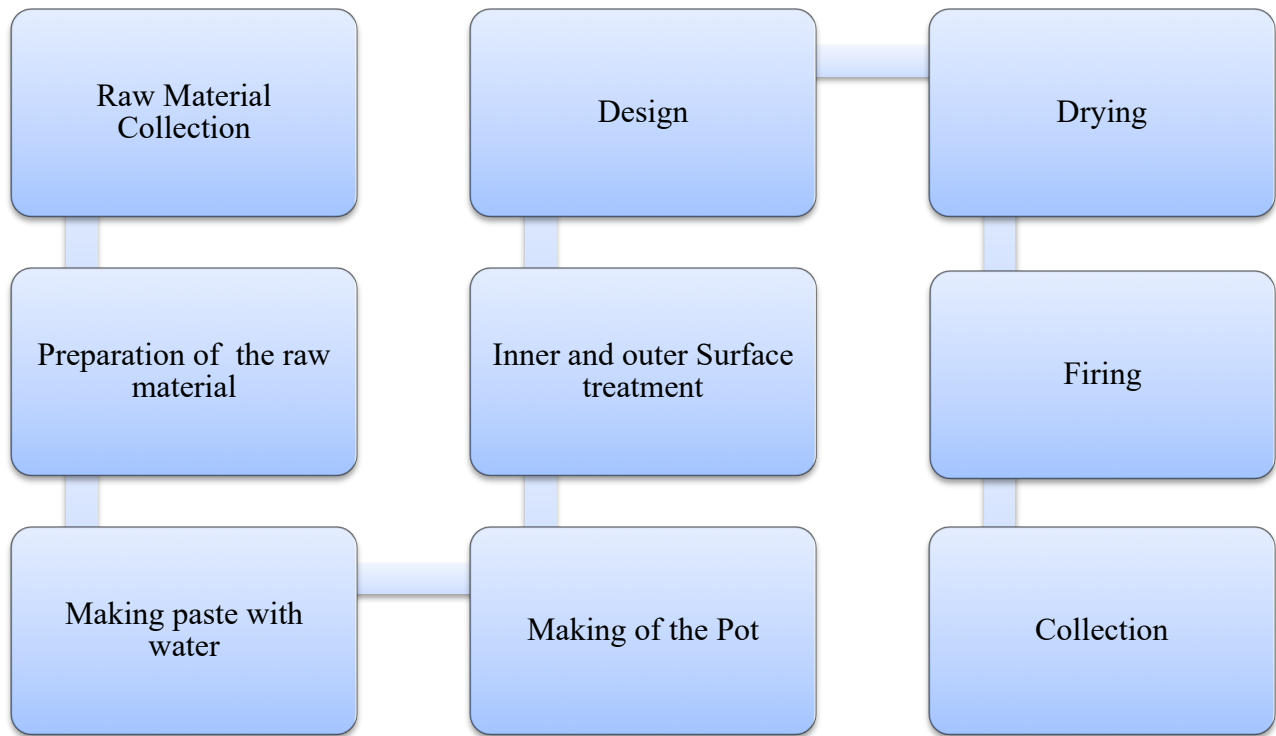


Figure 29: Pottery Production Sequence.

Raw material collection: The main material is clay for making pottery. Two or three various types of clay powder, some organic material and mineral need to prepare the appropriate clay. Grog is very important element to make pottery which is also known by fire sand and it contains a high percentage of Silica and alumina. All the material has been collected from the local area.

Prepare the raw material: From the local area we collected some volume of clay. To make the paste first need to make very fine powder of the volume. For this work we use a stone block and wood to make powder and mix all the elements. When the powder is ready then we make the paste with water. In this time, it is very important to be conscious to put the water to make very fine clay dough.



Figure 30: Preparation of clay dough. 1. Crushing the raw material 2. Grinding of the raw materials 3. Clay paste with water.



Figure 31: Making a pot using different hand gesture.

Making of the Pot: To build the pot first need to take an amount of clay dough. Then make a round shape ball after that with the finger turn the ball into flat to have the base of the pottery. Then give the shape of the pottery.

Surface Treatment and Design: In this situation we only polish with water the outer and inner surface of pot. For the design a bone skewer has been used.



Figure 32: Surface Polishing and design.

Firing method: The pot needs to be dry in the sunlight before firing. When it is dry after that it's the firing time. For firing the pot, we used open firing where it takes 40-45 minutes to burn the pot. Slowly we increase the fire temperature; on the other it necessary to keep in mind about the pot that it does not crack for over or lower heating.



Figure 33: Firing of the ceramic.

5.1.3. Experimentation of Metal Casting

The use of metal raised on the late Neolithic or early chalcolithic time period. In this research we have tried to get the gesture of the Metal age. To complete the experiment the protocol has been followed. In this work we took copper for the experiment.

Work Protocol: First need to make the burner to melt the metal. Make the fire with some dry leaf and expected mineral. Usually 3 types of mineral are common to make fire for metal work, charcoal, Malachite and Azurite. Here we used charcoal.

The melting process was performed on 100 gm. of copper. The mineral placed on a ceramic pot and the cover with another ceramic in the burner. To finish the work process, it is necessary to have at least 12 hours. And the most important thing, the temperature was controlled between 600° to 900°. In the work the highest temperature was 850° and the lowest was collected 100° (in the starting of the work).

To record the temperature, we used a thermos-couple chrome-vanadium IEC 584 CR-ALK and a thermometer HANNA HI-93530 were used during all the experiments (PITONE, 2018). This experiment was conducted with artificial air to keep the fire constant. To make the blow, two blow pipes were used, one is made by wood another one is leather blowing bag.



Figure 34: Metal casting processing

In the last two hours of the firing the ceramic pot turns in the red color. When the copper was melted then with a metal hook the ceramic pot brings outside from the burner and put the melted copper in the mold.

5.2. Digital resources to introduce the exhibition

5.2.1. Videography

Museums and cultural heritage institutions recreate an environment not only the exhibited objects and works of art, but also new ideas and experiences (ZANCARANO *et al.*, 2003). In this research all the experimental work has been recorded by cinematography to present in the conducive to exploring museum by using the big screen and visual exhibition. For the videography there were several experts from the Polytechnic Institute of Tomar. This work is a correlation work of IPT, Institute Terra e Memoria, Prehistoric Art museum of Mação. Here the archaeological work has been done by archaeology student and the for the cinematography IPT Film department student. For the Cinematography the equipments used were:

- Two Canon EOS 6D camera were used
- Two Tripod
- Microphone
- Headphone
- Lighting gear.

Work protocol: For recording a video clip, a set of strategies similar to those used in documentaries are employed. Two broad classes of strategies have been identified. The first class encompasses constraints, imposed by the grammar of cinematography, while the second deals with conventions normally used in guiding camera movements in the production of documentaries. (ZANCANARO *et al.*, 2003)

For the work two people work on camera. The camera was attached with tripod with expected height and distance from the action of the activities. One person worked for the microphones and several people control the light with lighting gear from different point of view. After completing the video capture the file has been storage in the laptop and external hand disk

to collect the file properly. After collecting the video file, the important steps are editing of the capture. After the editing work the archaeological experimental video is ready.

5.2.2. Photogrammetry of Museum object

Photogrammetry has found a substantial role in immovable cultural heritage. Not only immovable but also in the museum, architecture, heritage site and etc. By this work, it enables to obtain:

- 3D print technologies are swiftly bridging the gap between digital and physical objects (YOUNAN 2015)
- Capture the form of real objects, and to store them as digital files.
- Using the photogrammetric technique is possible to create and upload in the web digital 3D models of an object directly from the field. (NICOLI & OOSTERBEEK 2018)
- The same can be done using 3D scanners that allow a very high precision of the acquired data.
- Dealing with preservation of cultural heritage without damaging.

The virtual models of the objects can be 3D printed for research or display purposes. This way additive manufacturing methods can be applied on cultural heritage to enhance its study, conservation and fruition.

Photographic process: This process has been completed with the help of expert photographer. Five different artifacts from the museum collection have been selected to perform Three-dimensional model. The artifacts are ceramic pot, stone hand-axe, schist plaque with design, flint arrowhead, metal spearhead (Figure 35). This process is very sensitive, so during the activity it is necessary to be very careful. The activity was performed using close range of photogrammetry techniques. The techniques and equipments are given below:

- A Samsung NX500 camera has been used, attached with
- A tripod used to capture the photo
- The photograph was taken approximately almost every 5° from two different point of view to obtain high overlap between the photos
- The pieces were placed on a turntable for the attribution of the measurement.



Figure 35: Selected objects for 3D model (Images are not according to Scale)

3d Models creation: Though there are many photogrammetry software packages, in this research the museum object of 3d modeling work preferred ones are:

Agisoft Photo scans: Developed by Russian company Agisoft LLC. Featuring real color texture to makes the model highly realistic.

Reading the models: To read or manipulate the models there are several software for Android and IOS application. On the other hand, for computer the popular software are:

- Meshlab Software: MeshLab is developed by the ISTI - CNR research Centre (<https://en.wikipedia.org/wiki/MeshLab>)
- Cloud Compare Software:(developed by Daniel Girardeau-Montaut) (<https://en.wikipedia.org/wiki/CloudCompare>)

5.2.3. Software application for digital integration:

In this study, experimental archaeology and filming take part in the visual display of museum collection. For that purpose, the museum has collaborated with the software company named, Museum Interaction eXperience s.r.l), in the framework of an ongoing PhD research, undertaken by Maria Nicoli at the University of Ferrara.

MuseumMix, shortened to MIX, is how the company named its mission and it is a project. MIX consists, on the one hand, in the possibility, for museum visitors, to visualize and interact with different types of information in an immersive environment, without ever losing touch with reality. On the other hand, MIX aims to provide museum curators with the possibility to customize the museum itineraries and integrate the physical collection with digital contents and information. The possibilities offered by MIX are based on the interaction between real objects and virtual objects. Its main purpose is the promotion and use of cultural heritage through digital technology. In this process two professional realities are involved: one working on 3D prototyping, the other on augmented reality software development. (<http://www.museum-mix.com/about/>).

Through the development of web platforms, usable by museum staff without any programming skills, MIX aims to be a tool to connect curators and visitors and to improve heritage communication. In a wider perspective, it would result in

- More exiting and involving visits, built on the needs of a varied audience,
- The generation of a system where the museum is conceived as a place to come back to, to discover each time new contents,
- The promotion of post-visit interaction (e-shop, virtual tours, accessibility of knowledge and sharing of information through social media),
- Finally fostering the socio-economical sustainability of the museum institution



Figure 36: Visual description of MIX workflow. (Courtesy: Museum Interaction eXperience s.r.l.)

Protocol of the work: The methodology consists in that for each museum that chooses to be part of the platform MIX, an account is activated (providing one's email). Once the account is

operative, the museum staff is able to work independently from the companies. The curator is provided by a dashboard where he will be able to upload the digital contents the staff produces (such as videos, pdf files, images) and to link them to a target image. Figure 36 shows the possibilities offered by the dashboard. Curators can link to the target images audio files, web sites, videos, images, PDF files or 360° video files. For this purpose, the selected icon should be dragged on the target image and it will appear in the same place on the target when the visitors will point it with the camera of their phone, using the app MIX-AR experience

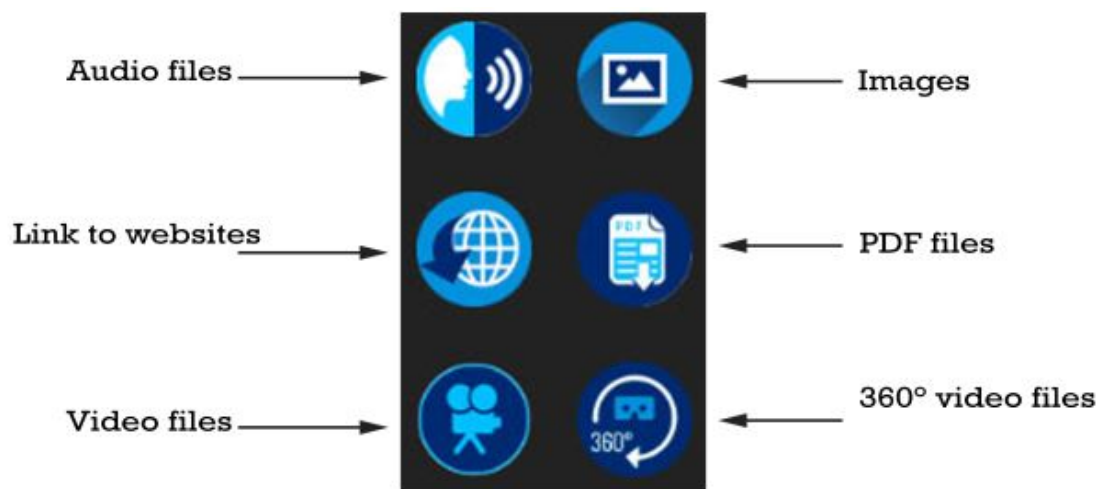


Figure 37: Options for augmented reality contents in the museum exhibition. (Courtesy: Museum Interaction eXperience s.r.l.)

As a visitor, to join in the *MIX-AR experience app* on smartphones and tablets, the procedure is:

- Download the app by framing the related QR code with the smartphone, or directly from the app stores
- Enter the code (provided by the museum) upon finding the name of the museum in the list that collect the names of all the other institutions inscribed in the platform
- Choose the thematic itinerary you prefer and search for points of interest (indicated by stickers or specific target images). To discover lots of extra information just point the camera of your device towards one of the targets and click on the icons, which will appear on the screen. (<http://www.museum-mix.com/come-fare/>).

- All the procedure is describing below with the photo-from download with QR code to open the museum account museum in the museum device list.

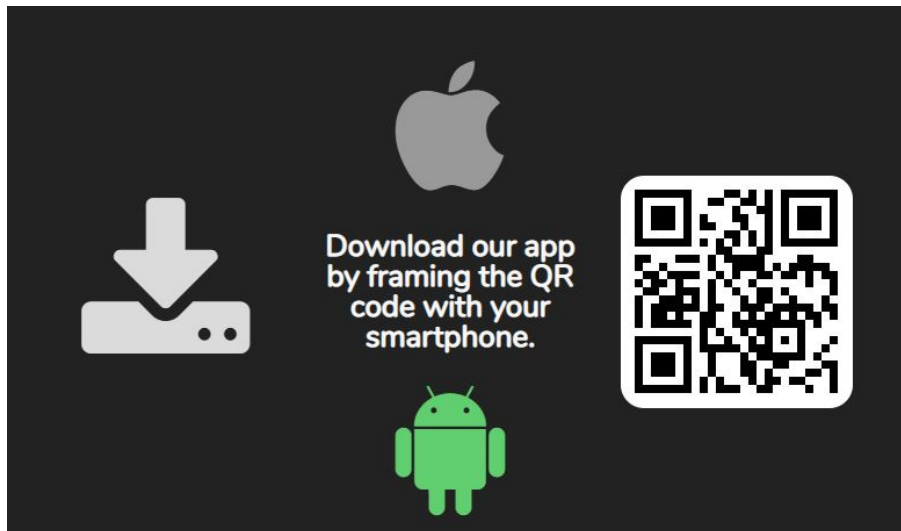


Figure 38: QR code to download the app in mobile phone. (Courtesy: Museum Interaction eXperience s.r.l)

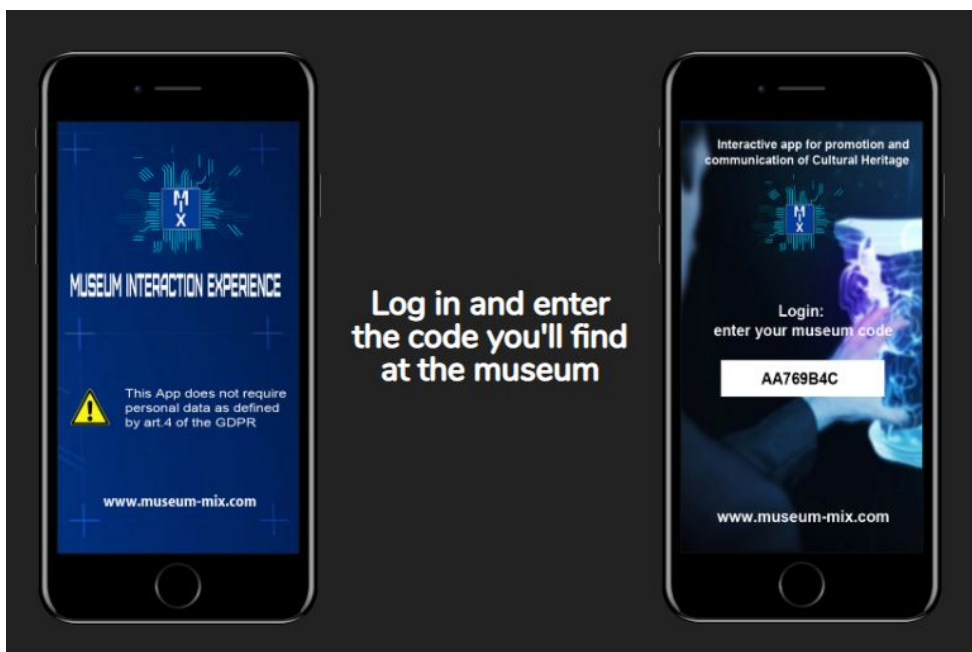


Figure: 39: Login with the code and enter the museum page. Courtesy: Museum Interaction eXperience s.r.l

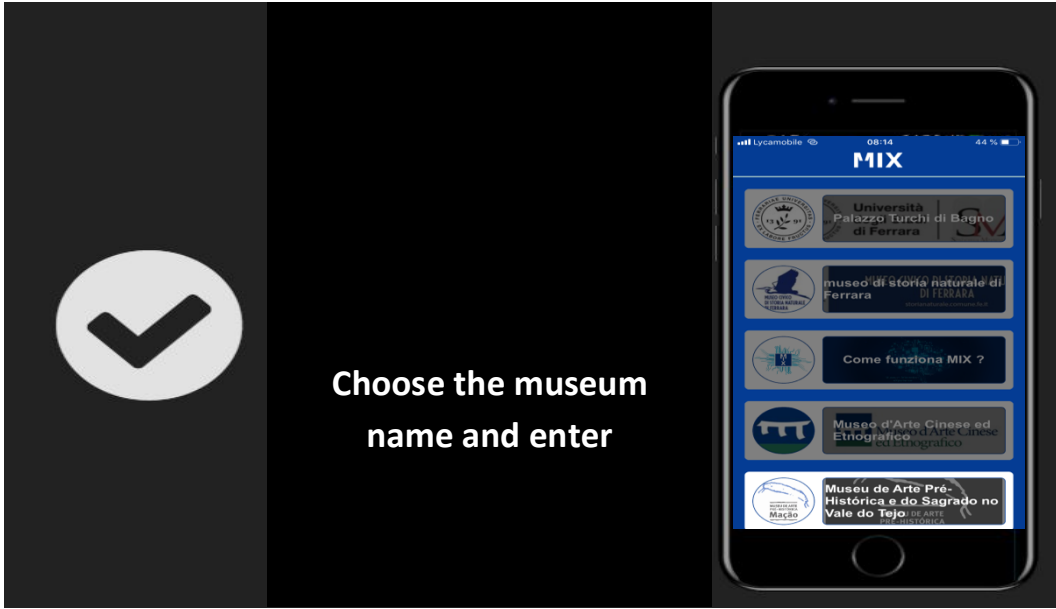


Figure 40: Prehistoric Museum museum of Mação in the of list of the MIX software. (Courtesy: Museum Interaction eXperience s.r.l)

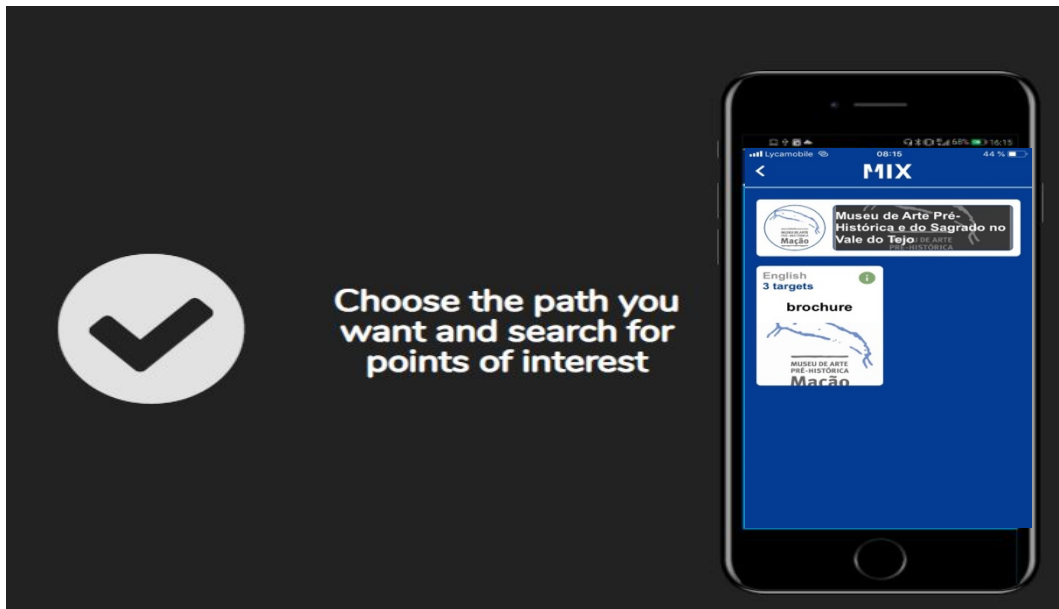


Figure 41: The targets in the software to choose (Courtesy: Museum Interaction eXperience s.r.l)

5.3. Integration with society:

In this research work, a survey work has been done involving inhabitants of Mação, including students and teacher. The questionnaire was designed to address a specific segment of the research. The interviews were conducted in two languages: -English and Portuguese. All the questions had multiple choice answers, and the option to write the opinions and suggestions. The questionnaire had two segments. One is about the prehistoric art museum of Mação, its exhibition and the intuition of the people about the museum category. On the other hand, the second segment concern on the archaeological activities of the museum and the Institute Terra e Memoria. The survey work was analyzed statistically by using Microsoft word and Microsoft Excel software.

The questionnaire was designed with few questions to gather knowledge and the concern of the local people about the museum and museum activity. To get the different idea of the people, there were asked some personal information (sex, age, education and profession) of the participants. With this information it will help to analysis the concept of the people prof different age and profession. Then in the first segment of the questionnaire, they were asked about their visit in the museum. This information gives a big idea about the integration of museum with the local people. Based on the visit of museum, the second question were asked about the museum category of the respondents own point of view. Further question was asked to know the favorable experience of the visitors. There were some questions to choose the answer.

In the second segment, there were also three questions about the archaeological activity of the museum and Instituto Terra e Memoria. The first question was about their participation of the activity. In second question, answer bears the knowledge of the participant's idea or knowledge which they gather from the activity. The last question of this segment, to know the participants pleasantry activity which one they enjoyed mostly.

Moreover, in the last question, participants rate the museum and activity (excellent to sufficient). By analysis this answer it will be easy to upgrade the museum and the activity.

CHAPTER 6: RESULT AND ANALYSIS

6.1. Augmented reality, rooted in experimental archaeology

Result of the archaeological research presentation is a representation of a wide range of activities. In this study the media of the representation is video recorded of the archaeological experiment and use it in the museum exhibition for all the visitors.

The video was recorded in three sections of all the experimentation of lithic, ceramic and metal work. The video contains all the methodology, process of work and the use of the object.

In the recording, all the work process has been shown in different ways. In the knapping process, videography keeps a great role to explain about process. Physical action of the knapping is difficult to explain, on the other hand a recorded video from different dimension can make it very easy. The same factor works for the ceramic production and metal casting also.

Ceramic technological tradition is examined in order to assess social relationships between communities. Technological practices are viewed not only as a means of delivering an end product but are also an essential part of complex, dynamic social strategies that may reflect social boundaries (DOBRES, 2000). The processes that lead to the production of ceramic objects are a result of cultural choices as technology is part of a cultural system. This notion suggests that potting technology may well convey equally significant information about the society as the object itself.

The main focus of the recording is to present in the augmented reality. Along with the video is also presented in the museum exhibition by a big screen attached in the museum wall. First of all, it will give a new idea of past technology and secondly visitor will be able to make a relation with the presented object.

From the experimental work all the gathered information is about the prehistoric gesture and the transformation of the object of physical, chemical and recycling (of the metal). Here is some example of the transformation of the object from stone object to metal object from Prehistoric Art museum collection. I.e. Axe, Sickle, Arrowhead and Spearhead (Figure: 42,43, 44)



Figure 42: Transformation and the development of technology. Stone Axe to Metal Axe. Top left and right (Almeida *et al.*, 2012:24)



Figure 43: Transformation and the development of technology of Sickle. Top left and right: (Almeida *et al.*, 2012:29)



Figure 44: Transformation and the development of technology of arrowhead and Spearhead. Top left and right: (Almeida *et al.*, 2012.30)

6.2. Digital integration of museum exhibition:

With the support of the software MIX and the emerging technologies, AR contents have been created which aims to recreate operational contexts for prehistoric artifacts displayed in museums (NICOLI & OOSTERBEEK, 2018). The study concentrates on the digital integration of physical and virtual information, as discussed in the methodology chapter.

The focus of the study is the communication of topics concerning exploitation of natural resources, operational chains, and production cycles, technological and sustainable development. The digital integration of the prehistoric collection addresses the human impact on the landscape and the mutual relations between humans and environment, as these are key concepts that characterize the prehistoric archaeological research as well as the actual debate on the ongoing societal, environmental and economic changes (NICOLI & OOSTERBEEK, 2018).

To implement augmented reality in the museum exhibition, the data for the creation of the digital contents has been collected from experimental archaeology sessions, archaeological researches, the study of the objects from museum collection, and survey expeditions in the related areas. The visitor of the museum will be able to access them after completing the installation of the mobile application called *MIX-AR experience*. Figure 45 (1, 2) shows an example of fruition experience through AR in museums. Figure 45.2, instead, shows the MIX application interface: the targeted object is the first page of the museum's brochure, with the prehistoric engraving of a horse at Ocreza river valley. When the visitors scan the target object, they will get a web link and a PDF document, indicated by two specific icons, see red triangles in Figure 45.2; clicking on the icons the visitors have access to more detailed information



Figure 45: 1. Target of the display supported by AR technology. 2. Contents display in devices.

Targeted object is visible in the mobile screen after scanning of the museum object. Several types of contents are presented which are added in the software. In figure 46.1 is indicating to tap the content. The contents in the software have been presented in the Figure 46.2 (the real photo of the prehistoric engraving of a horse at Ocreza river valley) and Figure 46.3. (PDF contents).

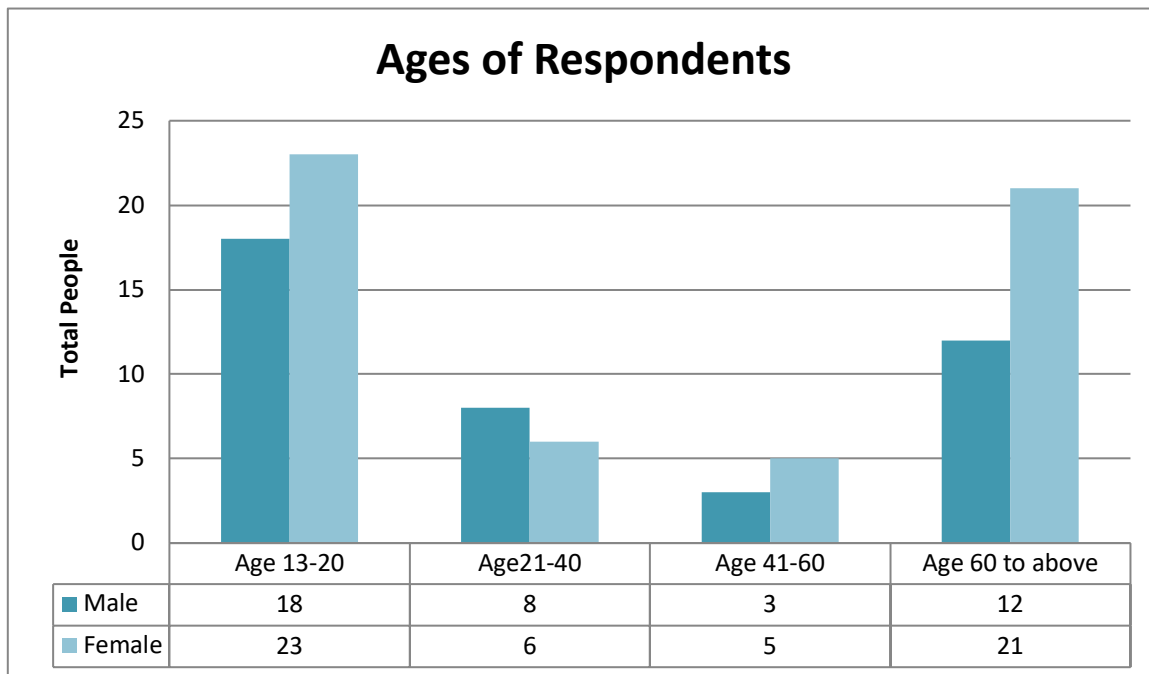


Figure 46:1 Instruction to tap the content to view the gallery, 2. Prehistoric engraving in the software gallery, 3. PDF file in the gallery.

As a result, it is possible to state that, the new addition of augmented reality (AR); visitor will take greater advantages by gathering knowledge about prehistory, objects and gestures of this by reading texts, articles, watching videos and exploring three dimensional models and panoramic photos.

6.3. Integration with Society:

The local survey explores the connectivity of the society with the museum and the archaeological Institute Terra e Memoria. A semi structured questionnaire was given to the people of Mação municipality. In total 96 people has answered the questionnaire. To collect the data all the respondents were contacted in different ways. In the first session, was contacted with secondary school (Escola básica 2, 3 secundária de Mação) student of Mação from the age limit 13 to above. They were very welcoming and interested with the work. On the other hand, some survey form was filled up from the general people of different ages by randomly. The questionnaire was concerning the about museum and museum activity for the local people. Concerning about museum, question was about the type of museum, the collection and the attraction of the museum. From the survey work, data has collected from 96 people, where, male 41 and female 55 people answered. The age limits are 13 to above. From the entire questionnaire total aged people are from 13-20 years old 41 people, from 21-40 years old 15 people, from 41-60 years old 7 people, from 61- above 33 people. All the people were asked the same question and they answered from their own point of view.



Graph 1: Age group of the participant.

The first segment of the questionnaire was about the museum. Considering the type of museum, the survey registered the following information-

- Visiting the museum: Within 96 people 88 people have visited the museum and 8 people remarks they are not aware about the museum, though in future they wish to visit the museum. From the data analysis, most of the people visit the museum more than twice.

Number of visits	Number of people	Percentage
1 time	25	24%
2 times	18	17.28%
3times	15	14.4%
More than 3 times	30	28.8%
Never visit	8	7.68

Table 1 Frequency of museum visit.

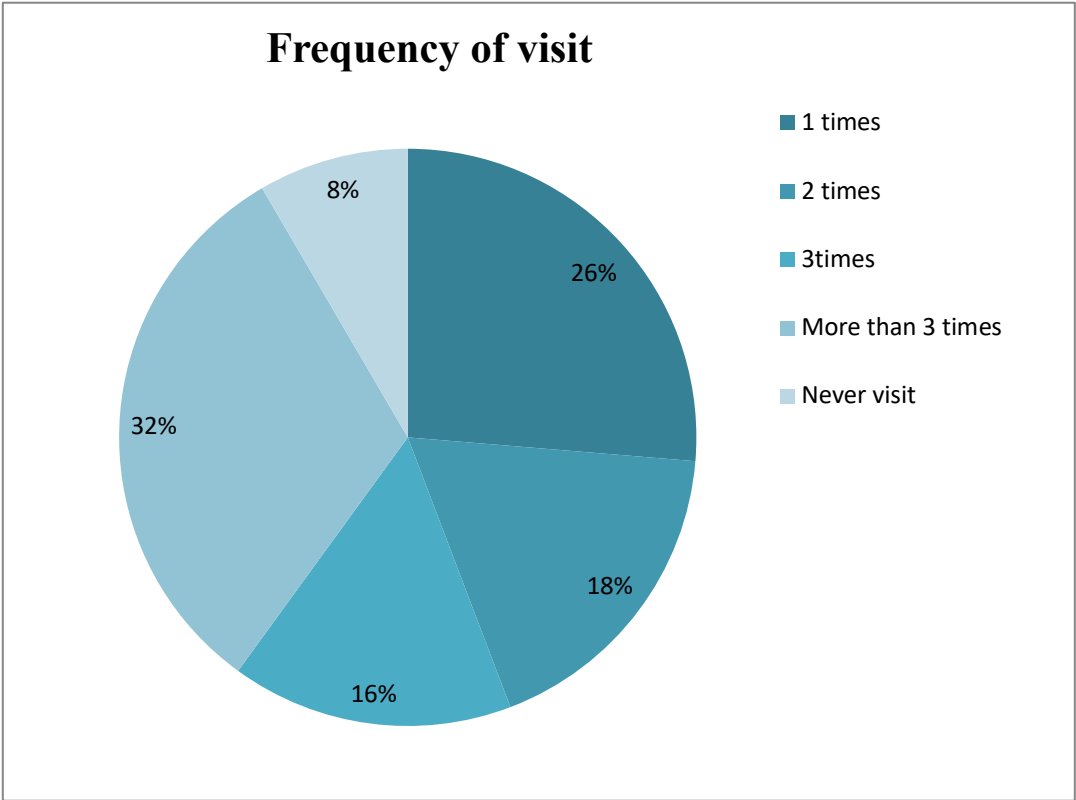


Chart 1: Data (in Percentage %) on frequency of visit.

- The main message of the museum from the visitor view. They rank the exposition 1-3 on the basis of museum exhibition. From the respondent's opinion, the museum is mainly presenting the cultural message, from their view 33.44% people think that museum message is cultural concept, 26.4% people's opinion is archaeological, and 14.96% people think that the museum is considering the main theme of the diversity of landscape. On the other hand, some of the people consider the museum exhibition is the combination of cultural, archaeological and the diversity of landscape here they did not rank the exposition but express their opinion.

Museum exhibition	Total answer	Percentage of 88 people
Cultural	38	33.44%
Archaeological	30	26.4%
Diversity of landscape	17	14.96%
Not answered	3	2.64%

Table 2 Assessments of the visitor opinions.

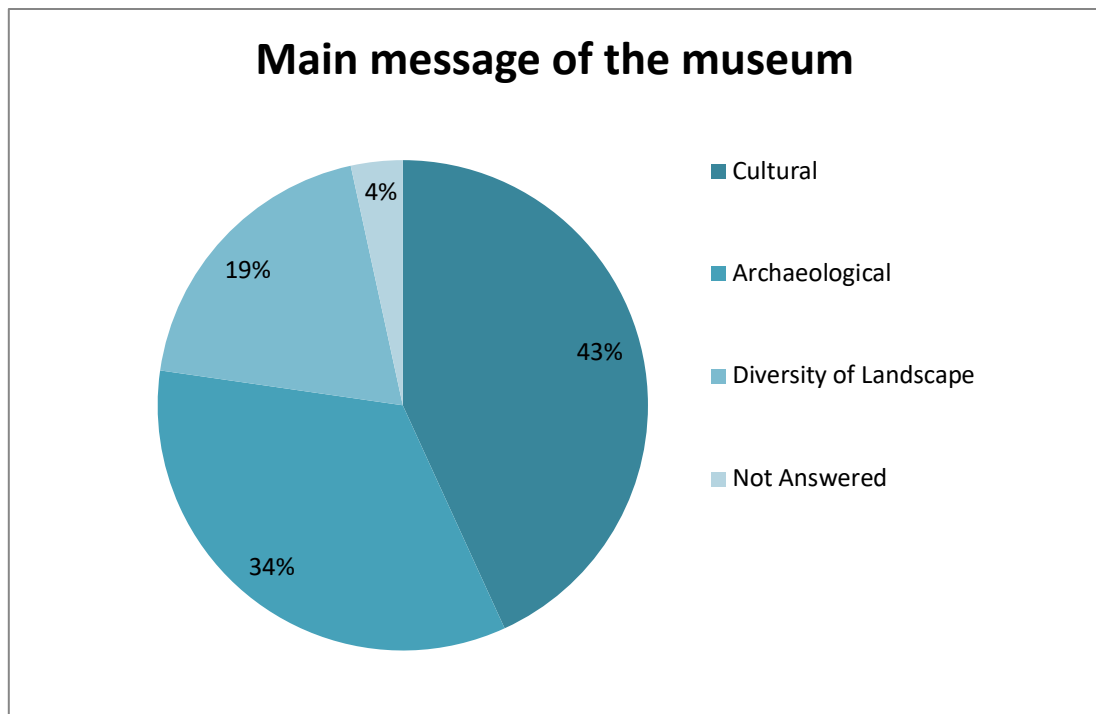


Chart 2: Quantitative research of Main message of museum from respondents.

- The third table shows the result of the enquiry for the people of their favorable experience of the visiting of the museum. From the data analysis 21% people like the exhibition design, 20% people like the overall exhibition and 13% people are very happy with museum guide and the instruction. The data analysis explains that most of the people, almost 35% people are happy of visiting the museum with different sector of the experience. Where 5% people did not answer of this question.

Option of favorable experience	Total answer	In percent from 88 people
Exhibition design	18	20.45%
Interaction with the Museum Guide	12	13%
Specific piece of Art or exhibit in display.	6	6.81%
The overall collection / exhibits	17	19.31%
More than one	30	34.09%
No comments	5	4.4%

Table 3 Favorable experiences of visiting of the respondents.

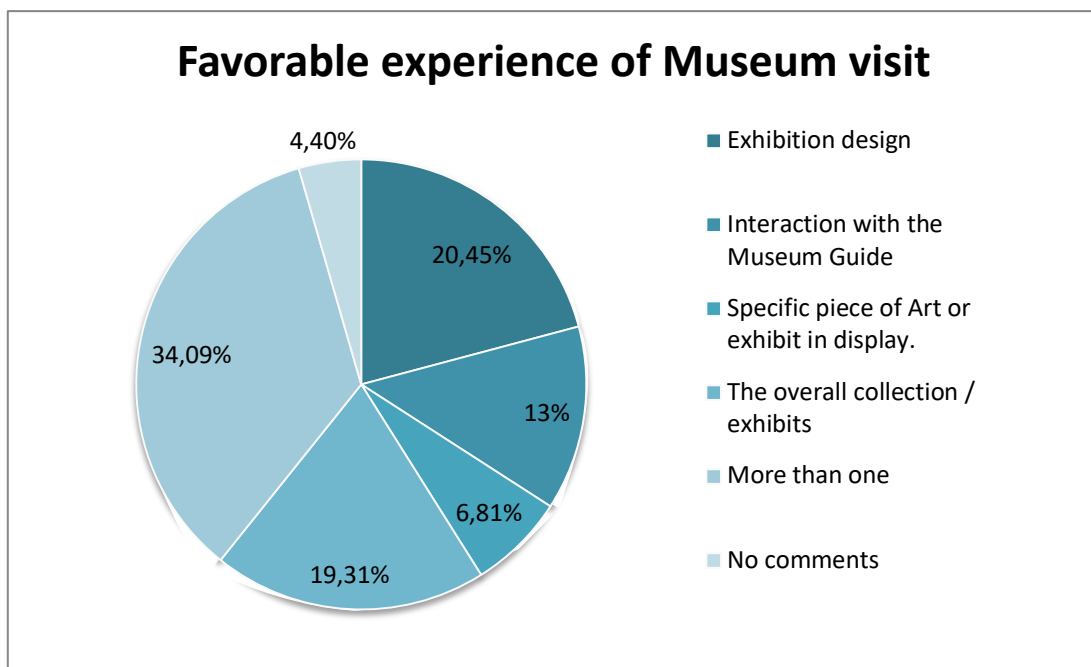


Chart 3: Quantitative research on Favorable experience of Visitor.

In the second segment of the data collection was about the archaeological activity of the museum and the museum laboratory, Instituto Terra e Memória. All the 96 people were asked the same question, where the results are 42 people attended the activities and 54 people are not aware of the project.

- The second data is what they learn from the activities. Majority of the people 55% have learned the relation of the present with the past. 22% people learn the ancient technology and 10% people in reconstruction of past behavior. Where 7% people mention they learn all the sector of the activities.

Option of activities	Total answer/people	In percent from 42 people
Ancient technologies	9	21.42%
Relation of the present with the past	23	54.76%
Reconstruction of past behavior	4	9.52%
Learn all activities	3	7.14%
No comments	3	7.14%

Table 4: Attended activities of the respondents.

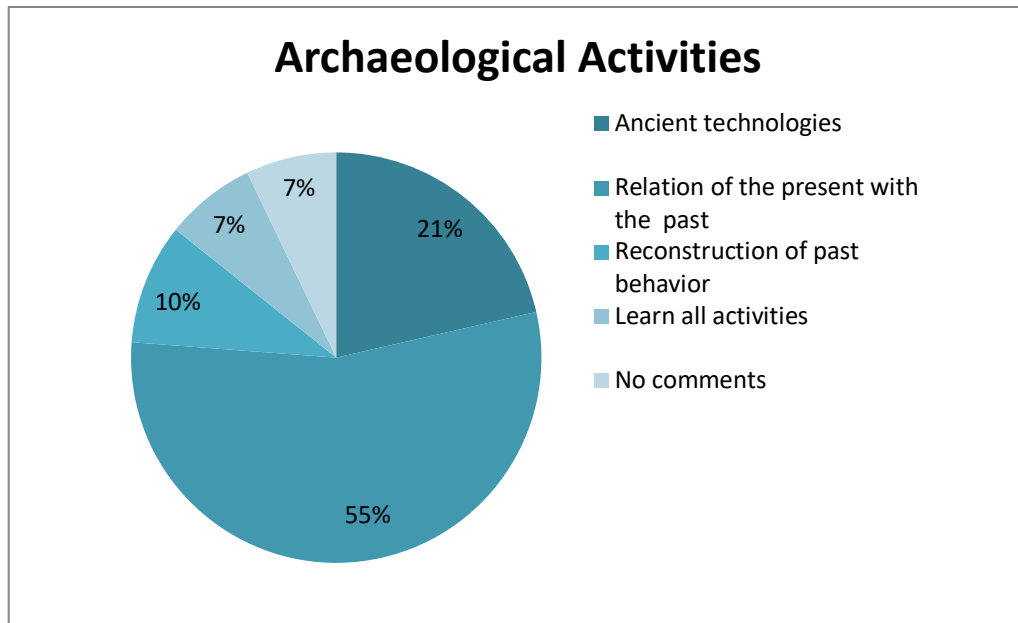


Chart 4: Quantitative research on Archaeological activities assessment.

Third question of the second segment is about different activities and the visitor's involvement. From the data review it is evident that most of the visitors enjoyed the ancient painting activities, almost 36%. Where 5% in ceramic production and 1% is excavation and knapping respectively. There is very important information that almost 34% of people enjoyed all types of activity. In question of favorite activity, 9 people have answered others, where 5 people answer that they like another section of the activity is, prehistoric cooking and another 4 people like the activity which is interacted with museum object and museum visit to explain the activity in the same time.

Option of activities	Total	Percentage of 42 people
Excavation & Propection	1	2.38%
Prehistoric rock art	15	35.71%
Stone tools making/ knapping	1	2.38%
Ceramics making process	2	4.76%
More than one section	14	33.33%
Other	9	21.43

Table 5 Most enjoyable activities of the respondents.

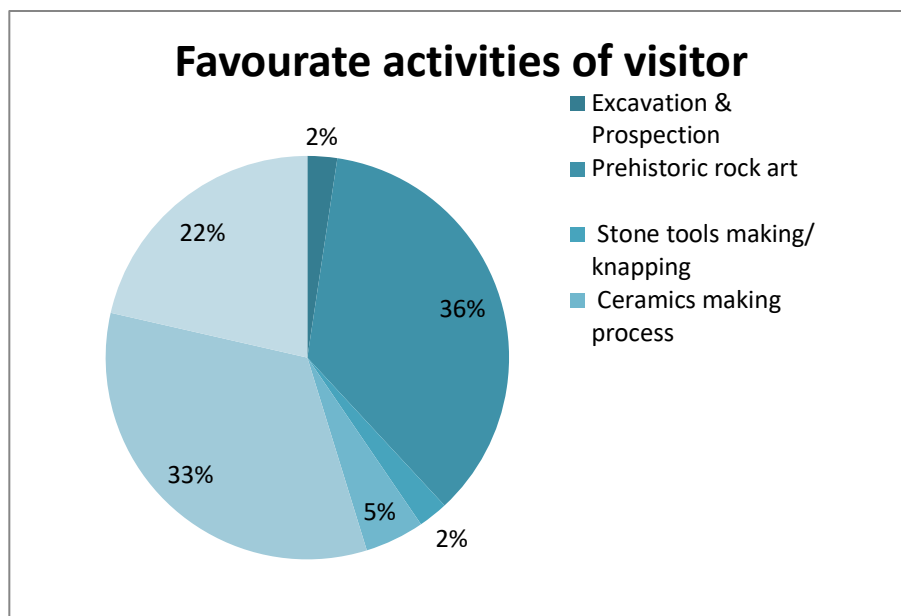


Chart 5: Quantitative research of Favorite activities of visitor.

In this quantitative survey for the Museum service assessment, the experience of the people. From the table 6 and chart 6, it shows that out of 96 respondents 35% consider the service of the Prehistoric art museum to good and only 9% indicate that the service is insufficient. 24% has considered as excellent and 29% as very good services. Only 3% of the people did not answer the question.

Options	Total answer	Percentage of 88 people
Excellent	21	23.86%
Very Good	25	28.41%
Good	31	35.23%
Sufficient	8	9.09%
No comments	3	3.41%

Table 6: Assessment of the museum service:

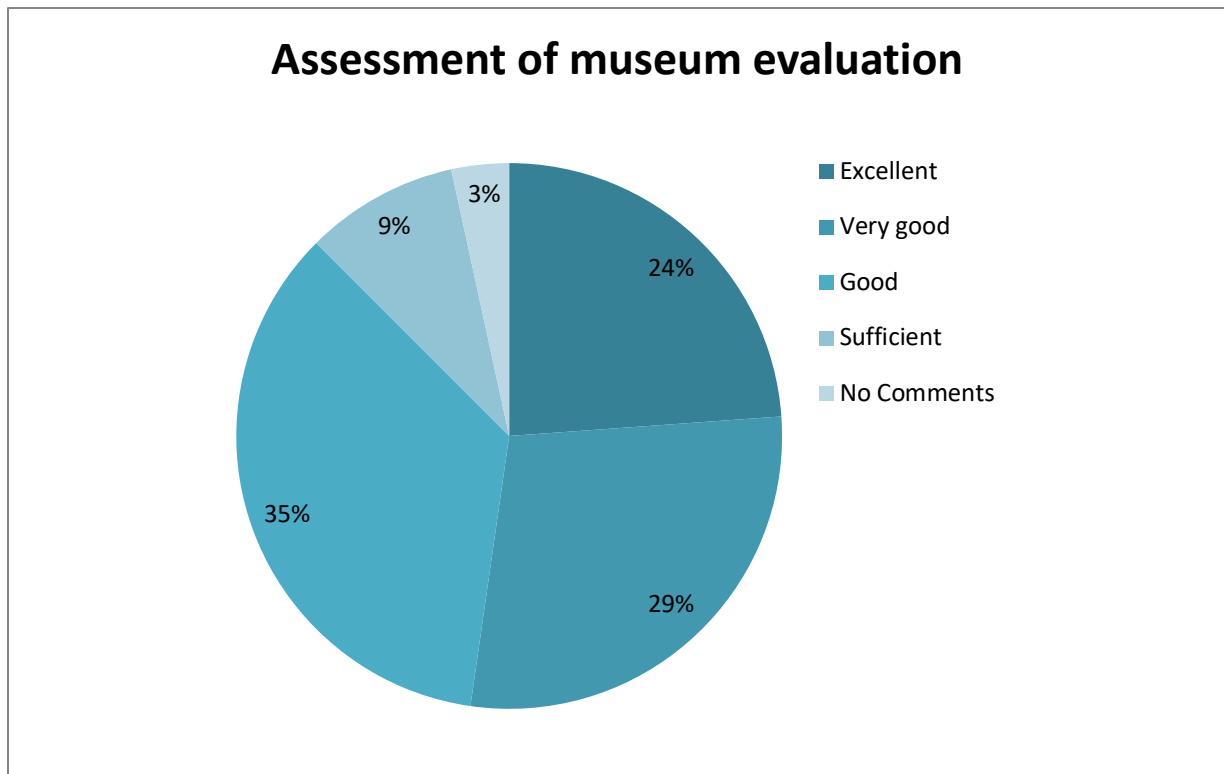


Chart 6: Quantitative research on Assessment of museum evaluation.

From the research it is observed that, the local people and the museum has a great relationship, it is clear with the percentage of the people whom visited the museum. From the 96 people 88 people have visited and most of them are several times. The research prove that museum is a place not only for the recreation but also an educational organization where people can get knowledge of the past, prehistoric technology, human behaviors.

According to the result of survey and the output of the data some observation can derive. The age group of respondents are mainly from teenager and senior citizen of the population. The number of young people is less. About the frequency of the visit, more than 30% people come to visit the museum more than 3 times. This is an important information. Also, more than half of the respondent visit at least once. Only 8% did not visit the museum. Almost half of the visitor among the respondent are getting message from museum is on cultural aspect. More than 30% getting message about archaeological from the museum visit. Other have found message about diversity of landscape. People have different favorable experience about museum visit. Almost 20% individual like the exhibition design and the overall collection. Besides, many visitors like more than one aspect. This is also an important thing to put more concentration. The most like activities is relation of past with present (55%). On the other side people also like ancient technologies. About the experimental activities people like more prehistoric rock art activities. About the assessment of more than half of the people put very good and excellent, 35% people review it as good.

CHAPTER 7: DISCUSSION AND CONCLUSION

Based on the objective of this research, to analyze didactics of gesture and the establishment of digital technology in the museum exhibition, experimental archaeology and digital resources of the technological development has been applied. At the beginning of the research a question was set out to reach in result of the work. The questioning answer of the way to know the prehistoric gesture is to go back to the prehistoric time period, by their techniques and activities, which give the real gesture, human behavior and lifestyle. In this research three experimental works has been followed to reconstruct the prehistoric gesture. The ceramic experiment can be evaluated by repetition of the work, understand the interdisciplinary approach, practical experience and the authentic skill of the work procedure. As the ceramic technology, lithic experiment also follows some procedure to complete the work which we can chain operator or the function of the work. Metal casting is a crucial transformation of the gesture of prehistory. Experimental work gives the information of the casting is about recycling and new start of human lifestyle discussed in the second chapter.

About the improvement of museum exhibition based on digital technology is the main feature of this ongoing research not only to integration of different technology but also of the knowledge and skill of this section. By using digital technology museum can be more updated and the exhibition will be more informative and make an international contact. The MIX Company set the technology where visitor access is very easy, and they can get so many types of information about the object as they wish. There are some advantages of digital museography and in the use of the MIX platform to create augmented reality contents for museum exhibitions:

- The platform refers to a mobile application directly downloadable by the users on their own devices. This results in the possibility, for the museum, to invest in the creation of digital contents, rather than in the purchasing of technological instrumentation, which represent an economical advantage. The life cycle of technological devices, in fact, is very short, implying the necessity of renewing the technological instrumentation or addressing maintenance costs. As a result, the museum could be able to foster the researchers' work and the creation of an interdisciplinary team, supporting the institution, its activities and the communication of the collection.

- It should be also noticed that, on the one hand, relying on the visitors' devices to provide the additional information, allows the museum to avoid the sanitization costs (and issues) for the technological instrumentation. On the other hand, it relieves the visitors from dealing with an unknown technological device, which functioning has to be learned and that could represent an obstacle to the visit instead of a help.
- The web tool offered by MIX implies the creation of digital contents by the museum institution; however, the advantage in the creation of digital data goes beyond the use of the platform. The digital contents, in fact, can always be editing for specific purposes and disseminated through other channels.
- Concerning specifically the MIX platform, it represents a valuable tool for the implementation of digital museography, as it allows to update and edit the information quickly and easily, allowing also the testing of new museum itineraries, without affecting the set-up of the permanent exhibition. Moreover, as the editing and the upload of the contents do not require the intervening of a third part, it results in a greater flexibility of intervention for the museum staff.
- Flexibility concerns also the possibility to create thematic or customized itineraries in order to improve the visiting experience of a varied audience and the accessibility of knowledge. In the MIX platform, in fact, the same target can be augmented with different contents depending on the chosen itinerary.
- The user can further customize the visit experience, as through the app he is free to query the targets related to his interests, or, for example, only those related to unclear topics. This would result in a more exiting and involving experience, possibly fostering the access to the museum by the public.
- Besides, the use of digital application to integrate the museum exposition allows to track user's choices anonymously. Consequently, it produces valuable feedbacks, which will help in the formulation of further museological choices aimed at improving the communication and the fruition of the collection.

In conclusion, the results of the present study aims to point out that the integration of museum collection with digital tools, namely augmented reality, can operate and make a difference at multiple levels: in the exhibition designing, in the communication strategies, in the visit

experience and in the feedback analysis. According to the result of survey data, it might be possible to relate few things with digital exhibition. From the result it seems that, people like to relate their past by better understanding the present. That means the experimental archaeology can solve this. And here is main necessity of digital technology as well as digital exhibition. One fact is very clear that, all age of people now a days are being dependable on moveable digital technology. Like smartphone, tablet, laptop etc. On the other hand, reality is, it is not possible to have someone for all the time to perform experimental activities. So, digital exhibition can play a vital role. In digital exhibition, the museum authority can make some documentary about experimental archaeology like, knapping of stone tool, ceramics making, prehistoric ornaments making, prehistoric rock art experiment etc. So, with this study, taking account the survey data, an attempt has been taken to attract more people to museum by using digital exhibition.

As from result of survey, the dataset indicates one more thing which can attract more people by changing or updating of exhibition gradually. It might be change by different theme. Sometimes bringing new objects from another museum and sometimes send some of the objects to other museum can attract people to visit the museum.

Museum plays various roles in the society. The main domain activity of the museum is education, social care, tourism, science and heritage. Research suggests that museum networks have an important role in promoting local cultural heritage and raising awareness concerning local museums. However, up to this time local museum networks have not gone beyond the simple goal of marketing communication through events, guided tours, brochures and guides, and they are still too weak to be able to succeed in innovating the services their museums offer.

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ANNEX-I



Survey form Of the Museum

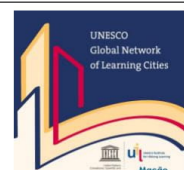
Sex		Age		Current Profession	
Address:		Year of study		Previous Profession	

Prehistoric Art Museum:	About the archaeological activities of the Museum and Instituto of Terra- Memoria:								
<p>1. Have you ever visited the Museum exhibition?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes. How many times _____ <input type="radio"/> No <input type="radio"/> If No what is the reason <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>i) Not aware about the museum ii) It was close iii) Do not have time</p> </div> <p>2. Which do you think is the main message of the museum? Rank the options from 1st to 3rd</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Cultural knowledge</td> <td style="width: 50px;"></td> </tr> <tr> <td>Archaeological information</td> <td></td> </tr> <tr> <td>Diversity of the landscape</td> <td></td> </tr> <tr> <td>None</td> <td></td> </tr> </table> <p>3. After you have visited the museum and had a favorable experience, is your response mostly based on?</p> <ul style="list-style-type: none"> <input type="radio"/> Exhibition design <input type="radio"/> Interaction with the Museum Guide <input type="radio"/> Specific piece of Art or exhibit in display. <input type="radio"/> The overall collection / exhibits <input type="radio"/> Other <p>Comments: Suggestion</p> <div style="border: 1px solid black; height: 20px; width: 100%; margin-top: 5px;"></div>	Cultural knowledge		Archaeological information		Diversity of the landscape		None		<p>1. Have you ever attend any archaeological activities?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No. <input type="radio"/> If no any specific reason <div style="border: 1px solid black; height: 30px; width: 100%; margin-top: 5px;"></div> <p>2. What did you learn from the activities?</p> <ul style="list-style-type: none"> <input type="radio"/> Ancient technologies <input type="radio"/> Relation of the present with the past <input type="radio"/> Reconstruction of past behavior <p>3. Which part of the activities did you mostly enjoy?</p> <ul style="list-style-type: none"> <input type="radio"/> Prehistoric rock art <input type="radio"/> Excavation/Prospection <input type="radio"/> Stone tools making/ knapping <input type="radio"/> Ceramics making process <input type="radio"/> Other. _Which? <div style="border: 1px solid black; height: 20px; width: 100%; margin-top: 5px;"></div> <p>Comments/ Suggestion:</p> <div style="border: 1px solid black; height: 30px; width: 100%; margin-top: 5px;"></div>
Cultural knowledge									
Archaeological information									
Diversity of the landscape									
None									

How do you rate your experience?

Excellent	Very good	Average	Weak	Low
-----------	-----------	---------	------	-----

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ANNEX-II



Questionário à população de Mação sobre o Museu

Sexo		Idade		Profissão atual	
Freguesia		Anos de estudos		Profissão anter.	

Sobre o Museu de Arte Pré-histórica e do Sagrado do Vale do Tejo em geral	Sobre as atividades arqueológicas do Museu e do Instituto Terra- Memória								
<p>1. Já visitou o Museu?</p> <ul style="list-style-type: none"> <input type="radio"/> Sim. Quantas vezes? _____ <input type="radio"/> Não <input type="radio"/> Se não, qual a razão? <div style="border: 1px solid black; padding: 5px;"> <p>i) Não tenho conhecimento da existência do museu ii) Estava fechado iii) Não tive disponibilidade</p> </div> <p>2. Na sua opinião qual é a principal mensagem do museu? Classifique as opções de 1 (mais importante) a 3 (menos importante).</p> <table border="1" style="width: 100%;"> <tr> <td>Conhecimento cultural</td> <td></td> </tr> <tr> <td>Informação arqueológica</td> <td></td> </tr> <tr> <td>Diversidade da paisagem</td> <td></td> </tr> <tr> <td>Nenhum</td> <td></td> </tr> </table> <p>3. Depois de ter visitado o museu e de ter tido uma experiência favorável, a sua resposta baseia-se principalmente em?</p> <ul style="list-style-type: none"> <input type="radio"/> Design (aspeto geral) da exposição <input type="radio"/> Interacção com a pessoa que guiou a visita <input type="radio"/> Peça de arte específica em exposição <input type="radio"/> A coleção/exposições em geral <input type="radio"/> Outros <p>Comentários/Sugestão:</p> <div style="border: 1px solid black; height: 20px;"></div>	Conhecimento cultural		Informação arqueológica		Diversidade da paisagem		Nenhum		<p>1. Já participou em alguma atividade arqueológica?</p> <ul style="list-style-type: none"> <input type="radio"/> Sim <input type="radio"/> Não <input type="radio"/> Se respondeu não houver alguma razão específica? <div style="border: 1px solid black; height: 30px;"></div> <p>2. O que aprendeu com as atividades?</p> <ul style="list-style-type: none"> <input type="radio"/> Tecnologias antigas <input type="radio"/> Relação do presente com o passado <input type="radio"/> Reconstrução de comportamentos passados. <p>3. Que parte das atividades gostou mais?</p> <ul style="list-style-type: none"> <input type="radio"/> Escavação/prospecção <input type="radio"/> Arte rupestre pré-histórica <input type="radio"/> Fabricação de instrumentos em pedra lascada <input type="radio"/> Processo de fabrico de cerâmicas <input type="radio"/> Outro. _Qual? <div style="border: 1px solid black; height: 20px;"></div> <p>Comentários/Sugestão:</p> <div style="border: 1px solid black; height: 50px;"></div>
Conhecimento cultural									
Informação arqueológica									
Diversidade da paisagem									
Nenhum									

Como avalia a sua experiência, em termos gerais?

Excelente	Muito bom	Bom	Suficiente	Fraco
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