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## META-MUSEUM

*Moving **E**motions towards confidence in the **T**ransformative  
**A**ppropriation for a **M**eaningful **U**nderstanding of cultural  
heritage: a neuro**S**cientific approach to **E**uropean **M**useums*

### DELIVERABLE D6.1

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**DISSEMINATION LEVEL**  PU - Public  SEN - Sensitive

**TYPE**  R - document, report  DMP - Data Management Plan  
 DATA - Data sets, microdata, etc  DEM - Demonstrator, prototype  
 OTHER

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## LIST OF ABBREVIATIONS

ACRONYM	DESCRIPTION
AP	Associated Partner
CH	Cultural Heritage
TMt	TransforMEANS theory
GA	Grant Agreement
WP	Work Package
Dn.n or DEL	Deliverable
MAC	Museu d'Arqueologia de Catalunya
GA	Grant Agreement
P1	Pilot 1
Tn.n	Task
EEG	Electro Encephalographic (device)
GSR	Galvanic Skin Response (device)
WP	Work Package
SD	Standard Deviation

## RELATED DOCUMENTS

Related Documents	Location
D1.2 Ethics Management Plan	<a href="#">Del 1.2 submitted.pdf</a>
D2.1 - TransforMEANS Theory (Version1)	<a href="#">DEL 2.1_TMt 1st version.pdf</a>
D2.3 – General Assessment and Interpretation Model	<a href="#">300525 KMOP D2.3 FINAL.docx</a>
D3.1 Data collection and sensors selection	<a href="#">D3.1 Data Collection and Sensors Selection.pdf</a>
D4.1 – Scoping document of design briefs	<a href="#">D3.1 Data Collection and Sensors Selection.pdf</a>
D5.1 – Protocol for the assessment of confidence and wellbeing	<a href="#">DEL 5.1.pdf</a>

## FRAMEWORK

### 1. Reference to WP and tasks as described in the DoA

WP6: *P1: experimentations in Museums*

Tasks: *T6.3 Status quo measurements implementation and T6.4 Status quo interpretation and assessment*

### 2. WP6 and task T6.3 and T6.4 objectives:

WP6 aims at performing experimentations in the AP museums (MAC, MUSEOPARC ALESIA, MUSEO EGIZIO), implementing Pilot 1, collecting related data through various devices and modalities, and encouraging co-creation activities.

D6.1 is related to task T6.3 and T6.4 which are described as the implementation of the status quo measurements in Associated Partner (AP) museums and the following interpretation and assessment of results.

#### Linked tasks

T2.2: Samples composition

T2.3: General assessment and interpretation Model

T2.4: Questionnaire design

T2.5: Development of subsequent and increasingly refined versions of TMT

T3.2: Sensors selection and data collection

T4.1: Design Brief scoping

T4.2: Digital prototypes

T4.3: Physical prototypes

T5.1: Definition of psychometric and physiological quantitative assessment

T6.1: Approval from Ethical Committee

T6.2: Technical surveys in museums

    T6.3: Status quo measurements implementation

    T6.4: Status quo interpretation and assessment

T6.6: P1 implementation

T7.3: Status quo and P2 implementation

T8.5: P3 implementation

## 1. Introduction

Recalling the general scope of META-MUSEUM in developing ways of communicating Cultural Heritage (CH) that can move the public and engage them personally, the overall methodology of the project is based on a strong interaction between theory and an experimental backbone:

- a **theoretical framework** is being developed in an iterative process throughout the project implementation, aiming at designing principles for transformative cultural experiences, to make people perceive CH in an empathic way, understanding its transformative nature and increasing confidence and resilience (see WP2, in particular D2.1 for the first version of the TransforMEANS theory – TMt, that can be considered as starting point.)
- the **experimental core** of META-MUSEUM aims at investigating neurophysiological parameters and cognitive responses, *i.e.* how people are emotionally involved, confident and resilient during different cultural experiences (WP5, Pilot 1 - WP6, Pilot 2 - WP7, and Pilot 3- WP8) (Figure 2).

Within the frame of WP6, two campaigns of measurements have been forecasted for each AP museum: the *status quo* (T6.3), where the participants' responses (emotional and cognitive) have been monitored and measured without inserting any further stimuli in respect of the current museum exhibit; in a second session (T6.6), participants will be instead offered cultural experiences through various prototypes developed within WP4 in accordance to the TMt, to offer narrative solutions and participatory experiences and generate empathic responses in visitors.

In this regard, the Deliverable 6.1 aims at presenting the first experimental phase in museums (*status quo*) and describing the main results emerged. In particular, D 6.1 is related to measurements of the existing situation carried out in the exhibit spaces of the three AP museums: Museo Egizio, Museu d'Arqueologia de Catalunya (MAC-Barcelona), and MuséoParc Alésia.

The measurements collected various types of data: cognitive responses to cultural stimuli, and neurophysiological data, movement trajectories, and gaze location, using the following wearable devices:



Mindtooth EEG headset



Shimmer 3 GSR+ device



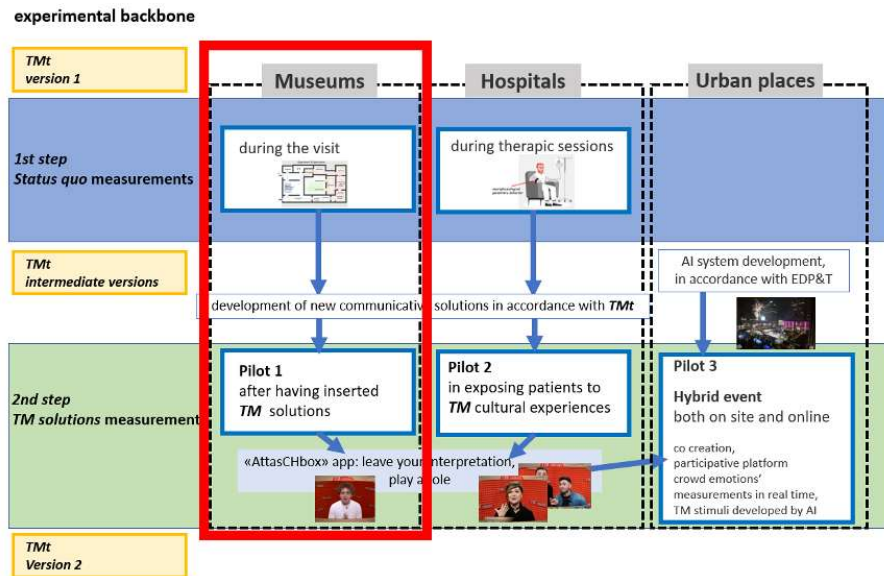
Tobii pro 3 eye tracker



Ultra-wide-band (UWB) tag

**Figure 1:** wearable devices

Further details regarding neurometrics and physiological indices have already been described in Deliverable 5.1 - *Protocol for the assessment of confidence and wellbeing*, while full description of devices used in the experimental phases can be found in D3.1 - *Data collection and sensors selection* and D2.3 - *General Assessment and Interpretation Model*.



**Figure 2:** Experimental backbone of META-MUSEUM

## 2. Preliminary steps

### 2.1 Ethical Committee approval

As declared in the GA and D1.2 - *Ethics Management Plan*, the Consortium ensures that appropriate standards of research ethics, research integrity, and privacy are respected throughout the project and in all its activities. All experimental protocols follow ethical standards and applicable international, EU and national laws. According to the Declaration of Helsinki for activities involving humans, Partners defined the protocols and informed consent specific for experiments to be carried out within WP6 in museums (T1.5). These documents have been sent to Research Ethics Committee of Politecnico di Torino for approval, which was obtained on the 26th February 2025 (Protocol number: 18069/2025).

### 2.2 Technical surveys in museums and dialogue with museums staff

Technical surveys at the three AP museums have been carried out in the first months of the project (T6.2). In particular, the visit at Museo Egizio took place during the Kick-off meeting (October 2024). Surveys at MAC-Barcelona and MuséoParc Alésia have been organized in November and December 2024, according to the museums availability and needs. POLITO, UNI JENA, OPI-PIB and NCK teams, together with the personnel of AP museums, have visited the collection and exhibits, shared impressions and ideas to design the *status quo* measurements (T6.3). The participation and precious support provided by the museums' staff have been vital for the development of the next phases of the work.

The survey at **Museo Egizio** took place on 15<sup>th</sup> October 2024, with all the Consortium during the Kick-off meeting in Turin. An additional survey has been conducted in January 2025 with POLITO team and Dr. Ying Sun (UNI JENA).

Museo Egizio of Turin, founded in 1824, is one of the most important museums in the world dedicated to ancient Egyptian civilisation. The museum offers a comprehensive overview of the culture and daily life of ancient Egypt, thanks to a rich collection of over 3,000 objects displayed along a 4-floor visit route, covering over 12,000 square metres.

During the site visit, museum staff guided the Consortium through the collection, starting with the newly opened section “Materia. Forma del Tempo” (Materials. The shape of time) (Figure 3).



**Figure 3:** The Consortium visiting the Museo Egizio during the KoM

The Consortium had the chance to visit most of the museum collection, with a particular attention to rooms related to Deir el-Medina village (Room 6) and Tomb of Kha and Merit (Room 7). The survey in Museo Egizio was seen as an interesting opportunity to involve the Consortium in a first short experimentation (Figure 4). With the support from curators, the tomb of Kha was identified as a suitable case-study to be tested thanks to a short video depicting the virtual unravelling of bandages while a voiced-over comment illustrated the history of Kha and the importance of amulets in Ancient Egypt. In particular, Partners had the chance to familiarize with the transformative nature of CH thanks to the scarab amulet placed on Kha’s heart. The video ended with a question to the audience, inviting them to think of an object they would carry on their hearts forever. All participants answers were then collected in a word-cloud (Figure 5).



**Figure 4** – The Consortium taking part to the co-creation activity



**Figure 5** - Wordcloud created by participants, in answering to the question:  
 "What will you carry on your heart for eternity?"

This small experiment showed how a simple object allows visitors to reflect on what modern time intends for the hereafter, but above all to reflect on one's present life. Further details and results of this participatory activity can be found in D2.1.

Among the outcomes of the site visit and in preparation of the experimental phase, attention was focused on the Deir-el Medina room, as it depicts daily life in the village, with objects also related to work and religion, and where death suggestions seem less prevalent. In fact, for reasons related to the Ethics Committee recommendations, the experiments could not involve human remains, excluding all mummies from the array of suitable artifacts. In particular, here some partners expressed interest in a vitrine displaying the *Strike Papyrus*: an administrative papyrus reporting the news of a strike that took place during the reign of Ramses III (1190-1077 BC), probably the most ancient strike in the history.

The exceptional richness of the collection and the highly scientific content of the information appeared to researchers to be both a strength of the museum and, from the visitors' perspective, a difficulty: for a less expert audience, there is a risk of becoming disoriented amid so many significant pieces and so much information. The audio guide can only partially compensate for this. Firstly,

because (like all audio guides) it excludes the social dimension of the visit; secondly, because - although it offers different lengths depending on the time available to visitors - it is very detailed and requires considerable attention, which is often incompatible with the well-known phenomenon of “museum fatigue”. Finally, the uniformity of the layout does not help to identify pieces or groups of pieces, and certainly does not support memorisation.

The survey at **MuséoParc Alésia** was held on 17<sup>th</sup>-19<sup>th</sup> November 2024 with researchers from POLITICO, UNI JENA, OPI-PIB and NCK.

MuséoParc Alésia, built on the plain of Alésia (Figure 6), relives the history of this territory, from ancient times to present days, thanks to a collection of more than 600 artefacts and interactive and multimedia devices, including film (sound design, illustrations, 3D), animated characters, soundscapes, 180° screen, models, mapping, manipulations, digital immersions, etc. The museum is divided into eight sections, and the visit follows a chronological order: from prehistory to the XX century (Figure 7). The visit starts with an immersive video where holograms depicting ordinary citizens go over a few stereotypes about ancient Gauls. Along the path, visitors can then learn about the Gallic tribes who settled in Alesia and the famous battle of Alesia (52 BC), which saw Vercingetorix and Julius Caesar clash (Figure 8). A section is dedicated to the confrontation between the Gauls and the Romans and discovering the daily life of Roman army. Finally, visitors take a leap back in time to the 19th century. The bust of the third emblematic figure of the site, Napoleon III, evokes the forgotten rediscovery of Alesia. Coming up to the last century, visitors enter the last permanent section, dedicated to the myth of the Gauls.

As previously agreed with MuséoParc staff, researchers got the chance to visit the collection without their guidance to avoid any influence on the experience. Following the visit, all participants reunited for discussion on impressions and inputs for future implementation of experiments with museum mediators. Some elements to further reflect on were identified together with museum staff:

- In relation of the introductory movie in the first room, museum curators informed that actors appearing in the movie are famous French actors (comedians), negatively affecting the audience’s perception of the content.
- What could be problematic or represent a weak spot in the exhibition? Following the discussion, Partners agreed that the section right after the battle could improve by adding elements for reflection such as:
  - How do people recover after a disaster?
  - Crises are handled by people through what seems to be a universal chain of emotions: shock, denial, rage, coping/repairing, and re-orientation. Are there things for the visitor to relate to?
  - Is there archaeological evidence or additional information that could be added to the story about what happened immediately after the battle in Alésia?



**Figure 6 – Partners entering MuséoParc Alésia**



**Figure 7 - MuséoParc Alésia exhibit and collection**



**Figure 8 – Video about the Alesia siege**

The survey at the **Museu d'Arqueologia de Catalunya** (MAC-Barcelona) was held in Barcelona on 9<sup>th</sup>-11<sup>th</sup> December 2024 with delegates from POLITO, UNI JENA, OPI-PIB and NCK (Figure 9).

MAC in Barcelona houses the management and central services of the Museum of Archaeology of Catalonia. Currently the permanent exhibitions are dedicated to presenting the historical roots of Catalonia, from prehistory to the early Middle Ages, framing them in their European and Mediterranean dimension. Considering the upcoming transformation of the museum exhibits, the team supported by MAC curators and staff decided to focus on the newly inaugurated exhibition *IMPERIVM. Històries romanes*. This permanent exhibition narrates what it was and what political, economic, social and cultural traits structured the Roman Empire, based on the presentation of more than 200 objects from the Roman and late antiquity periods that are preserved in the Museum. The exhibition incorporates video mapping, 360-degree immersive video and numerous state-of-the-art audiovisual resources. *IMPERIVM* exhibition is distributed over two floors in a double-height hall, marked by a strong deep red and consistent aesthetic gesture, giving the exhibition a clear identity (Figure 10-11). The visit alternates between large screens with videos featuring actors dressed in Roman costumes (audio guides are available at the museum entrance) and artefacts inside and outside display cases (Figure 12). Characters in videos were chosen to highlight different aspects of Roman life, such as a married couple debating the pros and cons with being part of the Roman empire, a female slave trader in Alexandria, and a male gladiator who accepted his fate to live and die in the arena.



**Figure 9 – Partners in visit at MAC-Barcelona**



**Figure 10 – IMPERIVM exhibit – Ground Floor**



**Figure 11 - IMPERIVM exhibit - Upper Floor gallery**



**Figure 22 – Large screens with videos featuring actors dressed in Roman costumes alternate with displays of artefacts.**

Through a brief introduction of MAC director and staff, the META-MUSEUM team was informed about plans to renovate some sections of the museum. Researchers went through the exhibition like an ordinary visitor with no additional guidance from staff other than the information received upon arrival at the museum. After about two hours in the exhibition, the team was joined by the MAC staff to discuss impressions and points for reflection, as follows:

- IMPERIVM is a comprehensive exhibition which takes about two hours to go through; such duration is incompatible with experimental needs, for this reason the design should construct an experience targeting a smaller selection of installations and objects.
- Researchers felt that the pillar of the exhibition might not be the objects, but the ten videos with made-up characters from the Roman era. In particular, “hotspots” or most popular parts of the visit were the video about the mosaic of the circus, the Proserpina sarcophagus and the video with the bickering spouses (POPULUS section).
- The audio description of videos throughout the exhibition on the audio guides were in Catalan and not yet translated into English during the survey, which affected the overall experience even though translation was available in the closed caption. Luckily, in the following months, translations were available for the implementation of the *status quo* measurements.
- Many visitors tended to crowd in front of the introductory video, leading to someone missing it or feel like they were in the way.
- Videos aim at showing visitors that they still are the same kind of people as the ancient Romans, but most of the videos are fictional and lack a direct connection and interaction with the audience, as well as a direct link to the exhibits. Researchers wondered if they were overshadowing the actual exhibits.
- The final video was judged as one of the clearest ending points of an exhibition ever seen by many of the team – often time the museum visitor mostly is sent off from an exhibition without a final word or a call for reflection. The ending film could feel depressing to some, but others interpreted it as a tribute to resilience – objects crumble, but people adapt over time to new situations and life ultimately carries on.

### **2.3 WP6 internal workshops, paving the way for the *status quo* measurements**

Each measurement session has been preceded by a dedicated workshop to highlight the values/topics/objects to focus on.

The WP6 workshops were based on ideas developed earlier in the project, especially in WP2 (D2.1 – *First version of the Transformative Museum theory*, TMt) and WP4 (D4.1 – *Scoping Document of Design Briefs*). The META-MUSEUM project sees CH as something that can help people feel more confident, connected, and resilient — especially in today’s uncertain world.

TMt is grounded on several assumptions: CH can foster human growth; cultural experiences should be “transformative encounters”; the role of emotions is crucial; both narratives and spatial environments affect visitors’ responses.

The foundations for prototype design, to be developed in WP4, built on this by creating early versions of visitor experiences, drawing on insights from previous EU projects (such as GIFT and EMOTIVE), museum surveys, and participative workshops. The WP6 workshops on the storyline of experimental interventions used these foundations to explore how to create engaging visitor experiences that could enhance visitors’ confidence and resilience. The goal was to identify the most promising narratives and themes within the exhibition content of each AP museum, which could be used to design experiences in line with the META-MUSEUM project’s objectives.

The main aim of the WP6 workshops was to turn the ideas and theories developed in earlier stages of the project into practical and testable visitor experiences. These workshops focused on creating early designs for experimental interventions that could later be evaluated in real museum settings.

The key objectives were:

- To explore how the TransforMEANS theory (TMT) could be applied in practice;
- To co-design transformative and emotionally charged experiences for museum visitors;
- To select stories, topics, and tools that fit the needs, approach and context of each museum;
- To define expected outcomes — especially how the experiences might improve confidence, empathy and resilience, and personal reflection.

The workshops were organised and facilitated by OPI-PIB, with around 20 participants taking part, representing project partners involved in WP2, WP4, WP5, and WP6. The group included researchers, designers, museum professionals, and other team members contributing to the development and testing of the prototype experiences. Three online workshops were organized — one for each AP museum taking part in the project. Each session lasted about 3 hours and was held using Microsoft Teams and the Miro platform.

- **March 31, 2025** – Workshop for Museo Egizio
- **April 14, 2025** – Workshop for MAC Barcelona
- **April 28, 2025** – Workshop for MuséoParc Alésia

Each of the three WP6 workshops focused on one museum and aimed to develop early concepts for experimental visitor experiences. The goal was to identify the values behind the objects/stories, emotional themes, and design directions that could later be turned into testable interventions. All workshops followed a similar structure, using guided discussions and collaborative work on Miro boards.

At the **Museo Egizio**, the workshop focused on the well-known "Strike Papyrus", which describes one of the earliest recorded workers' strikes in history. Participants worked in two separate groups, and although they explored the topic independently, both groups highlighted similar themes. The strike was seen not only as a historical fact but as a powerful story of courage, unity, and resistance in the face of injustice.

Discussions suggested that this story still resonates today. Even in a strict and hierarchical society like ancient Egypt, ordinary people found the strength to speak out and take collective action. It was a moment of desperation, but also of dignity and solidarity. The team explored the potential of developing a visitor experience focused on the idea of empowerment through unity — helping visitors reflect on the power of organized action and the values behind it.

Possible directions included an immersive sound experience simulating the atmosphere of the strike, interactive elements such as polls or open questions, and comparisons to modern protest movements. These ideas, even in an early development phase, already shaped an initial concept that connects past struggles with present-day emotions and reflections. Evaluation would focus on visitor confidence and beliefs about collective strength.

The second workshop focused on the *IMPERIVM* exhibition at **MAC Barcelona**, which combines Roman-era objects with video portraits of fictional Roman citizens, played by actors in period clothing. Participants discussed the exhibition's dual structure — with physical artefacts on one side and video narratives on the other — and explored how these elements could be better connected through visitor experience design.

Several key themes and values emerged during the session, including freedom, courage, empathy, and colonization, as well as the parallels between ancient Roman society and the challenges of today's world. Participants noted that visitors may find the separation between objects and videos confusing, especially if they skip the first video near the entrance, which explains the exhibition's concept. Making this structure clearer from the beginning was identified as a potential improvement point for future interventions.

Discussions also explored the meaning of freedom and courage in both Roman and modern contexts. The Roman idea of freedom was often tied to legal status and social hierarchy, while today it is more connected to personal choice and human rights. Similarly, courage in Roman times might have meant fighting in the arena or on the battlefield, whereas in modern life it might involve standing

up for justice, identity, or personal values. These contrasts offered rich ground for reflection and storytelling.

To help visitors engage more deeply with these themes, one idea was to introduce “character cards” — short fictional profiles of Roman individuals — that visitors could carry with them during their visit. These cards would prompt them to reflect on how that person might view the exhibition, and how their life connects to the values on display. Another idea was to begin with contemporary social issues such as migration, inequality, or discrimination, and use them as entry points to draw comparisons with Roman experiences.

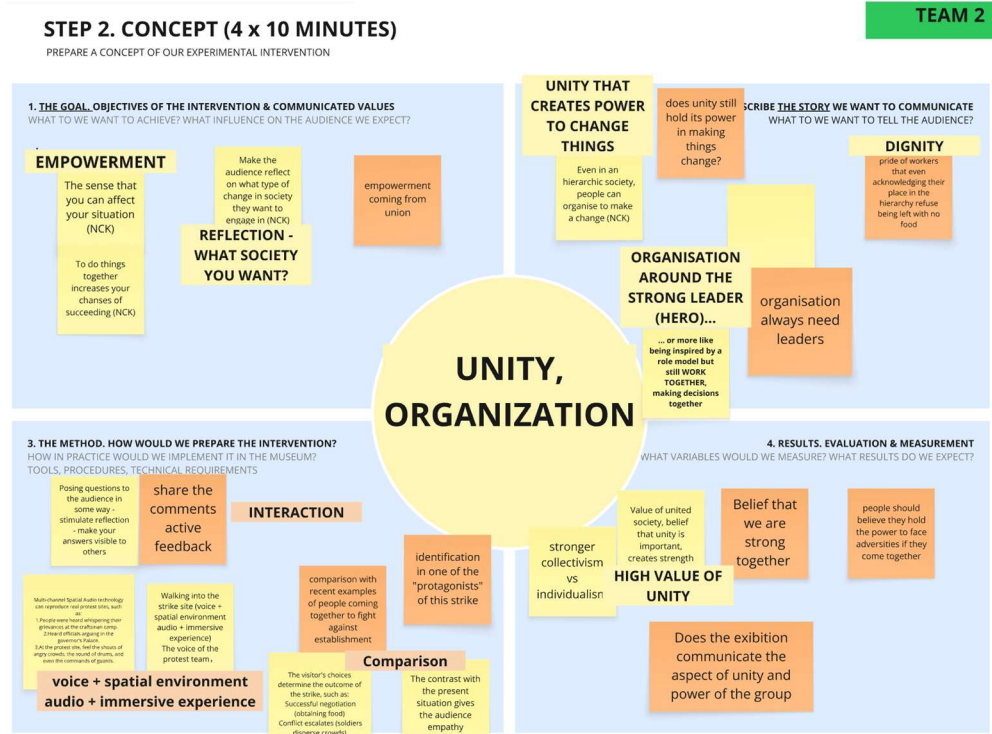
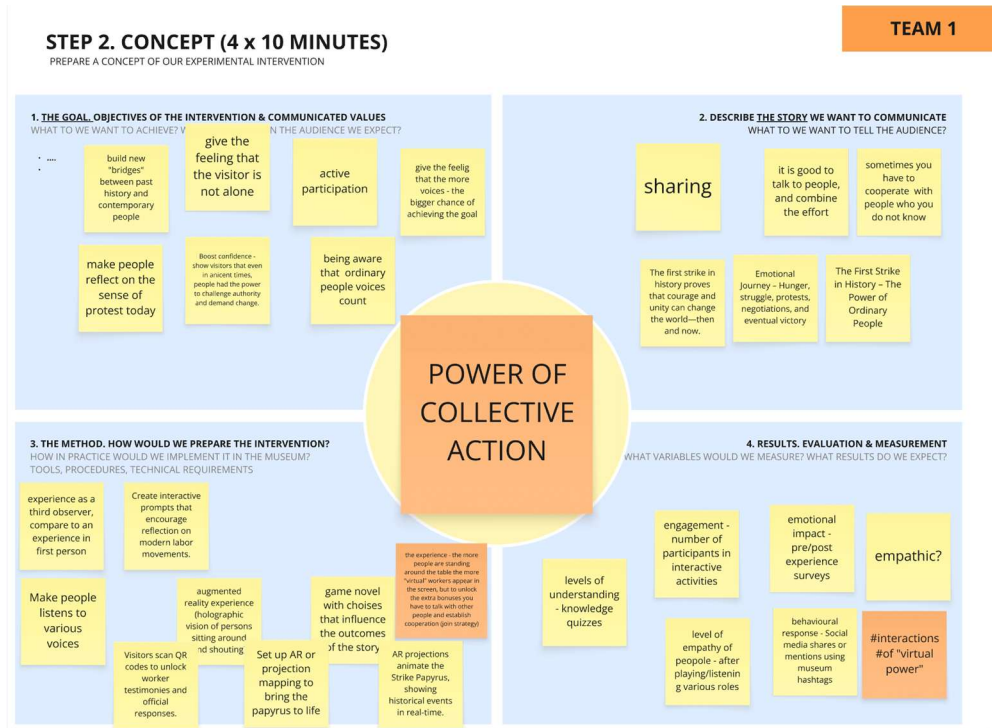
These early ideas pointed toward an intervention that would invite visitors to reflect on what freedom, courage, and belonging mean — both now and in the past — and how those values shape our personal and collective stories.

The third workshop focused on the powerful story of the Battle of Alesia, viewed primarily from the perspective of the Gauls at **MuséoParc of Alésia**. Rather than celebrating military success, participants explored the emotional and human dimensions of the event — particularly resilience, sacrifice, cultural identity, and the experience of loss. The goal was to move beyond traditional narratives of conquest and instead reflect on what the Gauls’ defeat might teach us today. The discussion revealed many potential directions. The story raises complex questions: *What happens when we fail, even if we did everything right? What does it mean to sacrifice for a cause? How do we carry on after defeat?* The group also considered how cultural identity can be both a unifying force and a source of strength in difficult times.

Another theme that emerged was cultural exchange, recognising that Roman and Gallic societies influenced each other, even in the aftermath of war. While the Romans brought new laws, infrastructure, and technologies, they also absorbed aspects of Gallic culture. This blend of influences challenges the idea of one-sided victory and opens space to talk about multiculturalism and heritage in a more nuanced way.

Participants also reflected on why the story of Alesia remains so memorable. It features strong leaders, dramatic turning points, high emotional stakes, and an uncertain outcome until the very end — all elements that give it lasting impact. Based on this, one possible direction for the intervention would be to invite visitors to retell the story in their own words, focusing on what stood out to them or what moved them most. Open-ended prompts and reflective questions could help visitors explore their own values and emotional responses. Overall, the workshop highlighted the potential for using the Alesia narrative not just as a military history, but as a transformative story — one that encourages reflection on loss, learning, and identity in both past and present contexts.

Below are screens of filled in templates, summarizing participants work at the workshops.  
**Workshop on Museo Egizio (March 31, 2025)**





Eventually, the workshops helped shape the goals of the experiments to be held in museums — especially around emotions like confidence, resilience, freedom, and belonging. These ideas guided the design of a *status quo* questionnaire given to visitors before and after their visit to the exhibition. During the workshops, a common direction emerged across all three AP museums: a focus on themes like **unity, courage, and facing challenges**. Participants agreed that the experiences should feel relevant to the challenges of the modern world and be emotionally engaging — helping visitors feel, reflect, and connect with the stories in a deeper way.

Based on this, we decided to include in the questionnaire a set of key dimensions to be measured as part of the *status quo* assessment:

- Confidence — both personal (*how I see my own future*) and social (*how I see the future of society*)
- Emotional engagement — including feelings of hope, empathy, empowerment
- Sense of relevance — whether the exhibition felt personally meaningful
- Reflection and interpretation — how visitors relate the past to their own lives today
- Knowledge — self-assessed knowledge of the exhibition topic

These focus areas helped define the structure of the pre- and post-visit questionnaire, ensuring that outcomes could be measured consistently across all three museums participating in the META-MUSEUM project.

### 3. “*Status quo* measurements” design

The experimental protocols have been developed in accordance with the Declaration of Helsinki and relevant European Union regulations. They will be compliant with the requirement to minimise the amount of personal data collected and the GDPR requirement to ensure data security.

The preliminary phase of experiment design requested the preparation of the necessary documentation required by the Ethic Committee (Information Sheet and Informed Consent form – see Annexes). To ensure language accessibility, and avoid discrimination or difficulties, all documentation provided to participants (including questionnaires) was made available in the language of the country where the experiment took place (Italy, France, Spain) as well as in English. Sample composition aimed at reaching a variety of population, over 18 and balancing female and male volunteers, and including frequent and occasional visitors, but also non-visitors. For the recruitment, MuséoParc Alésia and MAC-Barcelona have successfully launched online campaigns about a month before implementation of the measurements to reach a wider participation. In case of Museo Egizio, Polito team significantly collaborated in recruiting volunteers.

#### ***More in-depth discussion:***

*The sample size for WP6 measurements was calculated using G-Power 3.1 software based on data reported in previous studies [1] which used the same type of devices and similar neurometric measures. Considering the Emotional Index of their work, which will also be used as the primary outcome in this project, and assuming an effect size similar to theirs, i.e. 0.8, for a 2-tailed paired sample test, setting the alpha significance level at 5% and the test power (1-beta) at 95%, a minimum number of 23 subjects is obtained for each test. Considering a 30% drop-out rate and possible data affected by movement artefacts that cannot be removed in post-processing, the sample size is 30 subjects for each of the museums. As there are three museums, the total sample size is 90 subjects. Further, according to the a priori power analysis conducted in D2.3 using G-Power 3.1 software, a total of 54 participants per site is needed to achieve a statistical power of 0.95, assuming a small to medium effect size of  $f = 0.15$  in a repeated measures design within-subject interactions, with an alpha level of 0.05 and psychometric measurements taken at baseline and follow-up.*

To account for an anticipated dropout rate of around 30%, it was suggested to recruit at least a total of 70 participants per site. This number of participants was reached at all sites (see section 5.3): Egizio (138) MAC (95) and Alesia (78).

**The experimental protocol layout for all measurements conducted within WP6 has been defined by the partners involved, as follows:**

- After a brief description of the objectives of the study, participants receive the Information Sheet with all details (Annex 1), and, if they agree in taking part to the study, sign an Informed Consent module (Annex 2);
- Researchers provide them with an alphanumeric ID code to protect the participants' identity and anonymize subsequently collected data;
- Participants are asked to:
  - fill out a short questionnaire before the measurements;
  - wear the devices, supported by the researchers;
- Neurophysiological measurements start with a baseline: subjects are recorded at rest;
- Participants are accompanied on a short visit of selected rooms of the museum (15-20 minutes);
- At the end, a second and final measurement at rest is recorded (second baseline);
- The wearable devices are removed;
- Participants fill out a post-experience questionnaire.

According to the specifics of each AP museum, three protocols have been created with more details to describe precisely the elements of interest identified by researchers and curators for each measurement campaign. In particular, neurophysiological signals were divided in different tasks, corresponding to specific rooms or vitrines where recordings were carried out. Depending on each case, described in the following paragraphs, subjects have been asked to perform the experiment in different conditions and wearing one or more devices. Indeed, participants were divided in two main clusters: one group wore both the Mindtooth EEG headset and Shimmer device for computing the Skin Conductance Level (SCL), while another group only wore the Shimmer. In the Museo Egizio measurements, a third group wore the Eye Tracker device.

The **questionnaires** submitted to participants were developed as part of T2.4 and, split into pre- and post-experience parts. Items and topics included only in the pre-experience questionnaire:

- Socio-demographic variables
- Assessment of the frequency of visits to museums or art galleries
- Assessment of the importance of culture in the respondent's life
- The TIPI Big Five scale, assessing personality across 5 dimensions [2]

Items and topics included in both the pre- and post-experience questionnaires were:

- The General Confidence Scale, assessing the respondent's level of confidence [3]
- Assessment of expectations regarding the museum visit
- Assessment of emotions – anticipated before the visit and evaluated after the visit
- Self-assessed knowledge about the exhibition
- Assessment of confidence in one's own future and the future of society

Measurements included only in the post-experience questionnaire:

- Evaluation of the exhibition's attractiveness using the 8-item Perceived Beauty Scale [4]
- Evaluation of Generic Wellbeing based on Thomson & Chatterjee, 2014 [5]
- Assessment of personality along the dimensions of Individualism – Collectivism [6]
- Open-ended questions

Although the structure and content of the questionnaires remained substantially the same across the three data collection campaigns, some specific open-ended questions were designed for each museum and included in the post-experience questionnaire. They are described in the next paragraphs.

When designing experimental protocols some technical and logistic constraints emerged. For instance, the use of Mindtooth in similar experiments, due to factors relating to both technical aspects and the physiological needs of participants, requests a fixed time maximum duration, not to compromise the quality of measurements. For this reason, experiments can never exceed 45 minutes, both because prolonged wearing of the helmet might cause discomfort and because the sponges placed on the electrodes may dry out. Furthermore, according to the devices availability, the experiments had to be conducted with only three participants at a time.

### 3.1 Experimental protocol at Museo Egizio and research hypothesis

According to technical surveys outputs and further reflections among partners, *status quo* measurements campaign at Museo Egizio was focused on two rooms of the first floor: room 6 – Deir el-Medina and room 7 – Tomb of Kha and Merit. According to the protocol, some elements of interest (*tasks*) were identified to carry out the neurophysiological data collection:

- 1) the **Strike Papyrus** displayed in Room 6: according to researchers' hypothesis most of visitors do not usually see this artefact, displayed together with other papyruses. Even those who see it might not be particularly interested and/or have strong emotional response. Finally, researchers believe that the Strike Papyrus might not be considered one of the most memorable objects of the room (Figures 13-14).
- 2) The **threshold of Deir el-Medina room** (Figure 15), where to make a short neurophysiological measurement (10 seconds) before the participant start exploring the room, to investigate if there is a surprise effect. Researchers hypothesise that the surprise effect will be modest, the cognitive effort will be quite high, and the emotional involvement will be modest.
- 3) **Overall visit to Room 6 and Room 7:** combining neurophysiological indoor positioning data aim at detecting "hotspots" in the visit route. According to researchers' hypothesis the comparison between the values recorded at the beginning of the visit and those at the end might show a decrease in activation and an increase in fatigue, moreover, it is expected that there is no main route followed by the majority of visitors, but rather a fairly random exploration.



**Figure 33** – Room 6 – Deir-el Medina village. In the circle: the Strike Papyrus



Figure 44 – Strike Papyrus (front and back)

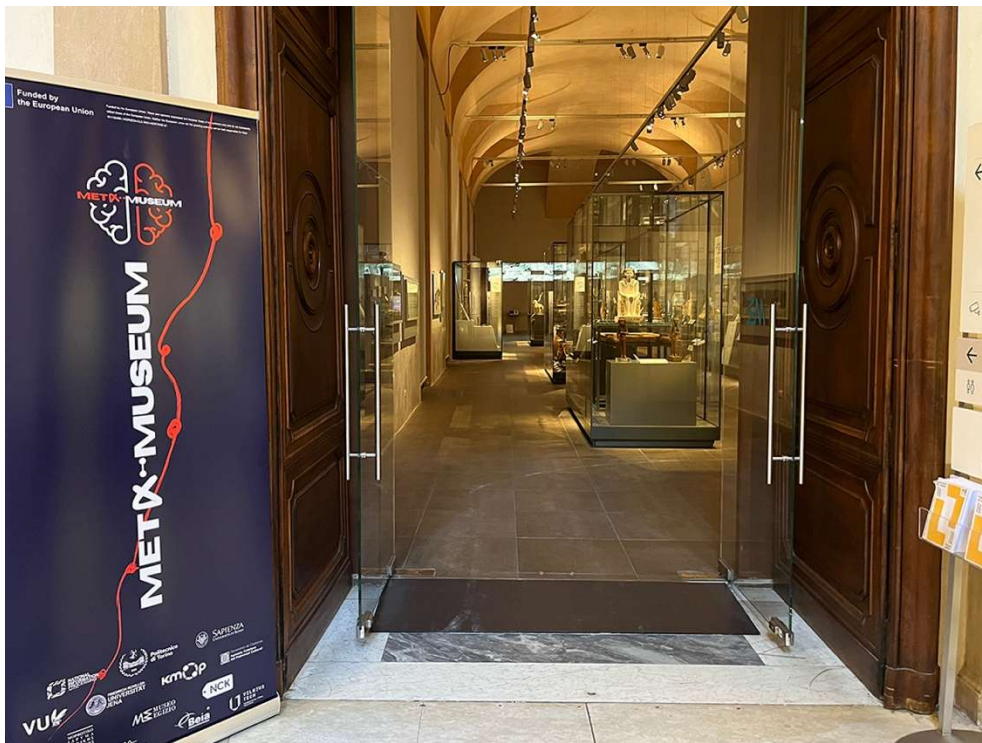


Figure 15 – Room 6 threshold

Sample was divided in two groups: participants wearing Mindtooth and Shimmer visited room 6 (15 minutes max), while participants wearing only Shimmer visited both room 6 and room 7 (20 minutes max). In both cases, participants were asked to freely visit the room(s) assigned and movement trajectories were recorded with UWB devices that they were asked to carry on them. Furthermore, among those who wore only Shimmer, some participants were asked to wear the eye tracker as well.

Questionnaires have been translated in Italian and English and an open-ended section of the questionnaire, containing three questions, was inserted at the end, to better investigate the to the core components of the project investigation (empathy – resilience – confidence):

- “*Did you identify with any of the stories you encountered in your visit?*”
- “*Did you encounter anything that could still be current?*”
- “*What would you want today that Egyptians had?*”

An additional section of the questionnaire was included to test for exhibit effectiveness and memory retention in subjects who went through room 7. After the open-ended questions section, a Y/N question asked participants if they had memory of seeing historical pictures hanging in the rooms; a negative response terminated the questionnaire while a positive one prompted to an additional set of questions enquiring about pictures topics and recognition. For those who wore it, results were compared with data from the eye tracking equipment.

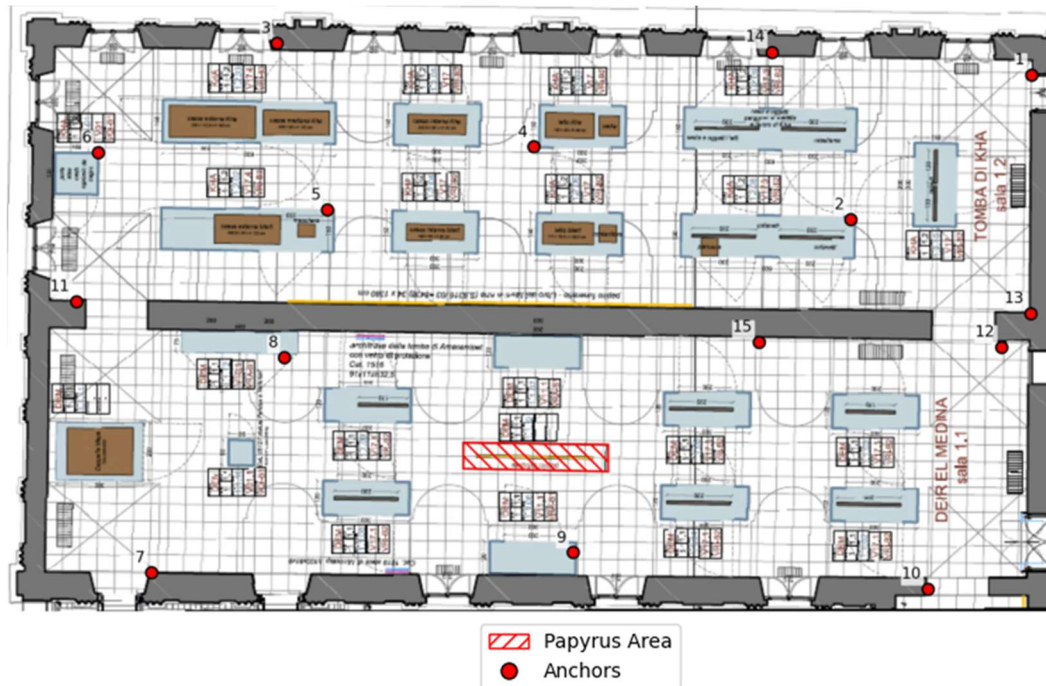
**Eye tracker tests.** Some additional tests were carried out in Museo Egizio using a Tobii pro 3 eye tracker with an attached registration box, and Shimmer skin conductance sensor. The course of an eye tracker subjects’ participation in the experiments began with a one-minute baseline calibration in which the subject was instructed to stand and look at a blank white wall for one minute. After the baseline, the participant was asked to maintain their gaze to the floor and led to the threshold of Room 6. Upon entering, they were instructed to stand in the corner near the entrance and look into the room without moving, then they were given 20 minutes to visit room 6 and room 7. The participants were left to roam freely during the 20 minutes while within a 10-meter radius from the researcher carrying the computer used for acquisition from the eye tracker glasses. After 20 minutes, the participant was stopped and invited to leave the exhibit maintaining their gaze down to the floor while chaperoned by one of the researchers. Upon exiting the participant was asked to repeat a baseline measurement looking at a blank wall for one minute, then was dismantled and released to complete the post-visit questionnaire.

The expected results were the recorded videos which highlight the gaze location for the entire 20-minute visit; this information combined with arousal data from the shimmer sensor can locate the potential trigger for elevated emotional or attentive states during the visit providing information about the most emotionally affective elements of the museum for an individual participant. This data can be elaborated upon and interpreted to find trends among participants which may point to common affects among a population for parts of the museum exhibit.

**Movement trajectories measurements.** To complement the neurophysiological and eye-tracking measurements, an indoor positioning system based on Ultra-Wideband (UWB) technology was implemented using the Pozyx® positioning platform. The aim was to accurately record visitor movement trajectories inside Rooms 6 and 7 of Museo Egizio, enabling spatial analysis of engagement with specific exhibits and the detection of “hotspots” along the visit routes. The UWB technology provides real-time location data with centimeter-level of accuracy  $\pm 10$  cm under optimal conditions. The positioning system comprised two main components:

- **Anchors:** a network of UWB anchors was strategically installed throughout both exhibition rooms to provide complete spatial coverage. The anchors were positioned to ensure optimal line-of-sight connectivity while minimizing interference from exhibit cases and architectural features. In Room 6 (Deir el-Medina), six anchors were installed, and in Room 7 (Tomb of Kha and Merit), nine anchors were positioned (Figure 16).
- **Tags:** each participant was equipped with a lightweight Pozyx UWB tag. The tags continuously transmitted positioning signals to the anchor network, enabling real-time visitor

tracking throughout the museum visit. The system recorded three-dimensional coordinates (x, y, z) of participants' positions within Rooms 6 and 7.



**Figure 16** - Floor plan of Rooms 6 (bottom) and 7 (top).  
The red hatched area highlights the position of the papyrus exhibit in Room 6.

### 3.2 Experimental protocol at MAC-Barcelona and research hypothesis

As seen and discussed with MAC-Barcelona personnel during the survey carried out on December 2024 (T6.2), a portion of the museum was identified as suitable for accurate testing: the exhibit *IMPERIVM. Històries romanes*, opened in the spring of 2024. Also in this case, it was needed to focus on a portion of the visit: however, unlike in the Egyptian Museum, here it was not possible to isolate just one part, being the storytelling well defined, so it was necessary for participants to complete the entire visit (even though the measurements would only focus on one portion).

After completing the pre-experience questionnaire, participants were invited to visit autonomously the first half of the exhibition on the first floor for a 30-minute period, with the option of using the audio guide provided by the museum. Upon expiration of the given time frame, participants were invited to proceed to the Gallery upper floor, where researchers made them wear the neurophysiological devices (Figure 17).

# IMPERIVM

ROMAN STORIES

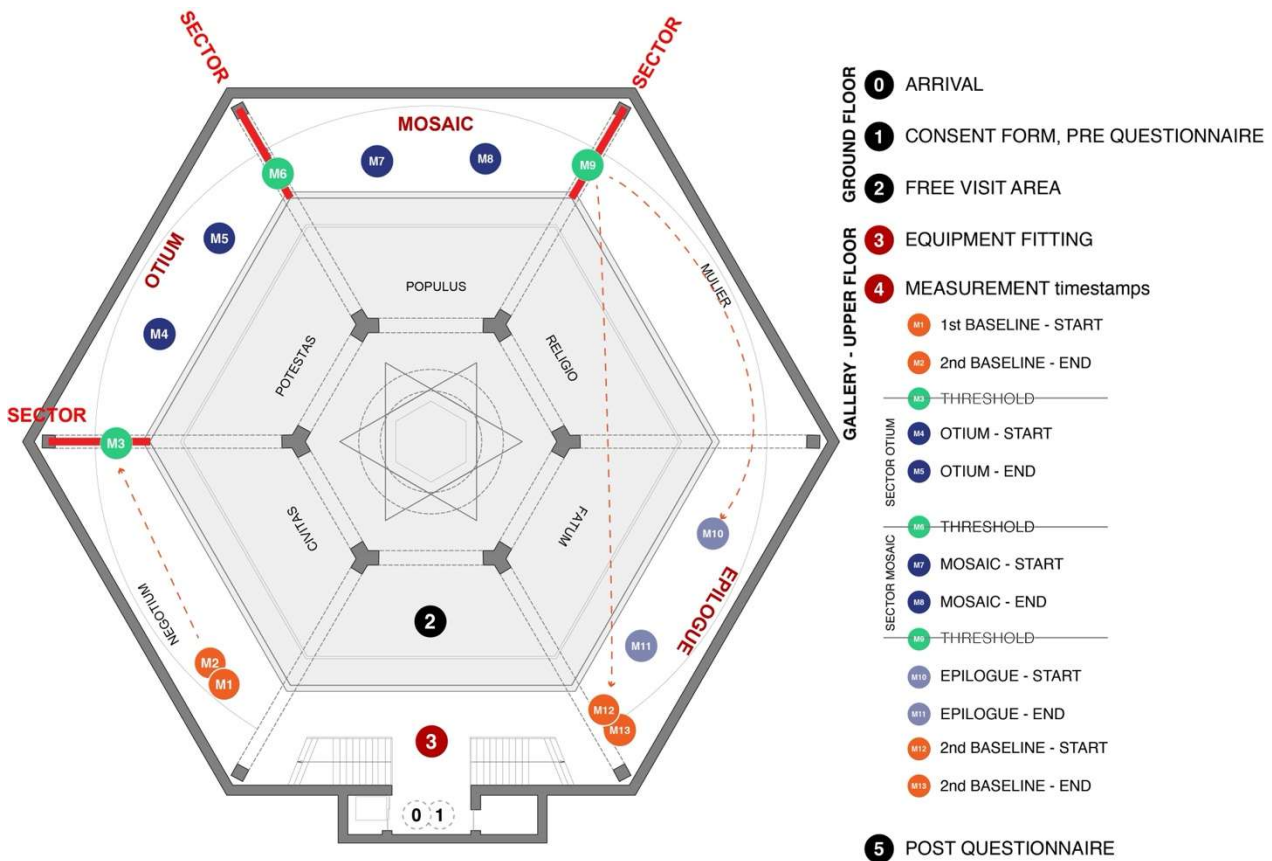


Figure 17 – Floor plans for the *IMPERIVM* exhibit

Three out of ten videos have been selected in the second floor of the Gallery to carry out the neurophysiological measurements. Participants were then asked to watch the following videos, while sitting on benches:

- A. **OTIVM** / Leisure (5'20''): a monologue from the perspective of a Roman gladiator slave explores themes of identity, power (and courage), survival, and freedom within the oppressive structure of the Roman Empire. The values behind this theme can be linked to those evoked by the strike papyrus in the Egyptian Museum, and researchers intend to verify what reactions the video triggers.
- B. The **mosaic of the Circus** (4'58''), which immortalizes a chariot race that might have taken place in the Circus Maximus in Rome. The mosaic is displayed using a digital video mapping which describes all its components depicted, through projections and audio narration. According to researchers' hypotheses, this video might generate an initial activation that decreases and leads to a relevant workload.
- C. **HEREDITAS** / Legacy, the final video (1'53''). This reflection contemplates the inevitability of impermanence and oblivion, emphasizing the transience of human life, civilizations, and achievements in the grand flow of time. Some questions are posed at the very end: "Will they remember how we dreamed? How we desired each other? How we stole kisses? How we murdered each other? How will they remember us?". Researchers are interested in understanding what effect this approach has on confidence.

Precisely to isolate the effect of the final video (epilogue), sample was divided in two groups: one group saw only the first two videos, while a second cluster saw also the final video. Due to the spatial layout and features of the exhibit, indoor positioning recording was extremely challenging at MAC-Barcelona, leading the researchers to avoid implementing it. In order to correlate spatial information and visiting times in the upper gallery, three thresholds have been identified along the visit path (Figure 18).



**Figure 18 – Spatial layout for the experimental protocol at MAC-Barcelona**

The participants' positioning was in any case facilitated by the fact that they were asked to sit down while watching the videos: by associating the signals with the duration of the video, it was therefore possible to understand at what point, for example, a response had been generated.

For MAC, questionnaires have been prepared in English, Catalan and Spanish. The conclusive set of open-ended section proposed in Museo Egizio was, for the occasion, edited to include additional questions tailored to the second museum. While at MAC no set of images to test for memory retention was present, the first additional question asked participants to identify an element of the exhibition that particularly impressed them, if it was an object or a video, and to describe what and why it was. Following questions were further targeting the topics presented in MAC:

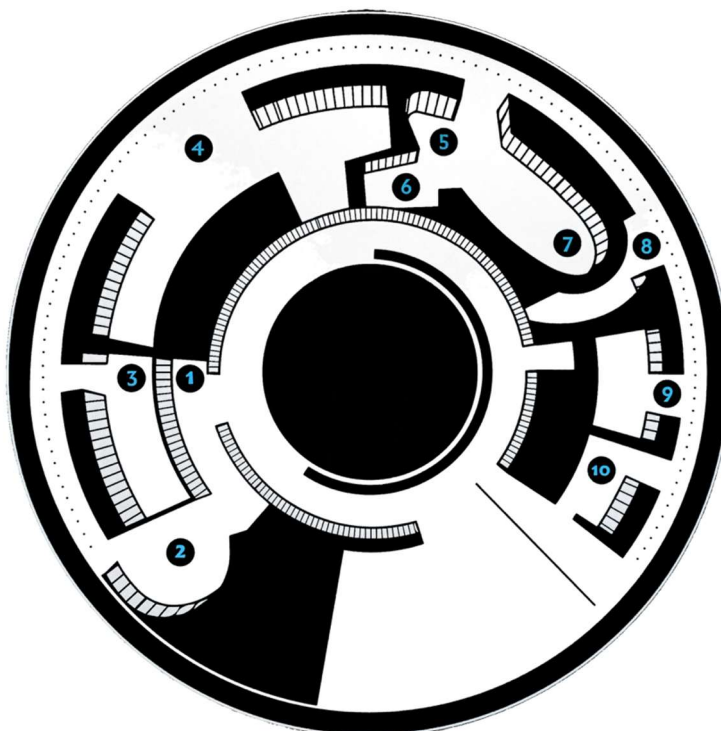
- Identification with “traditional” Roman values (multiple choice answer), linked to sense of belonging
- Overall message retrieved from the exhibition (open-ended answer), linked to the confidence feeling
- What visitors felt they were keen on giving up their freedom for (open-ended answer), linked to the values behind the exhibition.

### 3.3 Experimental protocol at MuséoParc Alésia and research hypothesis

As seen and discussed with MuséoParc mediation staff during the technical survey (T6.2) and following the discussion emerged from the WP6 workshop previously described, the hypothesis is that the three key points of a visit as recognised by traditional museography (i.e. introduction, climax and conclusion) are particularly powerful and evident in this case, then suitable for accurate testing. It was therefore decided to assess how much each of them affects the visit.

The tasks chosen for measurements were:

- A. **Introduction video** (room 2 - *The imaginaries*) (6'44"). Participants were asked to watch this video describing largely believed-to-be-true stereotypes about the Gauls people.
- B. **Siege of Alesia** (room 4 - *52 BC: the face to face*) (8'04"): Subjects were requested to watch a short watercolor animation film presenting the events that led up to the famous Siege of Alesia, ending with Vercingetorix's capitulation. The video succeeded to the prior version in 2021. This audio contains no narration, which entirely relies on essential closed captions, but intense sound effects that should induce a stronger feel of immersion in the battle scene. The exchange with the curators confirms the experience the team, as foreigners, had: although designed to reach a certain degree of neutrality in the narration, the video undoubtedly tends to overly empathize with Vercingetorix's defeat. The video represents, for its placement in the exhibition path and emotional intensity, the climax of the visit making it a more than necessary element to be tested in the implementation phase *T6.3 - Status quo measurements implementation*.
- C. **Conclusive room** (room 9 - *The myth lives on, the Gauls resist*): Participants were let free to roam the last room of the permanent exhibition for up to 5 minutes, dedicated to the figure and legend of the Gauls people. Exhibit describes their identity and its exploitation in politics and marketing through a series of political and advertisement posters and everyday objects ranging from sportswear all the way to cigarettes and schoolbooks. The room is proposed as the conclusive element in the exhibit, but the hypothesis is it fails to do so, seeming (apparently) rather to re-affirm the stereotypes of the first video and limitedly offering elements for a favourable reflection on the Gauls' image exploit; it was chosen as the last element for the visit monitoring in T6.3 for three out of the four testing combinations (Figure 19).



#### Rooms/sections

1. Start of the visit
2. The imaginaries
3. Welcome to where les Mandubii lived
4. 52 BC: the face to face
5. Still Gauls, almost Romans
6. ArchéoLab
7. Alesia in the Roman province
8. Regina in the land of Alise
9. The myth lives on, the Gauls resist
10. Forum

Figure 19 - Plan of MuseoParc Alesia

Picking up the interest from the museum staff to intervene on the introductory video and acknowledging the relative weakness of the room 9, the interest of the META-MUSEUM team focused on the influence each stimulus selected for the experiment could have on the visitor and their overall visit experience, targeting the project core topics of confidence, empathy and resilience. Following discussion among partners, participants were divided into groups, and each of them watched a different combination of the three tasks to test the individual effect of stimuli on visitors. So, four testing stimuli combination were identified (Figure 20):

- **ABC** (control condition): combination of all three tasks + 15' of free roaming (not recorded, about 10' between A and B, minimal variation possible waiting video B restart);
- **AC**: introductory video + conclusive room + 15' of free roaming between A and C (not recorded);
- **AB**: introductory video + siege video + 15' of free roaming (not recorded, about 10' between A and B, minimal variation possible waiting video B restart; 5' after video B);
- **BC**: siege video + conclusive room + 15' of free roaming (not recorded, about 10' before B, minimal variation possible waiting video B restart; 5' after video B).

Further randomization would have requested to have visitors go through the exhibition not necessarily following the correct order; the hypothesis, although understandable from an experimental standpoint, was discarded considering no ecological visitors go through the exhibition that randomly (In the other two cases, there was no such problem: at Alésia, participants were guided from one measuring station to the next, following the “correct” order; in the case of the Egyptian Museum, where they could move more freely, the positioning system allowed the variable of their route to be controlled as well).

As previously done for the other campaigns, the post-experience questionnaire repeated questions elaborated for the previous experiences to test for identification, empathy, resilience and confidence; considering the strong local tendency to identify with Gauls heritage, tailored questions aimed at assessing if the narrative proposed in the museum affected their views on the topic in any way.

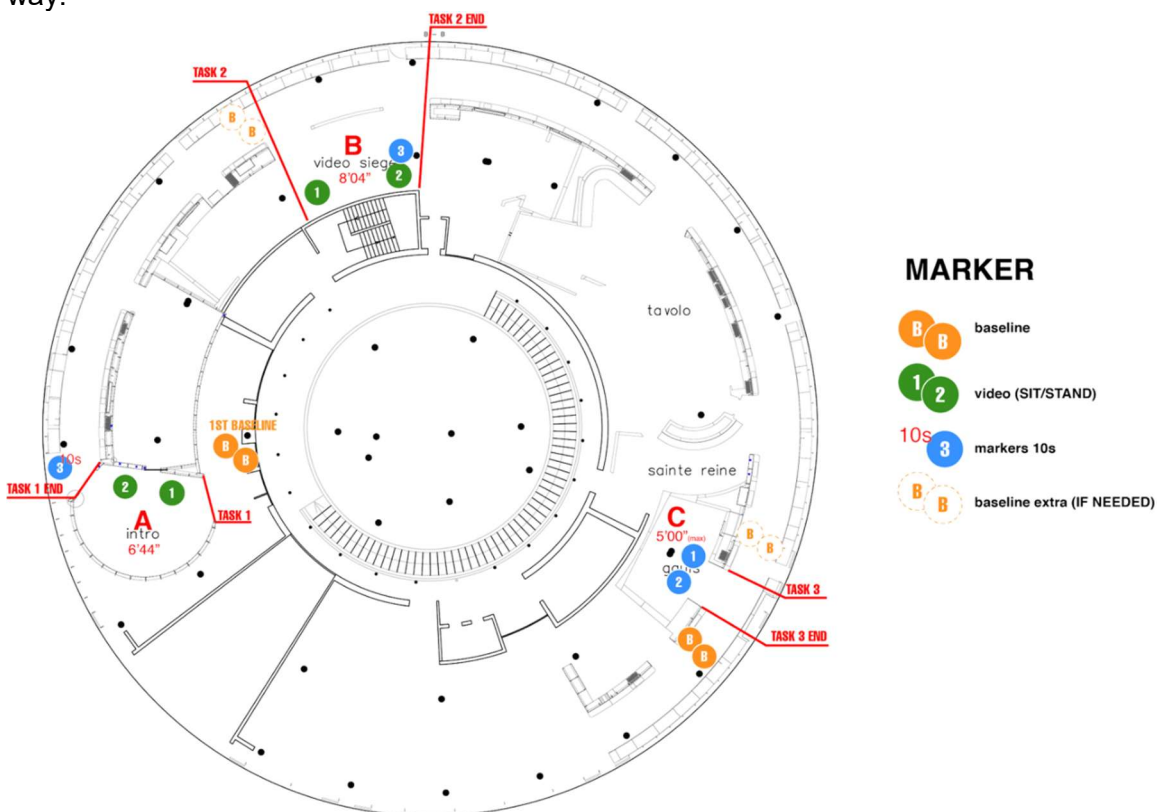


Figure 20 – MuséoParc Alésia floorplan

For Alésia, questionnaires have been prepared in English and French. The conclusive set of open-ended section was also in this case adapted to the specific context:

- Identification with “traditional” Roman values (multiple choice answer), linked to sense of belonging
- Overall message retrieved from the exhibition (open-ended answer), linked to the confidence feeling
- what message they had taken from the visit, and if there was anything that had bothered them (open-ended answer), linked to senso of belonging and confidence.

## 4. Implementation description

### Premise. Implementation Limitations and Challenges.

Implementation of *status quo* measurements took place in the Spring-early Summer 2025, according to the GA, thanks to availability and support of AP museums. All three data collection campaigns have been accomplished, with a wide interest and participation by citizens in the various countries. In general, some critical points of attention must be emphasised, as follows:

– **Volunteers recruitment.** It came with its challenges, requiring an extra effort from museum staff and researchers. Although most participants expressed their interest in participating in the experiments in advance by registering voluntarily, some of them did not show up on the assigned day. Sometimes the target number of participants per day was not reached. In both cases, researchers sought to recruit visitors directly at museums.

– **The neuropsychological measurement Measures** in an ecological environment are notoriously complicated. In the case of the Egyptian Museum, given the high number of visitors, measurements were limited to the hours close to opening and closing, and in all three museums, staff had to make an extra effort to cover any overtime. In some cases, the measurements were interrupted or there was a lack of connection, or the volunteers' movements altered the measurements. For this reason, during the experiments, it was realised that it was necessary to limit the movements of the arm wearing the shimmer, and the team got lightweight orthopaedic braces for the volunteers to wear. These and other limitations may certainly have affected the naturalness of the behaviour and therefore the relative signals. The researchers are aware of this and have taken it into account.

– **The logistics.** The protocols were studied with great attention to logistic, for which the availability of dedicated spaces and basic technical infrastructure was essential (the possibility of powering the equipment and devices, and working on laptops). Even with the greatest care in planning, unforeseen events (fortunately not serious) have always been lying in wait.

–  
The neuropsychological measures, as described in previous Deliverables, have been conducted using a wearable electroencephalographer and a sensor of electrodermal activity. The former measures brain activities computing two indices: **the cognitive workload** (that represents how much the participant is cognitively involved during the visit) and **the approach withdrawal index** (the positive values represent the interest for the stimuli, the negative values withdrawal tendency). The latter allows the measure of the Galvanic Skin Response (GSR) that represents **the emotional arousal during the visit**. These three indices are normalized with respect to their baselines measured during rest period pre- and post-visit and should be considered for their increment/decrease among different conditions, but not in their absolute values.

#### 4.1 Experiments implementation at Museo Egizio

The sample in Museo Egizio was of 104 participants, recruited thanks to extensive word-of-mouth effort by Turin researchers. Due to the large crowds that typically fill the rooms of the museum, it was necessary to carry out some measurements while it was closed (*controlled environment*) to ensure minimal disturbance of EEG data, otherwise potentially affected by interactions with other people or to some other confounders (Figures 21-22-23-24).

Sample was divided in groups depending on measurement conditions and device(s) used, as follows:

		EEG HEADSET + GSR		GSR ONLY		SENSOR	TOT	TOT detail	
		M	F	M	F			M	F
		CONDITION	CONTROLLED	PM				PS	
19	16			7	12	54	26	28	
ECOLOGICAL	EM*		ES						
	3		1	21	25	50	24	26	
<b>TOTAL</b>						<b>104</b>	50	54	

\*EM subjects started session in P (museum closed) and ended in E (museum open) condition; EEG data could have been affected



Figure 21 – Participants at Museo Egizio during the questionnaires phase



Figure 22 – Setting up of neuroscientific devices



**Figure 23-24 – Participants during the experimental campaign**

**Positioning.** To prepare both rooms for the anchor positioning, the anchors were installed during museum closing hours to minimize disruption to regular operations. Each anchor was attached to a power bank that provided continuous power throughout the entire testing period. At the end of each testing day, the power banks were charged and replaced the following day to ensure uninterrupted system operation. The position of each anchor was precisely measured using a total station within a local coordinate system established for both Room 6 and Room 7. These anchor coordinates were essential for the Pozyx system's trilateration algorithms to accurately estimate visitor positioning throughout the exhibition spaces. Following installation, a brief system calibration was performed to verify positioning accuracy before data collection began.

Two main questions have been answered:

- 1) Which areas are visitors more interested in, and is there any preferential path that visitors are following?
- 2) How many visitors spent time focusing their attention on the papyrus display in Room 6 and the display in the upper corner of Room 7?

To answer the first question, visitor movement patterns have been investigated within the exhibition rooms by generating heatmaps based on the UWB point data. The process began with the creation of individual heatmaps for each visitor, using kernel density estimation (KDE) to visualize the spatial distribution of their positions over time. These individual heatmaps are used to determine unique movement behaviours and areas of interest for single visitors. In Figure P1, four different heatmaps of visitors are shown.

After that, a normalized heatmap (P2) by combining visitor position data collected over several days across both museum rooms has been created. Using kernel density estimation, we calculated how densely visitors occupied different areas throughout the exhibition space on a uniform grid (5cm x 5cm). To make the results easier to interpret and compare, we normalized the density values so that the busiest spot in each room received a value of 1, and all other locations were scaled relative to this maximum. This creates a color scale from 0 to 1 that shows relative visitor activity rather than raw visitor counts. Areas with few or no visitors appear transparent on the map, while the most popular locations show up as bright hotspots. This method lets us easily compare how visitors used different spaces, regardless of how many people were actually counted or how much data we collected.

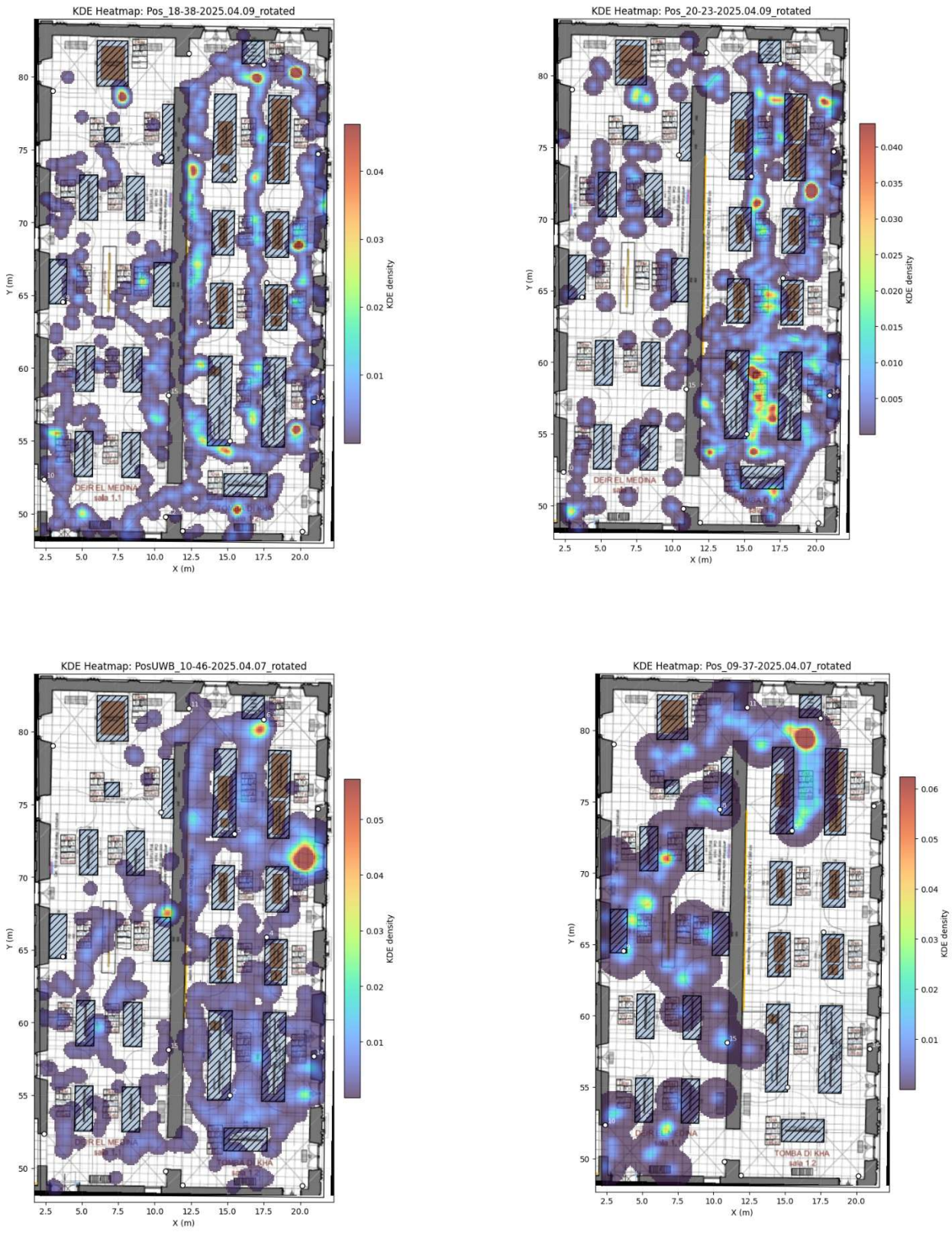
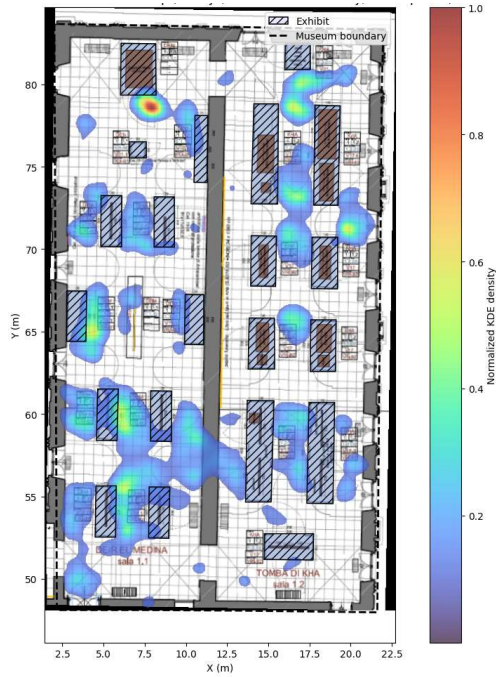


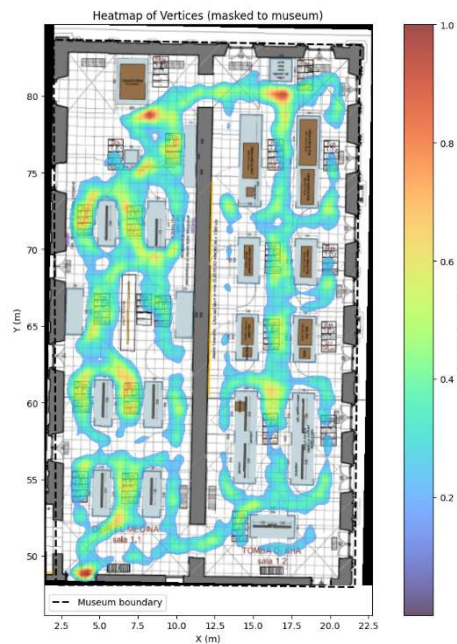
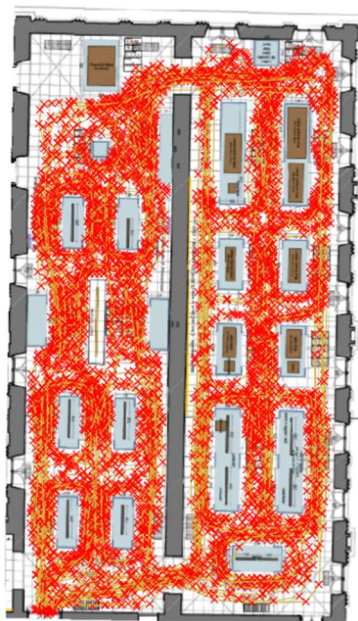
Figure P1: Four different heatmaps of visitors



**Figure P2: Normalized Heatmap**

To identify the main pathways visitors used, we analyzed all trajectory data. The resulting density map shows where people commonly walked and which areas they avoided, though it doesn't always reveal single, clear-cut routes since visitors naturally took different paths through the space. The heatmap visualization makes it straightforward to see which exhibition zones captured the most foot traffic and which remained relatively unused.

Using kernel density estimation offers a way to reveal which routes and spaces visitors used most frequently, while also highlighting areas with little activity, essentially the exhibition's "dead zones." This approach lets us understand both how visitors moved collectively through the space and identify which physical features influenced their navigation patterns.



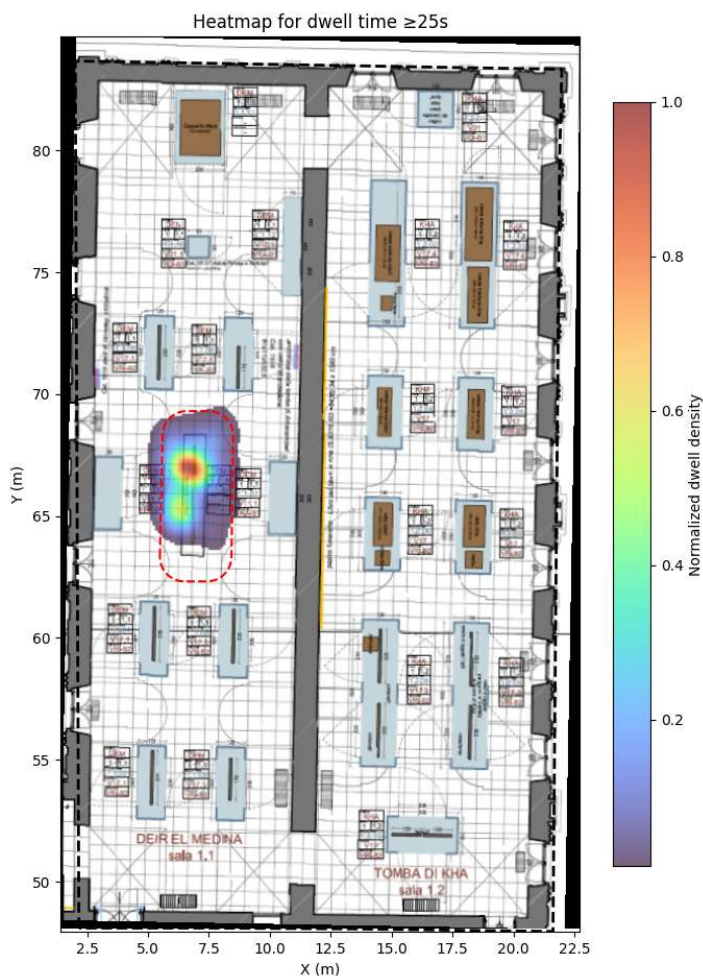
The next phase of the analysis focused on quantifying both the number of visitors and the time spent in specific areas of the exhibition rooms. In particular, the analysis is focused on the papyrus display in Room 6 and the display in the upper corner of Room 7.

- Papyrus Area:

To conduct this analysis, we established a 1-meter buffer zone around the papyrus exhibit. This method captures all visitor paths that came close to the display, no matter which side visitors approached from.

After identifying all the points associated to at least 25 seconds within 1 meter of the papyrus exhibit, we applied again then kernel density estimation algorithm to generate a dwell period heatmap. This method calculated the density of points across a fine grid, producing a continuous heatmap where warmer colours correspond to higher concentrations of stationary moments. The heatmap is normalized so that the most frequented area has a value of 1, facilitating comparison and visualization of visitor dwell patterns around the papyrus. The following statistics summarize our findings:

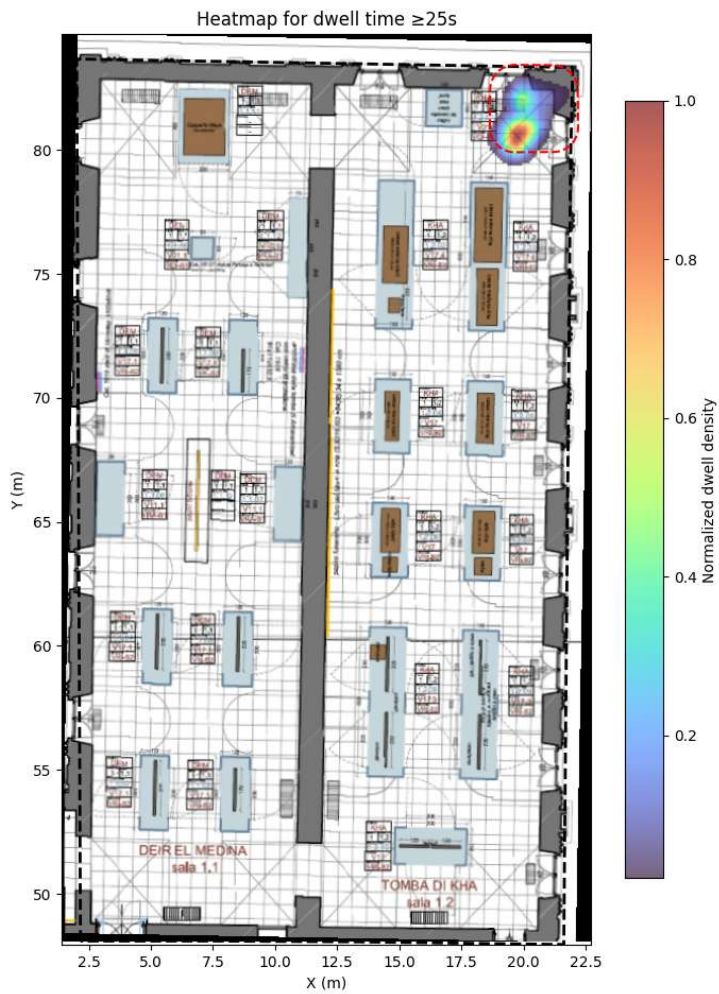
Total number of visitors considered	99
Percentage of visitors passed less than a meter from the papyrus	83%
Percentage of visitors that remained in the papyrus area for more than 25 seconds	15%



- Video Display:

We conducted a similar analysis for one of the video displays in the exhibit area, using the same metrics and heatmap approach as the papyrus analysis.

Total number of visitors considered	99
Percentage of visitors passed less than a meter from the papyrus	21%
Percentage of visitors that remained in the papyrus area for more than 25 seconds	4%



## Extra-activities

The research team took advantage of the measurement session to explore the potential of certain types of activities with some participants. The feedback and results obtained will be very useful for developing proposals for the pilot phase.

**Co-creation.** The experimental campaigns have been relevant and fruitful opportunity to organize and deliver some small co-creation activities, aligned with META-MUSEUM objectives. In Museo Egizio, POLITO and museum curators teamed up to propose activities centered on historical photographs of Schiaparelli's digs. Small groups of 15-20 people took part to the sessions (Figure 24-25).

The first of the proposed activities first requested participants to go through a set of thirty images selected by museum curators, picking five that impressed them the most and rating their emotional response (either good or bad) through stickers (green/red) to be applied on a separate, and personal, sheet listing a maximum of three keywords. Personal sheets were subsequently publicly commented together with curators to identify recurring observations from participants.



**Figures 24-25:** Participants during the co-creation activity

In the following activity, image C01982C was then projected (Figure 26) and participants were given a card and invited to write in one minute:

- a caption without any prompting from the mediators (maximum 15 words) on the front of the card,
- a question to the curator for additional information, on the back.



**Figure 26** - Image C01982C, representing some archaeological digs at the beginning of the XX century

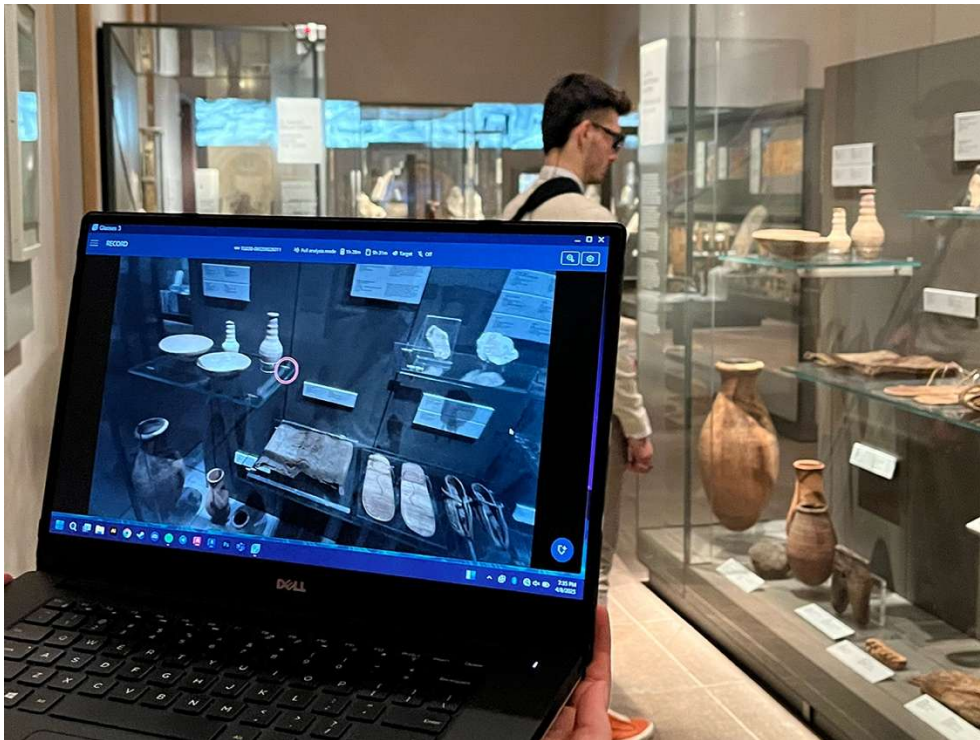
The curator answered the questions posed as concisely as possible, without adding further details or information that might influence the following activity. Following discussion between the group and curators, a single caption card was chosen and returned to the group who was then asked to modify it, each taking their turn, by removing, replacing or adding a maximum of two words. Eventually, curators commented on the final caption created and offered some additional reflections on the work done by participants.

The activity ended with a viewing of the photographic plate, while curators carried out an in-depth analysis of it, unveiling details to participants and explaining the photograph backstory, its composition and an explanation of its heritage value beyond the object itself, providing further elements for reflection on the content and message conveyed by the image.

Seen the interest taken by participants to co-creation activities in the experiments taking place in the museum, after planned activities with curators concluded, participants were invited to visit the two rooms selected for the experiments. Although not fitted any equipment for measurement (in use by the team with the sample recruited), this share of participants was still asked to fill out the pre- and post-experience questionnaires.

**Eye-tracker tests.** 24 participants were mounted with the Tobii pro 3 eye tracker glasses and given twenty minutes each to visit rooms 6 and 7 of the Egyptian Museum (Figure 27). The eye tracking glasses monitored the movement of participants eye motion in relation to visual stimuli within the museum. Regarding the execution of the eye tracker experiments it is noteworthy to consider the pool of subjects possible was limited to a pool of potential participants who have sufficient uncorrected vision, because the Tobii Pro 3 eye tracker used is not able to be worn over corrective lenses and also cannot be calibrated to track the vision of persons who have poor general vision. During the experiments the rate of accuracy for vision tracking was at 90% or higher meaning with respect to the limited participant pool the accuracy of vision tracking was very high. All participants who wore the eye tracker were followed through their course of the museum by an attendant by a distance no greater than 10 meters. This distance is the maximum extent of the “safe zone” in which the native Wi-Fi signal of the glasses can communicate the data to a computer. Since the eye tracker participants were followed quite closely through the museum this should be considered when

interpreting their behaviours in the museum galleries. It should also be considered that the participants are outfitted with devices they need to wear through the duration of the experiment, for example the eye tracker itself is composed of the glasses connected to a receiver box via a wire, participants were able to choose to keep the receiver box in their hand, clip or place within a pocket or use an external pocket that was provided for them. All eye tracker participants were outfitted with a shimmer skin conductance sensor mounted on their non-dominant hand, which was further kept in an arm sling to reduce movement. Therefore, it should be considered that these participants were not typical visitors in the museum gallery rather they were altered in a way that could have changed their behaviour or mobility, for example this may have caused participants to be less willing to bend down to look at a low placed artifact due to restricted mobility. These sensors also attracted attention from other visitors in the museum for participants in the “E” environmental conditions group. Some participants were interrupted by other visitors or museum staff who were curious about the experiments.



**Figure 27 – Eye tracker tests at Museo Egizio**

## 4.2 Experiments implementation at MAC-Barcelona

The museum launched a communication campaign through its newsletter and local networks approximately one month before the measurement campaign, to recruit volunteers interested in the project and willing to take part to the study (Figures 28-29-30). The collected sample was of 95 participants. To compensate for some defections among the participants recruited for the experiment, the museum staff was very helpful in involving technical and administrative colleagues from the museum, and the research groups recruited some visitors at the entrance. In the sample the male to female ratio was imbalanced towards the latter. In any case, the male sample reached the minimum size admissible. Attached below, a summary table of participants by gender, stimuli combination tested and measuring device(s) used.

		EEG HEADSET + GSR		GSR SENSOR ONLY		TOT	TOT detail	
		M	F	M	F		M	F
TESTED SEQUENCE	ABC	13	19	*0	14	46	13	33
	AB	13	23	5	8	49	18	31
TOTAL						95	31	64

\*seen the scarcity of male participants, these have been diverted to EEG+GSR testing to ensure reaching the requested number

As mentioned, the MAC exhibition experiment took place in was only redesigned and inaugurated a little over a year ago. On one hand, therefore, the museum staff is very confident in the potential of this new layout and features, but on the other hand, this experimental session is an opportunity to monitor the visitors' responses and their behaviour. In particular, the final video (*Hereditas*, the Epilogue) must be coupled with the introductory one (downstairs), and both disclose a clear interpretative approach, in which the stories told in the videos often take precedence over the objects on display.

Most of the participants did not visit the exhibit before, so they spent the entire time allowed (30 minutes) visiting the first floor of the exhibition, even though they were informed the time wouldn't have been enough to go through the entire exhibition floor and watch all the videos. When participants informed the researchers, they had recently visited the exhibition, their *free roaming* time was reduced to 15-20 minutes, compatibly with the ongoing recording taking place on the upper level.

Looking to compensate for some minor delays in execution, a small quota (four individuals) of participants was let roaming the first exhibition floor for up to 45 minutes; researchers duly took note of the extra visit time in case notable differences in measurement turned up.

### Extra-activities

Mainly due to the forecasted small size of the sample, and the layout of the museum, the META-MUSEUM team did not organize additional activities as previously done in Museo Egizio in Turin.



**Figure 28** – Setting up of neuroscientific devices at MAC





**Figures 29-30 – Participants during the experiments**

### **4.3 Experiments implementation at MuséoParc Alésia**

Before the implementation of the *status quo* measurements, cultural mediators of MuséoParc Alésia launched a campaign on social media to recruit volunteers for the scheduled week of experiments, collecting a sample of 78 participants, satisfying the requirement (minimum 70 people per measurement campaign) worked out by partners in WP2 – D2.3 *General assessment and interpretation model*. Aware of the average number of defections among recruited volunteers in previous sessions, during the whole week a great effort was dedicated by researchers and museum staff to recruit on-site among ecological visitors.

Throughout the week-long measurement campaign, POLITO and UNIROMA1 totalled 78 participants, not reaching the 100 forecasted in the GA due to the difficulty in recruitment and a significantly lower-than-average affluence to the museum in the experiment week due to the heatwave that interested the region during those days.

In the sample, as previously happened in MAC Barcelona, the male to female ratio was imbalanced towards the latter. Attached below, a summary table of participants by gender, stimuli combination tested and measuring device(s) used.

		EEG HEADSET +			GSR SENSOR ONLY			TOT	TOT detail		
		GSR	M	F	X	M	F		X	M	F
TESTED SEQUENCE	ABC	7	7	2	1	2	0	19	8	9	2
	AC	9	7	0	1	2	0	19	10	9	0
	AB	6	11	0	1	4	0	22	7	15	0
	BC	6	8	0	1	3	0	18	7	11	0
<b>TOTAL</b>								<b>78</b>	32	44	2

During the measurements campaign, some informal feedback was collected by researchers and museum staff. The irony and light toned-ness of the introductory video is most appreciated by non-locals and foreigners: according to the mediators' input the video tends to be perceived as ridiculing of the Gauls by people native to the area that strongly identify with their history and heritage. Moreover, again thanks to mediators' input, it was noted how middle-aged people and older tend to have a stronger aversion to the clip content due to the way the Siege has traditionally been illustrated in school textbooks. On top of this, comedians starring in the video further sustain this demographic's scorn. Younger generations, who have studied the romanization process without the heavy focus on the Vercingetorix-Julius Caesar antagonism, respond much better to the video, as foreigners do – although ignorant of the protagonists' background. Considering the video is the first element of the exhibition, and the amount of feedback collected by mediators long before META-MUSEUM, it was identified as an element for testing, so more so when the museum staff shared their considerations on the possibility of its substitution.

### Extra-activities

**Co-creation.** As previously done in Museo Egizio, a participatory activity was proposed in Alésia to the whole sample that took part to the measurement campaign. Participants were given a card asking them to pick between Julius Caesar and Vercingetorix, place a sticker of either one on the card and write down a quality the particularly admired of the chosen one (from French: *Pick one of the two characters and write down a quality you admire*). On the back of the card, two additional questions asked participants to try and individuate traces of Gaul and Roman heritage in themselves (from French: *what of ancient Gauls/Romans does still reside in you?*).

To ensure randomization of the results, half the sample was presented with the card before the experiment and the second half after. Additionally, to ensure the order Gauls/Romans of the questions could not affect participants, half of the cards asked the Gauls first and the Romans second and the other half did the opposite.

As expected, most participants chose Vercingetorix rather than Julius Caesar although a small percentage, mostly in the younger age group, did go for Julius Caesar. Qualities admired by participants were collected and turned into a wordcloud (Figure 31) from which a significant number of "unifier" (*rassembleur*) and "courage" responses emerged in appreciation of Vercingetorix character.

A somewhat hostile response to the perceived "Roman heritage" question was encountered in participants, many of whom either complained directly to the researchers, left the question blank or angrily wrote "nothing" on the card.

la qualité que tu admire de plus en ...Vercingetorix (post visite)



Figure 31 – Wordcloud as result of the co-creation activity carried out at MuséoParc Alésia

## 5. Results interpretation and assessment

### 5.1 Results and reflections from the sample selected

In addition to the considerations already made in relation to single cases, some general reflections on the samples can still be added. It shall be mentioned that recruitment, whether through the museum institution, by word of mouth or through direct involvement in situ, is a complex operation, the results of which are not guaranteed, and above all, it is difficult to achieve representativeness of the different categories. For example, it is obviously difficult to involve participants in the so-called non-public/disaffected public category. To overcome this last critical issue, the consortium is organising events in preparation for Pilot 3 (which should ensure greater heterogeneity of the public) in order to obtain valid indications for the second experimental phase as a whole.

Additionally, it appears that women are more inclined to get involved, or perhaps more curious about research.

In terms of age group, a fairly balanced representation has been achieved.

Regarding the cultural level, some questions pose challenges to both researchers and participants: for instance, it was sometimes difficult to effectively adapt and take into account the different educational systems in each country, challenging the following interpretation.

Moreover, it appears very important, in future recruitment campaigns, to identify ways to effectively reach the non-public/disaffected public, that inevitably falls out of the usual audience reached by museums initiatives, communications and campaigns.

### 5.2 Neurophysiological data analysis and interpretation

#### PRE-PROCESSING

##### ***More in-depth discussion:***

*Recorded signals were cut in a specific range of time corresponding to the single task in order to analyse the exact time-lapse of the physiological responses.*

*The EEG signal was firstly band-pass filtered with a fifth-order Butterworth filter in the interval 2–30 Hz. The blink artefacts were detected by means of the Reblinca method [7]. The reconstructed EEG signal was then segmented into 1-s-long epochs with 0.5 s of overlap in order to avoid any “boundary effect”, and three additional criteria for detecting artifacts based on the signals’ amplitude and trend [8], [9] were applied in order to remove those portions of data still affected by artifacts that had not been corrected before [9].*

*From the artefact-free EEG, the Global Field Power (GFP) was calculated for the EEG frequency band of interest, alpha and theta bands. This band was defined accordingly with the Individual Alpha Frequency (IAF) value [10], alpha [IAF-2, IAF+2] and theta [IAF-6, IAF-2] estimated specifically from each subject through one minute of eyes closed recorded before starting the experiment.*

*The Approach-Withdrawal Index (AW) was calculated starting from the Frontal Alpha Asymmetry index [11], [12] calculation, for which Formula (1) was employed:*

$$\text{Frontal Alpha Asymmetry} = GFP_{\alpha_{right}} - GFP_{\alpha_{left}}$$

(1)

*Where the GFP $\alpha$  right and GFP $\alpha$  left stand for the GFP values calculated among right (AF4, AF8) and left (AF3, AF7) electrodes, respectively, in the alpha ( $\alpha$ ) band. Positive values stand for a participant’s approach/interest tendency, while negative values for a withdrawal tendency in relation to the stimulus.*

The Cognitive Workload Index (CWL) was obtained considering the GFP in the theta band over all the frontal electrodes (AFz, AF3, AF4, AF7, AF8). Increased frontal theta values would imply an increase in the cognitive workload required during the task [13], [14].

The Electrodermal activity (EDA) signals acquired from the Shimmer were analysed employing the LEDALab software [16]. The tonic component of the skin conductance (Skin Conductance Level, SCL) was estimated. The SCL corresponds to the slow-changing component of the EDA signal, consistently related with the arousal and stress levels [17], so the signals were low-pass filtered with a cut-off frequency of 1 Hz. The final signals were normalized using the following Formula :

$$SCL_{[0-1]tot} = \frac{SCL - \min(SC_{baseline+task})}{\max(SCL_{baseline+task}) - \min(SC_{baseline+task})}$$

## ANALYSIS

As mentioned above, participants were divided in two groups: one group wore both the Mindtooth EEG headset and Shimmer and one group only wore the Shimmer. Therefore, for the first group all three indices were computed (approach-withdrawal, cognitive workload and arousal), while for the second group only the arousal was calculated.

For each task of the museums, two different and parallel analyses were performed: average over time and analysis in time. The first analysis aims to compare the averages values of the indices during the tasks among participants. The second analysis aims to visualise the trend of the indices' values in all the duration of the single task seconds per seconds.

For the average over time analysis of each index of each task, the steps were: (i) to make a distinction of subjects who wore both Mindtooth and Shimmer or only the Shimmer; (ii) for each group, to compute the mean over time for each participant; (iii) to compute the global mean and standard deviation of all participants for each group.

The analysis in time were performed only for the long tasks and the steps were: (i) to cut the signals according to the time-laps of the tasks decided by the protocol or the video length; (ii) to compute the mean of all participants corresponding to each second of the acquisition and standard deviation; (iii) to evaluate the trend of the average signal.

## RESULTS

### 5.2..1 MUSEO EGIZIO OF TURIN

1. First impact effect task, with the duration of 10 seconds, acquired at the entrance of Room 6 for all participants;
2. Room 6 task, with a set duration of 15 minutes for participants wearing Mindtooth and Shimmer devices, or with free duration (average 11 minutes) for participants wearing only Shimmer;
3. Room 7, freely visited by participants wearing only Shimmer or Shimmer + Eye tracker, up to the 20 minutes mark.

For the interpretation of the results, it is important to take into consideration that participants wearing Mindtooth and Shimmer visited Room 6 in a controlled environment (i.e., the museum was closed), while the participants wearing only Shimmer visited both rooms during museum's opening hours.

### AVERAGE OVER TIME

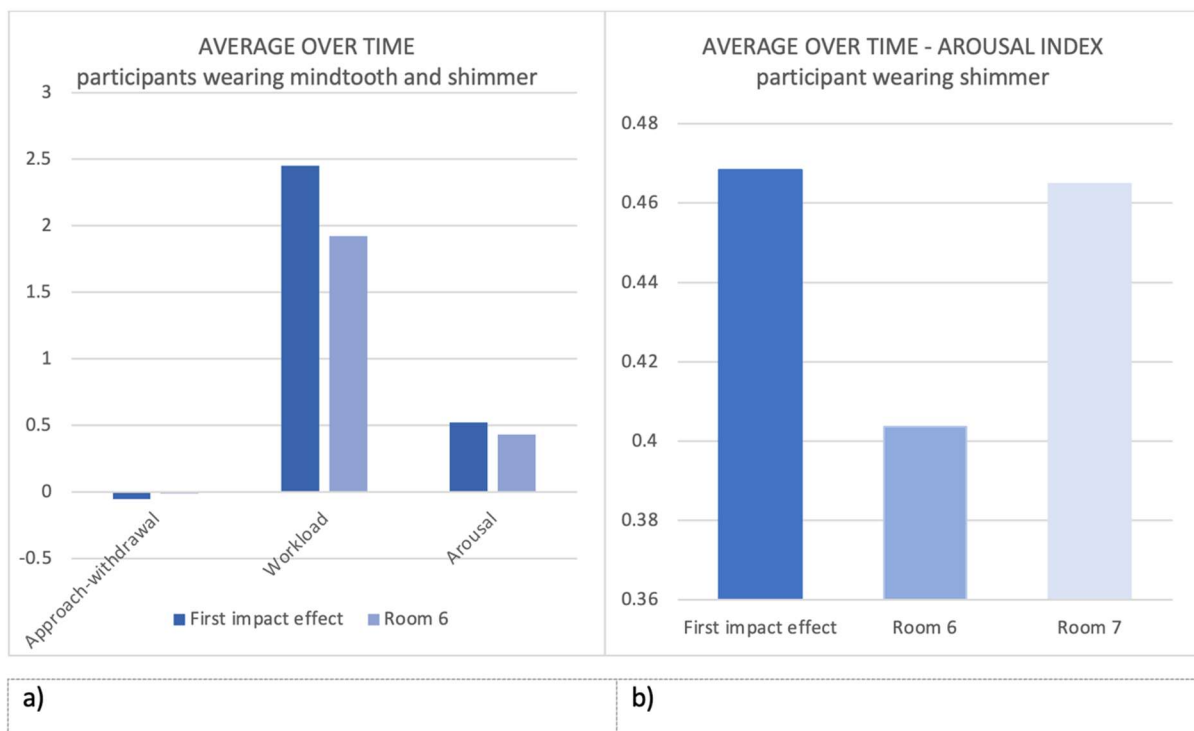
In Table 1, the average value of the mean over time of each participant are reported with the standard deviation together with the number of participants resulting after the cleaning process of the data. The participants are also divided in two groups according to wore devices. Figure 32 shows the results in bar diagrams. The arousal index is the only index that can be calculated for participants wearing Shimmer without Mindtooth.

In Table 1, results of the statistical tests are also reported. For data of participants wearing the set Mindtooth + Shimmer, T-test (with confirmed normal distribution) were applied among the two conditions (Impact effect and Room 6) for each index although no significant differences were

obtained. For data of participants wearing only Shimmer, a within-subject repeated-measures Anova was applied to evaluate dependency across the tasks (First impact effect, Room 6, Room 7) for the arousal index. Since normality condition was not respected, Friedman Anova was applied. The effect of Task resulted not significant. Subsequent Wilcoxon tests comparing means across tasks showed only a significant difference between Room 6 and room 7 ( $p = .029$ ).

SUBJECT WEARING MINDTOOTH/SHIMMER				T-TEST P. VALUE	SUBJECTS WEARING ONLY SHIMMER			ANOVA P. VALUE
		FIRST IMPACT EFFECT	ROOM 6		FIRST IMPACT EFFECT	ROOM 6	ROOM 7	
APPROACH-WITHDRAWAL	mean	-0.053	-0.011	0.488	-	-	-	
	std	1.165	0.661		-	-	-	
	Num. participant	31	36		-	-	-	
WORKLOAD	mean	2.451	1.924	0.465	-	-	-	
	std	2.200	1.426		-	-	-	
	Num. participant	31	36		-	-	-	
AROUSAL	mean	0.524	0.432	0.142	0.468	0.403	0.465	0.161
	std	0.289	0.170		0.260	0.162	0.289	
	Num. participant	38	40		61	62	58	

**Table 1:** Means and standard deviations of the indices computed for both groups of participants in each task of the experiment.

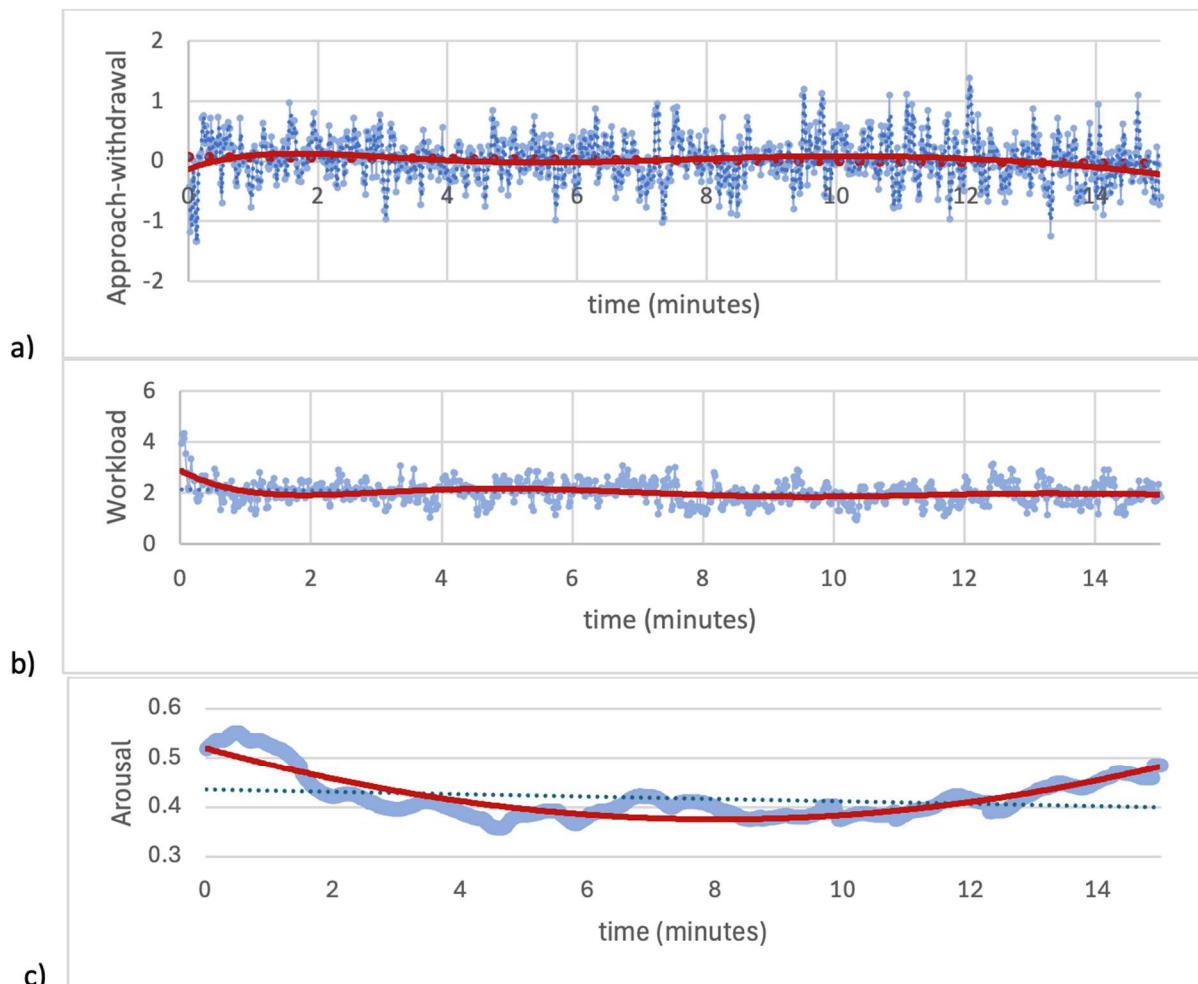


**Figure 32:** Bar graph of the indices' means in each task: a) indices and tasks for participants wearing Mindtooth and Shimmer, b) indices and tasks for participants wearing only Shimmer.

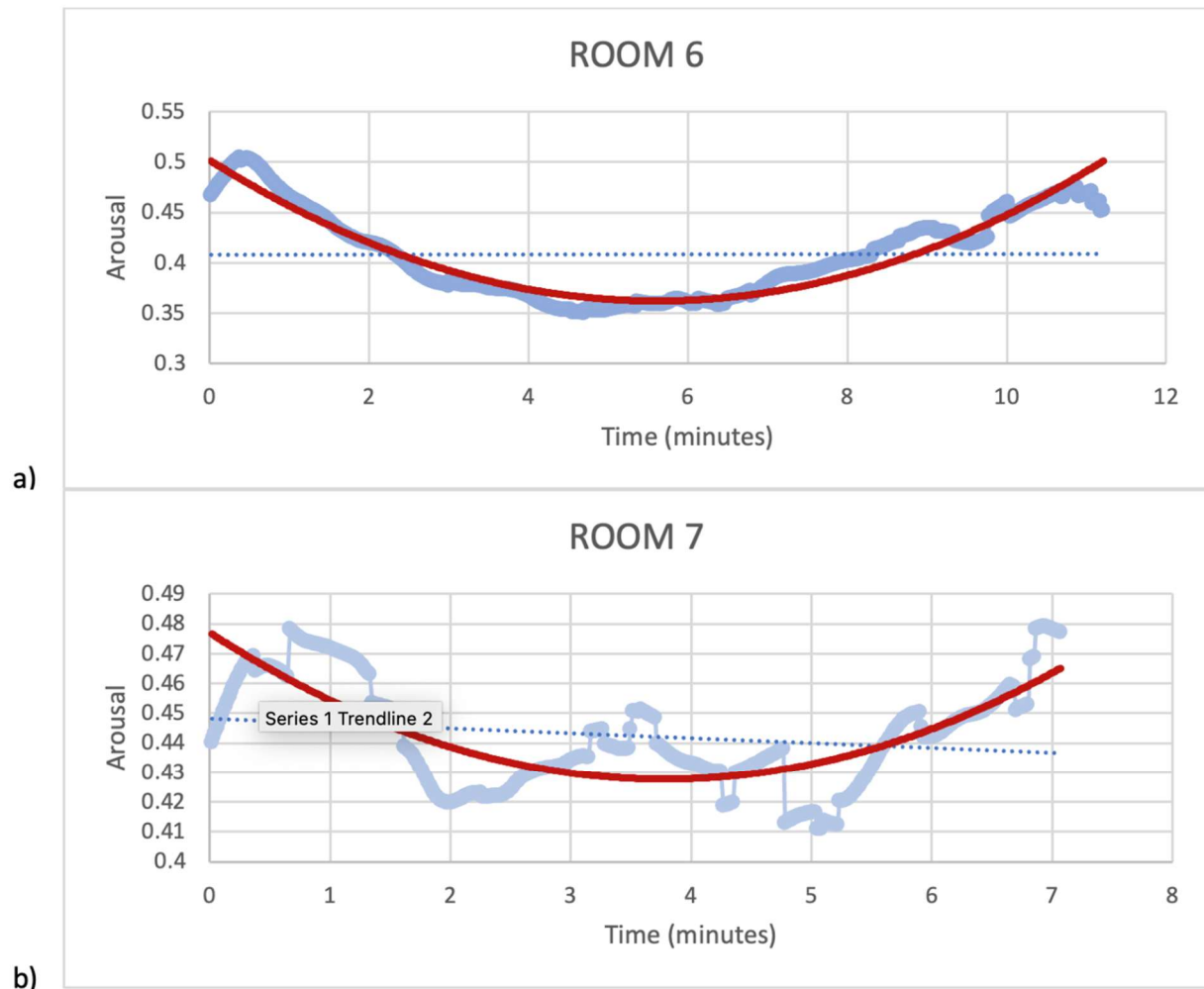
## ANALYSIS IN TIME

Figure 33 and 34 show mean signals obtained for each index from the analysis in time of the tasks. Figure 33 reports results for all indices acquired during Room 6 from participants wearing Mindtooth and Shimmer. According to the protocol, the total time considered is 15 minutes for the participant wearing the set Mindtooth + Shimmer in Room 6. Figure 34 reports results of the arousal index of participants wearing only Shimmer for both Room 6 and Room 7. The total time for participants wearing only Shimmer was 20 minutes for both rooms. The time of representation of each room was calculated as the mean time of visit of the room among the group of participants (11 minutes for Room 6 and 7 minutes for Room 7).

In each graph the polynomial regression has been represented to evaluate the tendency. The regression analysis is a process of constructing a curve fitting the data observed with random errors. The Figures show that visitors had a higher emotional arousal and cognitive engagement at the beginning of the visit, than they decrease, with the cognitive workload that is quite constant, instead the emotional engagement increase again after this phase of the decrement in the last part of the visit. This trend of the emotional engagement was similar in the two rooms. The interest (approach/withdrawal) is quite constant during the whole visit.



**Figure 33:** Average signals in time for Room 6 from participants wearing Mindtooth and Shimmer, considering a total of 15 minutes time of the visit: a) Approach-withdrawal index, b) Workload index, c) Arousal index. Red lines represent the polynomial regressions of the signal to evaluate the global trend, whereas dotted lines represent linear regressions.



**Figure 34:** Average signals in time of Arousal index for participants wearing only Shimmer in: a) Room 6 (total time 11 minutes); b) Room 7 (total time 7 minutes). The red line is the parabolic regression of the signal to evaluate the global trend, better representing the trend than a linear regression (dotted lines).

## DISCUSSION MUSEO EGIZIO

### AVERAGE OVER TIME

In the following graphs and tables we report the average across participants values **plotted with respect to time of museum visit**.

Table 1 shows descriptive statistics of means and Standard Deviation (SD) of each participant averaged across tasks. The large SD values suggest high inter-individual variability, as can be also observed in the time-course graphs. This variability may reflect the visiting pace of each participant, as the experimental protocol allowed free exploration of the rooms. Therefore, within-subject analyses were used to overcome this limitation. However, no significant differences were found.

Regarding those participants who tested both experimental conditions wearing Mindtooth and Shimmer devices, although the values obtained for the Approach-withdrawal index are negative, they fail to support the presence of a clear withdrawal tendency. Both Approach-Withdrawal and Cognitive Workload indices show no significant differences across tasks.

Regarding participants who wore only the Shimmer device, it seems that globally Room 6 elicited a lower overall Arousal index compared to Room 7.

### ANALYSIS IN TIME

Approach-Withdrawal and Workload indices showed **a trend** resembling a U-shape.

The pattern of the Arousal parameter seems to be characterized by two peaks: one at the beginning, and one towards the end of the 10 minutes acquisition. The initial peak is roughly related to the entrance of Room 6, and the final peak to be in proximity of the chapel artifact located at the end of Room 6, close to the entrance of Room 7. However, Arousal pattern for Room 7 (participants wearing only Shimmer) showed a similar trend to that for Room 6, although at the end of Room 7 there was not a specific artifact to which it is possible to relate higher arousal indices. Therefore, similar trends from both rooms may suggest a common tendency to show higher arousal at the moment of entering and leaving the rooms, compared to the rest of the visit.

An additional analysis was carried out to evaluate visitors who lingered over two specific exhibits in Room 6 and the possible influence this had on neurophysiological parameters. In particular, the Papyrus of the Strike and the Tomb Chapel of Maja, located at the end of the room, were selected. To assess **whether participants lingered to observe the exhibits**, positioning data was used to identify whether the participant stopped for more than 5 seconds in an area of up to 1 meter in diameter around the exhibit. If the participant passed by the exhibit for less than 5 seconds, they were considered to be just passing by and not actually observing it.

This analysis determined that **out of a total of 100 visitors, 44% passed by the papyrus vitrine and 53% passed by the chapel**. For each neurophysiological parameter (Approach-withdrawal, Workload, and Arousal), a T-test was applied to assess any differences between the group of participants who observed the individual artifact and the group who did not observe it. For the papyrus, for subjects with only Shimmer,  $p=.054$ , while for subjects with Mindtooth, the following were obtained:  $p=.83$  for AW,  $p=.96$  for WL,  $p=0.06$  for AR. Considering all the participants for the Arousal index, the test results also not significant ( $p=.11$ ). On the other hand, for the observation of the Chapel,  $p=.27$  for subjects with only Shimmer,  $p=0.32$  for AW,  $p=.25$  for WL, and  $p=.14$  for AR. Therefore, no test was statistically significant. Also for the Chapel, the test for the Arousal index results not significant ( $p=.47$ ) considering all the participants.

## **CONCLUSION – MUSEO EGIZIO TURIN**

Concerning results for the Approach-Withdrawal index, although negative values were reported, results did not confirm a consistent withdrawal tendency. No significant variation was found in the AW index across tasks. Similarly, results for the Cognitive Workload index showed no significant differences across tasks and groups, **indicating consistent cognitive demands throughout both rooms**.

Observing the overall trends of participants' experiences, all indices exhibited a pattern of higher values at the beginning of the visit in Room 6, followed by period of stabilisation during the room exploration. Moreover, the Arousal index showed an increase at the end of the visit. A similar pattern was observed for the Arousal index elicited from Room 7 (participants only wearing Shimmer). This may suggest a general **tendency for increased arousal at the beginning and end of each room visit, possibly reflecting anticipatory and reflective responses**.

However, no statistically significant differences emerged from the analyses.

### 5.2..2 MAC-BARCELONA

According to protocol, the tasks considered are:

- the *Otium* video (duration: 5 minutes);
- the *Circus Mosaic* video (duration: 3.5 minutes);
- the *Hereditas* (epilogue) video (duration: 2 minutes); only for a half the participants.

#### AVERAGE OVER TIME

In MAC, the effects of the three videos were very different on the participants, as detailed below: **a higher cognitive engagement was elicited by the *Mosaic***, while emotional arousal turned out to be higher while observing the Epilogue (*Hereditas*), concluding with ***Otium* that found to be the less stimulating of the proposed stimuli**. Despite these differences, during the observation, both the cognitive and emotional engagement progressively reduced in all the three scenarios.

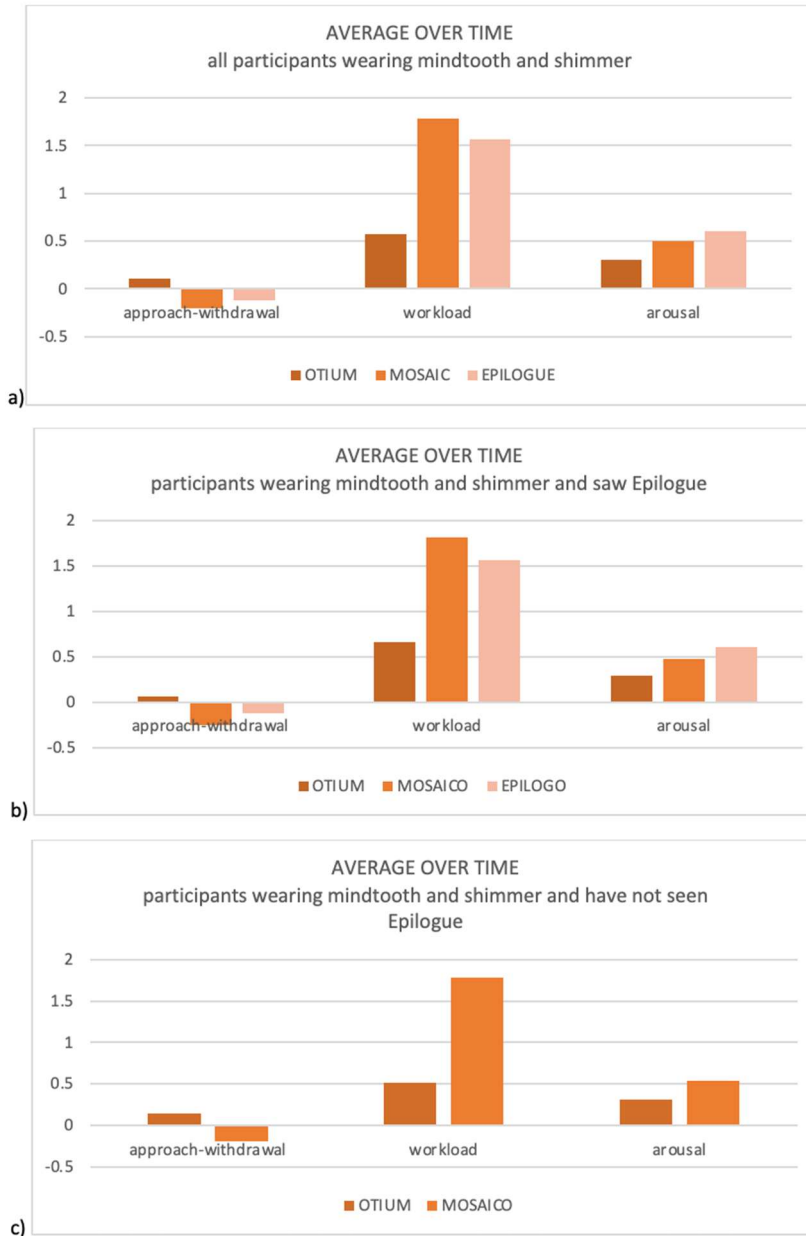
In Table 2, the value of the average over time of each participant is reported with the standard deviation and the number of participants resulting after the cleaning process of the data.

Since the epilogue video has been presented to participants as the last task of the experience, participants' responses to previous tasks were not influenced by the vision of the epilogue. However, participants' responses are shown presenting two groups of participants according to those who saw the Epilogue video and those who did not see the video. Figure 35 and Figure 36 show the results in bar diagrams. For participants wearing only the Shimmer device, only data of arousal were obtained.

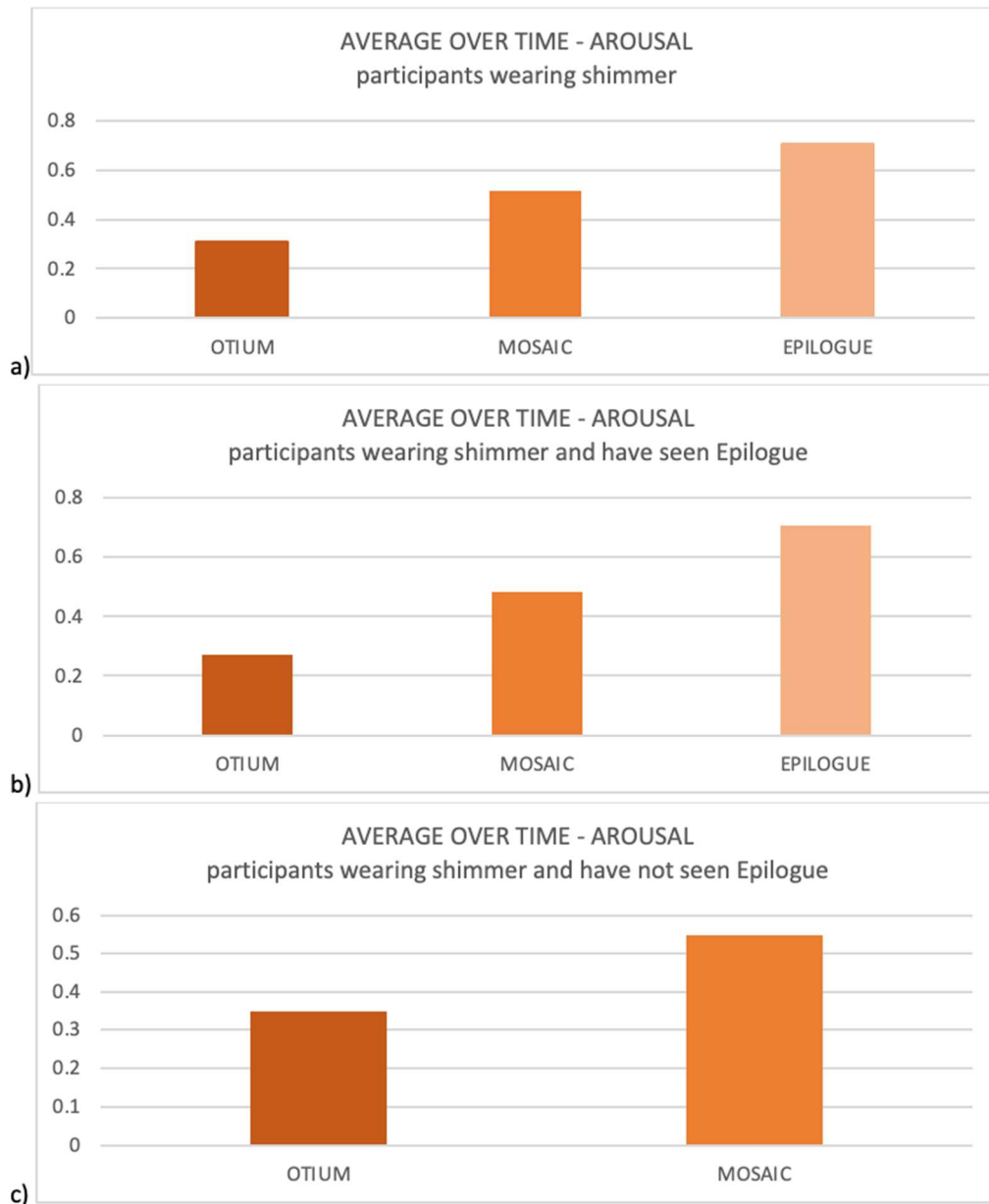
A within-subject repeated-measures Anova was applied to evaluate dependency across tasks for each index for all participants. Since the normality distribution was not respected and the number of participants varied across tasks, Friedman Anova was applied. The Approach-Withdrawal was significant ( $p = .039$ ). Pairwise comparisons (Durbin-Conover) showed a significant difference between Otium and Mosaic tasks ( $p = .010$ ), with higher index of approach for the Otium task, compared to the Mosaic task. Moreover, also Workload and Arousal showed significance ( $p < .001$ ), due to significantly difference between all tasks. Specifically, Cognitive Workload index was significantly higher during the vision of the Mosaic video, compared to the other videos, and it was significantly higher also for the Epilogue video, compared to the Otium video. Finally, results for the Arousal index showed a significant increase from the first to the last video, with significantly higher values for the Epilogue video compared to both Otium and Mosaic videos, and also significantly higher values for the Mosaic video compared to the Otium video (a unique analysis for the Arousal index was conducted on both groups of participants wearing Shimmer+Mindtooth and only Shimmer). Results are reported in Table 2.

SUBJECT WEARING MINDTOOTH/SHIMMER					SUBJECTS WEARING ONLY SHIMMER			ANOVA P-VALUE
		OTIUM	MOSAIC	EPILOGUE	OTIUM	MOSAI C	EPILOGUE	
APPROACH-WITHDRAWAL	mean	0.112	-0.199	-0.121	-	-	-	0.039
	std	0.420	0.673	0.513	-	-	-	
	Num. participant	67	59	29	-	-	-	
WORKLOAD	mean	0.577	1.781	1.568	-	-	-	<0.001
	std	0.791	1.153	1.107	-	-	-	
	Num. participant	67	64	29	-	-	-	
AROUSAL	mean	0.304	0.504	0.603	0.310	0.515	0.707	<0.001
	std	0.172	0.172	0.204	0.124	0.207	0.199	
	Num. participant	64	62	26	25	25	13	

**Table 2:** Mean and standard deviation of the indices calculated for both groups of participants in each task of the experiment. The p value resulting from the Anova test is also reported for each index.



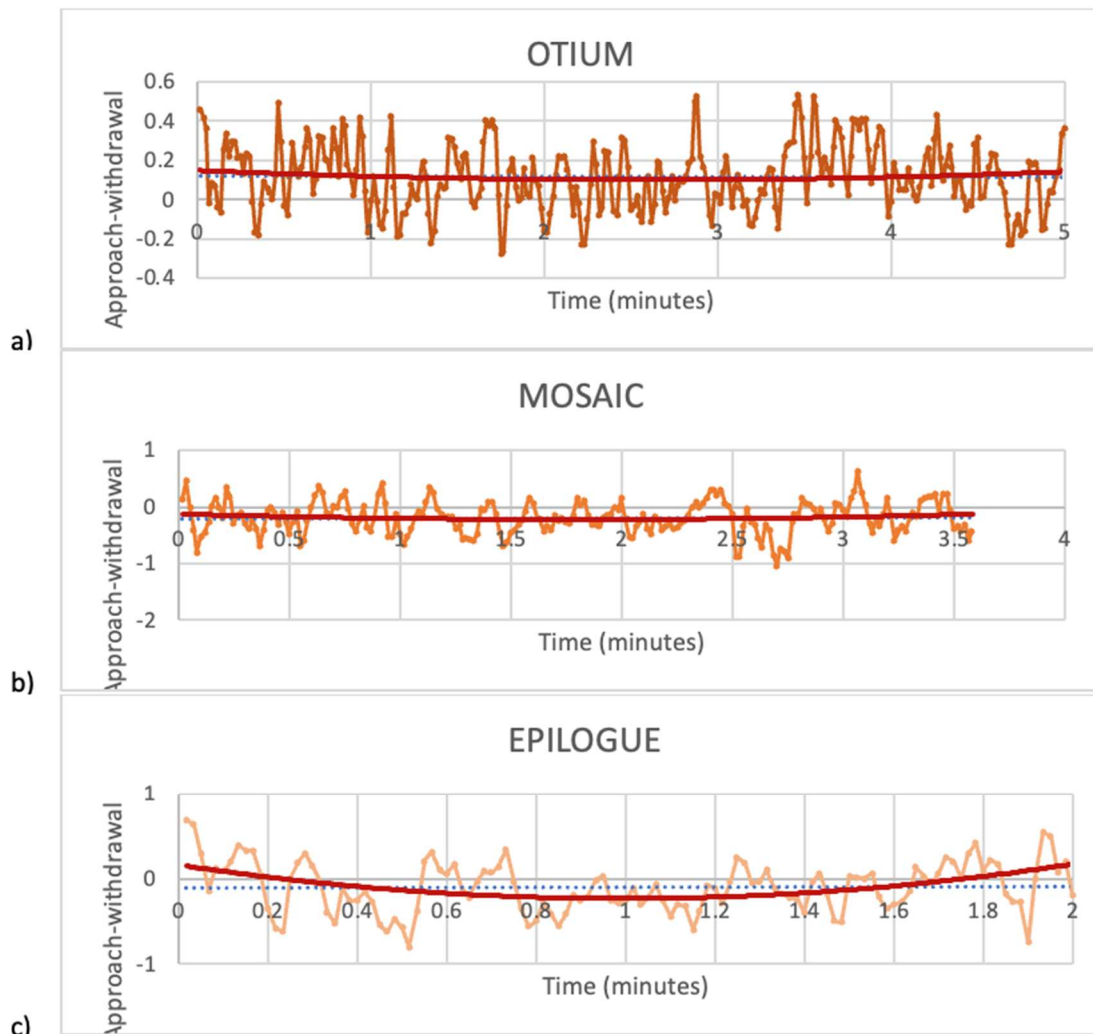
**Figure 35:** The bar graphs show indices' means in each task for participants wearing Mindtooth and Shimmer: a) all participants, b) participants who have not seen the epilogue video; c) participants who have seen the epilogue video.



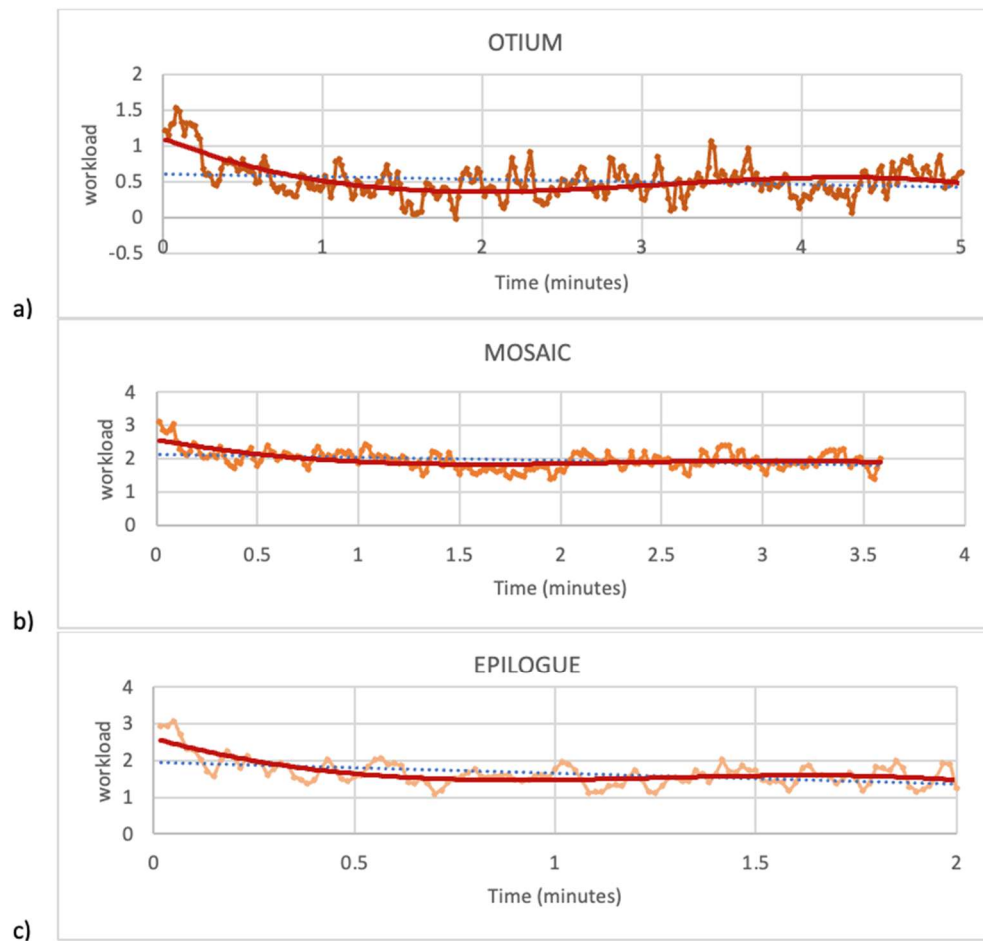
**Figure 36:** The bar graphs show indices' means in each task for participants wearing only Shimmer: a) all participants, b) participants who have not seen the epilogue video; c) participants who have seen the epilogue video.

### ANALYSIS IN TIME

Figure 37 and Figure 38 reports respectively the Approach-Withdrawal index and the Cognitive Workload index across tasks. Figure shows the Arousal index across tasks for participants wearing Shimmer. In each graph the linear progression has been represented to evaluate the tendency of each index.



**Figure 37:** Average signals in time for Approach-withdrawal index of all participants wearing Mindtooth for: a) Otium video (5 minutes), b) Mosaic video (3.5 minutes), c) Epilogue video (2 minutes). The red line is the polynomial regression of the signal to evaluate the global trend. The blue dotted line is the linear regression.



**Figure 38:** Average signals in time for Workload index of all participants wearing Mindtooth for: a) Otium video (5 minutes), b) Mosaic video (3.5 minutes), c) Epilogue video (2 minutes). The red line is the polynomial regression of the signal to evaluate the global trend. The blue dotted line is the linear regression.

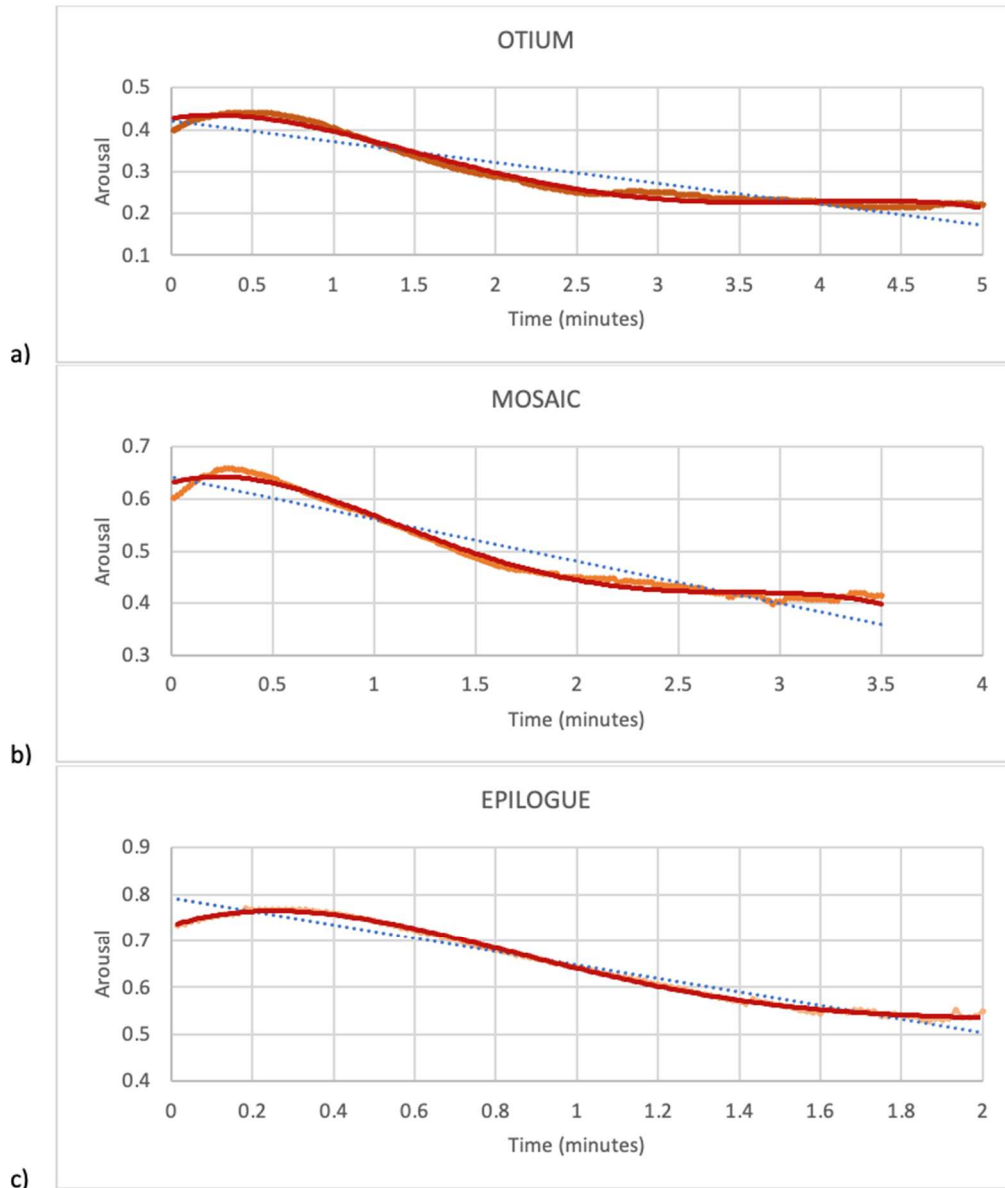
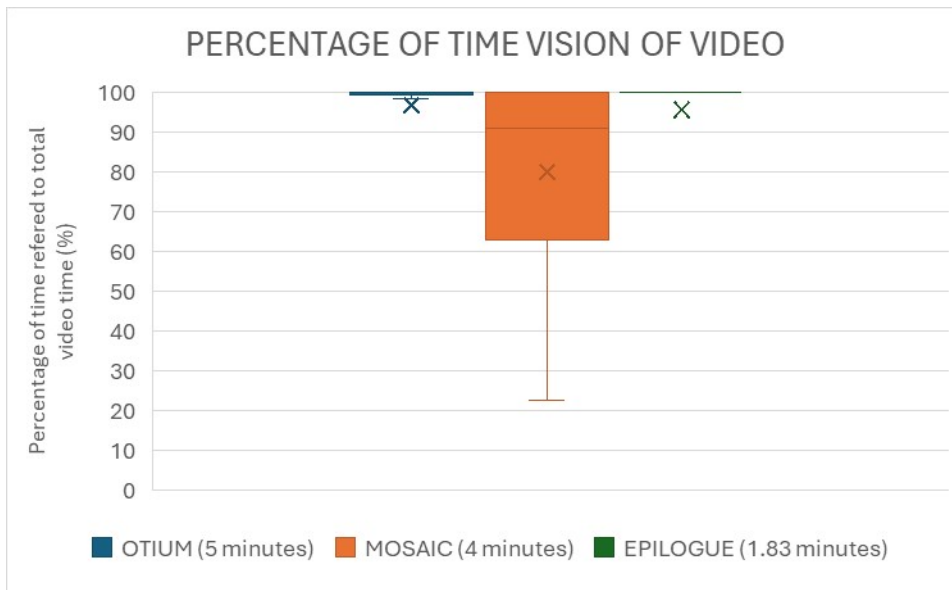


Figure 39: Average signals in time for arousal index of all participants wearing Shimmer for: a) Otium video (5 minutes), b) Mosaic video (3.5 minutes), c) Epilogue video (2 minutes). The red line is the polynomial regression of the signal to evaluate the global trend. The blue dotted line is the linear regression.

In Table 3, the results about the time participants dedicated to each video are reported while in Figure 40 the box plot summarized the distribution in percentage of the total video the participants looked at.

	OTIUM (5 minutes)	MOSAIC (4 minutes)	EPILOGUE (1minutes 83 seconds)
TOT PARTECIPANTS	86	85	38
>90% OF THE VIDEO	79	44	33
<90% OF THE VIDEO	7	41	5

**Table 3:** for each video, the number of participants that looked at list 90% of the total time of the video are summarized



**Figure 40:** box-plot of the percentage of the total of time of the video the participants looked at.

## DISCUSSION ABOUT MAC - BARCELONA

### AVERAGE OVER TIME

Observing the participants who wore both Mindtooth and Shimmer, the mean trends across tasks remained consistent between those who viewed the Epilogue and those who did not, highlighting the homogeneity of the two subgroups.

Considering the Approach-Withdrawal index, the Otium task was the one reporting the highest positive mean values, indicating a **greater approach tendency to the Otium video**, compared to the other videos. In contrast, **Mosaic and Epilogue videos elicited more negative values, suggesting a Withdrawal tendency.**

The Cognitive Workload index was lower for the Otium task compared to Mosaic and Epilogue tasks, whereas it was higher for the Mosaic task, compared to the Epilogue task.

The Arousal index showed a progressive increase in mean values across the three tasks, from Otium to Mosaic to Epilogue. Such increase is also confirmed by the results coming from participants tested with Shimmer only.

### ANALYSIS IN TIME

The Approach-Withdrawal index was examined by observing the values averaged throughout time and did not show variation throughout the experimentation. This is further confirmed by the regression graph, showing a roughly constant flat line, except for the epilogue video where the regression line presents a U-shape.

The Workload index shows a slight decreasing regressing line across all the tasks over time, probably reflecting a decline in attention/cognitive engagement.

Finally, for the Arousal index the temporal pattern was similar across tasks, characterized by an initial peak in the first minute, and a linear decrease over time. However, overall, a general increase was observed from the first to the last task.

Combining CW and Arousal, across all tasks **it seems that after about 1 minute of each video, both cognitive and emotional engagement are reduced.**

## CONCLUSION BARCELONA

In summary, results from the study conducted in Barcellona concerning the Approach-Withdrawal index showed that **the Otium video evoked the highest positive mean values**, suggesting higher approach for the video. Conversely, Mosaic and Epilogue elicited negative values, signalling a withdrawal tendency. During the visit, the pattern remained stable, except for the Epilogue task, which elicited a U-shaped trend.

Concerning the Cognitive Workload trends, participants experienced the least cognitive workload value during the Otium task, a greater workload during Epilogue, and the highest workload during the Mosaic task. **Across time, across task there was a slight decrease in cognitive workload, potentially reflecting reduced attention or mental fatigue as tasks progressed.**

Finally, results for the Arousal index showed an increase from Otium to Mosaic to Epilogue, indicating a **consistent build-up of emotional arousal across tasks**. Across time, all tasks showed a peak in arousal within the first minute of vision for all videos, followed by a steady decline, indicating initial emotional engagement that attenuates over time.

A general trend across all videos showed that **after the first minute, both cognitive workload and arousal declined, suggesting that participants' engagement—both mental and emotional—decreased as each video progressed**. This confirms a known temporal limit to sustained engagement with the stimulus materials, likely due to habituation or fatigue.

### 5.2.3 MUSÉOPARC ALÉSIA

According to the protocol, the tasks were as following:

- Task A: introduction video (duration: 6 minutes);
- Impact effect after task A: access to the principal corridor of the museum while staying still (duration: 10 seconds);
- Task B: video of the Siege (duration: 7.5 minutes);
- Impact after the task B: sitting remaining still after the end of the video (duration: 10 seconds);
- Task C: free visit of the Hero Room (duration: maximum 5 minutes).

#### AVERAGE OVER TIME

In Table 4 the average value over time of each participant is reported with the standard deviation and the number of participants resulting after the cleaning process of the data.

Figures 41 and 42 show the results.

A repeated-measures Anova was applied to compare indices across task without considering group assignment. Results for the CW index showed a significant difference between those who performed the AC tasks ( $p < 0.001$ ) and those who performed BC tasks ( $p = 0.04$ ), whereas results for the Arousal showed a significant difference between AC ( $p = 0.008$ ) and BC ( $p = 0.02$ ).

A second ANOVA was performed on Group by considering acquisitions for each task as independent parameters. However, no significant differences were found out.

At last, data from individual tasks were analysed for subjects who observed them, also considering the combination of tasks (e.g., for task A, all participants of the groups that observed ABC, AB, AC were considered). Again, an Anova was applied to determine whether the effect generated by the individual tasks depended on the observed combination. The significances found out were:

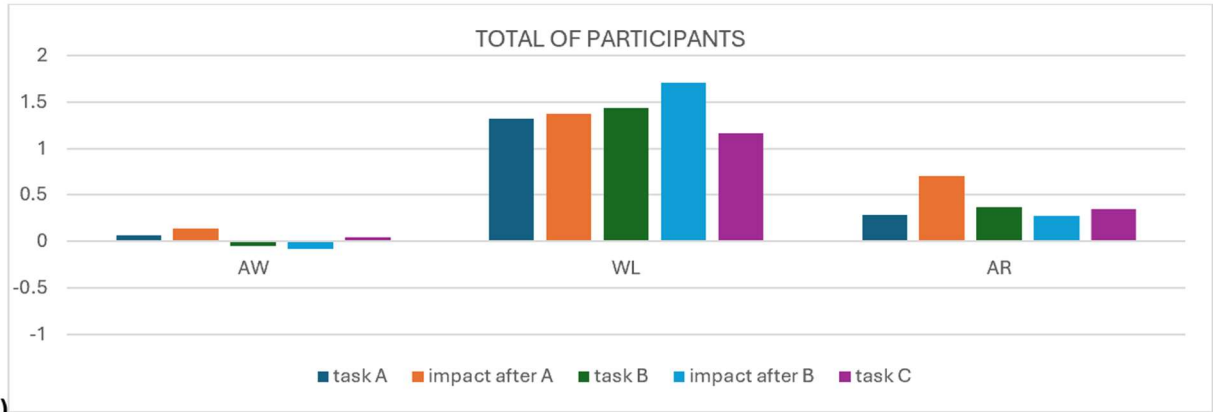
- For task A, a significant effect of cognitive workload was found ( $p = 0.029$ ), although post-hoc test showed no significant differences;
- For task B, a significant effect of cognitive workload was confirmed ( $p = 0.029$ ), and post-hoc showed a lower WL index for BC than AB ( $p = 0.04$ ) and ABC (although  $p = .07$ ).
- For task C, the effect of cognitive workload ( $p = 0.022$ ) was also confirmed by post-hoc test showing a higher WL index for ABC compared to BC ( $P = .031$ ) e AC ( $p = .047$ ).

Table 4: Mean and standard deviation of the indices calculated for all groups of participants in each task of the experiment.

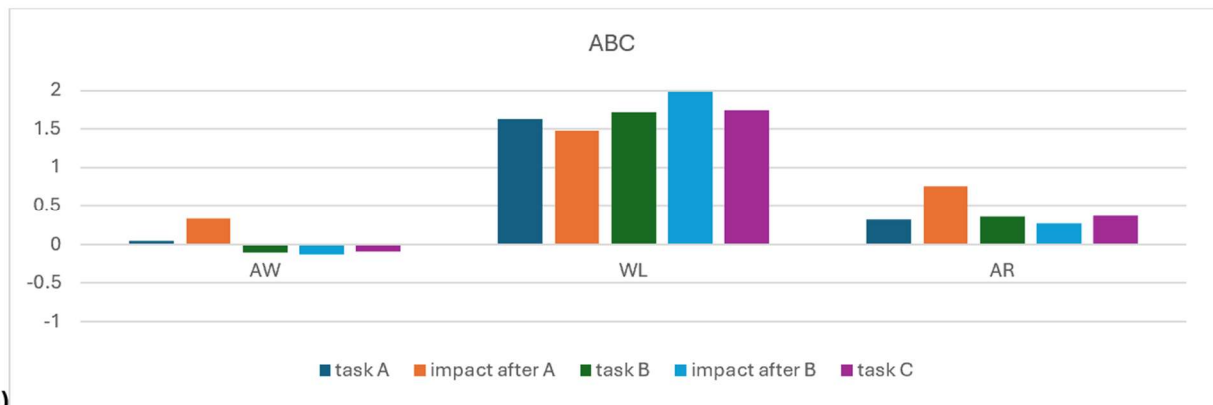
INDEXES

SUBJECT WEARING MINDTOOTH/SHIMMER

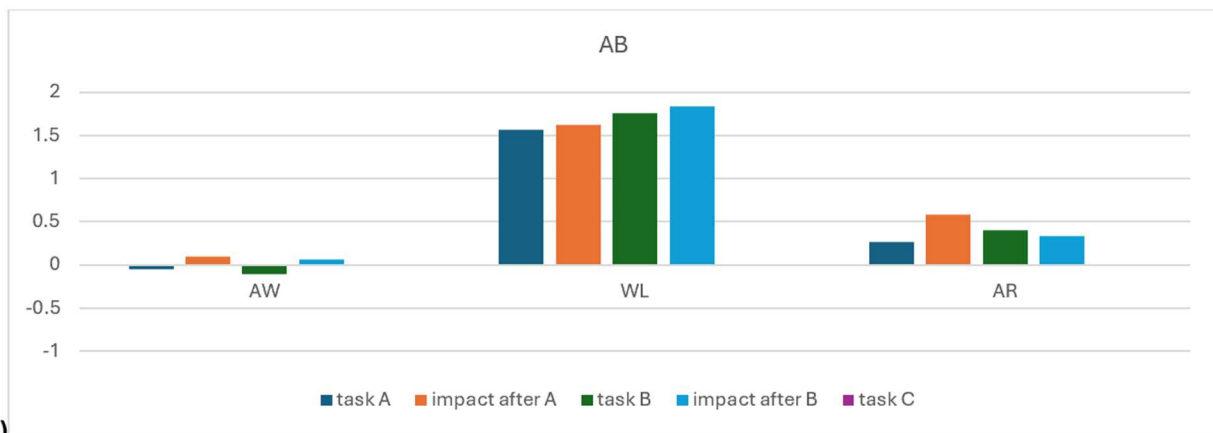
		TASK A	IMPACT TASK A	TASK B	IMPACT TASK B	TASK C
<u>Approach-withdrawal</u>	<u>mean</u>	0.064	0.141	-0.052	-0.086	0.048
	<u>std</u>	0.528	0.843	0.589	0.940	0.527
	<u>Num. participant</u>	45	45	45	45	44
<u>workload</u>	<u>mean</u>	1.324	1.378	1.440	1.712	1.164
	<u>std</u>	0.915	1.249	1.014	1.358	0.899
	<u>Num. participant</u>	45	45	45	45	44
<u>Arousal</u>	<u>mean</u>	0.287405	0.702598	0.373329	0.278701	0.344345
	<u>std</u>	0.180036	0.273865	0.189115	0.285144	0.149032
	<u>Num. participant</u>	55	55	55	52	51



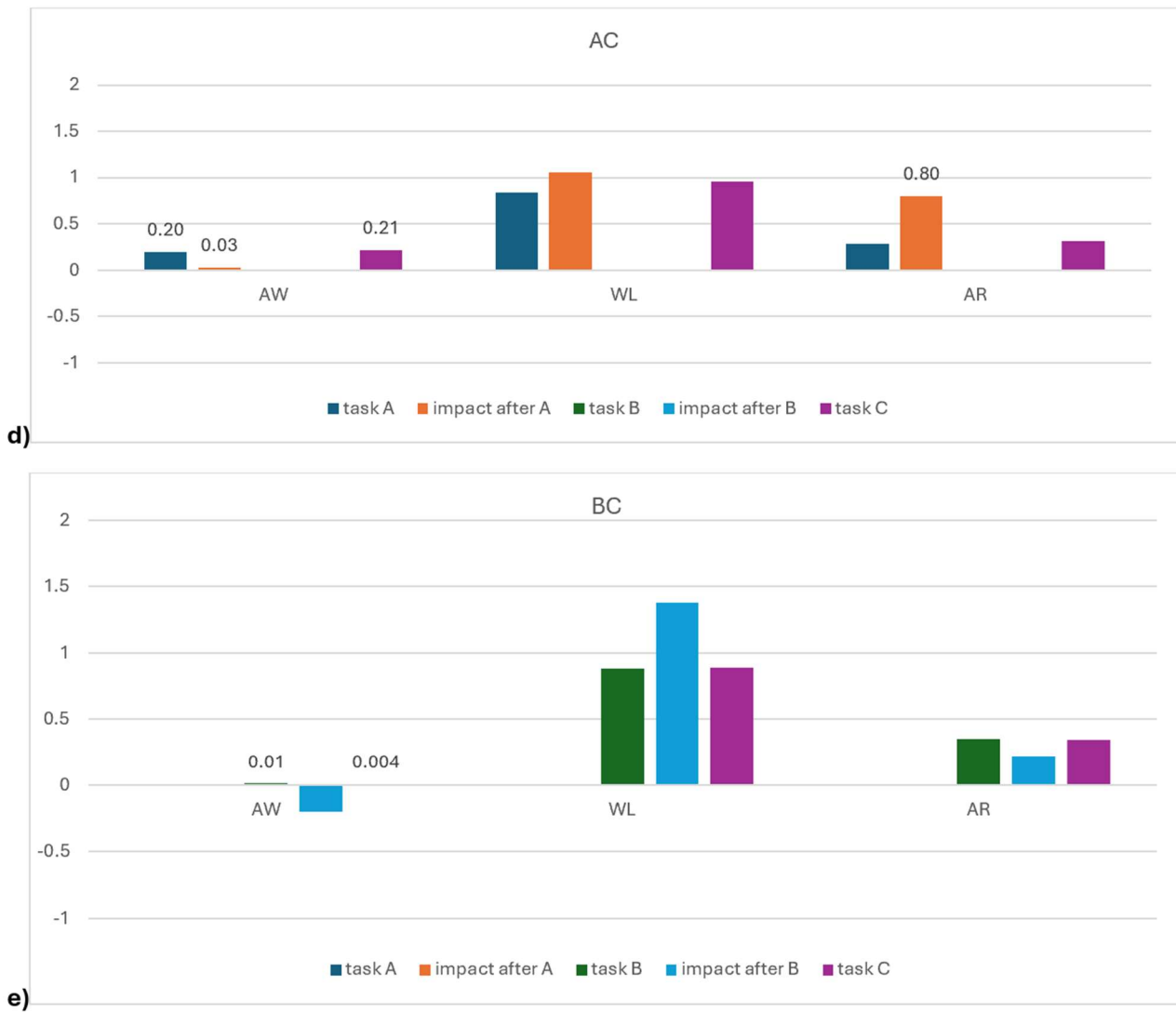
a)



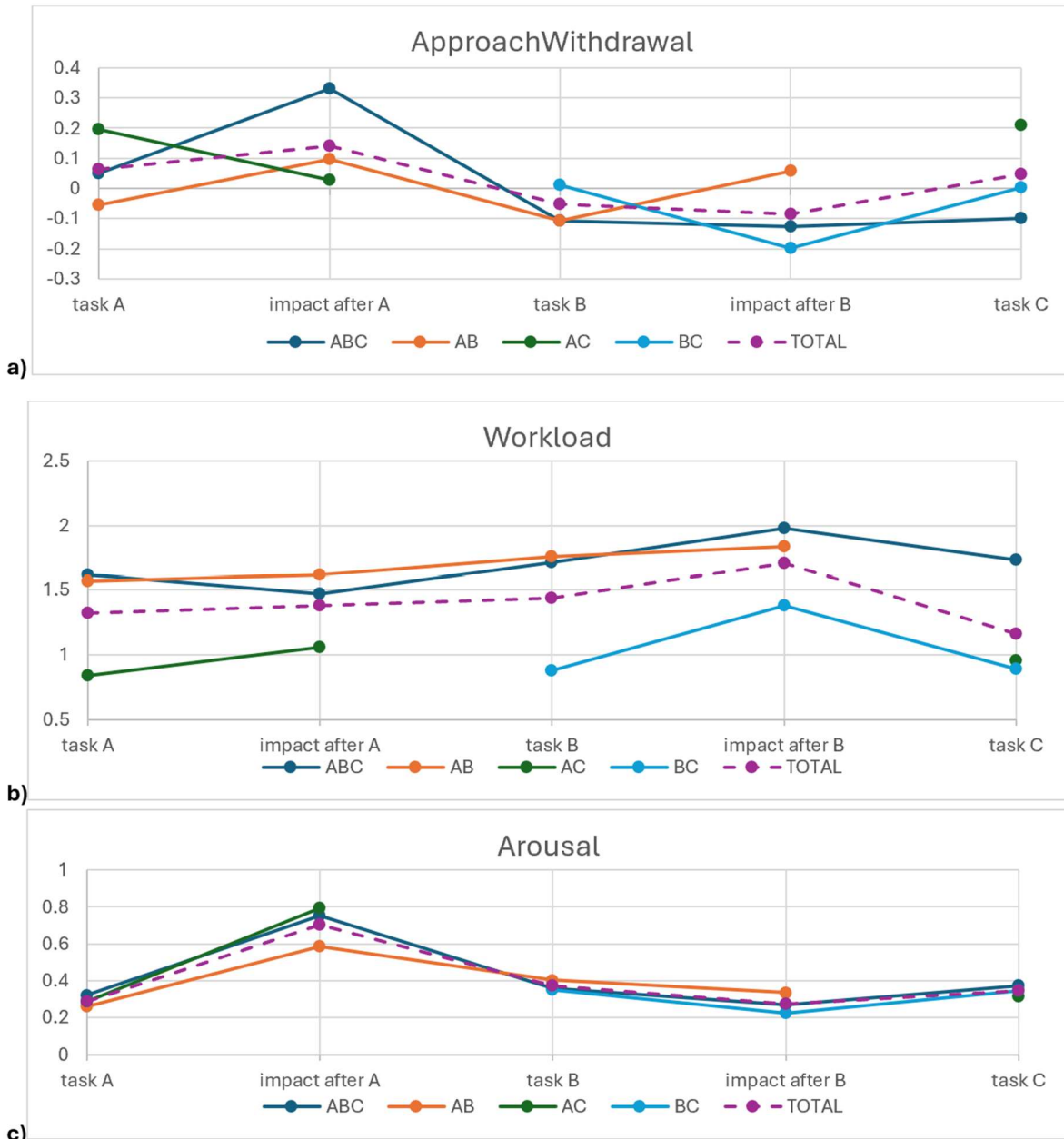
b)



c)



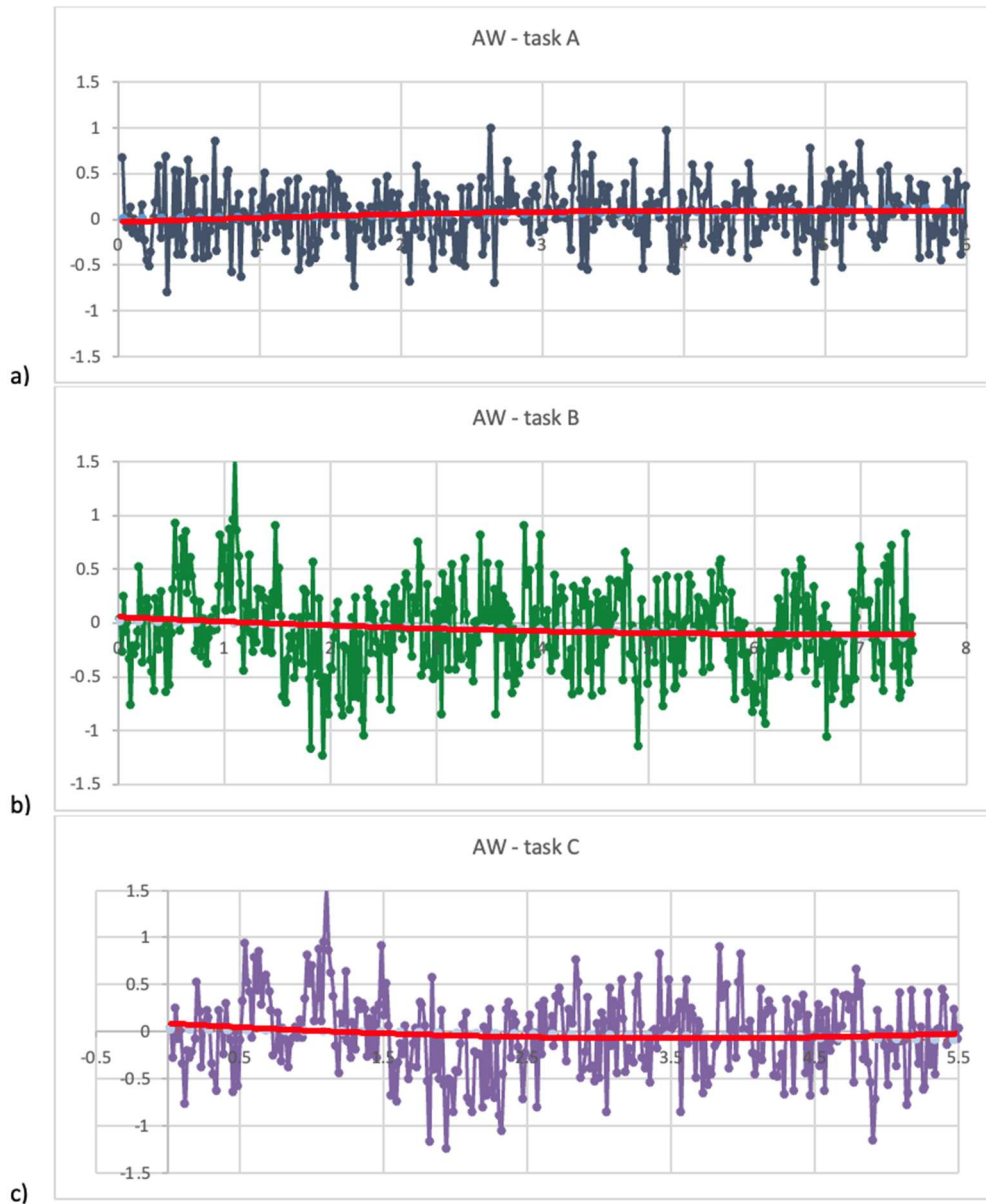
**Figure 41:** Bar graph of the indices' means values in each task for participants wearing Mindtooth and Shimmer: a) all participants, b) participants who have seen all tasks; c) participants who have seen only task A and B; d) participants who have seen only tasks A and C; e) participants who have seen only tasks B and C.



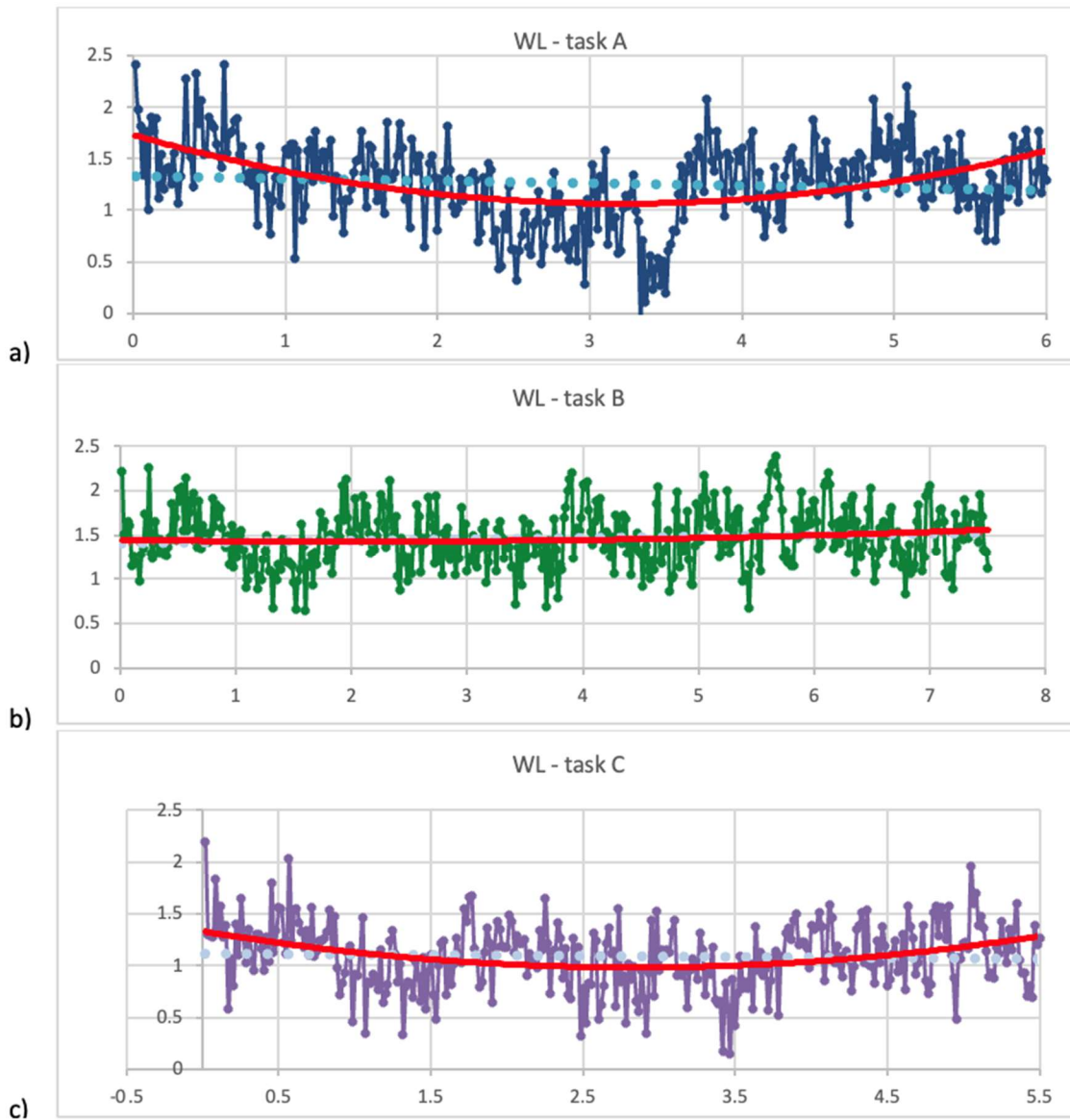
**Figure 42:** different representation of the same results that shows during all the tasks the trend of the parameters comparing the mean of the groups of participants.

## ANALYSIS IN TIME

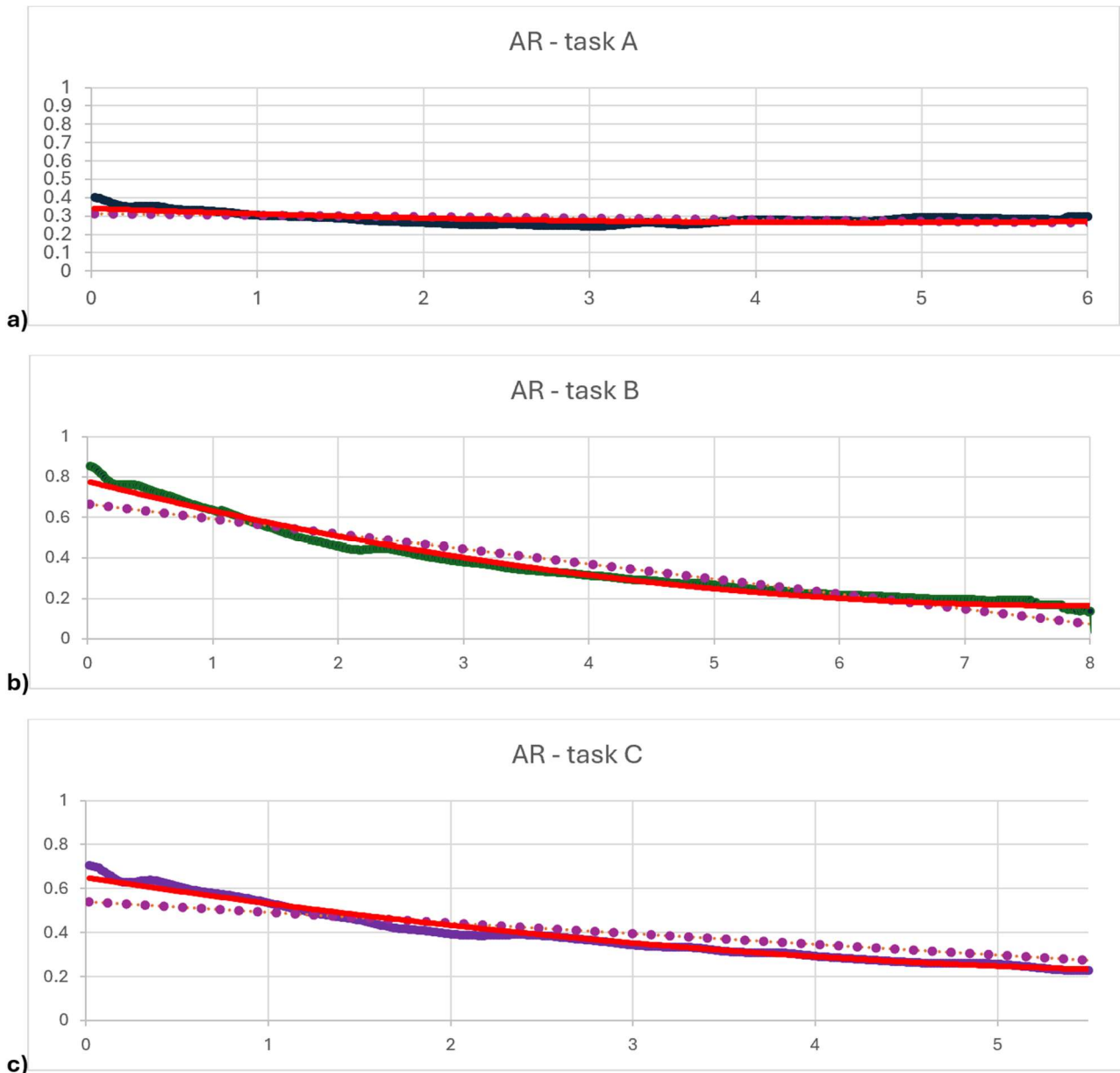
Figure 43, 44 and 45 show graphs of the mean signals of indices in time off all participants across tasks. In each graph the linear progression has been represented to evaluate the tendency.



**Figure 43:** Average signals in time for Approach-withdrawal index of all participants for: a) task A (6 minutes), b) task B (7.5 minutes), c) task C (5.5 minutes). The red line is the polynomial regression of the signal to evaluate the global trend. The blue dotted line is the linear regression.



**Figure 44:** Average signals in time for Cognitive Workload index of all participants for: a) task A (6 minutes), b) task B (7.5 minutes), c) task C (5.5 minutes). The red line is the polynomial regression of the signal to evaluate the global trend. The blue dotted line is the linear regression.



**Figure 45:** Average signals in time for Arousal index of all participants wearing Shimmer for: a) task A (6 minutes), b) task B (7.5 minutes), c) task C (5.5 minutes). The red line is the polynomial regression of the signal to evaluate the global trend. The blue dotted line is the linear regression.

## DISCUSSION ALESIA

### AVERAGE OVER TIME

Results did not reveal any significant differences across all indices when comparing across tasks (A, B, C). This finding holds both when considering only participants who observed all tasks (noting that each group included a maximum of 16 individuals, which is a small sample), and when including all participants regardless of the specific combination of tasks they observed (some comparisons including between-subjects analyses).

A significant effect of CW was observed across all tasks. In task A, this effect was not supported by significant post-hoc comparisons. In contrast, in task B, participants who completed tasks BC exhibited a lower cognitive workload compared to those who completed AB or ABC. Lastly, in task C, CW was higher among participants who completed all tasks (group ABC) compared to the other

groups. No significant differences were found for the AW and Arousal indices.

#### ANALYSIS IN TIME

The Approach-Withdrawal index was examined by observing the values averaged throughout time and temporal patterns did not show variation throughout the experimentation. This is further confirmed by the regression graph, showing a roughly constant flat line.

The Workload index shows a slight increasing regressing line over time for task B, whereas for tasks A and C, the temporal pattern slightly resembles a U-shape, indicating an initial and a final peak.

Finally, for the Arousal index the temporal pattern showed a U-shape for task A, with an initial and a final peak, whereas for task B and C, it showed a linear decrease over time.

#### CONCLUSION ALESIA

In summary, regarding the average over time results, **the most informative outcome was provided by the Cognitive Workload index, which was generally higher among participants who completed all tasks.**

Results from the temporal analysis showed similar patterns across tasks for the **Approach-Withdrawal index, which remained stable over time.** For CW, only task B exhibited a decreasing trend in engagement over time, while tasks A and C followed a U-shaped pattern. Finally, Arousal displayed a U-shaped trend in task A, but a marked linear decrease over time in tasks B and C.

### 5.3 Indoor positioning results

The focus of the present analysis is the Egyptian papyrus exhibit, located at the centre of Room 6 (see Figure below). This artifact represents the primary point of interest, providing a reference location for assessing how visitors engage with museum displays. The analysis considers several behavioural metrics such as spatial proximity (how closely visitors approach the exhibit), stopping behaviour (whether and for how long visitors pause), gaze patterns (where and how visitors direct their visual attention), and dwell time (the total time spent in the display area). The participants who wore the eye-tracking glasses and carried a UWB tracking device are summarized in the Annex 3.

A threshold distance of 1 meter was chosen to define the papyrus interaction zone, considering both the front and back of the exhibit, as shown in Figure below. The analysis showed that almost all visitors either stopped at or passed through the papyrus area within this distance, except for the following two participants (T032PS and T111ES).

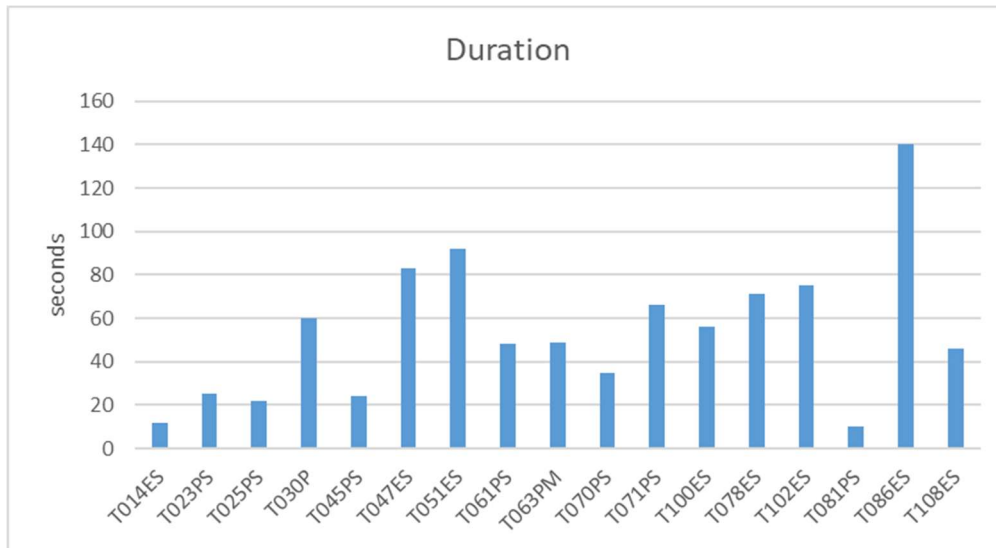


Figure 46 - Papyrus Exhibit with 1 m interaction zone

Among the 22 visitors who entered this interaction zone, we distinguished between those who paused to look at the exhibit and those who continued walking. This distinction is important because passing close to the display does not necessarily imply active engagement. We found that 17 of the 22 visitors ( $\approx 77\%$ ) stopped to observe the exhibit, while 5 visitors ( $\approx 23\%$ ) passed through without stopping.

For the group of 17 stopping visitors, a further analysis was conducted using the timestamps extracted from the UWB results and eye-tracking videos. These timestamps allowed us to calculate the exact duration of each stop, expressed in seconds. The Figure below presents the results by participant ID, showing that dwell times varied considerably, ranging from as little as 10 seconds to more than two minutes. This stationarity information provides insight into the level of attention the papyrus exhibit was able to capture, forming the basis for subsequent analysis of where visitors directed their gaze (towards the papyrus itself, the caption, or surrounding elements).

To better understand visitor engagement, the stopping visitors were classified according to the length of their dwell time in front of the papyrus. As shown in Table 5, five visitors paused only briefly ( $<30$  s), the majority (6 visitors) remained for 30–60 s, five visitors observed for between one and two minutes, and one visitor stayed for more than two minutes.



**Figure 47:** results by participant ID

Category	Range (s)	Count
Short	< 30	5
Medium	30–60	6
Long	61–120	5
Very long	> 120	1

**Table 5** - Classification of visitor stop durations at the papyrus exhibit

The use of eye tracking technology enabled the detection of visitors' gaze direction patterns. We identified two macro categories and subdivided the visitors into Brief scanning and Selective engagement behaviours. In the case of brief scanning, visitors checked both the papyrus and captions without spending significant time reading specific parts of the text; they conducted a general overview of the exhibit. In the case of selective engagement, visitors spent more time focusing on specific captions or specific details of the papyrus artifacts. A more detailed analysis on the eye tracking results will be described in the following section.

User	Gaze Pattern
T014ES	Brief scanning
T023PS	Selective engagement
T025PS	Brief scanning
T030PS	Selective engagement
T045PS	Selective engagement
T047ES	Selective engagement
T051ES	Selective engagement
T061PS	Brief scanning
T063PM	Brief scanning
T070PS	Brief scanning
T071PS	Selective engagement
T100ES	Selective engagement

<b>T078ES</b>	Brief scanning
<b>T102ES</b>	Selective engagement
<b>T081PS</b>	Brief scanning
<b>T086ES</b>	Selective engagement
<b>T108ES</b>	Selective engagement

## 5.4 Eye-tracker test results

This data is uniquely able to indicate what elements of visual stimuli were engaged by the subjects in the experiments. The following section includes an explanation, analysis and discussion of trends of viewing behaviours among specific groups of participants.

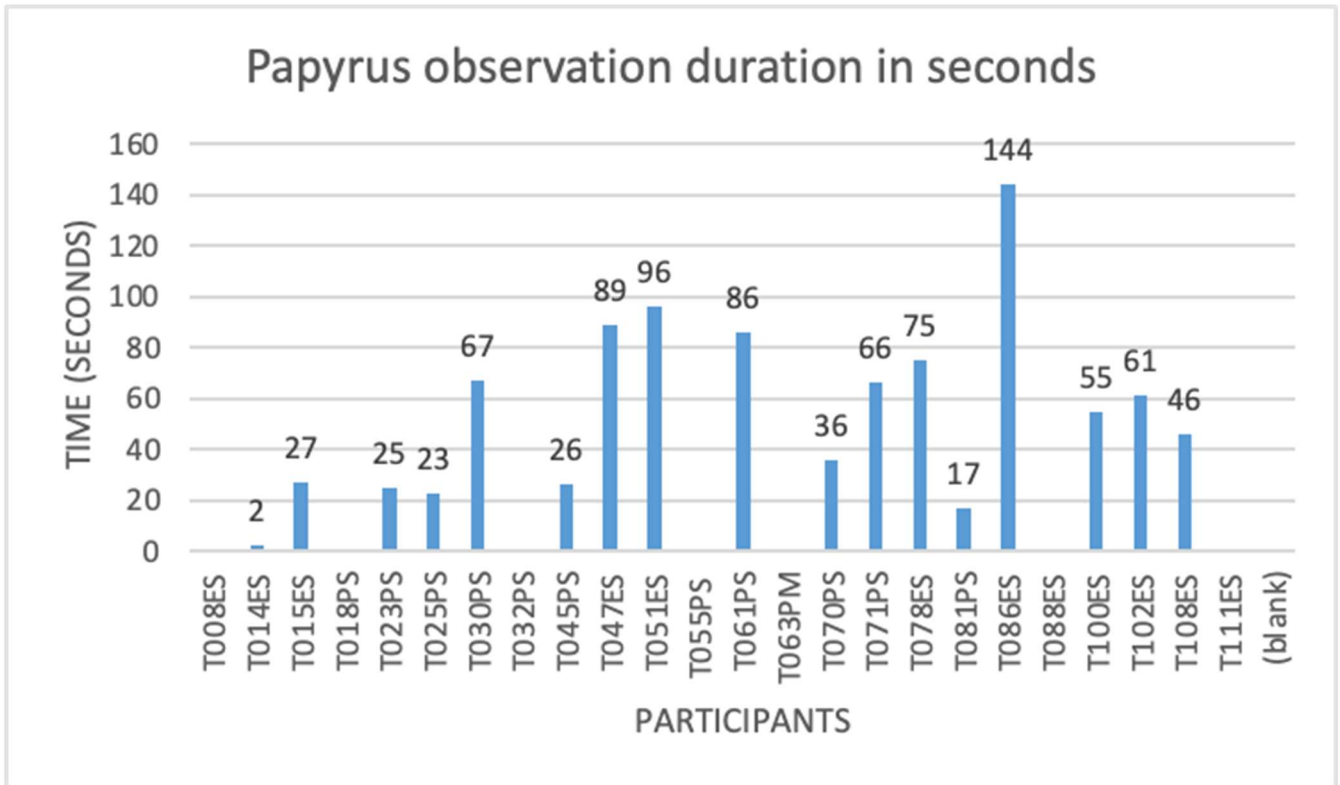
The results of the eye tracker experiment were extracted manually through viewing the recorded videos. Objects of interest to the Egyptian museum include the historic photos. In the gallery of Kha and Merit. Based on an extrapolation of the data of about two thirds of the participants in the experiments looked at the papyrus strike 18/24 and the majority of those who observed it, did so for one minute before moving on to something else. Most of the subjects who observed the papyrus only observed one side with the side left of the gallery entry being far more popular than the right. The gaze points of each participant is in the process of being mapped onto a 3d model of the two galleries of the museum experiments. The results of the heat maps show trends in the visual attention paid by subjects. Generally little attention was paid to the room beyond the artifacts. Most subjects followed a similar rout through the museum with hotspots of attention on particular regions (see section 5.12 kernel density maps).

Considering the technical framework and hardware previously described, a preliminary analysis was conducted focusing on visitor behaviour in the Strike Papyrus area within Room 6. For this initial analysis, only eye tracking and UWB positioning methods were utilized to examine visitor proximity, stopping behaviour, attention patterns, and engagement duration through these multimodal data collection techniques.

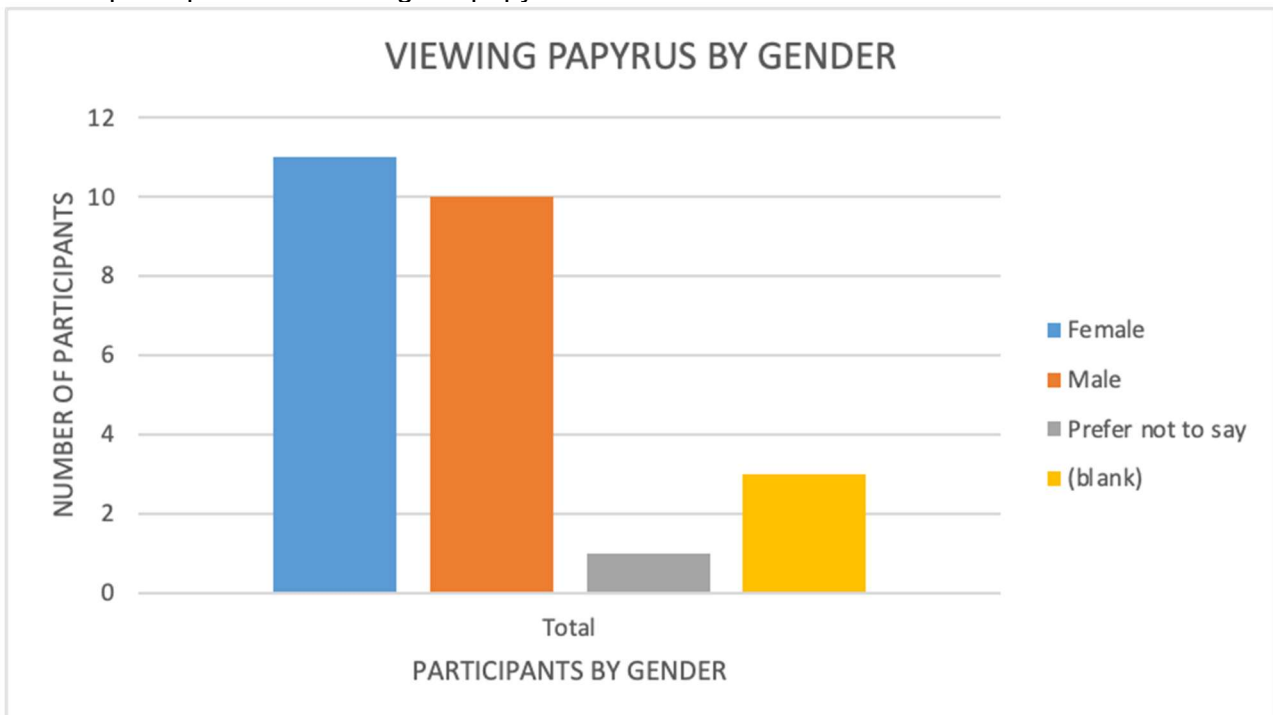
A total of 24 visitors were equipped with eye tracking devices for this analysis. Each participant was assigned a unique ID along with the corresponding test date, as detailed in Table 6. The analysis aimed to determine:

- (1) how many visitors passed by the papyrus display area,
- (2) which visitors approached within one meter of the exhibit,
- (3) which participants stopped at the display, and
- (4) the duration of any stopping behaviour observed.

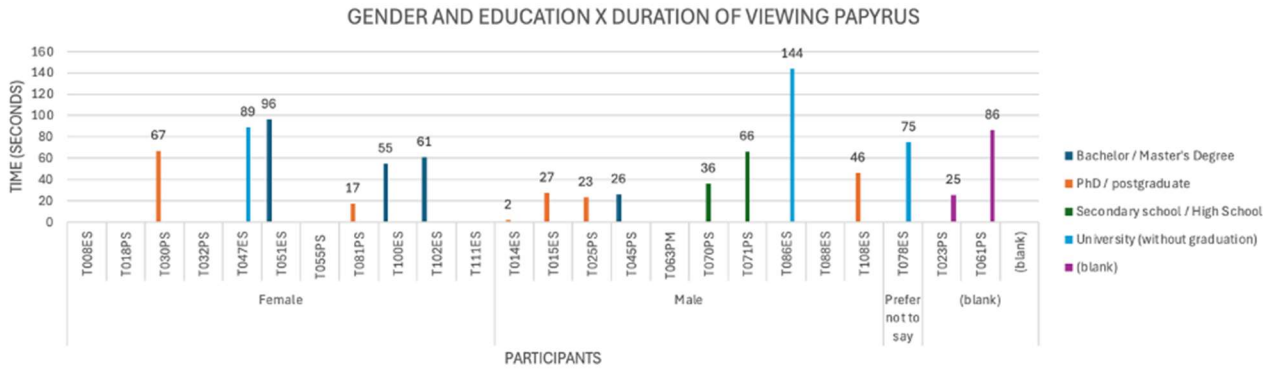
5.4..1 Demographic Analysis.



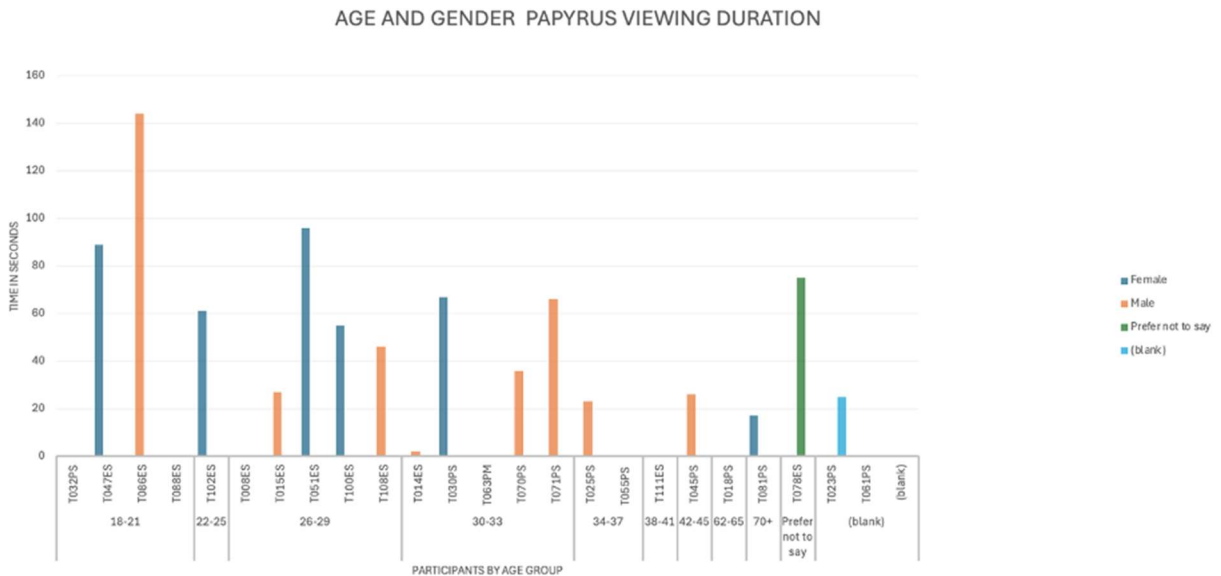
**Table 6:** Representation of the total time spent viewing the strike papyrus, most participants viewed the papyrus for a period of time less than 70 seconds, with a major outlier being participant T086ES viewing the papyrus for 144 seconds, much more participants viewed the papyrus than did not view it with 6 participants not viewing the papyrus at all.



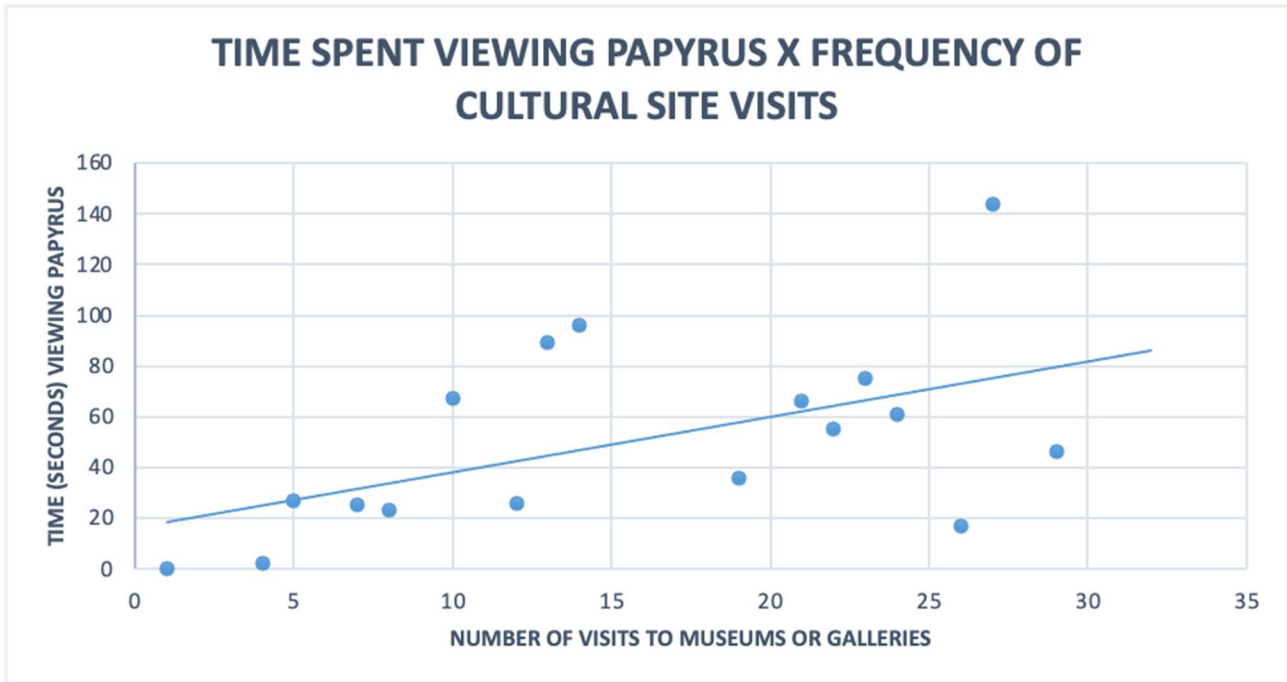
Comparing the gender of the participants, there is a difference of 1 between the number of males and females that viewed the papyrus, but this must be considered in relation to the participants that left the question of gender blank or selected prefer not to say in the questionnaire, therefore there is not likely a significant difference of gender relating to who chose to view and not view the papyrus.



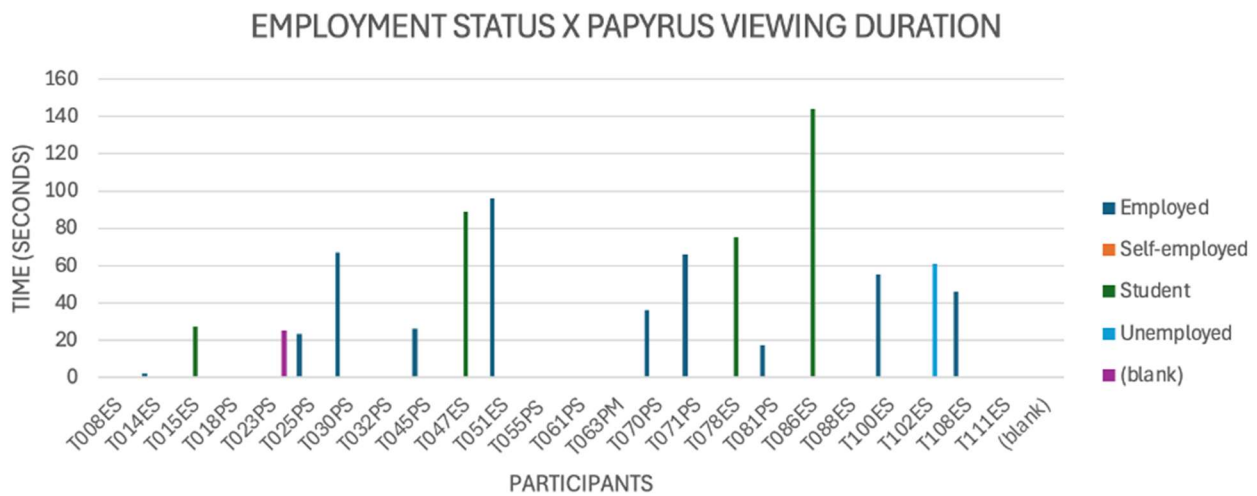
Taking into consideration the total duration of viewing the papyrus compared to education and gender, the participants who viewed the papyrus the longest belong to those who selected “University without graduation” in the questionnaire. Those who selected PhD/ Postgraduate viewed the papyrus for the lowest duration. Women viewed the papyrus for much more consistent durations than men who viewed the papyrus with a greater range of durations. The least represented group of people who viewed the papyrus are men with a secondary school education and the most represented group who viewed the papyrus are women with a PhD/post graduate education, with PhD/postgraduates being the most represented group overall.



Broken down by age group and gender it becomes clear younger participants between the ages of 18 to 33 were more likely to view the papyrus and view it for a longer period of time. Again, women were overall more consistent in their viewing duration while men display a greater variability with extreme durations of both high and low values. Older participants were less likely to view the papyrus and did so for less time. In the over 33 category men were more likely to view the papyrus than women.

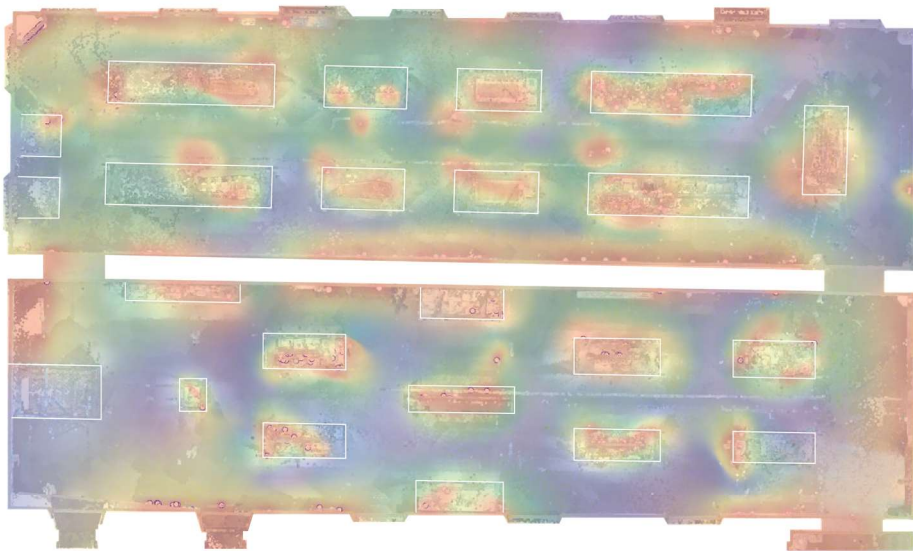
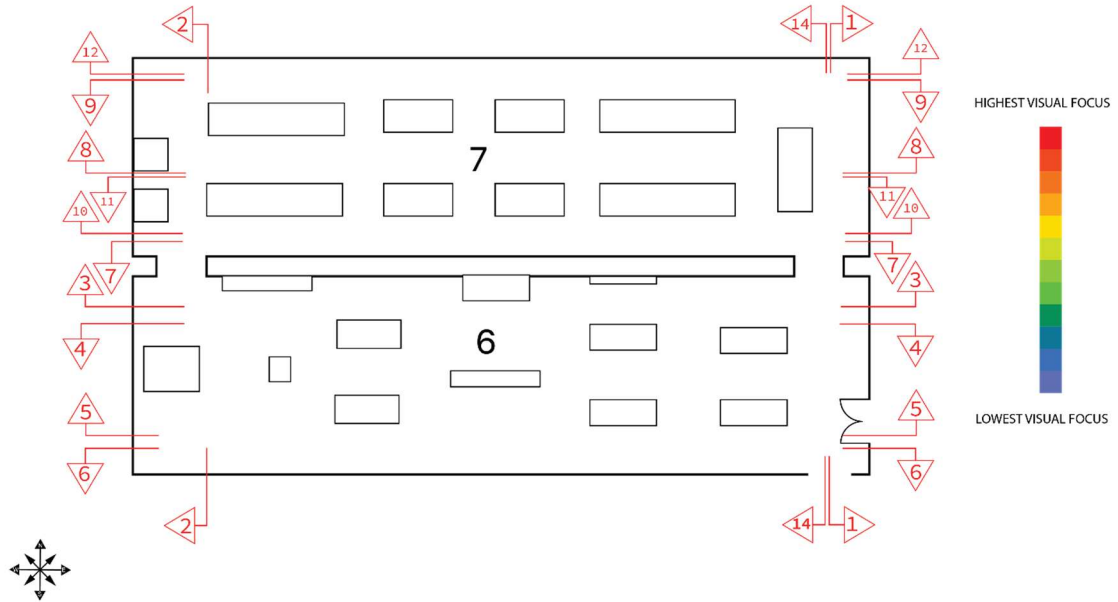


When comparing viewing durations with the estimated number of visits to museums and art galleries over the last 12 months reported in the questionnaire there is a correlation between those who reported higher numbers of visits to museums and cultural institutions having higher viewing durations of the papyrus.

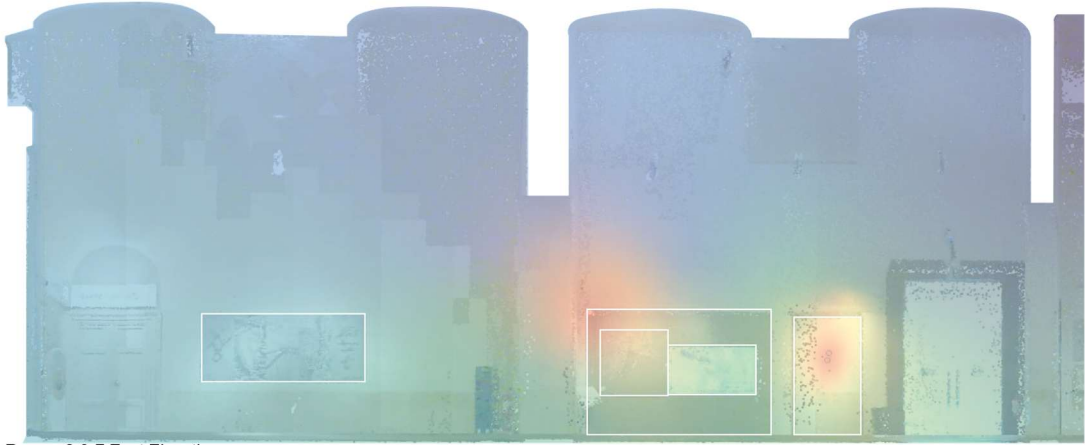


Of those who indicated their employment status in the questionnaire, none who selected self-employed viewed the papyrus. The most represented group among those who viewed the papyrus indicated they are employed; they are also the group who viewed the papyrus for a more consistent duration. Those who indicated their employment as “student” viewed the papyrus for the longest duration.

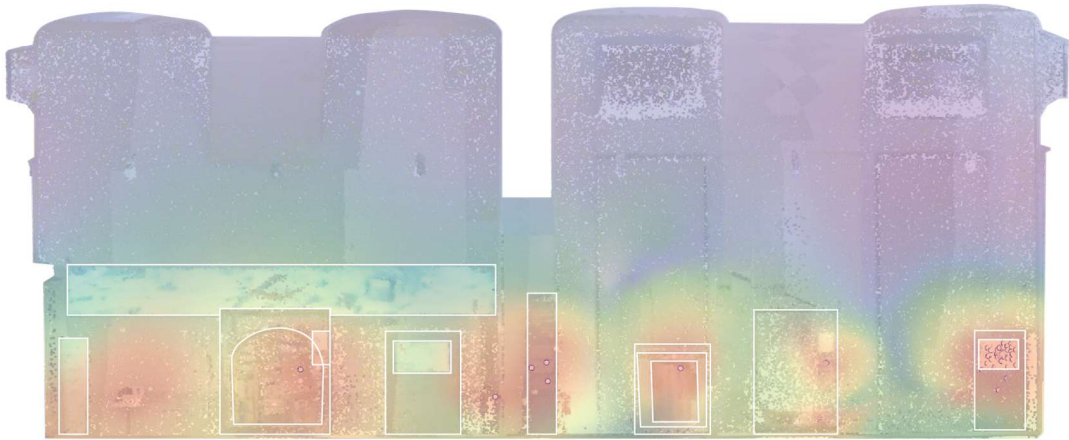
5.4..2 Kernel Density Maps



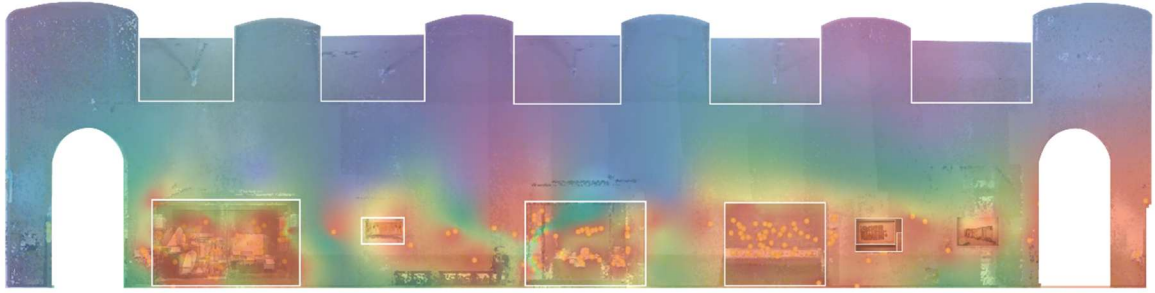
1 Room 6 & 7 Plan



1 Rooms 6 & 7 East Elevation



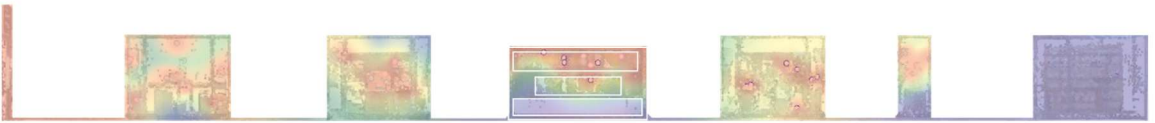
2 Rooms 6 & 7 West Elevation



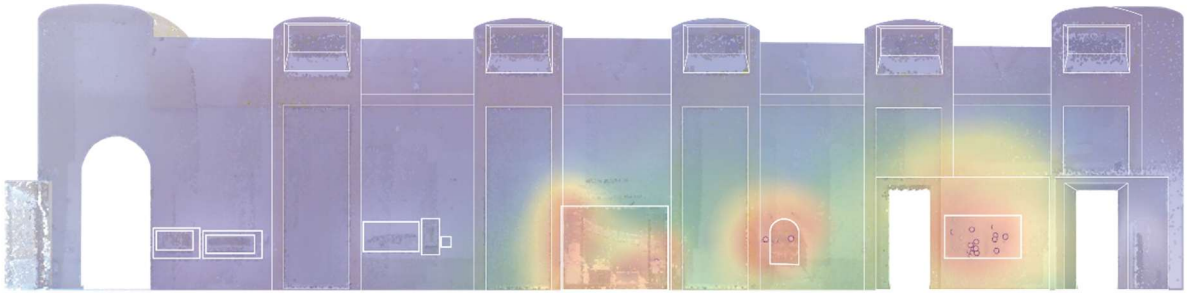
3 Room 6 North Elevation



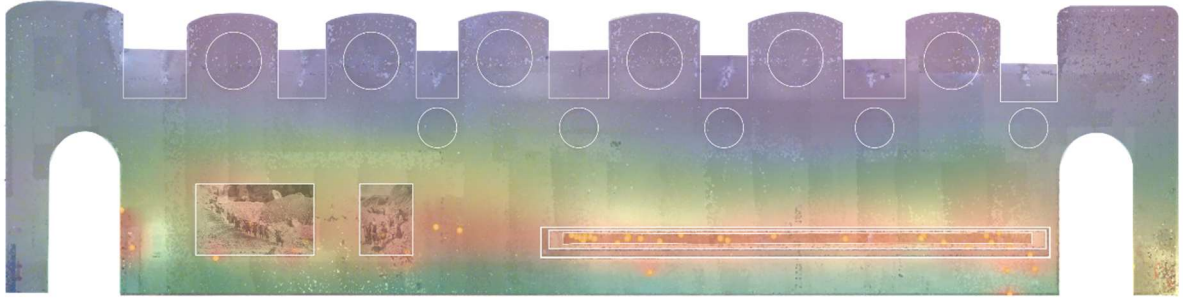
4 Room 6 North Elevation- Chapel of Maya, Strike Papyrus



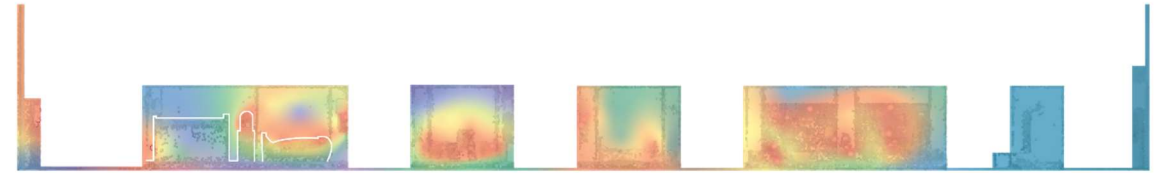
5 Room 6 South Elevation- Chapel of Maya, Strike Papyrus



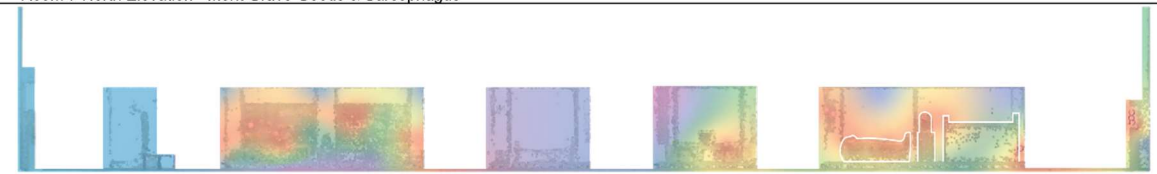
6 Room 6 South Elevation



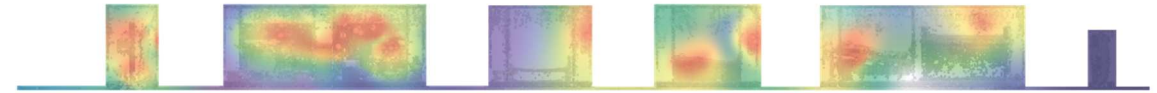
7 Room 7 South Elevation



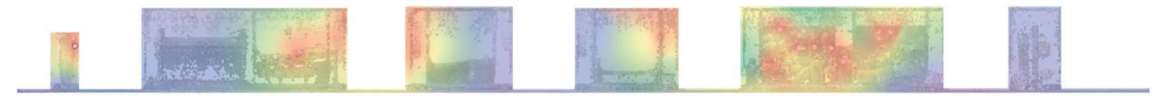
8 Room 7 North Elevation - Merit Grave Goods & Sarcophagus



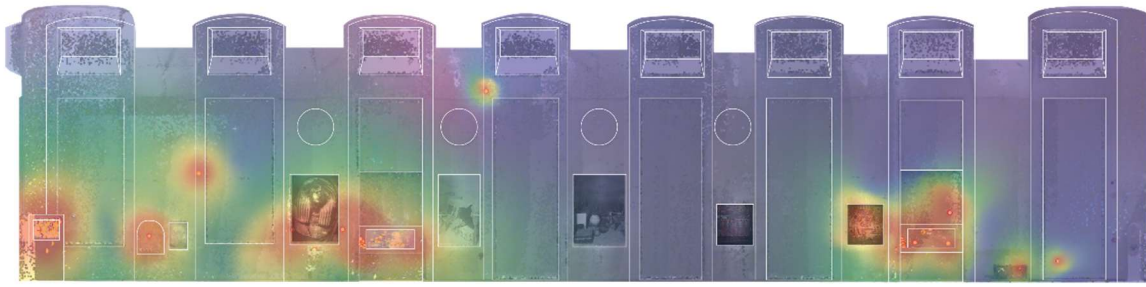
9 Room 7 South Elevation - Merit Grave Goods & Sarcophagus



10 Room 7 North Elevation - Kha Grave Goods & Sarcophagus



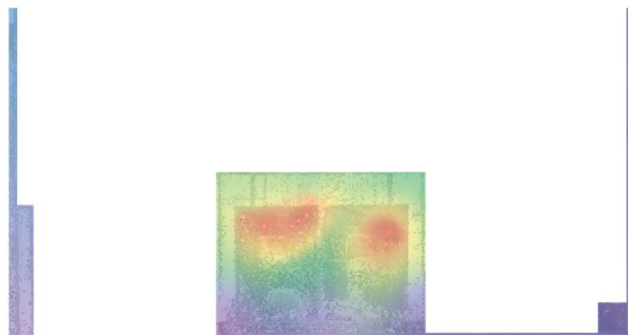
11 Room 7 South Elevation - Kha Grave Goods & Sarcophagus



12 Room 7 North Elevation



13 Room 7 East Elevation- Kha's Cloaks



14 Room 7 West Elevation- Kha's Grave Goods

These Kernel density maps represent the cumulative density of visual focus among eye tracker participants. Where red regions represent the centre of visual focus as indicated by the eye tracker glasses and purple indicates regions that are outside of the cone of vision completely. Yellow to blue indicate regions within the cone of vision with yellow being closer to the centre and blue being the peripheral vision. These heat maps were produced by mapping the centre points of visual focus onto a 3D model of the Galleries of the papyrus and Kha and Merit, within the Egyptian museum. After gaze points are mapped color-coded kernel density maps were produced to visualize the trends between multiple participants viewing of the rooms.

These maps provide information on the overall trends of a group of participants instead of an individual's attention throughout the museum. In general participants spend more time viewing stimuli that is at or near their eyelevel, stimuli on the ground or at a great height above the participants was rarely to never viewed. Participants were most likely to view multimedia stimuli for more time, videos, light displays interactive explainers received the highest frequency of attention, when compared to objects such as pottery, tools, paintbrushes which received little attention. Of non-multimedia stimuli that consistently received high levels of attention where stimuli that represent the human form, statues, paintings, human remains, and funerary masks received targeted and consistent attention. Participants did not spend time viewing architectural elements of the galleries, the ceiling, walls and floor of the galleries were rarely to ever viewed, as evidenced in the plan visual attention is neatly and consistently attached to the locations of vitrines within the two galleries. The papyri that were viewed the most were the strike papyrus, the erotic papyrus and the book of the dead, receiving consistent and sustained attention from many participants.

## Conclusions and General Reflections Eye Tracker Results

Between the demographic and spatial representations of this data it is interesting that the strongest correlations come from not fixed parts of one's identity like gender but how much one believes they are interested in the material for example the strongest predictor for long duration papyrus viewing was the self-reported frequency of visits to cultural institutions within the last year. The higher the reported number the greater the viewing duration tended to be. Within the gallery, the stimuli that was most likely to visually engage viewers were objects which in some way directly reflected the human form, whether human remains, statues paintings, drawings or photographs these articles received the highest and most consistent visual attention from participants. This could suggest that participants feel a higher level of engagement with stimuli that allow them to be visual engaged and represents a familiar aspect of the human experience, while articles from daily life such as clothing pottery and tools did not catalyse sustained visual attention from participants. How educated a participant was or their employment status does not seem to be as strong of an indicator of their behaviour inside the museum as much as their perceived level of interest in cultural programming did.

## 5.5 Questionnaires analysis and interpretation

This section presents the results of the *status quo* (pre- and post-visit) questionnaires, reported separately for each museum. Each museum had a different exhibition, visitor profile, and survey sample. Therefore, the results are reported separately and are not directly comparable across sites. The dashboard below gives a high-level overview of changes within each museum, followed by detailed summaries for Museo Egizio, MAC Barcelona, and MuséoParc Alésia.

*Pre/post changes – within each museum (non-comparative)*

Indicator	Museo Egizio	MAC Barcelona	MuséoParc Alésia
<b>Personal confidence</b>	↑	↑ (small)	→
<b>Confidence in society</b>	↑	→	↑
<b>Knowledge</b>	↑	↑	↑
<b>Emotional engagement</b>	Moderate	Strong	Moderate - Low
<b>Key emotions</b>	Respect, Empathy, Joy, Inspiration	Empathy, Respect, Joy, Touched, Belonging	Empathy, Respect, Belonging, Sadness

**Note:** Arrows indicate direction of change *within each museum*. Results are not directly comparable across sites due to differences in sample structure, exhibition content, and museum context.

The table below presents the structure of survey samples across the three participating museums.

Characteristic	Museo Egizio (N=138*)	MAC Barcelona (N=95)	MuséoParc Alésia (N=78)
<b>Age</b>			
18–25	33%	16%	14%
26–33	26%	24%	18%
34–49	12%	31%	24%
50 and above	28%	29%	44%
<b>Gender**</b>			
Female	57%	65%	56%
Male	41%	32%	41%
<b>Education</b>			
Elementary	1%	1%	0%
Secondary school	11%	2%	24%
University (w/o graduation)	12%	12%	17%
Bachelor / Master's degree	61%	71%	51%
PhD / Postgraduate	13%	15%	8%
<b>Occupation</b>			
Employed	28%	56%	55%

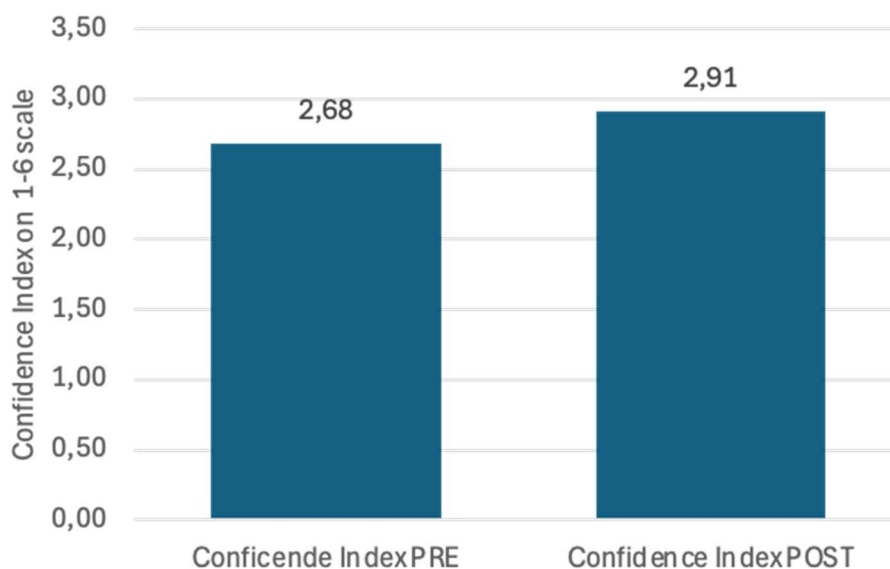
Self-employed	9%	9%	4%
Student	37%	16%	10%
Retired	15%	2%	15%
Unemployed	6%	5%	4%
Other	2%	12%	3%
<b>Total sample (N)</b>	138*	95	78

\*The discrepancy between the measured sample (n=104) and the number of answers collected to the questionnaire (n=138) has to be ascribed to the participation of the co-creation groups who completed the visit, took the survey but were not fitted the neurophysiological equipment.

\*\*The sum does not reach 100%. Other selectable options (*non-binary, I'd prefer not to say and other*) each scored <1%.

## QUANTITATIVE RESULTS FROM MUSEO EGIZIO

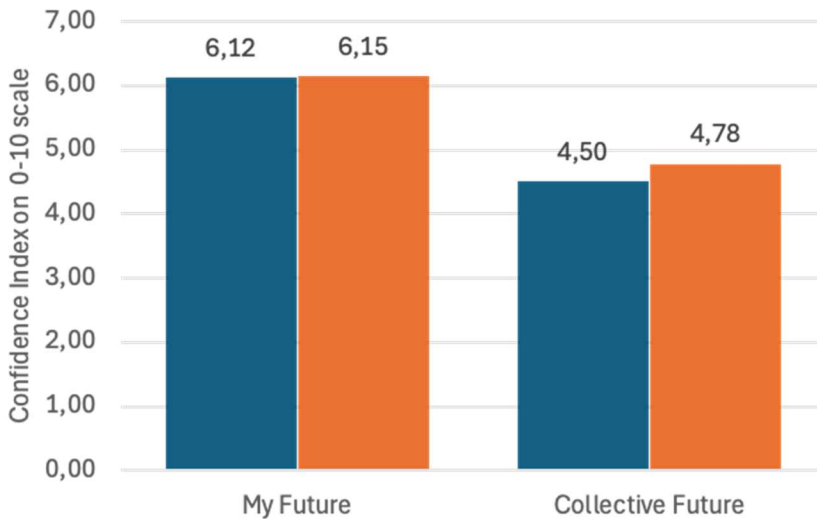
**Influence of the exhibition on the confidence levels and self-assessed knowledge.** After visiting the exhibition, **overall confidence** measured by the 6-item General Confidence Scale **increased from 2,68 to 2,91 on 1-6 scale**, on total sample. This shows that generally confidence levels are low, with average result below the middle point of the scale (3.5). The **largest gains** after the visit in the museum were **observed among male and older participants. Visitors with higher education and greater cultural engagement also reported stronger confidence post-visit.** This suggests that the exhibition may have reinforced feelings of future security, especially among those already more confident or culturally active, but overall levels are low. This, as previously mentioned, confirms the need to direct efforts towards the non-public/disaffected public.



**Chart 1.** Confidence measured by the 6-item General Confidence Scale, scale 1-6. Results show moderate improvement, but overall results remain low.

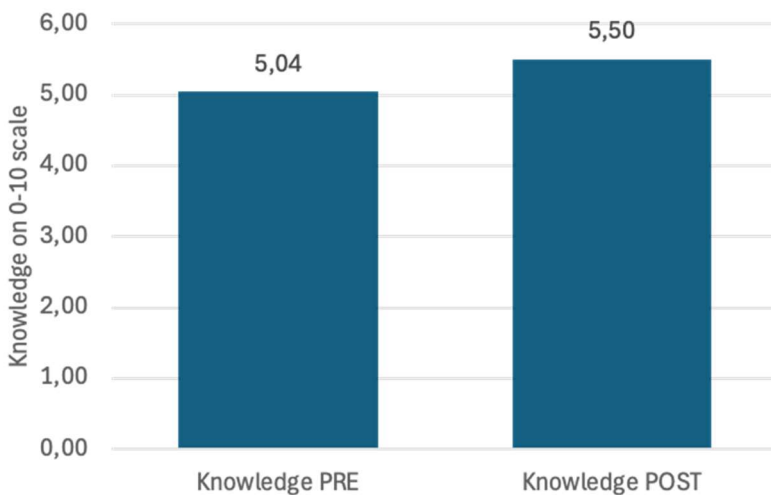
Confidence **measured by single item, regarding personal future remained largely unchanged** after the exhibition. However, **views on the future of society did improve slightly.** Also in this case, the highest increases were seen among visitors who were more culturally engaged and had

higher collectivism scores. This suggests that the exhibition may have supported a more hopeful and socially oriented outlook, particularly among those who value shared experiences and community well-being. This may indicate that **an innate collective mindset enhances people’s confidence in society’s ability to face the future.**



**Chart 2.** Confidence about the Future, scale 0-10 – slight rise for personal future (How I feel about my personal future), clearer gain for collective future (How I feel about collective future).

Self-rated knowledge about the exhibition topic increased from 5,04 to 5,50 (0-10 scale) after the visit, especially among those with lower initial knowledge. The increase was consistent across most groups, with slightly higher gains among older and more educated visitors. This suggests the exhibition was effective in delivering its core content and transferring information and data.

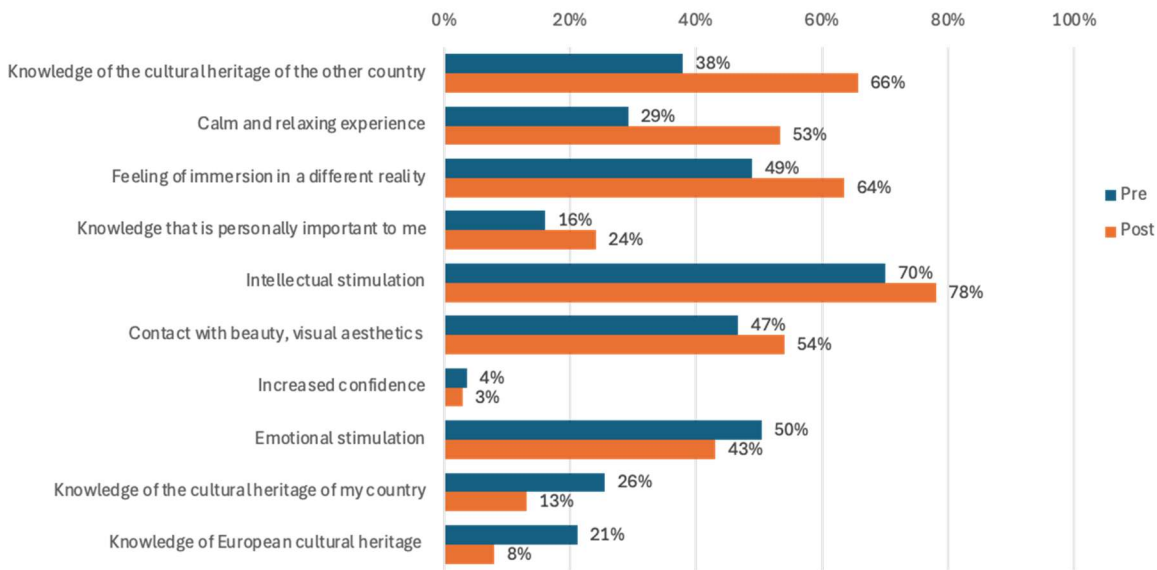


**Chart 3.** Self-reported knowledge of the theme of the exhibition, before and after the visit, scale 0-10. Results show noticeable increase after the visit.

### Expectations before and after the visit.

Question: *What kind of effects do you expect? / What kind of results did you get from this visit?*

The visit to the Museo Egizio exhibition led to **differences between what participants expected and what they actually experienced**. After the exhibition, visitors reported stronger effects related to immersion, relaxation, and learning about another culture. Effects such as **emotional stimulation or learning about their own or European heritage were mentioned less often after the visit**. This suggests that the exhibition delivered results aligned with what one might expect from a museum about ancient Egypt—focusing on calmness, discovery, and cultural exploration.

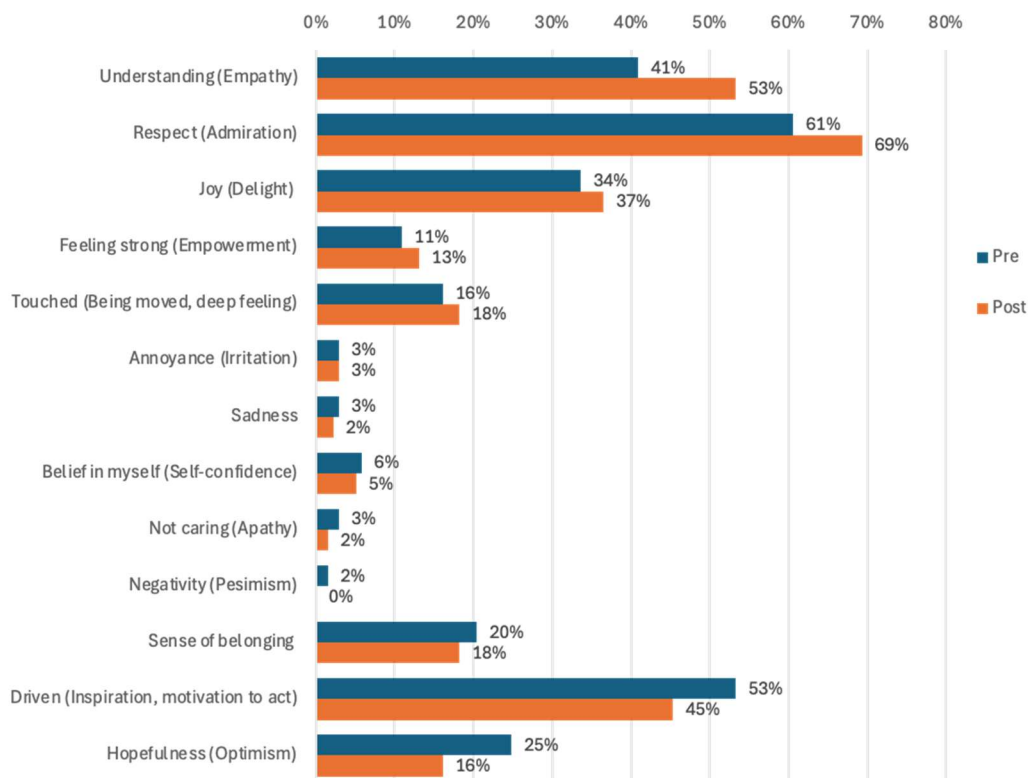


**Chart 4.** *Expectations and results of the visit, sorted according to the difference between post and pre measurement, N=138.*

### Emotions expected before the visit and reported after the visit.

Question: *What emotions do you think this exhibition might evoke (did evoke) in you?*

The emotional responses reported after the exhibition show both continuity and change compared to visitors' expectations. Emotions such as empathy, admiration, and joy were not only the most commonly expected but also confirmed more strongly after the visit. Meanwhile, **motivational and forward-looking feelings—like hope, inspiration, and a sense of belonging—were reported less often than anticipated**. Negative emotions remained low and mostly unchanged. Overall, the exhibition appears to have reinforced emotional engagement while tempering more personal or future-oriented expectations.



**Chart 5. Emotions before and after the exhibition, sorted according to the difference between post- and premeasurement, N=138.**

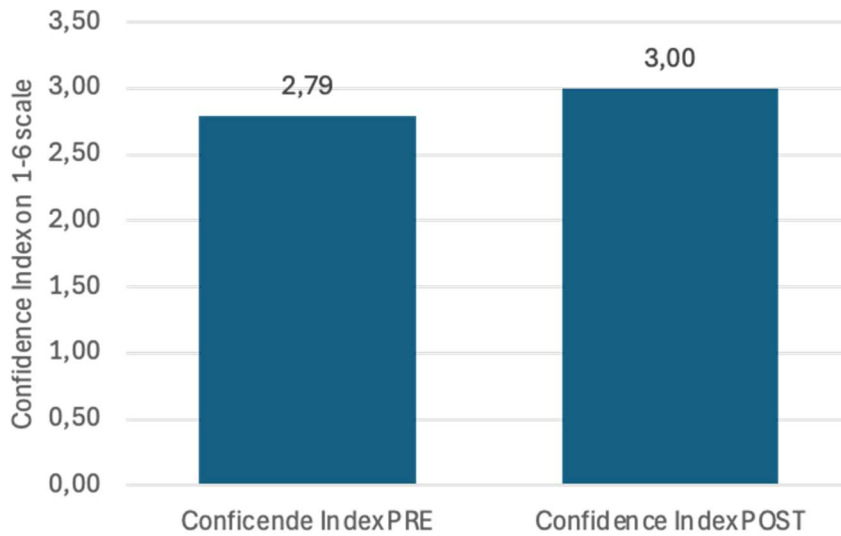
### Evaluation of the status-quo survey considering the workshop results for the planned intervention at Museo Egizio

The workshop concept built around unity, empowerment, and collective strength aligns reasonably well with the *status quo* results from the current Museo Egizio exhibition. Post-visit data shows a modest increase in collective confidence and knowledge, suggesting that the exhibition may already foster some reflection on societal resilience. **However, more emotionally activating outcomes — such as *feeling strong* or *driven to act* — did not rise significantly, indicating room for deeper engagement on these dimensions.**

The planned experimental intervention and prototypes creation aim to strengthen visitors' sense of confidence and resilience by highlighting the **power of collective action**, as illustrated by the story of the ancient Egyptian strike. An intervention that includes elements such visitor interaction, stimulating reflection, and modern parallels could be expected to lead to stronger changes in the desired direction — **increasing feelings of courage, solidarity**, and belief in the power of unity.

### QUANTITATIVE RESULTS FROM MAC BARCELONA

**Influence of the exhibition on the confidence levels and self-assessed knowledge.** General confidence, measured on a 1–6 scale, showed only a modest improvement after the exhibition, rising from 2.79 to 3.00 across the total sample. While this change suggests a slight positive effect, the overall level of confidence remained well below the scale midpoint (3.5), indicating that visitors' sense of security and outlook stayed relatively low. Men reported consistently higher confidence (3.04 → 3.27) compared to women (2.66 → 2.86), but differences between age groups were small and did not reveal a clear pattern: this last result is interesting and quite unexpected. Overall, the exhibition had limited, positive impact on strengthening visitors' general confidence.



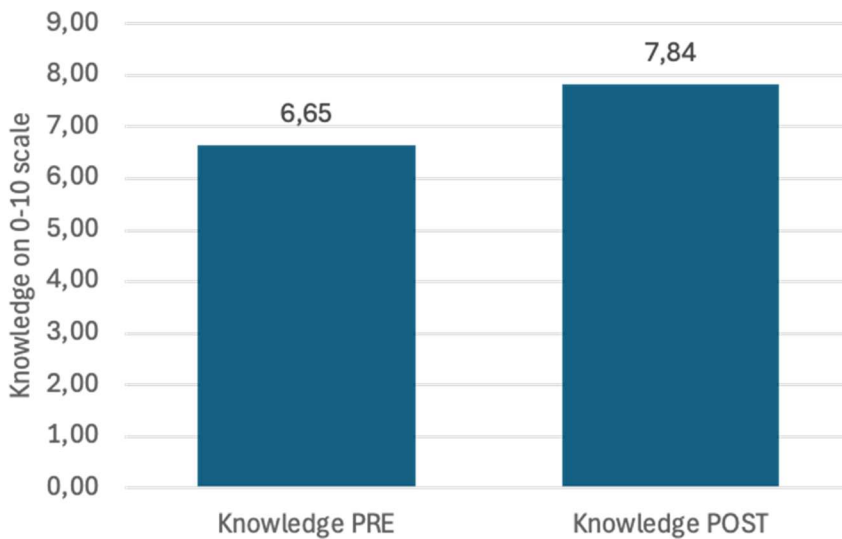
**Chart 1.** Confidence measured by the 6-item General Confidence Scale, scale 1-6. Results show moderate improvement, but overall results remain low.

Visitors felt a little more confident about their own future after the exhibition, with scores going up from 6.81 to 7.12 on a 0–10 scale. This shows a **small but steady rise in personal optimism**. However, **confidence in the future of society did not change** (5.18 before, 5.12 after), meaning people stayed rather doubtful about collective prospects. Men were slightly more positive than women, but the difference was minor. The exhibition helped people feel a bit better about their personal future, but it did not change their views about society’s future (that is, the opposite result compared to the Egyptian Museum).



**Chart 2.** Confidence about the Future, scale 0-10 – slight rise for personal future (How I feel about my personal future), clearer gain for collective future (How I feel about collective future).

Perceived knowledge increased substantially after the exhibition, from 6.65 to 7.84 on a 1–10 scale across the whole sample. The relative gain was larger among men (6.07 → 7.77) than among women (6.87 → 7.87), though both groups reached nearly the same post-visit level, suggesting a possible *ceiling effect* for women who already reported higher knowledge before the visit. Visitors who attend museums and galleries more frequently started with the highest baseline knowledge, but the largest gains were observed among those who visit less often and reported lower knowledge initially, indicating that the exhibition was particularly effective for less experienced audiences. A similar pattern was found when considering the importance of culture in respondents' lives: those highly engaged with culture had high initial knowledge and showed smaller changes, while those for whom culture plays a less central role reported stronger learning gains.

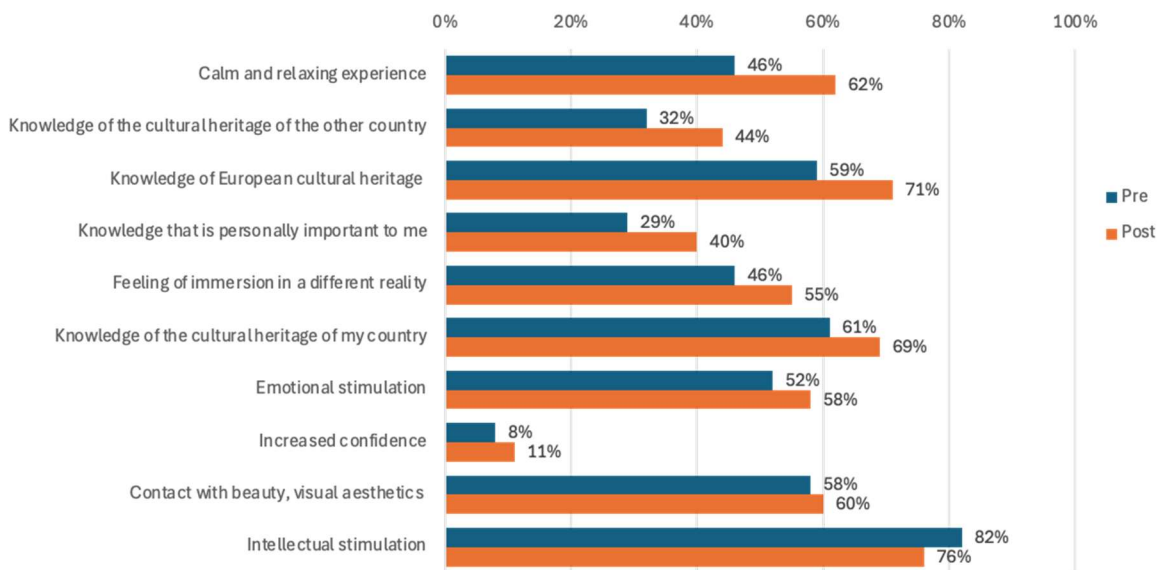


**Chart 3.** Self-reported knowledge of the theme of the exhibition, before and after the visit, scale 0-10. Results show noticeable increase after the visit.

**Expectations before and after the visit**

Question: What kind of effects do you expect? / What kind of results did you get from this visit?

The exhibition largely exceeded expectations in providing a relaxing and educational experience. Visitors also came with high expectations of intellectual, aesthetic, and emotional stimulation, and these were generally met despite being set at a high level. From the perspective of the META-MUSEUM project, it is worth noting that although the exhibition in its current form does not explicitly focus on confidence, data from the MAC Barcelona museum indicate a slight increase both in reported 'Increased confidence' as an outcome of the visit (Chart 4) and in 'Belief in myself/Self-confidence' as an emotion felt after the visit (Chart 5). These results suggest that the type of experience provided by this museum may be relatively more effective in fostering values related to confidence and resilience.

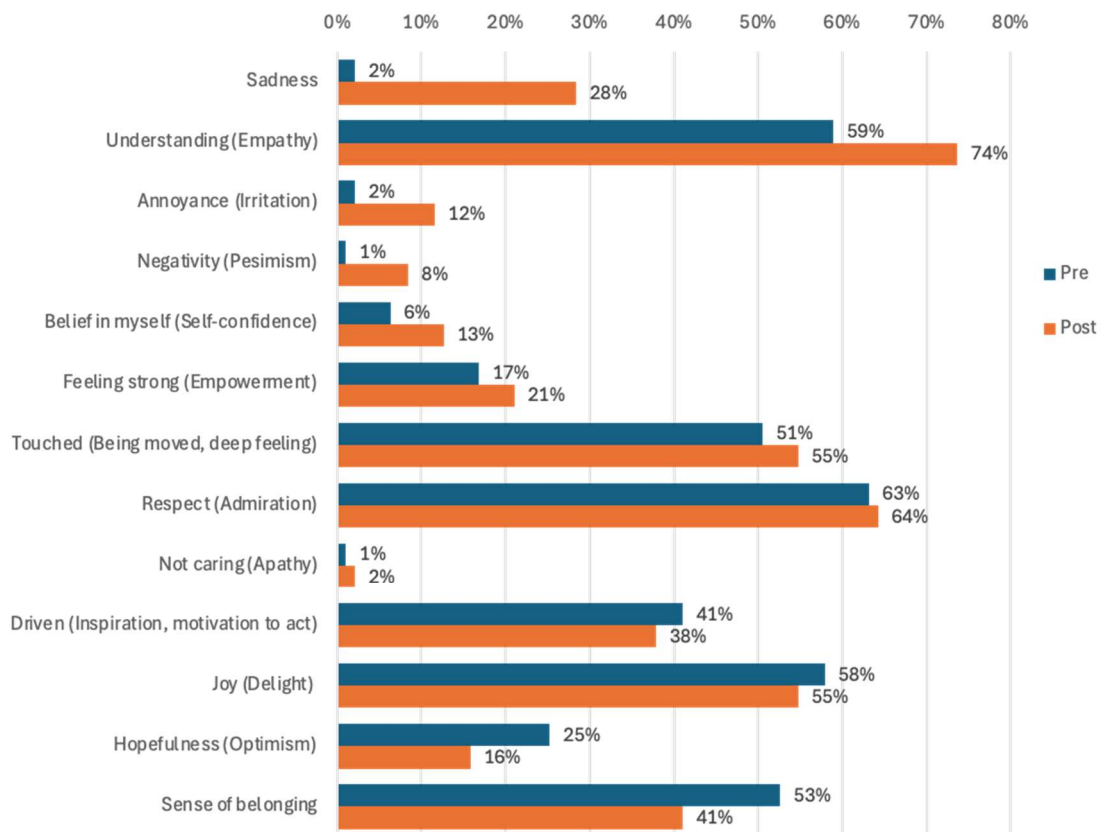


**Chart 4.** *Expectations and results of the visit, sorted according to the difference between post- and pre-measurement, N=95.*

**Emotions expected before the visit and reported after the visit.**

*Question: What emotions do you think this exhibition might evoke (did evoke) in you?*

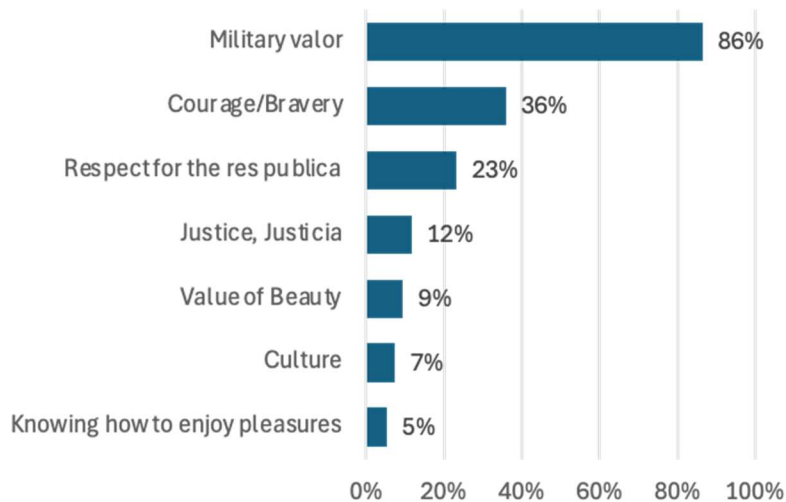
The most frequently mentioned emotions were those linked to admiration, empathy, belonging, and joy, showing that the exhibition mainly evoked relational experiences. **The most visible post-visit changes were a strong increase in empathy and in sadness**, suggesting that the exhibition was powerful in encouraging deeper understanding but also emotionally heavy, confronting visitors with difficult topics. From the META-MUSEUM perspective, this pattern highlights a gap: the exhibition in its current form does not focus on confidence, resilience, or optimism, as shown by the rise in sadness, irritation, and pessimism, and the drop in hopefulness. At the same time, the fact that self-confidence and empowerment increased—even if from a low base—is encouraging, as it indicates a potential starting point for planned experimental intervention. The fact that emotions such as empathy, sadness, and being touched were felt more strongly after the visit — alongside a slight rise in feelings of empowerment and confidence — suggests that the exhibition did trigger deeper reflection and engagement.



**Chart 5.** Emotions before and after the exhibition, sorted according to the difference between post and pre measurement, N=95.

### Distance to Roman values

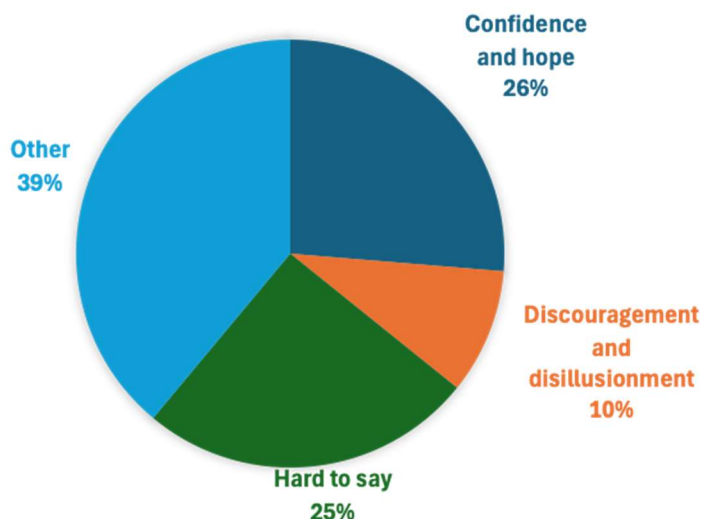
Visitors felt most distant from values linked to war, with **military valour standing out as the least shared**. Courage and bravery were also seen as less close. Ideas such as justice and respect for the *res publica* created some distance, but less strongly. In contrast, values connected to daily life—like enjoying pleasures, culture, and beauty—were the ones people still related to most, showing **stronger links with human and cultural aspects** than with martial or political ones.



**Chart 6.** Answers to the question: *From which of these traditionally Roman values do you feel the furthest from?*, N=95.

### Message that exhibition left visitors with

When asked “What kind of message did this exhibition leave you with?” most visitors chose “hard to say” (25%) or the “other” option (39%), suggesting **they did not take away a clear message from the exhibition**. About a quarter selected confidence and hope (26%), while only a few mentioned discouragement (9%, although this was higher in other, related answers). In the “other” group, people spoke about learning, culture, history, and mixed feelings.



**Chart 7.** Answers to the question: *What kind of message did this exhibition leave you with?*, N=95.

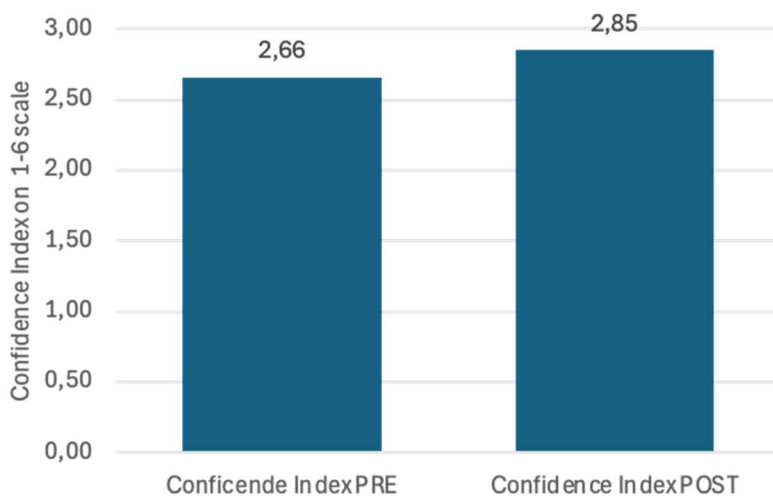
Note: answers in category ‘Other’ included these topics:

- Continuity of human nature – people and societies remain similar across time, empires fall but little really changes
- Knowledge and memory – importance of knowing history and learning from the past
- Identity and belonging – cultural heritage and sense of connection
- Critique of society – power of the rich, role of women, contemporary media
- Existential reflections – time, fragility of life, seizing the moment
- Mixed emotions – discouragement, sadness, contradictory feelings

## QUANTITATIVE RESULTS FROM MUSEOPARC ALESIA

**Influence of the exhibition on confidence levels and self-assessed knowledge.** Confidence levels were generally low before the visit but slightly increased afterwards. The rise was consistent, though not very strong.

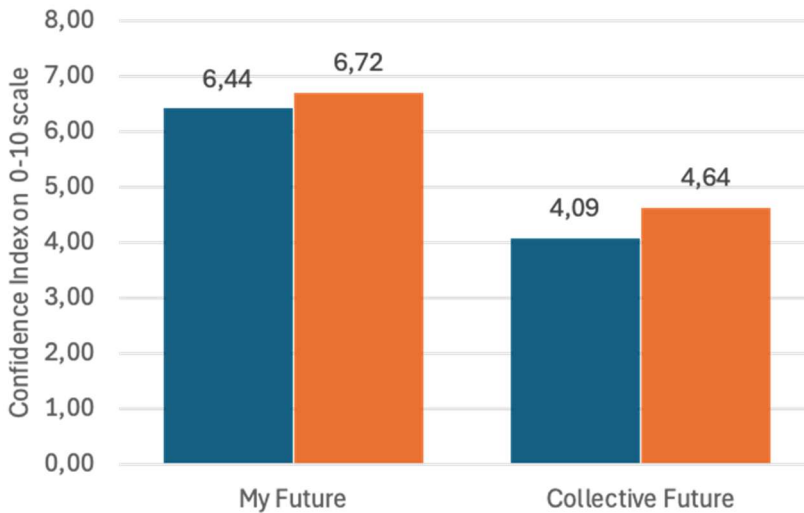
Across groups, as emerged in the previous cases, increases were found for both men and women, with men showing a slightly stronger effect. **Middle-aged and older visitors benefitted most, while younger participants also improved but to lower levels.** Education level does not show a clear pattern. Confidence improved slightly across all groups, but the changes are small and not consistent enough to say that one education group benefitted more than another. **People who visit museums more often or who report culture as important already start with higher confidence.** They still improve, but the gain is slightly lower compared to those less culturally active.



**Chart 1.** Confidence measured by the 6-item General Confidence Scale, scale 1-6. Results show moderate improvement, but overall results remain below the middle point of the scale.

Visitors' confidence in their personal future was already high before the museum visit (this data point, perhaps, could be influenced by elements of the rural context; stronger community ties and mutual support). The parameter of confidence showed a small improvement after visiting the museum. This modest change suggests that the exhibition slightly strengthened people's outlook on their own future.

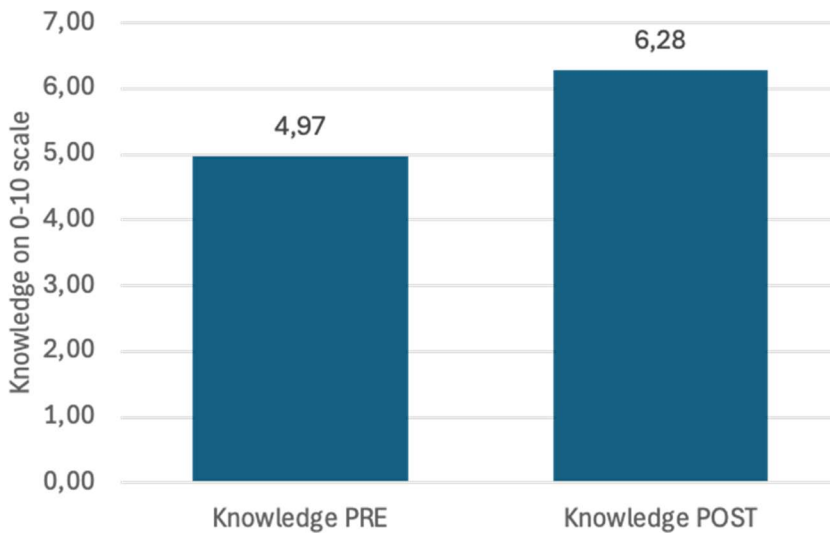
**For the collective future, the starting point was much lower and the exhibition had a stronger impact. The largest gains were observed among younger participants and women.** People who place more importance on culture in their lives, or who visit museums more often, already start with higher confidence in their own future. After the visit they still improve, but only slightly. By contrast, those less engaged in culture begin with lower levels of confidence, especially regarding the collective future, and they show a more visible improvement after the exhibition. This suggests that the Alésia museum experience may help reduce the gap between frequent and less frequent cultural participants, particularly in how they view the future of society.



**Chart 2. Confidence about the Future, scale 0-10 – slight rise for personal future (How I feel about my personal future), clearer gain for collective future (How I feel about collective future).**

Self-assessed knowledge about the topic of the exhibition increased after the museum visit. Beforehand, levels were moderate, but afterwards they increased, showing the exhibition helped visitors learn.

All groups improved. Men gained a bit more than women. The youngest visitors (18-25) started lower and made good progress, while older ones improved from a higher base. People already active in culture knew more and added a little, while less experienced visitors showed the biggest step forward.



**Chart 3. Self-reported knowledge of the theme of the exhibition, before and after the visit, scale 0-10. Results show noticeable increase after the visit.**

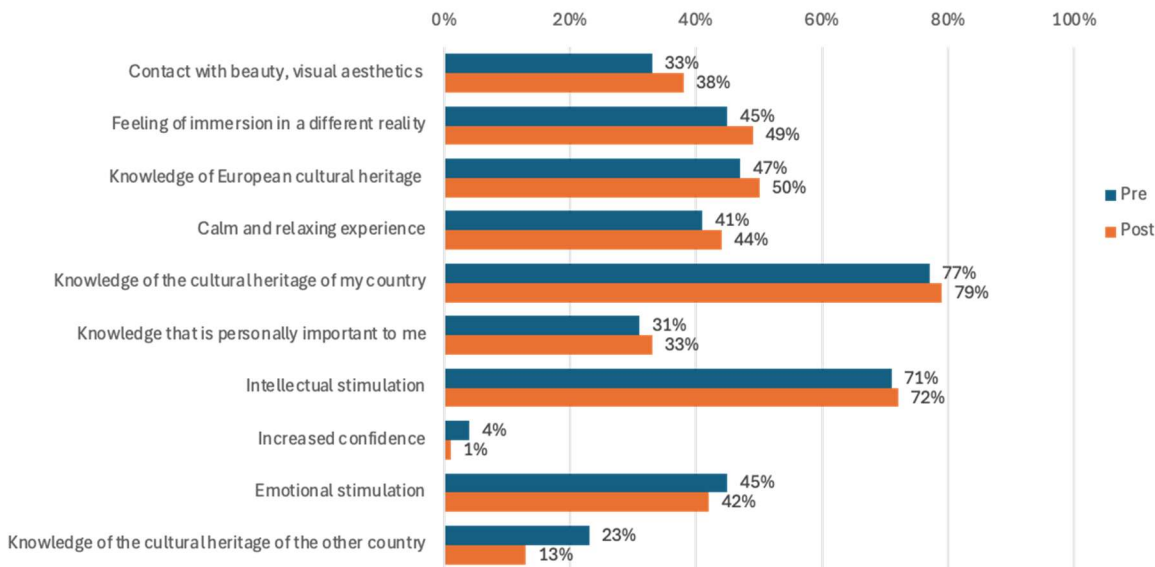
## Expectations before and after the visit

Question: *What kind of effects do you expect? / What kind of results did you get from this visit?*

Results show that expectations and experiences of the visit matched closely, suggesting that visitors had a good sense of what they could expect from this museum. The most often mentioned areas were **knowledge of visitors' own country's heritage and intellectual stimulation**, showing that people came with strong **expectations of learning and reflection**. Experiences such as immersion, emotional stimulation, and knowledge of European heritage were also common, while confidence and knowledge of the other country's heritage were much less central.

Most expectations were met or exceeded. However, for the META-MUSEUM project it is important to note that **increased confidence was the least commonly mentioned expectation**, and it was mentioned even less after the visit. Emotional stimulation also decreased slightly after the visit, raising questions about the exhibition's potential to engage and empower.

Overall, the results suggest that the exhibition is effective in delivering learning and cultural enrichment, especially related to French heritage, and that this direction is in line with audience expectations. However, it's clear that most of the participants were already aware of what they were going to see.



**Chart 4.** *Expectations and results of the visit, sorted according to the difference between post- and pre-measurement, N=78.*

## Emotions expected before the visit, and reported after the visit.

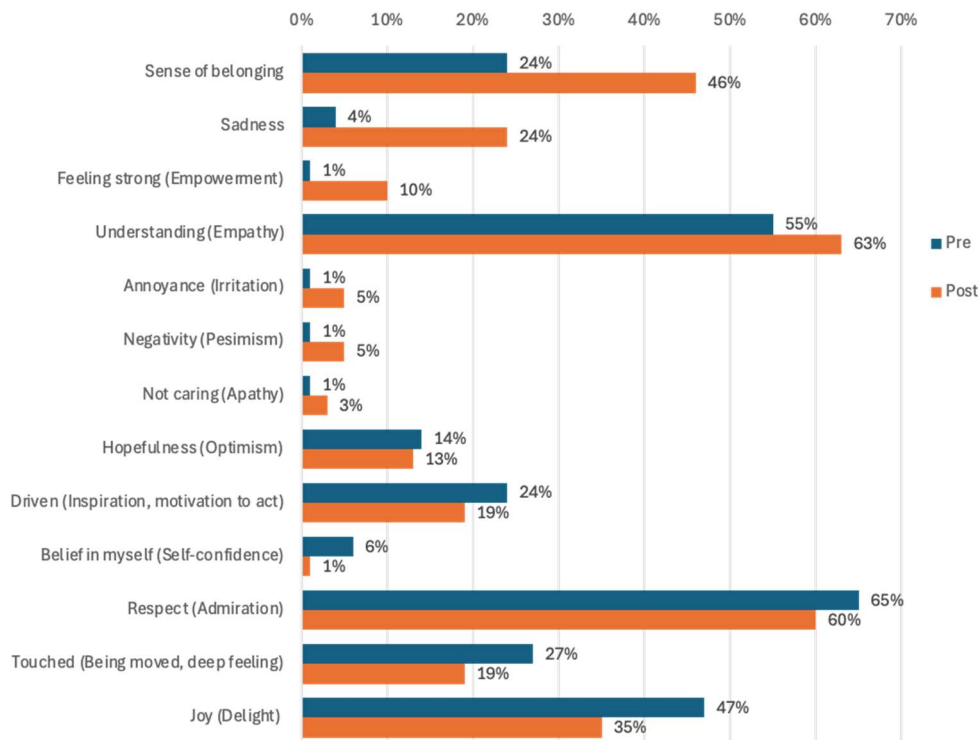
Question: *What emotions do you think this exhibition might evoke (did evoke) in you?*

**The results show that both expectations and experiences focused on positive and thoughtful emotions.** Before the visit, people mostly expected to feel respect, understanding (empathy), and joy, showing that they thought the exhibition would be meaningful and uplifting. After the visit, respect and empathy were still the strongest emotions, **while a sense of belonging almost doubled and became one of the main experiences.**

Some emotions increased after the visit, especially those linked to reflection and connection with others. **Sense of belonging and sadness was much stronger than expected, showing that the exhibition touched people on a deeper and sometimes difficult level.** Empowerment also grew, but it was still not very common.

At the same time, some positive emotions became weaker. Joy and being touched were felt less often than expected, and inspiration also went down. Self-confidence dropped a lot and was almost not mentioned at all. This suggests that **while the exhibition built empathy, belonging, and reflection, it was less successful in bringing joy, motivation, or personal strength.**

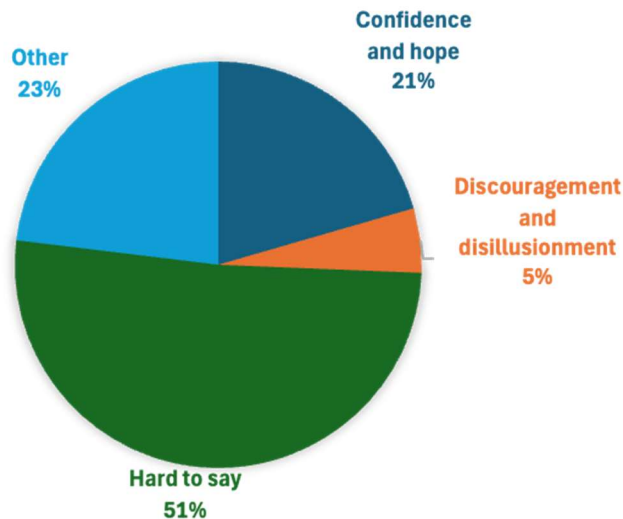
Overall, the exhibition seems to lead visitors toward **serious and reflective emotions, building connection and empathy more than lightness or optimism.** This fits the character of the museum but shows space to work more on inspiration and uplifting feelings.



**Chart 5.** Emotions before and after the exhibition, sorted according to the difference between post- and pre-measurement, N=78.

**Message that exhibition left visitors with.** For most visitors, the question “What kind of message did this exhibition leave you with?” was hard to answer, and many gave short or vague replies. This data point is significant, especially considering that the majority of participants already knew the history told by the museum: it could mean that **strong preconceptions regarding the exhibit content** could cause a hesitancy to reflect on other unique interpretations of historical narratives, or – vice versa – that **museum does not intend to convey any particular message, but only transfer information.**

The most common clear message was confidence and hope (21%), while only a few mentioned discouragement. In the “other” category, people spoke about learning, personal impressions, and historical lessons.



**Chart 6.** Answers to the question: *What kind of message did this exhibition leave you with?*, N=78.

Note: answers in category ‘Other’ included these topics:

- Learning and knowledge – knowledge of a period, lessons, need to explore further
- General impressions – interesting, enjoyable, amazing, immersive
- Understanding and reflection – comments about reality of things, understanding
- History and continuity – history repeating, evolution of civilizations, current conflicts
- Values and warnings – notes on power leading to harm, general warnings
- Resilience and action – mentions of human resilience, fight for freedom

### Summary of *status quo* results:

The *status quo* measurement results reveal that each of the three museums had a distinct character. Museo Egizio presents the culture of ancient Egypt, which is relatively less familiar to visitors than the culture of ancient Rome featured in the IMPERIVM exhibition at MAC Barcelona, or the historical struggles between Romans and Gauls presented at MuséoParc Alésia. The museums engaged visitors in different ways and offered varying levels of interactivity.

Museo Egizio exceeded visitors’ expectations by providing extensive knowledge about ancient Egyptian culture and offering a calm, reflective experience that fostered empathy and respect for other cultures. Visitors noted stories that resonated with the present day and with their own emotions and values. Particular attention was given to papyri section — not only those that dealt with serious topics like the workers’ strike, but also those with erotic or humorous themes. **Many visitors remarked on how everyday objects, such as furniture or sandals, resembled items still in use today.** The knowledge of ancient Egyptians was admired, as well as their attention to detail, the beauty of their art and architecture, and their deep belief in something greater — the continuation of existence after death.

The IMPERIVM exhibition at MAC Barcelona stood out for its efforts to present ancient Roman artefacts in an accessible and engaging way. Animations projected onto reliefs brought the objects to life, and in addition to artefacts, visitors encountered video portraits of actors dressed in Roman-era clothing, portraying different characters from Roman society and speaking about their lives, concerns, values, and plans. These elements fostered **a high level of emotional engagement, encouraging reflection on impermanence, changing values, and the similarities and differences between ancient and contemporary societies.** The most frequently mentioned exhibition elements were the mosaics (especially the Circus mosaic), the sarcophagi, and the video recordings — particularly the one in which a gladiator reflects on the meaning of freedom.

MuséoParc Alésia presents the story of the ancient Roman-Gallic conflict, culminating in the siege and eventual fall of the fort at Alesia. The museum visit increased visitors' knowledge and, to a lesser extent, their confidence. While the museum generally met expectations declared before the visit, it did not significantly surprise or emotionally move visitors, even considering the fact that many of the participants had already visited the Muséoparc.

. **It primarily fostered a sense of belonging, understanding, and respect.** Compared to the other museums, visitor engagement was noticeably lower — it was more difficult for them to describe how the exhibition affected them, what they particularly remembered, or whether they identified with any part of the presented story. The most frequently mentioned exhibition element was the animation depicting the siege of Alesia by the Romans.

From the perspective of the META-MUSEUM project, an important finding is that in each of the studied museums, the level of confidence either increased or remained stable after the visit. This confirms that contact with cultural heritage has a positive impact on visitors' sense of self-confidence. Interestingly, visitors did not list increased confidence among their expected outcomes before the visit — but when asked directly about confidence after the visit, they reported similar or slightly higher levels. The study suggests that museum visits become more emotionally engaging when they spark the imagination and present stories, objects, or themes that feel relevant to today's world and encourage personal reflection. In the next stage of the project, experimental intervention should be designed to enhance emotional engagement and potentially trigger a transformative experience, to lead to an increase in confidence levels compared to the status quo study.

## **5.6 Results and reflections in light of the workshop discussions — recommendations for future interventions in the museums**

The results of the study – both quantitative and qualitative, based on the analysis of responses to open-ended questions from the *status quo* questionnaire – confirm that the proposed direction for developing prototypes and experimental interventions in the museums is appropriate.

In Museo Egizio, visitors paid attention not only to exhibition elements related to ancient Egyptians' beliefs about the afterlife, but also to their daily lives and to aspects that can be related to the present – such as everyday objects (furniture, sandals, cosmetics, toys), and stories of people who practiced professions still existing today (architects, writers, builders). In this context, the selection of the “Strike Papyrus” as the object to be used in the next phase of the project appears to be well-justified. This object was mentioned by some respondents, indicating that it already captured their attention, even though no special emphasis was placed on this part of the exhibition during the study. The story of the strike described in the papyrus opens a pathway for reflection and contemporary relevance – particularly around themes such as courage, strength, and the effectiveness of united action. By further comparing these results with the analysed eye tracker data (summarised below), It can be noted that, although two-thirds of participants appear to have observed the strike papyrus, few actually did so and, of those, the majority did not bother to look at the back: ultimately, only a small percentage (one-twentieth) were sufficiently impressed by it to mention it in the questionnaire.

At MAC Barcelona, visitors reflected on the values held by ancient Romans and on what their daily lives were like. The exhibition encouraged contemplation of the passage of time – what changes in people's lives and what remains constant across centuries. Among the presented objects, the *Circus Mosaic* was most frequently mentioned. The animation reconstructing its fragmented form and narrating the associated story made a strong impression on visitors. It was one of the key exhibition elements with a particularly strong emotional impact. Other important elements include the video stories, which dealt with themes such as freedom (stories of slaves and a gladiator), gender roles (children talking about their future), and pronounced class differences. These stories, presented in the videos, also have the potential to serve as a basis for the experimental intervention in the upcoming phase of the project. However, the negative emotions mentioned by many visitors after

the vision of the last video (*Epilogue*) confirms the potential of the narrative choices in affecting the confidence.

In MuséoParc Alésia, the central element of the exhibition is a video presenting the story of the siege of the fortress of Alesia and its capture. It therefore seems natural to focus on this narrative in the next stage of the project and to present it in a way that encourages deeper reflection on the challenges we face in life, the difficult decisions we must make, and the potential consequences of failure. The story of the siege of Alesia is unique – full of turning points, dramatic choices, shifting fortunes, and the determination and sacrifice of both sides. It appears to have strong potential to stimulate reflection on many challenges we face today. It contains numerous elements that can be related to contemporary dilemmas and decisions we make – both individually and collectively. However, although participants showed a further increase in their sense of belonging, they did not demonstrate increased confidence in their individual futures, but only in the collective one. This can be related to what the curators themselves said about the two rooms, the initial one and the final one, which did not achieve the expected results in terms of personal reflection. Important insights can be drawn from this for the design of the second experimental phase.

## 5.7 Combining/merging all the collected data: Final reflections

The large amount of data collected and its heterogeneity were the biggest challenges in this articulated and multifaceted task. The consortium experimented with transdisciplinary work, not without difficulties and limitations arisen during data processing and merging for DEL drafting.

On one hand, the disciplines of communication/enhancement of CH normally deal with conditions that go beyond fixed and measurable parameters, focusing on the interpretation and quality of spaces and communication solutions whereas neurosciences protocols require perfectly controllable experimental conditions in order to precisely identify the impact of each variation on measurable parameters. Ecological conditions are extremely difficult and complicated from this perspective, logistically challenging in museums during opening hours. Geomatics sciences deal with quantitative data that acquire meaning when correlated with the behaviour of subjects and the spatial features and conditions, not posing significant challenges to experiment organization or out-carrying. Social sciences interpret complex contexts, often based on data derived from personal interpretation, feelings and perceptions in the diversity of citizens.

However, this complex framework forced researchers to engage in lengthy discussions, find common ground, and better understand each other's points of view.

The insights gained from interpreting this first, complex phase of experimental measurement proved very useful both within the phase itself, to refine the protocol each time, and to plan the next steps. In fact, the prototypes to be developed in the second year of the project will have to deal with the many constraints imposed by each discipline present in the Consortium.

Even the hypotheses and research questions were complex and not always precisely predeterminable, and this was perhaps one of the greatest barriers.

A more in-depth analysis was carried out about the confidence and a possible relationship with neurophysiological indices. Particular interest was placed on determining a dependency between the increase in confidence at the end of the experiment and the indices.

What emerged clearly was that when the communication of cultural content focuses on scientific data and information, the emotional response is low, inhibited by the high intellectual effort required. The conscious response of visitors is therefore influenced by what they have learned, rather than by the reflection that has been aroused in them. Museum fatigue is evident, not only in terms of neurophysiological parameters, but also in terms of progressive reduction of time spent down the visit, the characteristics of the route and the direction of gaze. An abundance of objects and stimuli tends to induce this kind of reaction. This is the case of Egyptian Museum, which is primarily an experience of in-depth study and knowledge, and neurophysiological analysis confirms the prevalence of intellectual effort and lesser emotional involvement. This result is confirmed by the questionnaires, which show that visitors are aware of this cognitive effort and report fairly low emotional stimulation, in line with their expectations. Among people who seen papyrus according to eye tracker, despite the sample size, differences are quite clear: they report higher knowledge gain after the visit and higher confidence in collective future. **This is consistent with the high values of Workload as measured by Mindtooth device.**

Where instead the narrative approach prevails, the emotional response is stronger but in itself exposed to a sort of rapid habit onset that constantly requires new and unexpected stimuli. If the narrative tone remains constant, museum fatigue manifests itself even in the absence of high intellectual effort. This is the case of MAC, where attention during the videos rapidly decreased, and some visitors chose not to watch the videos until the end. In particular, **the impact on confidence in collective future is negative in those who seen the epilogue video (although the differences are small), and actually the neurophysiological measurements show that it elicited negative values.**

In Alésia the video narration of the siege is very engaging, but visitors are absorbed reading the captions without missing the attractive images: this is probably why **the mental effort increases unexpectedly (i.e. the Workload values) and reduces the purely emotional reaction**. In Alésia we see that knowledge did increase and the confidence in personal future is slightly higher among those who seen Siege video, while they are lower among those who seen the last room (although it could apparently seem in favor of sense of identity).

Moreover, it appears that **men and women, young and elderly individuals respond differently to stimuli, and cultural background does play a significant role**: those who do not habitually visit museums showed greater satisfaction in learning (but the issue of how to approach such users remains unresolved).

Although this is a very complex and challenging task, given the many factors (environmental and individual) that can influence not only neurophysiological parameters but also responses to questionnaires, some general correlations can be drawn in order to provide **useful information for the second experimental phase**.

In Egyptian Museum, although emotion is not high, the satisfaction that comes from learning can be linked to a slight increase in confidence, more evident in relation to the collective future than to one's personal one. However, the components related to confidence are fairly lower than expectations. In the case of MAC, from a neurophysiological point of view, it seems that the vision of the epilogue (*Hereditas*) does not change the final effect on visitors, while the questionnaires reveal a minor effect on confidence level and sadness. Finally, in the case of Alésia, the low emotional activation clearly observed in the measurement of neurophysiological parameters is reflected in the questionnaire responses, which show effects very much in line with expectations. The only “emotion” that increases significantly is the sense of belonging, comprehensibly due to a strong inclination already present in the selected, local, sample.

**One finding that could be deemed unexpected is the lower inclination of young people to be confident about their individual future, which does not seem to be influenced by CH, let alone be improved by it**. However, no decrease in confidence was registered after the experience of the visit (but rather seems to increase, albeit sometimes very slightly): this could prove that **the cultural experience can raise confidence levels**.

Moreover, it should be noted that this data, which detailed description is incompatible with its inclusion in this document, reflects the current situation, for which significant areas have been identified where action can be taken to increase individual responses to CH. For instance, **the opportunity to engage in co-creative activities seems to produce good results in terms of more transformative experiences**, while also helping to focus visitors' attention on important pieces: in the case of Egyptian Museum, the strike papyrus is one of the most important pieces in the room and is displayed in a vitrine that differs from the others in shape and position; nevertheless, it was revealed to be ignored most of the time (even though most visitors passed very close to it).

One final point worth considering is that in any case – whether mental effort prevailed or emotional responses did – most visitors did not seem to leave the exhibition with a clear message to keep reflecting on.

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## Annexes

### 1. Information Sheet

#### *PROTOCOL OF STUDY - META-MUSEUM PROJECT*

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Dear Ms/Mrs,

With this document we would like to invite you to participate in a research study. In order to inform you about the purpose and characteristics of the study so that you can make an informed and free decision about whether to participate, we invite you to carefully read the following information. The researchers involved in this project are available to answer any questions you may have.

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Principal Investigator of the study

Valeria Minucciani  
valeria.minucciani@polito.it

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#### **What is the purpose of this study?**

The study is based on the premises that cultural heritage can transform people (through new knowledge and reflections) and that people can in turn transform cultural heritage by interpreting it and giving it meaning. The aim is to develop ways of communicating cultural heritage that can move the public and involve them personally. To this end, emotional reactions (involving not only the mind but above all the body) are studied, and participants are asked a number of questions. The study aims to build a scientific foundation for designing engaging cultural experiences that can help improve citizens' quality of life and their confidence in contemporary society.

The study does not raise any safety concerns: the devices used are all commercially available devices with CE marking. They are not medical devices and do not provide indices or data that can be traced back to clinical parameters useful for making a diagnosis. In particular, no medical devices are used, and no data monitoring will be carried out by medical personnel.

#### **How will the study be carried out?**

The experiment will take place in three steps: the first involves filling out a pre-visit questionnaire, the second involves visiting part of the museum, and the third involves filling out a post-visit questionnaire. The activities include recording neurophysiological parameters, which requires participants to wear some non-invasive and painless measuring equipment.

#### **Why are we asking you to participate?**

Because we are interested in finding out how museum visitors react and whether the explanations and displays are effective in relation to the aim of the project.

### **Are you obliged to participate in the study?**

Your participation is completely voluntary, and refusal to participate will not result in any negative consequences. Furthermore, if you change your mind and wish to withdraw from the study, you are free to do so at any time without having to provide any explanation.

In the event of withdrawal, you may choose whether you wish to revoke the processing of your data from the beginning of your participation in the Study, requesting its complete deletion. In this case, your personal data previously collected will be deleted, or the recordings made and the data derived will be stored in a completely anonymous form, meaning that the data already collected and stored until revocation or withdrawal from the Study/research may still be used.

### **Which steps do you need to take to participate in the study?**

Participation in the study is subject to detailed information about its characteristics, risks and benefits. At the end of the information phase, you may consent to participate in the study by signing the informed consent form. Only after you have given your written consent will you be able to actively participate in the proposed study.

### **What will you be asked to do?**

You will be asked to:

- fill out a short questionnaire before the experiment;
- wear a bracelet with soft rings for your fingers, which will measure your skin conductance, and/or a soft helmet to measure your brain activity during the visit;
- you will be accompanied on a short visit, which you will do partially independently, following the researchers' instructions;
- at the end, the equipment you are wearing will be removed;
- you will be asked to complete a second questionnaire;
- you will be free to leave. The time required will not exceed two hours (in case of delays) and will not be less than 45 minutes.

### **What are the possible risks and disadvantages of the study?**

No particular discomfort is usually reported, but please note that: you will need to remove any cosmetics from your forehead; the electrodes on the soft helmet will be moistened with a few drops of saline solution and your hairstyle may be affected. The helmet and rings may cause slight discomfort at first, but they do not cause any pain and you will usually get used to them after a few minutes. You should simply avoid making sudden or excessive movements with your hands.

### **What are the potential benefits of the study?**

The study aims to increase accessibility to cultural heritage for everyone, as better communication of our heritage makes it more understandable, appreciated and useful.

### **How is the confidentiality and security of information/data/samples guaranteed?**

The researcher will ask you to provide some personal information, such as your first name and surname, in order to obtain your informed consent. You will then be assigned a random numerical code for the study, which will no longer be linked to your name in any way. Subsequent experimental observations will therefore only be associated with this code and cannot be linked to your name. The answers we ask you for are strictly necessary for the proper execution of the test and the subsequent processing of the data, and cannot be traced back to you.

This information, as well as the data that will emerge during the research, is important for the proper conduct of the study. The lawfulness of the processing and the confidentiality of all information will be guaranteed in accordance with current legislation (European Regulation EU 2016/679 on the protection of individuals with regard to the processing of personal data and on the free movement of such data - <https://www.garanteprivacy.it/regolamentoue>).

### **Ethical Committee approval**

We inform you that this study was approved by the Ethics Committee of the university Politecnico di Torino on 26th February 2025, with protocol number 18069/2025.

### **Other important information**

The original copy of the Informed Consent Form signed by you will be kept by the person responsible for this study, while you are entitled to receive a copy.

During the study, you may request any information from the Principal Investigator at the following contact details:

Valeria Minucciani [valeria.minucciani@polito.it](mailto:valeria.minucciani@polito.it)  
Michela Benente [michela.benente@polito.it](mailto:michela.benente@polito.it)  
Paolo Dabove [paolo.dabove@polito.it](mailto:paolo.dabove@polito.it)

We thank you for your availability.

## 2. Informed consent form

### PRINCIPAL INVESTIGATOR DECLARATION

I declare that I have provided the participant with complete information and detailed explanations about the nature, purpose, procedures and duration of this research project. I also declare that I have provided the participant with the information sheet.

Signature of the Principal Investigator of  
the study

Date

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VALERIA MINUCCIANI

### INFORMED CONSENT FORM

I, the undersigned,

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#### DECLARE

- that I have received comprehensive explanations regarding the request to participate in the experimental study in question and sufficient information regarding the risks and benefits involved in the study, as set out in the information sheet attached hereto.
- that I have been able to discuss these explanations, ask all the questions I deemed necessary and receive satisfactory answers;
- that I have also been informed of my right to withdraw from the research at any time.

In light of the information provided to me, therefore:

<input type="checkbox"/>	I AGREE	<input type="checkbox"/>	I DO NOT AGREE	to participate to the study
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Place and date

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Participant signature

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### 3. Indoor positioning tests at Museo Egizio - List of participant IDs, organised by day, for visitors who observed the papyrus exhibit

Day	ID
<b>Monday 07.04.2025</b>	T008ES
	T014ES
	T015ES
	T018PS
	T023PS
	T025PS
	T032PS
	T030PS
<b>Tuesday 08.04.2025</b>	T045PS
	T047ES
	T051ES
	T058PS
<b>Wednesday 09.04.2025</b>	T061PS
	T063PM
	T070PS
	T071PS
<b>Thursday 10.04.2025</b>	T100ES
	T078ES
	T102ES
	T081PS
<b>Friday 11.04.2025</b>	T086ES
	T088ES
	T108ES
	T111ES
	T111ES

# [META-MUSEUM] POST MUSEO EGIZIO - Status quo Measurement

Welcome back! Once again thank you for the interest paid to our project and the time you chose to dedicate to us.

In this section of the questionnaire we'll inquire about the experience you just had; there aren't many questions but we ask you to answer carefully taking all the time you need.

Some questions might seem repeated but don't worry: it's by design.

We take the chance to remind you that the questionnaire is strictly anonymous and it won't be possible to link answers to any participant.

There are 20 questions in this survey.

## Experiment ID

Please indicate here the ID code that was assigned to you before the experience, ask for help from the team if you're not sure. \*

Please write your answer here:

## Experience evaluation

Please evaluate what you just visited following the inputs \*

Please choose the appropriate response for each item:

	0 - Not at all	1	2	3	4	5	6	7	8	9	10 - Very much
How beautiful is it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you like it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it make you think or reflect?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much could others like it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much contentment does it raise?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it raise positive emotions in you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it raise positive sensations in you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How surprising is it for you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## What kind of results did you get from this visit? \*

Select all that apply

Please choose **all** that apply:

- Knowledge of the cultural heritage of my country
- Knowledge of the cultural heritage of another country
- Knowledge of European cultural heritage
- Knowledge that is personally important to me
- Intellectual stimulation
- Emotional stimulation
- Increased confidence
- Contact with beauty, visual aesthetics
- Calm and relaxing experience
- Feeling of immersion in a different reality
- Don't know / hard to say

Other:

## What emotions did this exhibition evoke in you? \*

Select all that apply

Please choose **all** that apply:

- Respect (Admiration)
- Joy (Delight)
- Understanding (Empathy)
- Touched (Being moved, deep feeling)
- Driven (Inspiration, motivation to act)
- Belief in myself (Self-confidence)
- Feeling strong (Empowerment)
- Hopefulness (Optimism)
- Sadness
- Annoyance (Irritation)
- Negativity (Pesimism)
- Not caring (Apathy)
- Sense of belonging
- Don't know / hard to say

Other:

## How would you rate your knowledge on the themes of the exhibit after seeing it? \*

Please choose the appropriate response for each item:

	0 - Completely lacking knowledge	1	2	3	4	5	6	7	8	9	10 - High level of knowledge
My knowledge of the exhibition themes is	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\*

Please choose the appropriate response for each item:

	None of the time	Not often	Some of the time	Often	All the time
I felt happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt engaged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt safe and secure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed the company of other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your personal life, how much confidence do you have about the future? \*

Please choose the appropriate response for each item:

	0 - Not confident	1	2	3	4	5	6	7	8	9	10 - Very confident
How I feel about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How I feel about collective future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the context of the European Union, express your agreement on the following statements  
 1 = Strongly disagree 6 = Strongly agree \*

Please choose the appropriate response for each item:

	1 - Strongly disagree	2	3	4	5	6 - Strongly agree
In the future, society will be functioning as well as today	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our society is well equipped to solve future problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future safety and security of our population is assured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future of our society is bright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nowadays, things seem to be getting more and more out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Altogether, we live in a safe and secure time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Please indicate how would you describe yourself on the following dimensions \*

Please choose the appropriate response for each item:

	1 - Never / Definitely not	2	3	4	5	6	7	8	9 - Always / Definitely yes
I'd rather depend on myself than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I rely on myself most of the time / I rarely rely on others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often do "my own thing"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My personal identity, independent of others, is very important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is important that I do my job better than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning is everything	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Competition is the law of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When another person does better than I do, I get tense and aroused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If someone close gets a prize, I would feel proud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The wellbeing of others is important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 - Never / Definitely not	2	3	4	5	6	7	8	9 - Always / Definitely yes
To me, pleasure is spending time with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel good when I cooperate with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parents and children must stay together as much as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is my duty to take care of my family, even when I have to sacrifice what I want	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family members should stick together no matter what sacrifices are required	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To me it is important that I respect decisions made by my groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Open ended questions



Please consider whether this exhibition has influenced your view of the world or changed anything about your personality or values? If so, please briefly describe the impact of the exhibition on you. \*

Please write your answer here:

Did you identify with any of the stories you encountered in your visit? \*

Please write your answer here:

Please recall an element of the exhibition that particularly impressed you.  
Please write down which element of the exhibition it was, what impressions and emotions it evoked in you and why? \*

Please write your answer here:

Did you encounter anything that could be still current? \*

Please write your answer here:

What would you want to have today that Egyptians had? \*

Please write your answer here:

If something bothered you during this experience please tell us down below \*

Please write your answer here:

## Monitor

How many rooms have you visited on this floor? \*

Choose one of the following answers  
Please choose **only one** of the following:

- 1  
 2

During your visit, did you notice the presence of historic images? \*

Only answer this question if the following conditions are met:

Answer was '2' at question '[G04Q18]' (How many rooms have you visited on this floor?)

Please choose **only one** of the following:

- Yes  
 No

## Pictures

Could you indicate which subjects were depicted? \*

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '[G04Q14]' (During your visit, did you notice the presence of historic images?)

Select all that apply

Please choose **all** that apply:

- Artifacts  
 Details of artifacts with inscriptions  
 Details of artifacts without inscriptions  
 Archaeological contexts artifacts are coming from  
 Excavation moments  
 People  
 Archaeological sites  
 Landscapes  
 Other:

Are there themes from the previous list, or not included, that have captured your attention or sparked reflection in you? If so, why? \*

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '[G04Q14]' (During your visit, did you notice the presence of historic images?)

Please write your answer here:



## [META-MUSEUM] PRE MUSEO EGIZIO - Status quo Measurement

Welcome! Thank you for taking an interest in our project and thank you for choosing to lend us some of your time!

You will now be asked to answer a couple questions to get to know you better. The questionnaire is short but please take your time filling it out! We take the chance to remind you that the questionnaire is strictly anonymous and it won't be possible to link answers to any participant.

There are 14 questions in this survey.

### Experiment ID

Please indicate here the ID code that was assigned to you, ask for help from the team if you're not sure.

\*

Please write your answer here:

### A couple questions about you...

Personal info

#### Gender \*

Choose one of the following answers  
Please choose **only one** of the following:

- Male
- Female
- Other
- Prefer not to say

#### Age \*

Choose one of the following answers

Please choose **only one** of the following:

- 18-21
- 22-25
- 26-29
- 30-33
- 34-37
- 38-41
- 42-45
- 46-49
- 50-53
- 54-57
- 58-61
- 62-65
- 66-69
- 70+
- Prefer not to say

#### Education \*

Choose one of the following answers

Please choose **only one** of the following:

- Elementary / Primary School
- Secondary school / High School (without Diploma)
- Secondary school / High School
- University (without graduation)
- Bachelor / Master's Degree
- PhD / postgraduate

### Current job status \*

Choose one of the following answers

Please choose **only one** of the following:

- Student  
 Employed  
 Self-employed  
 Retired  
 Unemployed  
 Other

### Cultural habits

Number of visits to museums / art galleries in the last 12 months.

**Please indicate the most accurate number you can, *do not consider today's visit.*** \*

Please write your answer here:

Please indicate the extent to which museums and art galleries play an important role in your life  
**1 = Definitely not**      **10 = Definitely yes**

\*

Please select one answer

Please choose the appropriate response for each item:

	0 - Definitely not	1	2	3	4	5	6	7	8	9	10 - Definite yes
Museums / art galleries play an important role in my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## I see myself as.... \*

Please choose the appropriate response for each item:

	Strongly disagree	Moderately disagree a little	Neither agree nor disagree	Agree a little	Moderately agree	Strongly agree
Extroverted, enthusiastic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Critical, quarrelsome	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dependable, self-disciplined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anxious, easily upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open to new experiences, complex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reserved, quiet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sympathetic, warm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disorganized, careless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm, emotionally stable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conventional, non creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Expectations before visit

## Which statements best describe why you are here today? \*

Select all that apply

Please choose all that apply:

- I want to spend time with friends/family/other people
- I am here with an organized group
- I am a tourist from this country
- I am a tourist from abroad
- I want to get away from the routine of my life
- I want to visit an important site
- I don't know / hard to say

Other:

In the context of the European Union, rate your agreement with the following sentences  
**1 = strongly disagree**      **6 = strongly agree**

\*

Please choose the appropriate response for each item:

	1 - Strongly disagree	2	3	4	5	6 - Strongly disagree
In the future, society will be functioning as well as today	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our society is well equipped to solve future problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future safety and security of our population is assured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future of our society is bright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nowadays, things seem to be getting more and more out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Altogether, we live in a safe and secure time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What kind of effects do you expect from this visit?  
**Select all that apply \***

Select all that apply

Please choose **all** that apply:

- Knowledge of the cultural heritage of my country
- Knowledge of the cultural heritage of another country
- Knowledge of European cultural heritage
- Knowledge that is personally important to me
- Intellectual stimulation
- Emotional stimulation
- Increased confidence
- Contact with beauty, visual aesthetics
- Calm and relaxing experience
- Feeling of immersion in a different reality
- Don't know / hard to say

Other:

What kind of emotions do you think this visit could elicit in you?  
**Select all that apply \***

Select all that apply

Please choose **all** that apply:

- Respect (Admiration)
- Joy (Delight)
- Understanding (Empathy)
- Touched (Being moved, deep feeling)
- Driven (Inspiration, motivation to act)
- Belief in myself (Self-confidence)
- Feeling strong (Empowerment)
- Hopefulness (Optimism)
- Sadness
- Annoyance (Irritation)
- Negativity (Pesimism)
- Not caring (Apathy)
- Sense of belonging
- Don't know / hard to say

How would you rate your knowledge on the themes of what you're about to see? \*

Please choose the appropriate response for each item:

	0 - Completely lacking knowledge	2	3	4	5	6	7	8	9	10 - High-level of knowledge
My knowledge of the themes is...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your personal life, how much confidence do you have about the future? \*

Please choose the appropriate response for each item:

	0 - Not confident	2	3	4	5	6	7	8	9	10 - Very confident
How I feel about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How I feel about the future of our society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for completing this questionnaire, if there's nobody here with you wait for a researcher to give you instructions on the next steps.

We'll see you later for the post-experience questionnaire!

Submit your survey.

Thank you for completing this survey.

# [META-MUSEUM] POST MUSEU ARQUEOLOGIA CATALUNYA - Misura Status quo

Welcome back! Once again thank you for the interest paid to our project and the time you chose to dedicate to us.

In this section of the questionnaire we'll inquire about the experience you just had; there aren't many questions but we ask you to answer carefully taking all the time you need.

Some questions might seem repeated but don't worry: it's by design.

We take the chance to remind you that the questionnaire is strictly anonymous and it won't be possible to link answers to any participant.

There are 18 questions in this survey.

## Experiment ID

Please indicate here the ID code that was assigned to you before the experience, ask for help from the team if you're not sure. \*

Please write your answer here:

## Experience evaluation

Please evaluate what you just visited following the inputs \*

Please choose the appropriate response for each item:

	0 - Not at all	1	2	3	4	5	6	7	8	9	10 - Very much
How beautiful is it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you like it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it make you think or reflect?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much could others like it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much contentment does it raise?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it raise positive emotions in you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it raise positive sensations in you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How surprising is it for you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## What kind of results did you get from this visit? **Select all that apply.** \*

Select all that apply

Please choose **all** that apply:

- Knowledge of the cultural heritage of my country
- Knowledge of the cultural heritage of another country
- Knowledge of European cultural heritage
- Knowledge that is personally important to me
- Intellectual stimulation
- Emotional stimulation
- Increased confidence
- Contact with beauty, visual aesthetics
- Calm and relaxing experience
- Feeling of immersion in a different reality
- Don't know / hard to say

Other:

## What emotions did this exhibition evoke in you? \*

Select all that apply

Please choose **all** that apply:

- Respect (Admiration)
- Joy (Delight)
- Understanding (Empathy)
- Touched (Being moved, deep feeling)
- Driven (Inspiration, motivation to act)
- Belief in myself (Self-confidence)
- Feeling strong (Empowerment)
- Hopefulness (Optimism)
- Sadness
- Annoyance (Irritation)
- Negativity (Pesimism)
- Not caring (Apathy)
- Sense of belonging
- Don't know / hard to say

Other:

## How would you rate your knowledge on the themes of the exhibit after seeing it? \*

Please choose the appropriate response for each item:

	0 - Completely lacking knowledge	1	2	3	4	5	6	7	8	9	10 - High level of knowledge
My knowledge of the exhibition themes is	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## How would you rate your experience after the visit? \*

Please choose the appropriate response for each item:

	None of the time	Not often	Some of the time	Often	All the time
I felt happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt engaged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt safe and secure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed the company of other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## In your personal life, how much confidence do you have about the future? \*

Please choose the appropriate response for each item:

	0 - Not confident	1	2	3	4	5	6	7	8	9	10 - Very confident
How I feel about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How I feel about collective future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## In the context of the European Union, express your agreement on the following statements 1 = Strongly disagree 6 = Strongly agree \*

Please choose the appropriate response for each item:

	1 - Strongly disagree	2	3	4	5	6 - Strongly agree
In the future, society will be functioning as well as today	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our society is well equipped to solve future problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future safety and security of our population is assured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future of our society is bright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nowadays, things seem to be getting more and more out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Altogether, we live in a safe and secure time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Please indicate how would you describe yourself on the following aspects \*

Please choose the appropriate response for each item:

	1 - Never / Definitely not	2	3	4	5	6	7	8	9 - Always / Definitely yes
I'd rather depend on myself than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I rely on myself most of the time / I rarely rely on others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often do "my own thing"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My personal identity, independent of others, is very important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is important that I do my job better than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning is everything	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Competition is the law of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When another person does better than I do, I get tense and aroused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If someone close gets a prize, I would feel proud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The wellbeing of others is important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 - Never / Definitely not	2	3	4	5	6	7	8	9 - Always / Definitely yes
To me, pleasure is spending time with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel good when I cooperate with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parents and children must stay together as much as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is my duty to take care of my family, even when I have to sacrifice what I want	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family members should stick together no matter what sacrifices are required	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To me it is important that I respect decisions taken in groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Open ended questions

Please consider whether this exhibition has influenced your view of the world or changed anything about your personality or values? If so, please briefly describe the impact of the exhibition on you. \*

Please write your answer here:

Did you identify with any of the stories you encountered in your visit? \*

Please write your answer here:

Did you encounter anything that could be still current? \*

Please write your answer here:

What would you want to have today that Romans had? \*

Please write your answer here:

What element of the exhibition struck you the most?  
**Please specify which one in the correct box on the right. Don't worry about a correct title, a synthetic description is fine.** \*

Choose one of the following answers

Please choose **only one** of the following:

A video

An artifact or object

Make a comment on your choice here:

From which of these traditionally Roman values do you feel the furthest from?  
**Select all that apply.**

\*

Select all that apply

Please choose **all** that apply:

- Respect for the res publica
- Culture
- Courage/Bravery
- Military valor
- Value of Beauty
- Justice, Justicia
- Knowing how to enjoy life pleasures
- Other:

What kind of message did this exhibition leave you with?

\*

Choose one of the following answers

Please choose **only one** of the following:

- Confidence and hope
- Discouragement and disillusionment
- I wouldn't know / hard to say
- Other:

What would you sacrifice your freedom for? \*

Please write your answer here:

If something bothered you during this experience please tell us down below \*

Please write your answer here:

Thank you for completing the questionnaire, your answer will contribute to the success of the project!

If you'd be interested to learn more about our research, or stay updated on the projects advancement, you might want to visit our website [meta-museum-project.eu](https://meta-museum-project.eu) and subscribe to the newsletter (just a few and concise, we swear!) or follow our Instagram account [@meta\\_museum\\_project](https://www.instagram.com/meta_museum_project).

See you!

Submit your survey.  
Thank you for completing this survey.

# [META-MUSEUM] PRE MUSEU ARQUEOLOGIA CATALUNYA - Status quo measurement

Welcome! Thank you for taking an interest in our project and thank you for choosing to lend us some of your time!

You will now be asked to answer a couple questions to get to know you better. The questionnaire is short but please take your time filling it out! We take the chance to remind you that the questionnaire is strictly anonymous and it won't be possible to link answers to any participant.

There are 14 questions in this survey.

## Experiment ID

Please indicate here the ID code that was assigned to you, ask for help from the team if you're not sure. \*

Please write your answer here:

## A couple questions about you...

### Gender \*

Choose one of the following answers

Please choose **only one** of the following:

- Male  
 Female  
 Other  
 I prefer not to say

### Age \*

Choose one of the following answers

Please choose **only one** of the following:

- 18-21  
 22-25  
 26-29  
 30-33  
 34-37  
 38-41  
 42-45  
 46-49  
 50-53  
 54-57  
 58-61  
 62-65  
 66-69  
 70+  
 I'd prefer not to say

### Education \*

Choose one of the following answers

Please choose **only one** of the following:

- Elementary / Primary School  
 Secondary school / High School (without Diploma)  
 Secondary school / High School  
 University (without graduation)  
 Bachelor / Master's Degree  
 PhD / postgraduate

### Current job status \*

Choose one of the following answers

Please choose **only one** of the following:

- Student  
 Employed  
 Self-employed  
 Retired  
 Unemployed  
 Other

### Cultural habits

Number of visits to museums / art galleries in the last 12 months.

Please indicate the most accurate number you can, **do not consider today's visit.** \*

Please write your answer here:

Please indicate the extent to which museums and art galleries play an important role in your life  
**1 = Definitely not**    **10 = Definitely yes** \*

Please choose the appropriate response for each item:

	0 - Definitely not	1	2	3	4	5	6	7	8	9	10 - Definite yes
Museums / art galleries play an important role in my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**I see myself as.... \***

Please choose the appropriate response for each item:

	Strongly disagree	Moderately disagree a little	Neither agree nor disagree	Agree a little	Moderately agree	Strongly agree
Extroverted, enthusiastic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Critical, quarrelsome	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dependable, self-disciplined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anxious, easily upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open to new experiences, complex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reserved, quiet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sympathetic, warm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disorganized, careless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm, emotionally stable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conventional, non creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Expectations before visit**

**Which statements best describe why you are here today?  
Select *all that apply*. \***

Select all that apply

Please choose **all** that apply:

- I want to spend time with friends/family/other people
- I am here with an organized group
- I am a tourist from this country
- I am a tourist from abroad
- I want to get away from the routine of my life
- I want to visit an important site
- I don't know / hard to say

Other:



In the context of the European Union, rate your agreement with the following sentences  
**1 = strongly disagree**      **6 = strongly agree** \*

Please choose the appropriate response for each item:

	1 - Strongly disagree	2	3	4	5	6 - Strongly agree
In the future, society will be functioning as well as today	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our society is well equipped to solve future problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future safety and security of our population is assured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future of our society is bright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nowadays, things seem to be getting more and more out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Altogether, we live in a safe and secure time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What kind of effects do you expect from this visit?  
**Select all that apply**

\*

Select all that apply

Please choose **all** that apply:

- Knowledge of the cultural heritage of my country
- Knowledge of the cultural heritage of another country
- Knowledge of European cultural heritage
- Knowledge that is personally important to me
- Intellectual stimulation
- Emotional stimulation
- Increased confidence
- Contact with beauty, visual aesthetics
- Calm and relaxing experience
- Feeling of immersion in a different reality
- Don't know / hard to say

Other:

What kind of emotions do you think this visit could elicit in you?

Select *all that apply*

\*

Select all that apply

Please choose **all** that apply:

- Respect (Admiration)
- Joy (Delight)
- Understanding (Empathy)
- Touched (Being moved, deep feeling)
- Driven (Inspiration, motivation to act)
- Belief in myself (Self-confidence)
- Feeling strong (Empowerment)
- Hopefulness (Optimism)
- Sadness
- Annoyance (Irritation)
- Negativity (Pesimism)
- Not caring (Apathy)
- Sense of belonging
- Don't know / hard to say

Other:

How would you rate your knowledge on the themes of what you're about to see? \*

Please choose the appropriate response for each item:

	0 - Completely lacking knowledge	1	2	3	4	5	6	7	8	9	10 - High level of knowledge
My knowledge of the themes is...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your personal life, how much confidence do you have about the future? \*

Please choose the appropriate response for each item:

	0 - Not confident	1	2	3	4	5	6	7	8	9	10 - Very confident
How I feel about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How I feel about the future of our society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for completing this questionnaire, if there's nobody here with you wait for a researcher to give you instructions on the next steps.

We'll see you later for the post-experience questionnaire!

Submit your survey.

Thank you for completing this survey.



## [META-MUSEUM] POST MUSEOPARC ALESIA - Misura Status quo

Welcome back! Once again thank you for the interest paid to our project and the time you chose to dedicate to us.

In this section of the questionnaire we'll inquire about the experience you just had; there aren't many questions but we ask you to answer carefully taking all the time you need.

Some questions might seem repeated but don't worry: it's by design.

We take the chance to remind you that the questionnaire is strictly anonymous and it won't be possible to link answers to any participant.

There are 17 questions in this survey.

### Experiment ID

Please indicate here the ID code that was assigned to you before the experience, ask for help from the team if you're not sure. \*

Please write your answer here:

### Experience evaluation

Please evaluate what you just visited following the inputs \*

Please choose the appropriate response for each item:

	0 - Not at all	1	2	3	4	5	6	7	8	9	10 - Very much
How beautiful is it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you like it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it make you think or reflect?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much could others like it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much contentment does it raise?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it raise positive emotions in you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much does it raise positive sensations in you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How surprising is it for you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### What kind of results did you get from this visit? **Select all that apply.** \*

Select all that apply

Please choose **all** that apply:

- Knowledge of the cultural heritage of my country
- Knowledge of the cultural heritage of another country
- Knowledge of European cultural heritage
- Knowledge that is personally important to me
- Intellectual stimulation
- Emotional stimulation
- Increased confidence
- Contact with beauty, visual aesthetics
- Calm and relaxing experience
- Feeling of immersion in a different reality
- Don't know / hard to say

Other:

### What emotions did this exhibition evoke in you? \*

Select all that apply

Please choose **all** that apply:

- Respect (Admiration)
- Joy (Delight)
- Understanding (Empathy)
- Touched (Being moved, deep feeling)
- Driven (Inspiration, motivation to act)
- Belief in myself (Self-confidence)
- Feeling strong (Empowerment)
- Hopefulness (Optimism)
- Sadness
- Annoyance (Irritation)
- Negativity (Pesimism)
- Not caring (Apathy)
- Sense of belonging
- Don't know / hard to say

Other:

### How would you rate your knowledge on the themes of the exhibit after seeing it? \*

Please choose the appropriate response for each item:

	0 - Completely lacking knowledge	2	3	4	5	6	7	8	9	10 - High level of knowlec
My knowledge of the exhibition themes is	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## How would you rate your experience after the visit? \*

Please choose the appropriate response for each item:

	None of the time	Not often	Some of the time	Often	All the time
I felt happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt engaged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt safe and secure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed the company of other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## In your personal life, how much confidence do you have about the future? \*

Please choose the appropriate response for each item:

	0 - Not confident	1	2	3	4	5	6	7	8	9	10 - Very confident
How I feel about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How I feel about collective future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## In the context of the European Union, express your agreement on the following statements

1 = *Strongly disagree*      6 = *Strongly agree* \*

Please choose the appropriate response for each item:

	1 - Strongly disagree	2	3	4	5	6 - Strongly agree
In the future, society will be functioning as well as today	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our society is well equipped to solve future problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future safety and security of our population is assured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future of our society is bright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nowadays, things seem to be getting more and more out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Altogether, we live in a safe and secure time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Please indicate how would you describe yourself on the following aspects \*

Please choose the appropriate response for each item:

	1 - Never / Definitely not	2	3	4	5	6	7	8	9 - Toujours / Certainen oui
I'd rather depend on myself than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I rely on myself most of the time / I rarely rely on others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often do "my own thing"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My personal identity, independent of others, is very important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is important that I do my job better than others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning is everything	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Competition is the law of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When another person does better than I do, I get tense and aroused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If someone close gets a prize, I would feel proud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The wellbeing of others is important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 - Never / Definitely not	2	3	4	5	6	7	8	9 - Toujours / Certainen oui
To me, pleasure is spending time with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel good when I cooperate with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parents and children must stay together as much as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is my duty to take care of my family, even when I have to sacrifice what I want	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family memebers should stick together no matter what sacrifices are required	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To me it is important that I respect decisions taken in groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Open ended questions

Please consider whether this exhibition has influenced your view of the world or changed anything about your personality or values? If so, please briefly describe the impact of the exhibition on you. \*

Please write your answer here:

Did you identify with any of the stories you encountered in your visit? \*

Please write your answer here:

Did you encounter anything that could be still current? \*

Please write your answer here:

What would you want to have today that Romans had? \*

Please write your answer here:

What element of the exhibition struck you the most?  
**Please specify which one in the comment box on the right. Don't worry about a correct title, a synthetic description is fine.**

\*

Please write your answer here:

On the other hand, did you encounter anything that negatively impressed you?  
*Please indicate what was it and why.*

\*

Please write your answer here:

What kind of message did this exhibition leave you with?  
\*

Choose one of the following answers

Please choose **only one** of the following:

- Confidence and hope
- Discouragement and disillusionment
- I wouldn't know / hard to say
- Other

If something bothered you during this experience please tell us down below \*

Please write your answer here:

Thank you for completing the questionnaire, your answer will contribute to the success of the project!  
I you'd be interested to learn more about our research, or stay updated on the projects advancement, you might want to visit our website [meta-museum-project.eu](https://www.meta-museum-project.eu) and subscribe to the newsletter (just a

See you!

Submit your survey.

Thank you for completing this survey.

## [META-MUSEUM] PRE MUSEOPARC ALESIA - Status quo measurement

Welcome! Thank you for taking an interest in our project and thank you for choosing to lend us some of your time!

You will now be asked to answer a couple questions to get to know you better. The questionnaire is short but please take your time filling it out! We take the chance to remind you that the questionnaire is strictly anonymous and it won't be possible to link answers to any participant.

There are 14 questions in this survey.

### Experiment ID

Please indicate here the ID code that was assigned to you, ask for help from the team if you're not sure. \*

Please write your answer here:

### A couple questions about you...

#### Gender \*

Choose one of the following answers  
Please choose **only one** of the following:

- Male
- Female
- Other
- I prefer not to say

#### Age \*

Choose one of the following answers

Please choose **only one** of the following:

- 18-21
- 22-25
- 26-29
- 30-33
- 34-37
- 38-41
- 42-45
- 46-49
- 50-53
- 54-57
- 58-61
- 62-65
- 66-69
- 70+
- I'd prefer not to say

#### Education \*

Choose one of the following answers

Please choose **only one** of the following:

- Elementary / Primary School
- Secondary school / High School (without Diploma)
- Secondary school / High School
- University (without graduation)
- Bachelor / Master's Degree
- PhD / postgraduate



### Current job status \*

Choose one of the following answers

Please choose **only one** of the following:

- Student  
 Employed  
 Self-employed  
 Retired  
 Unemployed  
 Other

### Cultural habits

Number of visits to museums / art galleries in the last 12 months.

Please indicate the most accurate number you can, **do not consider today's visit.** \*

Please write your answer here:

Please indicate the extent to which museums and art galleries play an important role in your life  
**1 = Definitely not**     **10 = Definitely yes** \*

Please choose the appropriate response for each item:

	0 - Definitely not	1	2	3	4	5	6	7	8	9	10 - Definite yes
Museums / art galleries play an important role in my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## I see myself as.... \*

Please choose the appropriate response for each item:

	Strongly disagree	Moderately disagree a little	Neither agree nor disagree	Agree a little	Moderately agree	Strongly agree
Extroverted, enthusiastic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Critical, quarrelsome	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dependable, self-disciplined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anxious, easily upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open to new experiences, complex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reserved, quiet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sympathetic, warm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disorganized, careless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm, emotionally stable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conventional, non creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Expectations before visit

## Which statements best describe why you are here today? Select *all that apply*. \*

Select all that apply

Please choose **all** that apply:

- I want to spend time with my friends/ family/ other people
- I am here with an organised group
- I am a tourist from this country
- I am a tourist from abroad
- I want to get away from the routine of my daily life
- I want to see an important touristic site
- Don't know / hard to say

Other:

In the context of the European Union, rate your agreement with the following sentences  
**1 = strongly disagree**      **6 = strongly agree \***

Please choose the appropriate response for each item:

	1 - Strongly disagree	2	3	4	5	6 - Strongly agree
In the future, society will be functioning as well as today	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our society is well equipped to solve future problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future safety and security of our population is assured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The future of our society is bright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nowadays, things seem to be getting more and more out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Altogether, we live in a safe and secure time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What kind of effects do you expect from this visit?  
**Select all that apply**

\*

Select all that apply

Please choose **all** that apply:

- Knowledge of the cultural heritage of my country
- Knowledge of the cultural heritage of another country
- Knowledge of European cultural heritage
- Knowledge that is personally important to me
- Intellectual stimulation
- Emotional stimulation
- Increased confidence
- Contact with beauty, visual aesthetics
- Calm and relaxing experience
- Feeling of immersion in a different reality
- Don't know / hard to say

Other:

What kind of emotions do you think this visit could elicit in you?

Select *all that apply*

\*

Select all that apply

Please choose **all** that apply:

- Respect (Admiration)
- Joy (Delight)
- Understanding (Empathy)
- Touched (Being moved, deep feeling)
- Driven (Inspiration, motivation to act)
- Belief in myself (Self-confidence)
- Feeling strong (Empowerment)
- Hopefulness (Optimism)
- Sadness
- Annoyance (Irritation)
- Negativity (Pesimism)
- Not caring (Apathy)
- Sense of belonging
- Don't know / hard to say

Other:

How would you rate your knowledge on the themes of what you're about to see? \*

Please choose the appropriate response for each item:

	0 - Completely lacking knowledge	2	3	4	5	6	7	8	9	10 - High level of knowledge
My knowledge of the themes is...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your personal life, how much confidence do you have about the future? \*

Please choose the appropriate response for each item:

	0 - Not confident	2	3	4	5	6	7	8	9	10 - Very confident
How I feel about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How I feel about the future of our society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for completing this questionnaire, if there's nobody here with you wait for a researcher to give you instructions on the next steps.

We'll see you later for the post-experience questionnaire!

Submit your survey.

Thank you for completing this survey.



## 5. Correlating the status quo questionnaire results with the previous surveys carried out within WP2

The comparison between the WP2 survey findings (D2.2) and the Status Quo questionnaire results reveals not only consistent themes and mutual reinforcement across both data sets, but also meaningful differences that provide valuable evidence for the further evolution of museums in line with audience needs. Although the concept of the museum primarily as a builder and provider of knowledge belongs to a mission somewhat outdated, visitors first adapt to this idea, and actually they **remain primarily motivated by education and intellectual curiosity**, while emotional engagement, although present, plays a secondary role. This was evident at the Museo Egizio, where immersion and discovery were central, and at Alesia, where learning about heritage met expectations more strongly than emotional stimulation. **Emotional stimulation can be a stronger focus for museums, as it fosters more reflective and active engagement with visitors and helps build a long-term connection with the museum, rather than limiting the experience to passive learning.**

Both WP2 and the new results **confirm the transformative potential of CH, though in practice this manifests more in empathy, belonging, and reflection** rather than in empowerment, joy, or inspiration. The findings from Barcelona and Alesia highlight that while exhibitions foster empathy and connection, they can also evoke sadness or diminishing optimism if narratives are too heavy.,

**On confidence and resilience, the convergence is clear: all three museums produced modest improvements in personal or collective confidence, especially among women, younger visitors, and those less culturally active.** Yet, the results also mirror WP2's insight that visitors' confidence in collective futures remains significantly weaker than in their personal outlook, reflecting persistent societal anxieties.

Barriers to access, as emphasized in WP2, are partly addressed in practice, since **less experienced or less engaged visitors reported the largest knowledge gains, showing museums' potential to bridge gaps and broaden inclusivity.** Similarly, storytelling continues to be the central mechanism shaping engagement. Across sites, **narrative framing determined whether experiences led to immersion, empathy, or, at times, heavier emotional responses.** This aligns closely with WP2's finding that storytelling and digital integration must be carefully balanced to sustain both reflection and resilience.

Finally, **the social role of museums** is reinforced in both data sets: they act as spaces for dialogue, empathy, and belonging, with visitors resonating more with human and cultural values than with martial or political ideals. This convergence underscores the importance of curating exhibitions around small human stories and community connections, as WP2 recommended.

The table below summarizes the points to consider as identified in the WP2 Audience Preliminary and Exploratory Study and Status Quo Questionnaire Results (Egizio, Barcelona, Alesia)

Component	WP2 Study Findings	Status Quo Questionnaire Results	Points to Consider
<b>Motivations &amp; Expectations</b>	Visitors motivated by education, leisure, social interaction, emotional engagement, and curiosity. Museums must balance learning with inclusive experiences.	Egizio: Higher immersion & relaxation than expected; strong learning about other cultures. Barcelona: Educational & reflective expectations met; confidence not central. Alesia: Learning & heritage expectations confirmed; emotional stimulation weaker.	Education and intellectual curiosity dominate, with emotional engagement secondary.
<b>Transformative Potential &amp; Emotional Engagement</b>	CH fosters identity, reflection, emotional engagement, and social change; experts caution against overstating transformative effects.	Egizio: Strong empathy & admiration, but reduced hope/inspiration. Barcelona: Empathy ↑, sadness ↑, empowerment weak. Alesia: Belonging & empathy ↑, joy & inspiration ↓.	Transformative effects present (empathy, belonging), but empowerment and optimism underdeveloped, echoing WP2 cautions.
<b>Confidence, Resilience &amp; Societal Outlook</b>	Museums can foster reflection & confidence but impact on anxiety reduction varies. Global anxieties remain strong; trust in collective futures weaker than personal confidence.	Egizio: Collective confidence ↑ modestly. Barcelona: Personal optimism ↑ slightly; societal confidence unchanged. Alesia: Personal confidence steady; collective confidence ↑, esp. for women/younger visitors.	Museums boost personal and collective confidence modestly, but societal doubts persist.
<b>Barriers &amp; Accessibility</b>	Barriers include geography, finance, psychology, information, accessibility. Need for inclusive outreach & interactivity.	Less culturally active visitors showed greatest gains in knowledge and confidence. All groups improved, especially younger/less engaged audiences.	Exhibitions can reduce gaps and act inclusively.
<b>Storytelling &amp; Digital Engagement</b>	Engagement shaped by storytelling, immersion, authenticity, interactive elements. Balance needed between digital and traditional storytelling.	Egizio: Immersion & cultural discovery central. Barcelona: Storytelling evoked empathy but also sadness. Alesia: Storytelling fostered belonging & reflection, but limited joy/inspiration.	Storytelling is key driver. However, results show risks of heavy emotional tone, validating WP2's emphasis on balancing reflection with empowerment.

<b>Social &amp; Community Dimensions</b>	Museums foster dialogue, empathy, and community. Personal heritage often more engaging than national identity.	Egizio: Empowerment & empathy linked to collective themes. Barcelona: Visitors connected most to human values, least to martial/political ones. Alesia: Belonging ↑, reflection ↑.	Museums act as spaces for belonging & empathy, and focus more on reflection than joy or optimism.
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## 6. Crossing the interpretation of all results according to General assessment and interpretation Model (D2.3)

### Approach-Withdrawal (AW) Index

- **Museo Egizio:** Despite reporting negative AW values, no consistent withdrawal tendency was confirmed. Stability across tasks suggests a **neutral motivational balance**, with no significant variation across rooms (and actually the display, the vitrines and the set in general were omogeneous).
- **MAC Barcelona:** Clear differentiation emerged, **Otium video** elicited the highest positive approach values, while Mosaic and Epilogue elicited withdrawal tendencies. The Epilogue task's U-shaped trend indicated **reflective tension between approach and disengagement**.
- **MuséoParc Alesia:** AW remained stable across all tasks, showing no marked fluctuations, suggesting an **equilibrium in motivational orientation**.

### Cognitive Workload (CW) Index

- **Museo Egizio:** CW levels showed no significant differences across rooms and groups, pointing to **consistent cognitive demands** during exploration.
- **MAC Barcelona:** Clear task-related differentiation, lowest workload during Otium, highest during Mosaic, with Epilogue in between. A slight decrease across time indicates **attenuation of attention or fatigue** as tasks progressed.
- **MuséoParc Alesia:** CW was the most informative measure. Task B showed a **decreasing trend** in workload, while tasks A and C displayed U-shaped patterns, suggesting phases of initial ease, challenge, and re-engagement. Participants completing all tasks reported **higher overall workload**, underscoring sustained effort in cultural processing.

### Arousal Index

- **Museo Egizio:** Arousal increased at the beginning and closure of both Room 6 and Room 7, suggesting **anticipatory excitement** followed by **reflective activation**.
- **MAC Barcelona:** Arousal rose progressively from Otium → Mosaic → Epilogue, but declined across time within each video. Peaks in the first minute reflected **strong initial emotional engagement, followed by habituation**.
- **MuséoParc Alesia:** Task A showed a **U-shaped arousal pattern**, while tasks B and C showed a **linear decrease** over time, indicating diminishing emotional resonance during prolonged exposure.

### Status Quo Questionnaire Results

The status quo results across Museo Egizio, MAC Barcelona, and MuséoParc Alésia, when viewed through the **TMt framework**, reveal how cultural heritage exhibitions contribute to resilience, emotional resonance, and social connection.

- **Motivations & Expectations:** Visitors' strong orientation toward **learning, discovery, and reflection** illustrates how cultural interactions frame change as a **natural and meaningful process**. At Egizio and Alesia, where expectations of cultural exploration and heritage learning were confirmed, visitors connected knowledge with identity, reinforcing self-confidence through discovery. This aligns with TMt's principle that cultural artefacts do more than inform, they **anchor visitors in processes of growth and adaptation**.
- **Transformative Potential & Emotional Engagement:** the emotional outcomes at all three sites (empathy, belonging, reflection) show cultural artefacts as **sources of resonance** that extend beyond aesthetic appreciation. Egizio's reinforcement of admiration and empathy, Barcelona's heightened empathy but also sadness, and Alesia's growth in belonging demonstrate that CH fosters emotional depth. However, the limited rise in **hope, inspiration, or empowerment** highlights that while resilience is supported through reflection, opportunities to cultivate **forward-looking optimism** remain underutilized. In TMt terms, heritage interactions are strengthening **empathic bonds and reflective adaptation**, but not yet consistently enabling visitors to transform obstacles into opportunities.
- **Confidence, Resilience & Societal Outlook:** Across sites, confidence levels rose modestly, especially in collective futures (Egizio, Alesia), confirming TMt's view of **resilience as adaptation**. Even small gains show visitors learning to frame challenges collectively and to see continuity across time. However, Barcelona's lack of improvement in societal confidence underscores the persistent gap between **personal resilience and collective trust**, which TMt highlights as critical for social cohesion. Exhibitions that explicitly link historical narratives to contemporary difficulties could strengthen this bridge, helping visitors reinterpret anxiety into resilience.
- **Barriers & Accessibility:** The fact that less culturally active or younger visitors reported the **greatest learning gains** shows how cultural engagement can possibly act as a **catalyst for adaptation and personal development**. In TMt terms, inclusivity not only widens access but also equips new audiences with tools for resilience, turning museums into spaces where **cultural participation can support empowerment** and confidence in navigating challenges.
- **Social & Community Dimensions:** Findings from all sites show growth in **belonging, empathy, and human connection**, aligning with TMt's view that cultural interactions strengthen **social cohesion**. By anchoring visitors in shared narratives and small human stories, exhibitions encouraged reflection on identity and solidarity. However, as with resilience, the challenge is to extend these outcomes beyond empathy to foster **collective confidence and action**, enabling museums to become not only spaces of dialogue but also platforms for adaptive social change.

**TMt Synthesis:** Within the framework of the METAMUSEUM interpretation matrix, the results suggest that CH experiences are shaped by intertwined motivational, cognitive, and emotional dynamics. Motivational orientation (AW), measured through EEG neurometrics, shows how **storytelling can subtly draw participants closer or sustain neutrality, reflecting subconscious alignment or distance with cultural narratives**. Cognitive effort (CW), likewise derived from EEG, highlights **how engagement varies with task complexity and interpretive demands, pointing to the role of resilience in sustaining mental focus across time**. Finally, emotional resonance (Arousal), measured via electrodermal activity (EDA), reveals **cyclical phases of anticipation,**

**engagement, and reflection that scaffold memory consolidation and renew attentional resources.** Together, these indices illustrate how cultural storytelling functions as a regulator of subconscious processes, supporting resilience and deepening immersion in heritage experiences.

On the other hand, through the lens of TMt, the status quo questionnaire results confirm that cultural heritage exhibitions could support **resilience by normalizing change, fostering reflection, and building empathy.** Some visitors gained knowledge, reflected on emotions, and felt connections to identity and belonging, showing that cultural artefacts are experienced as **sources of resonance and adaptation.** On the other hand, many visitors struggled to summarize the exhibition's message and reflect on their emotions. Therefore, the results reveal a recurring gap: while reflection and empathy can be strong, **inspiration, empowerment, and collective confidence remain weak.** To fully activate TMt's transformative potential, exhibitions must move beyond reflective engagement to also **reframe contemporary anxieties as opportunities for growth,** embedding narratives that highlight resilience, solidarity, and forward-looking hope.