

EXTENDED MATRIX NARRATIVES: TEACHING AND ENGAGING THROUGH THE PAST*

1. INTRODUCTION

In this article, we propose open methods and tools that foster collaboration between academia and the creative industries, to enhance Cultural Heritage engagement and digital reconstruction. It suggests a way forward by initiating the development of open, interoperable methodological tools and software designed to establish a common theoretical and methodological framework. This initiative aims to promote standardisation and sharing across both academic and industrial domains. An example of this approach is the use and adaptation of systems such as the Extended Matrix (EM), which focuses on data provenance, to explore a narrative dimension that highlights communicative, experiential and emotional aspects, while maintaining a strong link to science and promoting the intangible Cultural Heritage (BALELA, MUNDY 2015) (Fig. 1).

The aim is to equip academia with the necessary tools to train future generations to create content that is technically sound, emotionally engaging and narratively rich (VEUGEN 2014). This ambition, highlighted at the end of the state of the art, represents a challenge for the future, prompting a re-evaluation and broadening of methodological and application horizons in the field of digital cultural heritage. To test this tool, we propose a case study about the reconstruction, through the analysis of literary sources and the application of the EM, of a dialogue between two characters set in the forum of a small Roman city.

The state of the art reveals that major companies in the creative industry, such as Paradox and Ubisoft, do not make their methodological tools available, which likely includes a range of software and applications. This opacity makes standardisation and adoption within academia challenging, rarely taught in universities. Our approach is to begin developing open, interoperable methodological tools and software that can foster a common theoretical and methodological framework.

2. METHODOLOGY

This research began by exploring the relationship between academia and the creative industries, aiming to bridge the gap between them. Creative tools

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C.01		Extractor icon = extractor node capable of extracting specific information from a source and passing it to a property
D.01.01		Combiner icon = combiner node capable of combining information provided by two extraction nodes and passing the result in value to a property
		Gray rounded square = property. A property node validates a VSU it is connected to
D.01		Document icon = source. A source node feeds a property of a VSU it is connected to (through an extractor node). A source can be an image, a text, a reference, a 3D model etc. More documents need a combiner node

Fig. 1 – EM legenda related to the notes devoted to track the data provenance.

are often undervalued in knowledge transfer. Deadlines and differing priorities create tension – academics prioritise content integrity, while the creative industry must consider commercial viability. Projects like ‘Assassin’s Creed’ (CASEY 2018) and ‘Pentiment’ demonstrate the potential of collaboration, while others, like ‘A Night in the Forum’ (PESCARIN *et al.* 2020), reveal ongoing challenges. A formalised approach is needed to balance the unique needs of each sector while ensuring both educational and entertainment value, as well as economic success. Our methodology addresses these challenges with an open framework that bridges data creators and the creative industry. As a prime example, we introduce the Extended Matrix Narratives, designed to extract communication-oriented data from primary sources without losing the connection between emotional and historical aspects, potentially even facilitating quicker information retrieval from these sources. These principles are the foundational pillars of our methodology. The Extended Matrix Narratives highlights the significance of Narrative Units in bridging data creators with the creative industry. The NUs are instrumental in extracting communicative information from primary data sources, preserving the connection between emotion and the historical context.

We demonstrate this by a practical case study where we aimed to produce academically accurate yet engaging content and using three Plautine comedies as primary sources. The project begins with a detailed analysis of the comedies, deconstructing dialogues to form the basis for a new scene. Close analysis of who spoke, when, and how, allows us to create historically grounded dialogue featuring plausible characters in realistic settings.

2.1 *Extended Matrix in brief*

The EM, developed by ISPC-CNR, is a formal language designed to track the digital reconstruction processes used in archaeology and Cultural Heritage. It expands upon Harris's stratigraphic principles, allowing for the integration of virtual and hypothetical elements. EM records data, sources, and the logic behind Virtual Stratigraphic Units (VSUs), ensuring transparency in the reconstruction process. Essentially, EM is a formalised graph database that enables hypothetical reconstructions, seamlessly blending excavation data with diverse historical sources (DEMETRESCU, FERDANI 2021).

The EM emphasises data provenance, especially the philological origins of digital information (DEMETRESCU *et al.* 2020). This focus helps maintain a clear link between emotional narratives and their historical context. Narrative units within EM precisely document this provenance, ensuring that created narratives remain grounded in authentic sources. This approach not only makes narratives more engaging but also strengthens the integrity of historical accounts, resulting in digital narratives that are both emotionally impactful and historically accurate.

2.2 *Extended Matrix Narratives in theory*

The Extended Matrix Narrative (EMN) expands upon the EM to ensure the coherence and accuracy of creative content produced for cultural heritage projects. Central to the EMN are Narrative Units (NUs). These units seamlessly blend scientific data with creative elements. For example, a dialogue's content might be strictly based on research, while its tone and pacing are guided by creative choices. Narrative units emerge as an essential tool for mapping events that unfold over time and belong to domains such as theatre, choreography, and music. These units enable the documentation of intangible heritage – dances, dialogues, musical events, rituals – characterised by a coherent scene where events follow one another. Elements like a ritual outside an Etruscan tomb, a conversation between merchants in a square, or a musical or dance performance are defined by a beginning and an end, rooted in a specific scene in time and space.

This scenic context is linked to a chronological phase that acts as a container for our virtual reconstruction, offering a platform to represent and perform intangible events. This structure provides not only a theoretical framework but also a narrative detail focused on theatre. The narrative progresses through the voice of the 'third actor', who introduces the scene and guides the narrative units composed of the characters' dialogues. Each dialogue, every sound produced, is a narrative unit connected to sources through Data Provenance nodes, ensuring a direct link to the historical and contextual authenticity of the represented events.

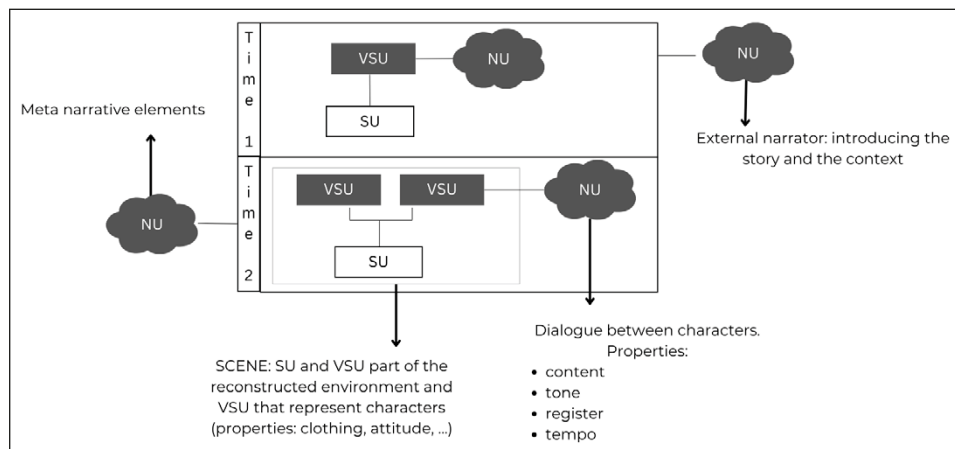


Fig. 2 – EMN scheme.

Thus, the use of narrative units in the context of EMN allows for a precise mapping of intangible cultural events, enriching the virtual reconstruction with temporal, spatial, and emotional dimensions. This approach not only enhances communication and emotional engagement (MILLER 2019) but also establishes a solid bridge to academia, enabling training based on tools that facilitate the creation of historically accurate and narratively engaging content. That being said, there may be two types of NUs: 1) a system or scene: several US and USVs form a scene in which a narrative takes place; 2) meta-narration: characterised by the need to open a further level of representation by means of a new plot in order to deepen a scene or a narrative.

With these concepts in mind, a schematic and simplified version of what the EMN might look like is proposed below (Fig. 2). It should be noted, of course, that each character, as a VSU, presents characteristics, such as clothing, appearance, attitude, that are validated either by scientific data and reported in the documentation, or by creative elements. Similarly, the UNs present characteristics that are validated from time to time by the relevant documentation.

3. CASE STUDY

In order to build an effective tool and to go through all the evidence coming from the initial analysis, it was decided to use it directly in a practical case: the virtual reconstruction of an episode in Nora's Forum. As announced, through the analysis of three Plautine comedies (QUESTA *et al.* 2004, 2007; QUESTA, SCANDOLÀ 2013), we created a dossier representing a temporal

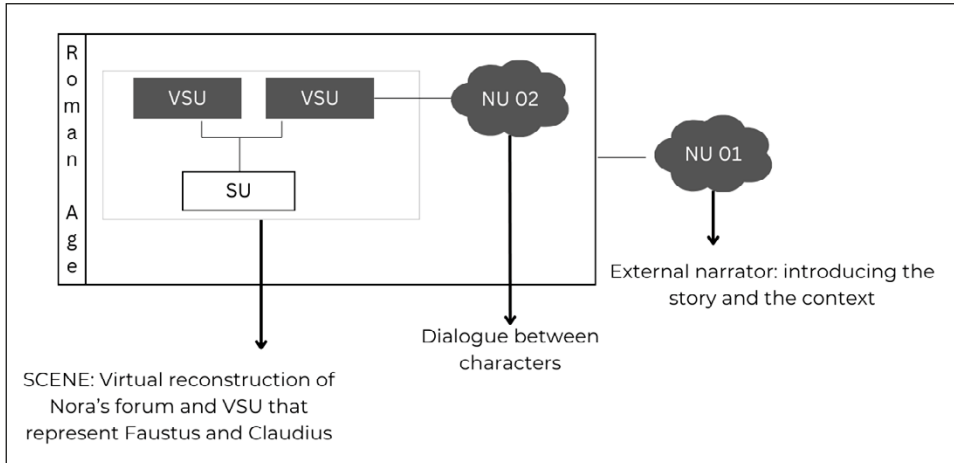


Fig. 3 – ‘Two Merchants in Nora’ EMN traditional schema.

fragment within a Roman city and experienced by two personas. In this way, a city was reconstructed: it was inhabited, it had characters, traditions and everyday events. The stratigraphic method and EM are used here to refine the temporal granularity, since the aim is no longer to show an epoch, but a fragment of life within history, based on a solid historical source.

3.1 *Nora: defining the setting*

Nora is situated on a peninsula about 30 km W of Cagliari and was one of the most important Sardinian cities in Phoenician, Punic and Roman times. The city, already developed, entered the Roman orbit in 227 BC, although the first phase of monumentalization in the Roman perspective did not take place until the second half of the 1st century B.C. During this period the city became a Roman *municipium*, leading to the construction of the Forum, the largest public monumental complex in the Roman city, the heart of political and administrative life. All this data is part of the EM of the virtual reconstruction of Nora (Fig. 3). The city's Forum (CARCOPINO 1993) is filled with the chatter of citizens discussing business and making purchases. Followed by their slaves, they move between *tabernae* and markets, reading edicts and walking between statues, and porticoes, some stopping to give alms to a few beggars. In the distance, musicians and jugglers can be heard. Among the crowd, two merchants stand out, haggling, making deals and engaging in a dialogue that we can reconstruct from the Plautin source (Tab. 1). This creates a small narrative (PERISSINOTTO 2022) through which we can glimpse the spectrum of that past world, made up of places, such as the Forum already

Character	Script
Narrator	Imagine yourself on an early winter morning in a square surrounded by arcades, full of people and chatter. Market stalls invite you in, jugglers and acrobats draw applause, musicians play in the corner. A few coins jingle in a beggar's bowl. There is talk of business, politics and religion. We are in a Roman forum, the forum of Nora. A small town in Sardinia, at the beginning of the imperial age. And here, in the midst of all the hustle and bustle of a small but lively town, two merchants doing business with each other cannot be missed.
Faustus	Hi Claudius, how are you?
Claudius	Greetings Faustus, I'm fine. I just arrived from the harbour with a shipload of Italic wine
Faustus	For Hercules! It would be really useful for me!
Claudius	And it is of the best quality!
Faustus	Dear me! You won't give me your usual prices I hope
Claudius	I certainly can't sell it for a bushel of salt! It is wine from Campania after all
Faustus	Immortal gods! I can't let this deal slip through my fingers...
Claudius	You have to spend if you want to earn!
Faustus	Eh, you are right, for Polluce!
Claudius	Then we are even and draw: much money, much goods
Faustus	I'll go to the harbour immediately then, we have a deal. I also need to buy more goods: I'll get two boars in the same lair.
Claudius	May the gods preserve you! See you later then!
Faustus	Bye, take care

Tab. 1

reconstructed, but also of characters, speeches and sounds. However, this information and the information in the Tab. 1 are reported and recorded in the EMN (Fig. 4), where it was reconstructed a virtual context made by Nora's Forum, traditions, sounds, people and words that make up NU1 and NU2 (Fig. 5).

3.2 *Two merchants in Nora: script and EMN application*

From the deconstruction of the Plautine plays described above, we were able to obtain a new script, a dialogue between two merchants in the Forum. As was customary in Roman times, the two characters were dressed with a purple toga and a gold ring.

All data and elements used to create this script, both creative and scientific, were recorded and managed in the EMN (Fig. 4). The script, the characters and the event itself are some of the creative elements. However, each of them is based on scientific and accurate information and helps to create a virtual reality of Nora's Forum.

4. CONCLUSION

4.1 *Future works*

A key future direction for EM-NU is the development of a software solution with a dedicated narrative unit node and integrated timelines.

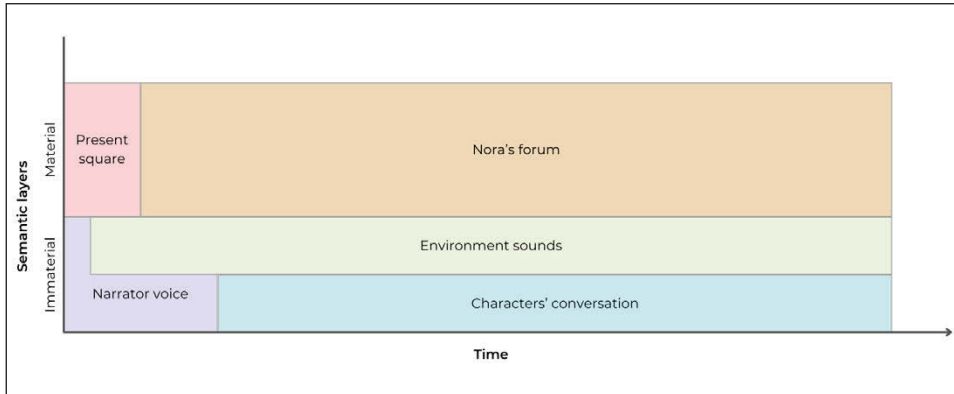


Fig. 4 – ‘Two Merchants in Nora’ EMN semantic layers view.

This shift to a horizontal knowledge graph on the X-axis, mirroring video editing timelines, will enhance the intuitive representation of time within narratives. This will streamline the storytelling process and align it with contemporary digital techniques, creating a more flexible and dynamic platform for managing cultural narratives. Another focus is the formalisation of the narrative unit itself, with specific graphic conventions and connections to the existing EM structure. This entails defining connectors, visual language (symbols, colours, lines), and clear rules for representing relationships between narrative units, data provenance, and historical elements. The goal is to enhance user interaction with digital narratives, making connections between events, history, and data provenance immediately evident. Natural Language Processing (NLP) offers potential for streamlining dossier creation, particularly under tight time and budget constraints. However, expert supervision is essential to guide research, evaluate results, and ensure accurate initial data selection.

Beyond the methodology, a compelling future application lies in using this framework to build virtual museums. This encompasses digital realities, video games, VR, and AR experiences accessible to a global audience. These experiences would offer immersive journeys into meticulously reconstructed historical locations, allowing users to learn and experience research that museums and inaccessible cultural heritage sites hold.

4.2 *Final conclusion*

Digital humanities serve as an important bridge between academia and the creative industries. This research aims to address the need for intermediaries between them. Despite the many issues highlighted in the state of the

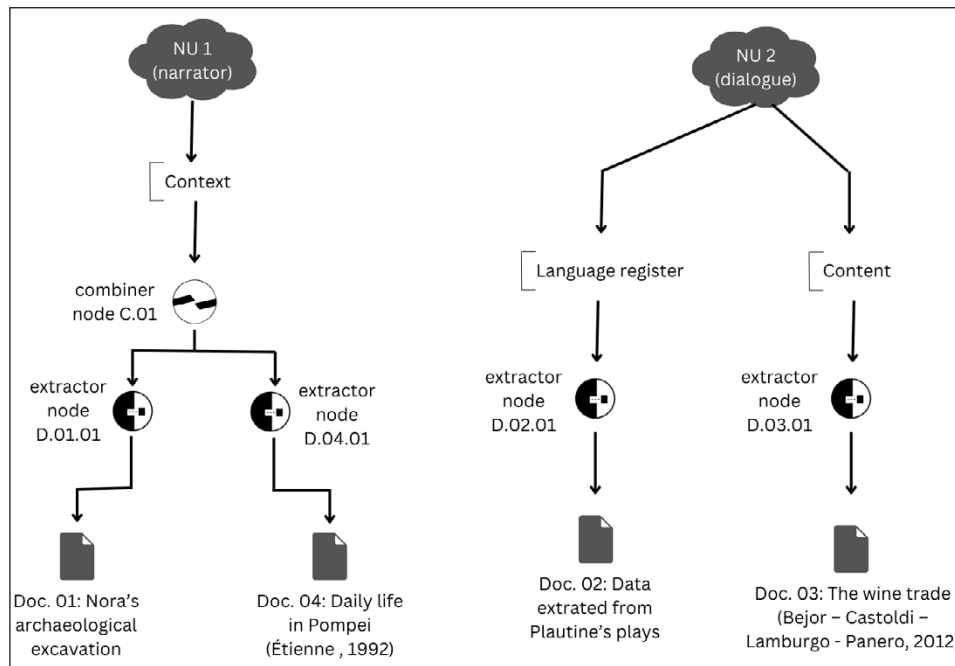


Fig. 5 – EMN synthetic scheme of ‘Two merchants in Nora’ NUs properties validation.

art analysis, such as the reluctance of academics to distort information or the needs of business and production creatives, there is great potential for collaboration between academics and creatives. For example, working with professionals from the creative industries can lead to fruitful collaborations with publishers who are confident in the developers’ abilities, which can also lead to greater visibility and financial support.

In order to realise this potential, this paper proposes a working methodology that consists in the compilation of a documentary dossier. This element gives the final product a solid scientific basis and directs the creatives to adhere to certain data. In this way, the repeatability of the processes is maintained and, on the other hand, any creative excesses can be better monitored and corrected. The EM tool, already used for archaeological digital reconstruction, is extended here to serve as a ‘working journal’ for narrative elements, called Extended Matrix Narratives. Using this tool, academics and creative people can construct real archaeological sites, realistic characters, clothing and sounds. The core of this work has shown how a product that balances both scientific data and creative content, such as Latin literature and storytelling, can create engaging narratives that connect users to the past. The work is

far from finished; adjustments and adaptations will certainly be needed, but it is likely that further research and practical applications will lead to new and interesting results.

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ABSTRACT

Digital reconstructions for valorization projects are becoming increasingly popular and the creation of narratives that catches the user's attention and instigates their curiosity is the key to edutainment. However, as shown by interviews and related work, there is still a lack of a working methodology for a balanced and fruitful collaboration between academia and creative industries. Even though this work is still in its early stages, in this paper we propose a methodology for bridging the gap between academia and creative industries through the

development of the Extended Matrix Narratives (EMN) tool. It allows academics and creative people to construct narratives, characters, dialogues, and scenes in a schematic way, helping to ensure that the virtual reconstruction is both accurate and engaging for the target audience. The main step is to compile a dossier documentative, a collection of all the information that may be necessary for the creation of context, setting, narrative, or characters. This document provides a solid scientific basis for the final product and helps to direct the creative team. The result is a narrative that is both accurate and engaging, and that can be used for a variety of purposes, such as education, entertainment, and cultural heritage preservation.