Which ideas do we get from war museums? A computational text analysis of the museums of the Battle of the Ebro (Spanish Civil War)

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A B S T R A C T

War museums convey traumatic experiences through complex and contested narratives that shape visitors' perceptions. The Ebro battlefield exemplifies these complexities, with multiple institutions preserving its heritage while presenting differing interpretations. This article employs a Digital Humanities approach to analyse the messages conveyed by these museums. The team digitised exhibition panel texts using OCR technology and applied various textual analysis and data visualisation methods, including word frequency counts and topic modelling. The integration of topic modelling in museum discourse analysis enables the quantification of trends and the identification of overlooked narratives. Results reveal a strong emphasis on the conflict's international dimension and a tendency towards politically equidistant narratives. The analysis also highlights the under-representation of certain groups, particularly civilians, and identifies tensions between museum portrayals of looting and heritage laws.

1. Introduction

The Battle of the Ebro (1938) was the decisive combat in the outcome of the Spanish Civil War, where the region's geography and World War I-style tactics led to intense bloodshed (Henríquez Caubín, 2009). The echoes of this battle are still present in Catalan and Aragonese societies (Sospedra and Hernàndez, 2022, 5), and this is reflected not only in politics but also in museums around this battle.

The struggle for the recovery of the memory of the Spanish Civil War in Catalonia has crossed paths on many occasions with the Battle of the Ebro (González Ruibal, 2012). This battle is now the most iconic site for dark tourism in Catalonia as its remembrance has been institutionalised through the creation of the COMEBE *(Consorci Memorial dels Espais de la Batalla de l'Ebre)* museum network. This network, run by the Department of Justice of the Catalan Government, preserves and promotes these war sites, while balancing democratic remembrance with tourism and local growth (González Vázquez, 2016, 1273–74).

In addition to the COMEBE network, other initiatives have emerged in the battle's territory. Local associations have promoted independent projects, some of which have evolved into alternative museums dedicated to the Battle of the Ebro. Notable examples include the Memorial Museum of the Battle of the Ebro (*Museu Memorial de la Batalla de l'Ebre*)

in Gandesa (Catalonia) and the Museum of the Battle of the Ebro (*Museo de la Batalla del Ebro*) in Faió/Fayón (Aragon). Although both centres originated from collaborative initiatives, the Faió/Fayón museum is now managed municipally, whereas the Gandesa centre is still managed by the CEBE association (*Centre d'Estudis de la Batalla de l'Ebre*).

In recent years, a series of research projects have focused both on the archaeological study of the battle—such as applying spatial analysis (Rubio Campillo and Hernàndez, 2015) or combining archaeological data with textual resources (Gallego-Vila et al., 2017)—and its memorialisation through qualitative approaches (Martín Piñol, 2011). However, there is a lack of studies that quantitatively analyse the narratives constructed and institutionalised around the most significant battle of the Spanish Civil War. This article aims specifically to explore both common and discordant points in the discourse of these war museums. We seek to discover whether there is a dissonance between the narrative promoted by the political power (COMEBE network) and by bottom-up initiatives (CEBE, the Faió/Fayón museum). Specifically, we intend to explore the following research questions: (1) On what aspects of the battle does the narrative of these museums' focus? What discursive differences exist between the museums managed by the different entities (COMEBE network, CEBE and Faió/Fayón Town Council)? (2) Is there a common narrative or are there conflicting narratives? Are there any

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taboo subjects? (3) What collectives linked to the battle are over-represented or forgotten for these narratives?

Our proposal is to address these research questions using a Digital Humanities approach by applying computational analysis to the texts displayed in these museums, which serve as the primary information source for visitors. This methodology allows for a global and contextual analysis of museum texts, providing a novel perspective on the study of museum narratives. Topic modelling has mostly been used to analyse the online impact of museums through reviews (Huo et al., 2024; Agostino et al., 2021) or media coverage (Kim et al., 2023). However, we aim to delve deeper into museum discourses, which are particularly complex due to the traumatic nature of warfare.

2. The last great battle of the Spanish Civil War: historical context and commemoration

2.1. Battle context

The Spanish Civil War (1936–1939) is often seen as a prelude to the Second World War (1939–1945), being the first European conflict between democracy and fascism (Claret Miranda, 2022). The impact of the war went way beyond borders due to the character of ideological struggle: the Francoist side was supported by the European fascists regimes (Germany, Italy and Portugal), whereas the Republic received help from the Soviet Union and over 35,000 volunteers from the international brigades (Prades Artigas, 2022).

By the summer of 1938, the Republican Army had suffered defeats that endangered its remaining territory. The Battle of the Ebro was a response to the Francoist Aragon Offensive (Beevor, 2007, 349), which split Republican-held areas into two (Fig. 1): Catalonia in the north and the Madrid-Valencia axis in the south. General Rojo's Republican army launched a counterattack near the Ebro River to demonstrate that they were still able to fight (Sospedra and Hernàndez, 2022, 7). The offensive began on July 25, 1938 and initially succeeded, advancing to Gandesa and Vilalba dels Arcs (Bitrian Varea, 2020, 1214). However, Franco's forces, with superior reserves and equipment, counterattacked heavily, recapturing the territory after seven costly assaults on the Cavalls and Pàndols mountain ranges.

Francoists' final offensive began on 30 October, eventually recapturing the mountain ranges and leading to the Republican withdrawal. The battle was the final offensive carried out by the Republican army and its heavy attrition expedited the Francoist conquest of Catalonia, ultimately leading to the Republic's defeat in April 1939.

2.2. Battle heritage narratives and selection of museums and interpretation centres

The narratives of military conflicts are inherently complex due to the large number of factors and political messages generated by war. This complexity persists in the case of the Battle of the Ebro, where varying interpretations, economic interests, and political agendas intersect in the presentation of this historical event (González Ruibal, 2020; Martín Piñol, 2011). As a result, various entities, individuals, and interpretation centres have emerged, each offering different perspectives on the battle.

The tensions arising from these actions of memorialisation reflect the complexities and different narratives that have arisen around this battle (Sospedra and Hernàndez, 2022). Given the wide range of heritage sites in the region, we selected six museums for our research based on two criteria: (1) the centre was located within the battlefield's perimeter and (2) the exhibition included textual descriptions of the battle.[1] Table 1

and Fig. 2 provide some basic data on the six selected institutions.[2]

Local grassroots associations started to recover the memory of the battle even before the approval of the Historical Memory Law in 2007 (the first legislation on the Spanish Civil War and Francoism legacy in Spain) and the creation of "Memorial Democràtic" (the institution that looks after the victims and the heritage of these conflicts in Catalonia). Their initiatives ranged from commemorative acts and monoliths to the establishment of memory spaces. One such initiative, the Memorial Museum of the Battle of the Ebro in Gandesa (*Museu Memorial de la Batalla de l'Ebre*, 1998), was promoted by the *Centre d'Estudis de la Batalla de l'Ebre* (CEBE) cultural association. This museum emerged from grassroots interest in the conflict, preceding political involvement (Monfort, 2011, 179–81) and became a pioneer in showcasing CEBE's collection of war materials.

The government of Catalonia legislated to deploy its narrative about the battle by creating the *Consorci dels Espais de la Batalla de l'Ebre* (COMEBE) in the early 2000s, responsible for managing the war remnants and memorial elements (González Vázquez, 2016). COMEBE currently manages 5 museums, 22 historical spaces and 1 memorial related to the Battle of the Ebro. Each museum focuses on a specific thematic aspect: an overall explanation of the battle (*CI 115 dies*), the role of the press and the propaganda (*CI Veus del Front*), the international brigades (*CI Internacionals a l'Ebre*), and wartime health (*CI Hospitals de Sang*). This specialisation aimed to create independent spaces which, in turn, are united by a common thread: the battle from different perspectives (Laporte and Bobes, 2004, 63). However, this official interest in the musealisation of the conflict clashed with the lack of archaeological works to investigate the battlefields and mass graves in the area during those years (González Ruibal, 2016).

The battlefield primarily lies within modern-day Catalonia, but a secondary action, the Faió/Fayón pocket, took place in Aragon. The border between the regions of Catalonia and Aragon plays a significant role in commemorating the battle. In 2012, the Aragonese municipality of Faió/Fayón opened the Museum of the Battle of the Ebro. This decision was motivated by the success of the Living History reenactments organized by the *Asociación para la Memoria Histórico-Militar Ebro 1938* in the late 2000s (Arcega Morales, 2018, 165; Santamarina Otaola and Herrero Acosta 2018, 252). The museum showcases civilian and military artifacts from private collections of Faió/Fayón residents (Sospedra-Roca et al., 2023, 467) and is currently undergoing a renovation to introduce new perspectives, including the application of archaeology to the study of the battlefield.

3. Methods

Since the rise of Digital Humanities, many text-based research fields have explored the potential of computational methods of analysis (Murrieta-Flores and Gregory, 2015, 167). However, their use in contested heritage studies remains limited (Rubio Campillo and González Cantera 2024).

Given the complexity of the text corpora, we employed tools suited to the scale of the analysis: a) Optical Character Recognition (OCR) for digitising exhibition texts, b) topic modelling to identify key themes, and c) data visualisation to explore complex multivariate patterns (Fig. 3). The transcription, dataset, and source code are available under open licences on GitHub (link).

3.1. Creation of textual corpus

After contacting the managing entities, the research team visited the museums with staff members in early 2024. Exhibition panel texts were

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[1] Initially, the selection also included the interpretation centre "The End of the Battle of the Ebro" in La Fatarella. However, this museum, which is managed by *Lo Riu* association, was excluded from this research as it does not have any written text but is limited to the reproduction of war materials.

[2] This article analysed all the museums managed by COMEBE, except for *CI Soldats a les Trinxeres* (Vilalba dels Arcs), which has been closed indefinitely with no planned reopening date.
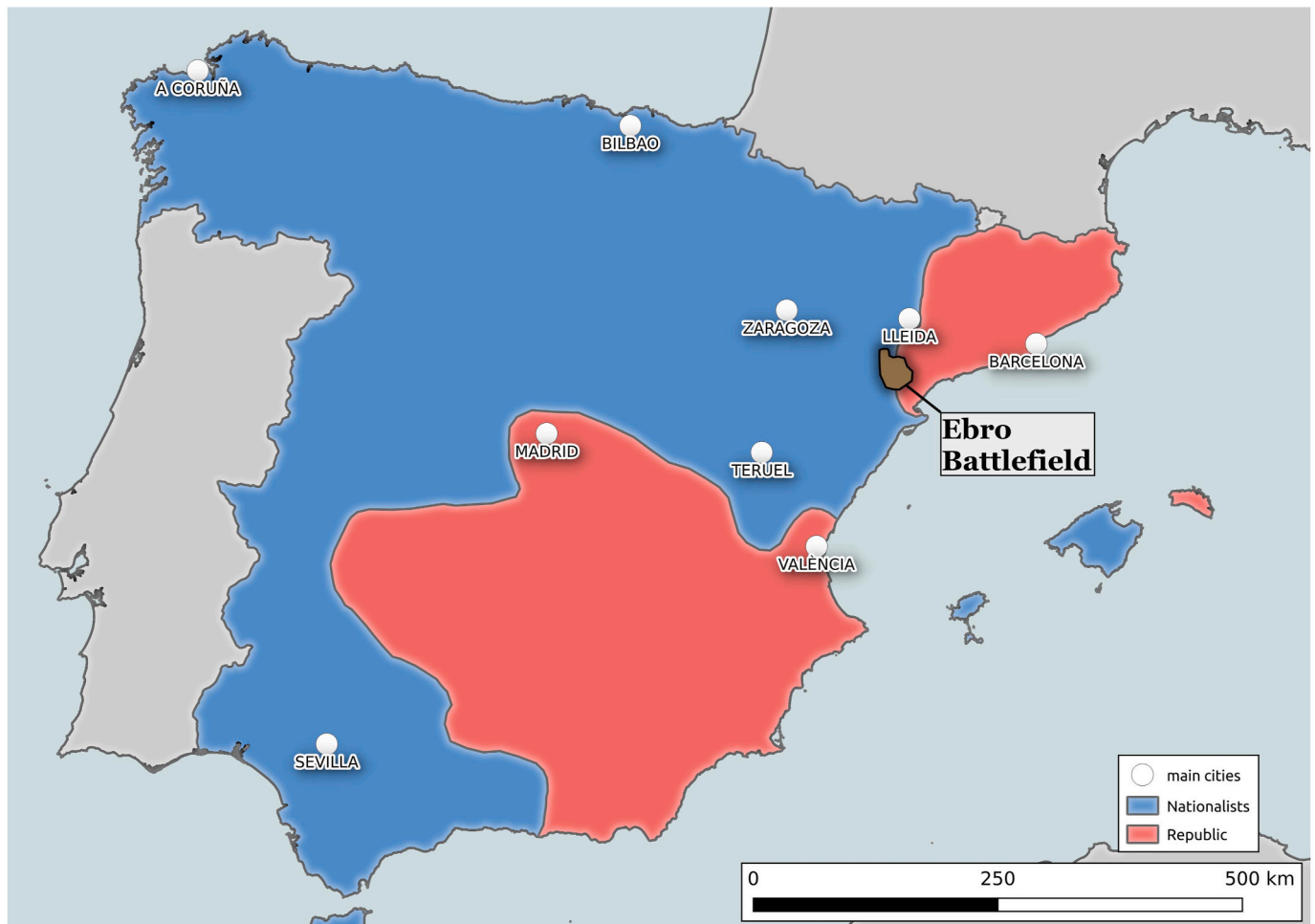
Fig. 1. War situation preceding the Battle of the Ebro.

Table 1
Basic data of the 6 museums analysed.

Name of centre	Location	Inauguration year	Renovation year	Management
CI 115 dies	Corbera d'Ebre (Catalonia)	2008	2023	COMEBE
CI Veus del Front	Pinell del Brai (Catalonia)	2005	–	COMEBE
CI Internacionals a l'Ebre	La Fatarella (Catalonia)	2010	–	COMEBE
CI Hospitals de Sang	Batea (Catalonia)	2008	–	COMEBE
Museu Memorial de la Batalla de l'Ebre - CEBE	Gandesa (Catalonia)	1998	2011	CEBE
Museo de la Batalla del Ebro	Faió/Fayón (Aragon)	2012	2024	Town council

photographed and digitised using Google Keep's Optical Character Recognition (OCR) technology. This method enables to convert input text into a machine-encoded and it is mainly used for the digitisation of manuscripts, older books and typewritten documents (Liceras-Garrido, 2019; Memon et al., 2020). In Faió/Fayón, where some new texts were unavailable, museum staff provided forthcoming materials. We also analysed the audioguide texts, as these will play a key role in future visits.

Thanks to this technique we captured and digitised the texts in an individualised word file for each centre. We then carried out a manual correction of OCR errors caused by the digitisation process. Due to the bilingualism of the Ebro area, museum texts are available in both Catalan and Spanish. To prevent duplication, we conducted the textual analysis in Catalan, as it is the original language of the exhibition texts.

3.2. Topic modelling and data visualisation

The first research question, which explores the key aspects of the battle highlighted in the Ebro museums, was addressed using topic modelling at a global level. Preprocessing involved normalising the dataset (e.g., converting terms to lowercase, removing punctuation) and creating a stopwords list (e.g., common verbs, connectors) to exclude irrelevant terms.

Topic modelling is an unsupervised machine-learning technique that identifies groups of related words, or topics, within a corpus (Park et al., 2022, 698). It relies on statistically significant word collocations, assuming that texts using similar vocabulary belong to the same semiotic domain. This method is increasingly being integrated into the archaeological and heritage disciplines as it is useful to identify macroscopic trends and patterns in large textual corpus (i.e. distant reading). Applications range from analysing social perceptions of archaeological heritage through TikTok comments (Graham et al., 2022, 213) to Pinterest posts (Axelsson et al., 2020). The technique holds diverse potential, with some experts suggesting its use in identifying archaeological sites and places of historical significance (Murrieta-Flores and Gregory, 2015, 173).
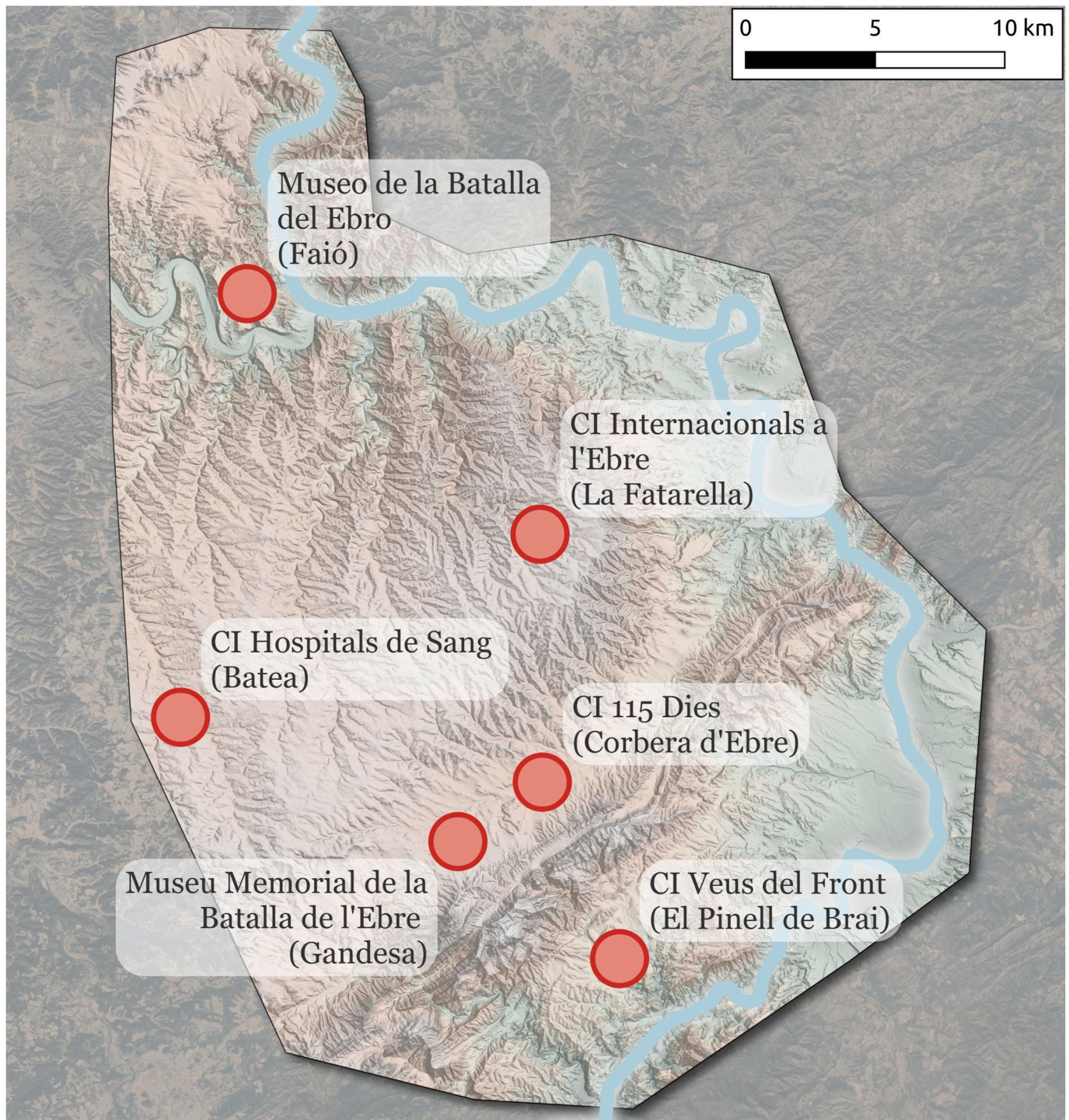
Fig. 2. Map showing the location of the interpretation centres and museums analysed within the perimeter of the battle.

Topic modelling was applied to this collected museum textual corpus using the Latent Dirichlet Allocation (LDA) algorithm implemented in the "lda" package (Chang, 2024) for R and R Studio. LDA calculates the probability that a document contains a given topic within a corpus of documents and considering a specific number of topics (Blei, 2012). After a preliminary exploration of the topics, we chose 11 number of topics based on two factors: 1) the size of the sample, 2) the feasibility and convenience of performing the analysis with this number of topics. LDA calculates the weight of each of the topics identified for each document in the corpus, allowing us to identify overlaps and frequent correlations between topics.

This approach was supplemented by a word frequency analysis to address research questions 2 and 3, along with data visualisation to present both overall and museum-specific findings. Specifically, we were interested on the discursive differences (question 2), taboos (question 2) and the treatment of different groups (question 3) by analysing the absence/presence and frequency of relevant terms linked to these concepts. Firstly, we identified four key concepts related to the research questions (Table 2). For the second research question, we selected: divergent narratives (Republican and Francoist), politics of memory, and looting. The third research question was addressed through the concept of groups involved in or victims of the battle.
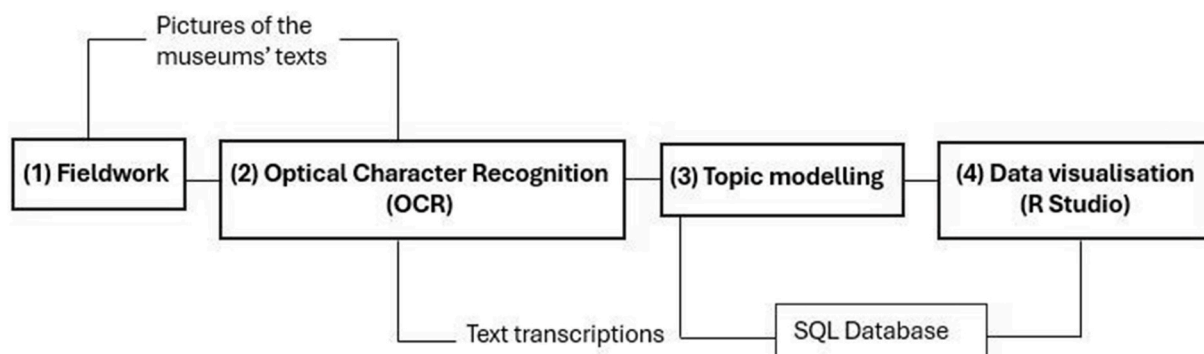
Fig. 3. Schematic representation of the methodological phases of the research: fieldwork, digitisation of texts, topic modelling and data visualisation.

Secondly, after defining the list of concepts, we compiled a corpus of keywords for each. The selection of keywords was carried out independently by the authors, with both of us contributing terms relevant to the subject matter to the table. Both concept and keyword selection followed manual proofreading of the OCR-processed texts, ensuring that both were grounded in a preliminary understanding of the ideas conveyed in these texts.

The LDA and keyword frequency analysis results were further processed using R Studio for visual representation. Data visualisation enhances the interpretability of complex patterns, making analysis more intuitive. In this study, a combination of bar charts, heatmaps, and treemaps was employed to facilitate the exploration of multivariate patterns (Reilly and Walter, 2015).

3.3. Limitations

The combined methodology employed aligns with the research questions, though each technique has inherent limitations that need to be addressed. OCR technology enables efficient digitisation of large text corpora, reducing manual workload. However, language, handwriting, and image quality can affect transcription accuracy, making manual verification necessary to prevent errors in key terms.

LDA is the ideal topic modelling algorithm for corpus where overlaps and correlations between themes are expected (Rubio Campillo, 2022). Its application presents two main challenges: a) the number of topics is predefined by the user, and b) identified topics need to be interpreted by the user. To tackle these challenges a diversity of existing indexes were computed to identify a coherent number of topics which in this case was defined at 11 (Cao et al., 2009; Deveaud et al., 2014). Additionally, the results of LDA were assessed based on the present-day research on conflict heritage. It is important to note that source code and dataset are openly available to facilitate replication and further exploration of the corpus.

In selecting keywords for frequency analysis, we took specific measures to mitigate potential interpretative errors. On the one hand, both singular and plural forms of terms were included in the keyword list (for example, "germà", brother, and "germans", brothers), rather than relying solely on word roots, as in lemmatisation (De Benito Moreno, Pueyo, and Fernández-Ordoñez, 2016). On the other hand, polysemous terms that could create interpretative challenges were carefully evaluated. For example, the verb *donar* (to donate) was initially included under the "looting" concept, as it can refer to the donation of objects to a museum. However, it is also used in a medical context (e.g., donating blood or organs). Since the concept of "looting" already included the terms *donació/donacions* (donation/donations), we determined that the specific idea of donating looted objects was already adequately represented by these terms.

4. Results

4.1. General topics

Fig. 4 presents the 11 themes identified by the LDA algorithm according to the terminology used in the museums' texts. While all topics are interesting to understand the diversity of narratives presented in these museums, we focus here on the four themes that are more clearly aligned with the defined research questions: battlefield medicine, international impact, battle development, and war propaganda.

Topic 3. Battlefield medicine. This group of terms relates to health care during the Battle of the Ebro. They cover the treatment of casualties (*ferits, ferides*), the medical advances made during the war and and the healthcare workers (*sanitaris*) who facilitated them, as well as the field hospitals and evacuation network established during the battle (*hospitals, evacuació*).

Topics 6–7. International impact of the war: the International Brigades vs. Franco's collaborators. Two of the topics identified by LDA are strongly linked and can be grouped because they provide different narratives on the central theme of international intervention. On the one hand, topic 6 refers to the international volunteers (*internacionals*) who chose to support (*suport*) the Republic (*república, govern, republicà, espanya*) during the war (*guerra*). Topic 7, on the other hand, shows that international support for Francoism plays a prominent role in the narratives depicted by the Ebro museums. Among them, it highlights the troops (*soldats*) sent by Nazi Germany (*alemany/alemanys, legió -Còndor-*) and by Fascist Italy (*corpo, truppe, italians*), which were key to the battle.

Topic 8. Battle development. This group includes terms about the Republican plan (*ofensiva, republicà*) of attacking the Ebro area (*zona, ebre, catalunya*). Results suggest that the museums focus more on the planning from the Republican General Staff than on the battle itself (e.g. the crossing of the Ebro River on the night of July 25, 1938). Francoist counter-offensives and the outcome of the battle do not constitute a clear and distinct theme in the results.

Topic 1. War propaganda. These terms refer to the role of propaganda (*propaganda*) in maintaining the morale (*moral*) among the troops (*front, soldats*) and the civilian population (*població, civil*).

The remaining groups of words are more challenging to categorise within an individual and differentiated theme. Some terms in topic 9, such as *tropes, franco, franquista*, and *franquistes*, could potentially refer to Franco's troops. Topic 5 may similarly be associated with the Faió/ Fayón pocket, given the presence of terms related to military tactics (*faió, artilleria, posició*). The other topics identified by the algorithm are even more ambiguous and, therefore, more difficult to interpret. For example, certain terms in topic 2 might suggest the daily life of farmers in the Ebro region (*vida, camp, casa, ebre*), although the specific time frame of this reference remains unclear. Likewise, topic 4 comprises a mix of terms related to wartime health (*hospital*) and international brigades (*brigades, internacional, internacionals*).

Table 2

Selection of keywords to analyse research questions 2 and 3 based on the concepts extracted during the reading of the museum texts.

Research question (RQ)	Concept	Keywords
RQ2	Divergent narratives: • Francoist narrative • Republican narrative	• germà, germans, nacional, nacionals, convulsa, caòtic, caos, pau, ordre, germanor, concòrdia • revoltat, revoltats, sollevats, sollevat, feixista, feixistes, alçament, pacte, munic, exili, èxode, retirada, dictadura, dictatorials, insurrectes, insurrecció
RQ3	Representation of groups participating in and/or victims of the Battle of the Ebro	franquista, franquistes, república, republicans, brigadistes, internacionals, ctv, corpo, truppe, volontarie, nazi, legió, legión, còndor, tercio, regulars, requetès, requetè, carlista, carlistes, voluntaris, mobilitzats, comunistes, anarquistes, sanitaris, sanitària, metges, infermera, portalliteres, practicants, cirurgians, soldat, soldats, malalts, batalló, batallons, divisió, divisions, brigada, brigades, mixta, cnt, poum, psuc, erc, generalitat, català, catalans, nacionalista, basc, cristians, catòlics, catòliques, capellans, religioses, mossèn, pagès, pagesos, civil, rural, urbà, ciutat, poble, jovent, jove, joves, homes, home, dones, dona, femení, nen, nena, nens, nenes, escolars, ancians, ancianes, esquerra, esquerres, dreta, dretes, falange, gènere, lleva, biberó, biberons, milicià, milicianes, cavalleria, aviació, infanteria, enginyers, enginyer, tinent, coronel, comandant, capità, comandament, general, democràcies, europeus, europees, estudiant, graduat, oficinista, comissari, barber, electricista, xofer, intel·lectuals, intel·lectual, poeta, poetes, periodistes, periodista, escriptor, escriptora, escriptors, corresponsal, corresponsals, reporter, reporters, realitzador, camèra
RQ2	Memory	arqueologia, intervencions, arqueològiques, foses, cossos, ossos, morts, adn, genètica, baixes, monument, monuments, llei, protecció, polítiques, memòria, víctimes, cicatriu, cicatrius, empremta, empremtes, repressió, record, recordar, reparació, exterminades, exterminat, exterminació, democràcia
RQ2	Looting	metralleros, metralla, metall, metalls, ferralla, ferro, acer, llautó, coure, alumini, plom, recol·lectors, aficionat, afició, col·leccionista, col·leccionistes, col·leccionar, col·lecció, espoli, peces, donació, donacions, saquejos, saqueig, estudiosos

4.2. Divergent and conflicting narratives

The discursive differences in the Ebro museums have been explored through word frequency analysis, based on the key concepts of the Republican and Francoist narratives. Fig. 5A and B shows the frequency of terms linked to Francoist and Republican narratives in the analysed museums. Comparing these terms with the dates of inauguration or renovation reveals a clear shift in how the Battle of the Ebro is presented over time. Museums in the COMEBE network, established between 2005 and 2010, maintain an equidistant stance, emphasising the internationalisation of the conflict with references to the Munich Agreement (*pacte, munic*) and frequent use of Francoist terms like "bàndol nacional" (national side) or "guerra de germans" (sibling war).

In contrast, newer or recently updated centres have moved away from this terminology. For example, the Faió/Fayón museum, opened in 2012 and under renovation, refers to the coup participants as participants in a rebellion (*revoltats, sollevats*); the CEBE centre, which was renovated in 2011, labels Franco's regime as a dictatorship (*dictadura*). These subtle differences reflect evolving memory policies from both Spanish and regional governments (Catalonia and Aragon), which are now evident in the museums' narratives.

Despite recent updates, some terms remain unchanged. For instance, "feixista/s" (fascist/s) continues to describe exclusively Mussolini's regime, particularly at the *CI Internacionals a l'Ebre*, which focuses on the international aspect of the war. These terms carry an international connotation and are not typically applied to Franco's regime, except at CEBE.

4.3. Taboo subjects and (in)visibilised collectives

4.3.1. Memory politics applied to the Battle of the Ebro

Word frequency analysis has also revealed that the Faió/Fayón museum stands out for its strong focus on memory policies (Fig. 6). It emphasises archaeological excavations (*intervencions, arqueològiques*) recovering remains (*cossos, ossos*) and the importance of remembrance (*record*). While other museums address historical memory, war's imprint (*empremtes*), and scars (*cicatrius*), their references to Spain's memory policies are more anecdotal. In contrast, the Faió/Fayón museum takes a more explicit stance.

4.3.2. (In)visible collectives: both on the front and in the rearguard

The over- and under-representation of groups linked to the Battle of the Ebro has also been investigated through word frequency analysis. The results (Fig. 7) show that museums primarily represent the opposing armies' units, focusing on soldiers (*soldats*), brigadists (*brigadistes*), brigades (*brigades, brigada*), divisions (*divisió*), battalions (*batalló*), and volunteers (*voluntaris*). The Francoist side is clearly described as "Francoist" (*franquistes*) and generally depicted as a unified entity, ignoring its diverse components like Falangists, Carlists, and Moroccan troops. Similarly, the Republic's diversity is downplayed, with international brigades being the most prominent group (*brigadistes, internacionals*).

Results suggests that the museum corpus seldom include content on the controversy over the International Brigades' withdrawal or their farewell in Barcelona, nor mentions of communists (*communistes*) or anarchists (*anarquistes*). Additionally, there are scarce references (*lleva, biberó*) to the baby bottle conscription ("Lleva del Biberó" in Catalan or "Quinta del Biberón" in Spanish), which mobilised underage soldiers during the battle (Caralt Giménez, 2017).

In contrast, COMEBE museums emphasise soldiers' technical roles rather than ideological affiliations, aligning with their specific exhibition themes. For example, *CI Hospitals de Sang* focuses on medical corps roles (*sanitaris*), including stretcher bearers (*portalliteres*), combat medics (*metges*), and nurses (*infermeres*).

None of the Ebro museums dedicate a specific section to women in this battle. Only *CI Internacionals a l'Ebre* highlights their presence with a
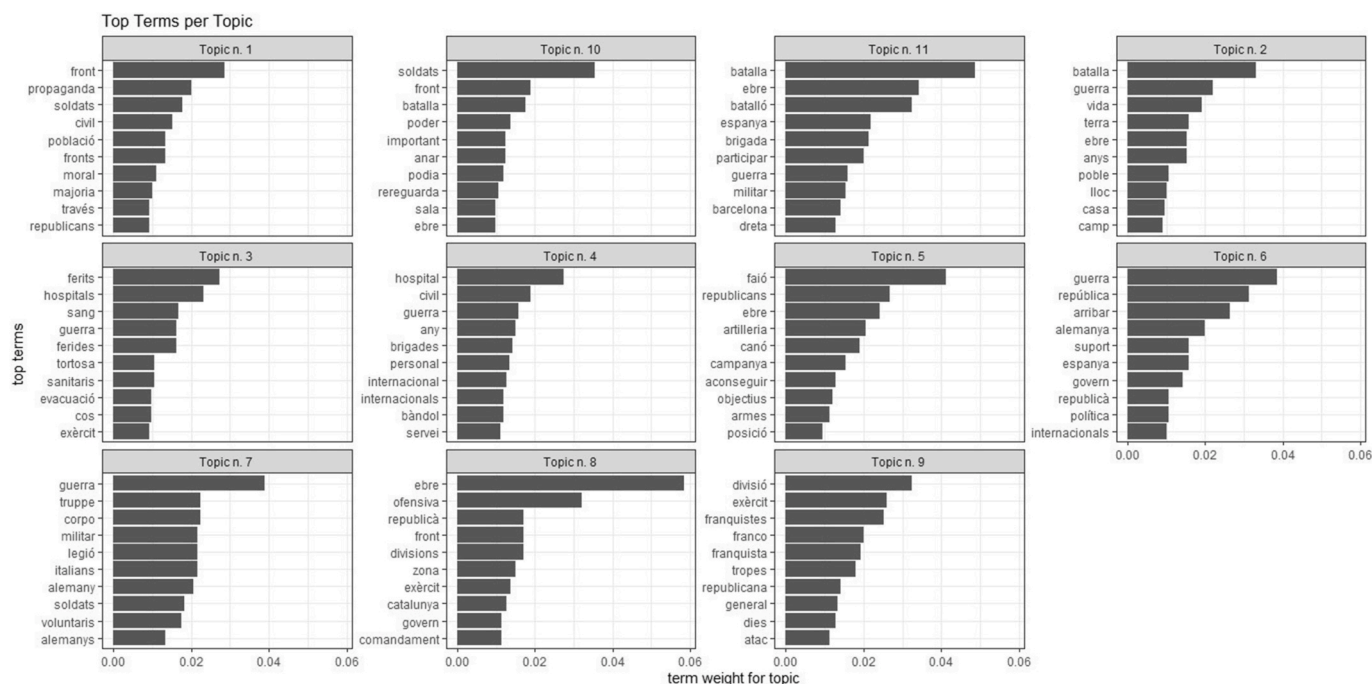
Fig. 4. Representation of the topics detected by the LDA algorithm in museum texts of the Battle of the Ebro.

biographical section of personalities linked to the battle, which includes numerous women from both sides (brigade members, nurses, politicians). Elsewhere, references to women require close reading of exhibition texts.

Notably, there is a contrast in terminology: COMEBE centres focused on military themes, such as *CI 115 dies* and *CI Internacionals a l'Ebre*, frequently use *homes* (men). In contrast, *CI Hospitals de Sang* and *CI Veus del Front*, which address traditionally feminised professions like nursing and journalism, more prominently feature terms such as *dones* (women), *sanitària*, and *infermera* (nurse). In the associative-origin museum CEBE, *dona* (woman) and *dones* (women) feature prominently. Despite its primary focus on military equipment, CEBE highlights civilian groups, including women (*dones*), children (*nens/nenes*), and peasants (*pagesos*). This creates a counternarrative, where the textual narrative foregrounds civilian experiences alongside the military hardware on display.

4.3.3. Battlefield looting: a non-taboo but problematic issue

Fig. 8 rejects the idea that post-battle looting is a taboo topic in the Ebro. The COMEBE network, CEBE, and the Faió/Fayón museum all include information about the local recovery of battlefield remains during the post-war and democratic periods. While their approaches vary, the widespread inclusion of this topic highlights both the prevalence of looting and the enduring presence of the battle in local memory.

Both the terminology and treatment of this issue vary greatly. CEBE justifies its collection's origins by referencing collectors (*col·leccionistes*), machine-gunners (*metralleros*) or even collectors (*recol·lectors*) who retrieved iron fittings (*ferralla*) and artifacts (*peces*) from the battlefield, to create a collection (*col·lecció*). CEBE portrays these lootings (*saquejos*) as a hobby (*afició*) for scholars (*estudiosos*) and continues to encourage them, reflecting a more positive view of past and future looting practices. This perspective is exemplified in the following quote:

> "Els col·leccionistes que avui en dia surten al camp a buscar restes ni tan sols havien nascut quan es produí la batalla, però són conscients que cada peça es un bocí d'història que mereix ser valorat".

Translation: Today's collectors who go out into the field to look for remains were not even born when the battle took place, but they are aware that each piece is a piece of history that deserves to be valued.

Memorial Museum of the Battle of the Ebro – CEBE (Gandesa), Section 1 – CEBE's collection (*La col·lecció del CEBE*).

In contrast, the COMEBE network takes a different approach. *CI Veus del Front* omits the topic entirely, while *CI Internacionals a l'Ebre* briefly references metals from war materials, and in *CI Hospitals de Sang* these terms are used in a medical context. *CI 115 dies* and Faió/Fayón discuss the recovery of shrapnel (*metralla*), lead (*plom*), and other materials as a means of economic survival in the post-war period, with some objects repurposed for daily use, such as soldiers' helmets displayed in *CI 115 dies* (which were reused as animal feeders). However, none of these museums legitimises or promotes hobbyist metal detecting of battle-related artifacts or the activities of scholars (*estudiosos*) and collectors (*col·leccionistes*) involved in such practices.

5. Discussion

The textual corpus of the Ebro museums provides an excellent example on the complexity and diversity of narratives around a contemporary battlefield. After Franco's death, new monuments and museum installations were introduced under the dictatorship's "reconciliation" agenda (del Arco Blanco 2022). It wasn't until the early 2000s, with the rise of public archaeology and civil society's push for a democratic memory, that new perspectives emerged (Sospedra-Roca et al., 2023, 452). All the museums analysed were established during this period of increased interest on the memory of the conflict, resulting in thematic similarities despite their unique features.

Topic modelling identifies the most common themes in the Ebro museums as combat medicine, the international impact of the war, the development of the battle and war propaganda. The first topic is particularly interesting because advances on combat medics during the Spanish Civil War had a major impact on the Second World War yet these advances are seldom discussed within mainstream narratives (Redmond, 2013). Among other topics, the Ebro centres emphasise the Trueta method —a wound treatment that prevented amputations and the spread of infections—, blood banks and mobile hospitals. These museums also pay tribute to the medical personnel (doctors, nurses, pharmacists) who worked in the Ebro area under challenging conditions, much like the population's appreciation for healthcare workers
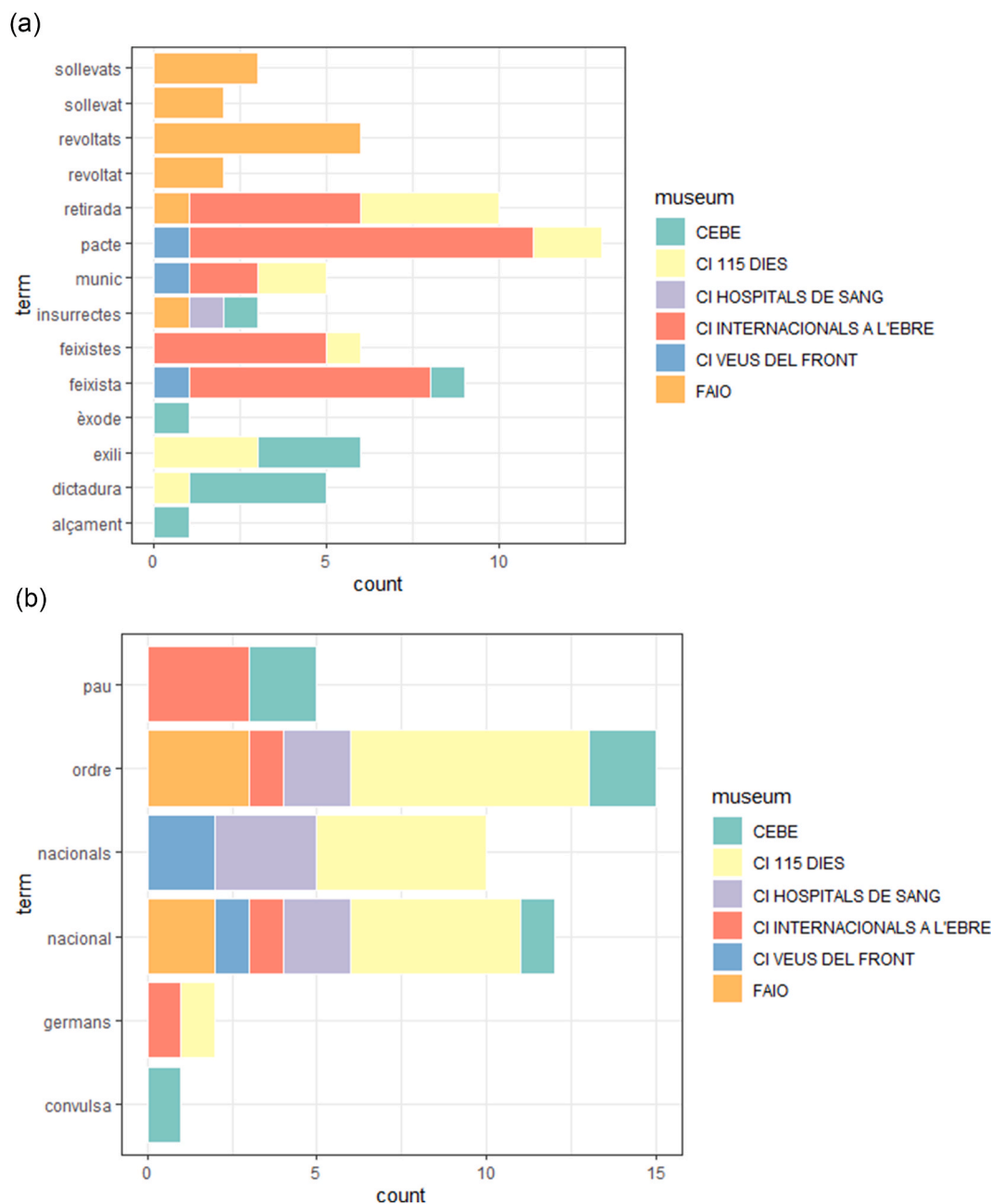
(a)

(b)

Fig. 5a–b. Bar charts showing the frequency of keywords related to narratives of Republican and Francoist origin.

during the COVID-19 pandemic (Zlobina and Dávila, 2022, 1333).

The Ebro museums prominently feature the military intervention of various allies on both sides of the conflict. They showcase Franco's alliances with Nazi Germany and Fascist Italy and emphasise the role of the International Brigades on behalf of the Republic. The International Brigades are commemorated not just in the battle area but also in their home countries. Although Anglo-Saxon brigadiers, particularly British, Americans, and Canadians, are prominent academically and socially (Tremlett, 2020), the Ebro museums do not differentiate them in their presentations, treating all international combatants equally.

War propaganda together with the causes and planning of the Republican offensive at the Ebro are also key themes in these museums. In contrast, the battle's outcome and consequences, such as the Republican exile and forced labour during Francoism, are not discussed. The only museum that delves into the almost 40 years of Francoism is a centre of associative origin: the CEBE (Gandesa). The museums of public

origin on the Battle of the Ebro continue to reflect the apolitical position on the war that became generalised with the return of democracy and after the so-called Pact of Forgetting (Preston, 1986).

The existence of multiple war museums within a small geographic area reflects the diverse perspectives on the Battle of the Ebro. These museums originate from various sources, including associative initiatives and institutions managed by the regional governments of Catalonia and Aragon; however, none are administered by the Spanish state. Indeed, there is no national museum dedicated to the Spanish Civil War, nor has the Spanish government established an official exhibition on the conflict (Barreiro Mariño, 2017). This absence contrasts with a battlefield landscape densely populated with war-related structures, small memorials, signage, and both religious and secular monuments (González Ruibal, 2020, 316). The lack of a state museum largely stems from political tensions and the significant role of autonomous communities in shaping memory policies. Regions such as Catalonia, the Basque
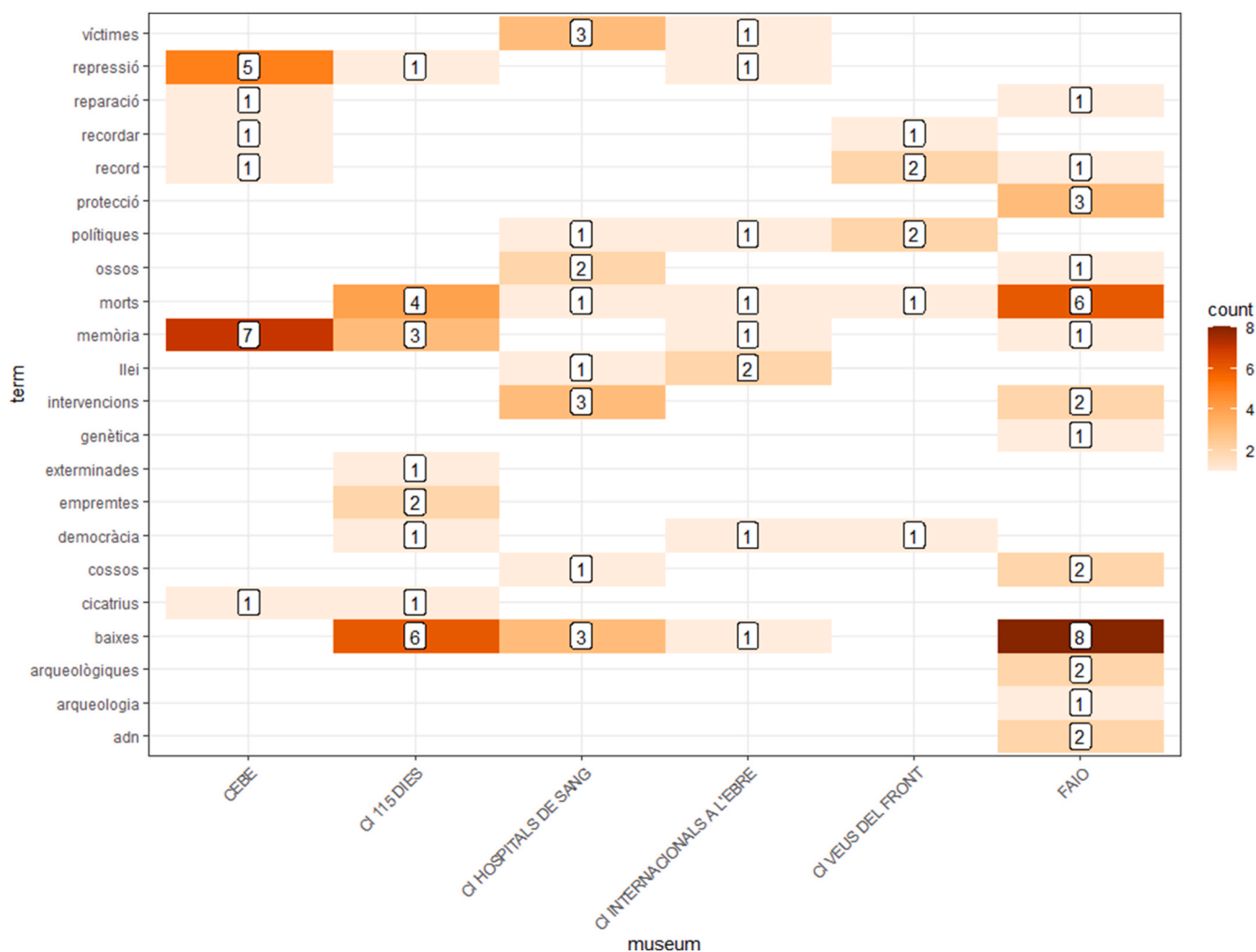
Fig. 6. Heatmap showing the representation of the keywords linked to memory in the Ebro museums.

Country, and Andalusia have led commemorative efforts, often diverging from national approaches (Faber, 2018).

The different origin (public or associative) of the Ebro museums marks not only their mission and values, but also their discourse and the materials exhibited. These museums display a significant number of original battle artifacts and weaponry, thus reflecting the impact of the materiality of modern warfare. This daily impact of warfare continued in the post-war period: the local economy was nourished by the sale of scrap metal from these materials; an activity that also ended up leading to the creation of these collections. Memory, being a political tool, leads each centre to apply its narrative, resulting in significant discursive differences among the museums, which persist despite their long existence.

5.1. Civilian population: the great forgotten

The representation of the civilian population that suffered first-hand both the Battle of the Ebro and its consequences (such as women, children and the elderly) is testimonial, except for the CEBE. The Ebro museums are therefore also part of the trend of under-representing civilians in war museums (Szitanyi, 2020). Civilians and soldiers are continually presented as opposite ends of a chain, which at the same time is separated by gender (Taber and Grover, 2021). Some of these museums attempt to fill the gap in civilian and women representation through temporary exhibitions. One example is *CI 115 dies*, the central museum of the COMEBE network, as it is currently hosting a temporary

exhibition entitled "Invisibles però decisives. Dones a la Guerra Civil i la batalla de l'Ebre" (*Invisible but decisive. Women in the Spanish Civil War and the Battle of the Ebro*). They plan to convert this exhibition soon into an online format to complement the physical visit.

5.2. Depoliticising the battle and "unifying" the contenders

The Ebro museums reflect a homogenised view of the war's participants. Since its early years, the Francoist regime eliminated any internal diversity in the movement. The brief mentions of Carlist *requetés* and Moroccan regulars illustrate the regime's effort to consolidate a unified rebel identity. However, Francoists soldiers are deliberately separated and overshadowed by some international partners in this narrative, particularly Nazi forces and the Italian *Corpo Troppe Voluntarie* (CTV), while Portugal's military and logistical support remains largely unacknowledged (Pena Rodríguez, 2015).

The Republic is similarly depicted as a unified side, with the International Brigades receiving the most attention. While references to communist and anarchist troops are rare, the International Brigades are extensively represented across all museums and even lend their name to a centre focusing on the international perspective of the battle (*CI Internacionals a l'Ebre*). The museums briefly mention the baby bottle conscription, a group of 17- and 18-year-old Catalan soldiers whose symbolic significance in Catalonia surpasses their limited role in the battle (Montellà, 2013). Although they have become a myth of the war's impact to the region, their sociocultural impact is not directly reflected
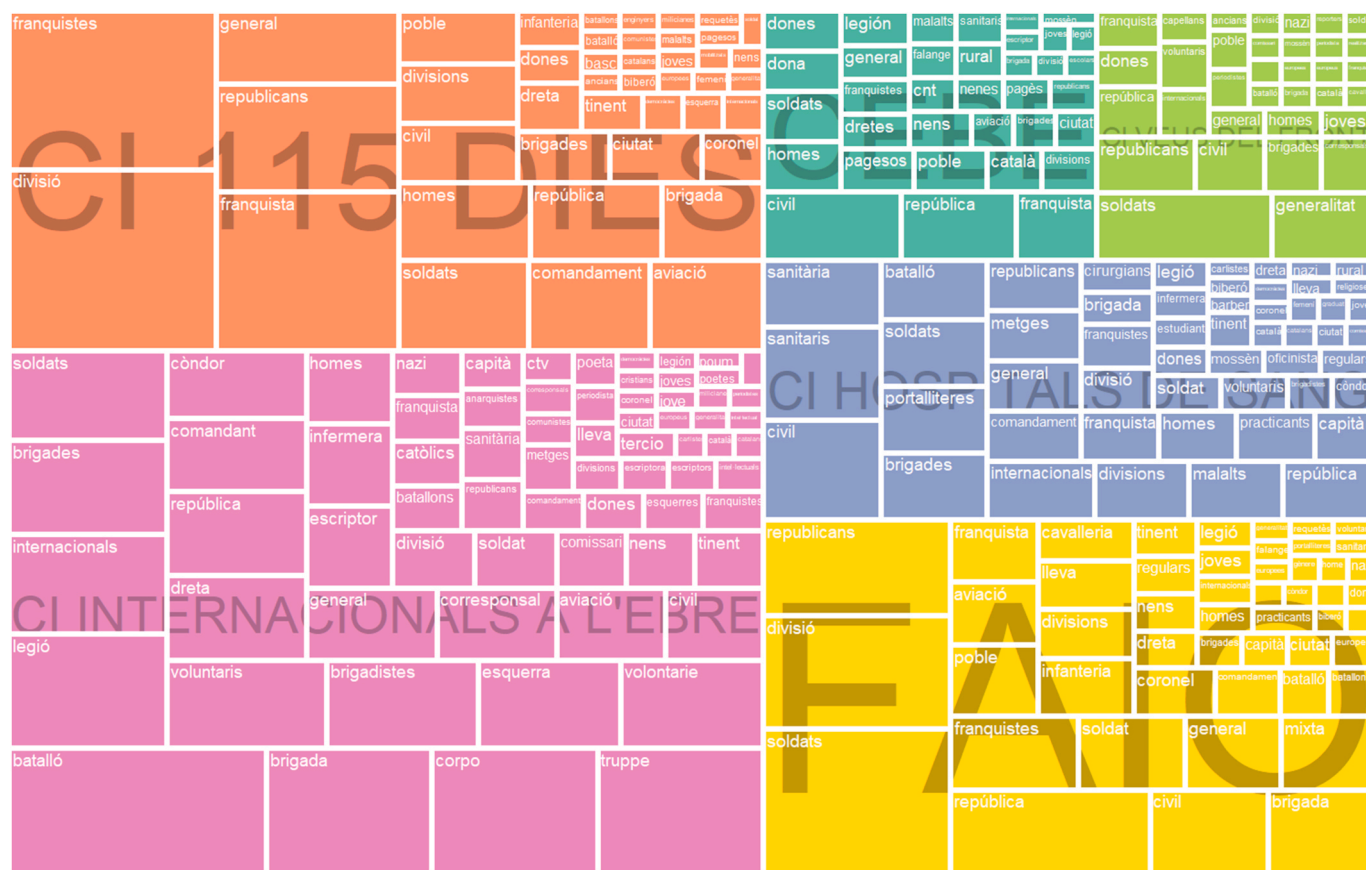
Fig. 7. Hierarchical treemap of the keywords for the concept "representation of groups participating in and/or victims of the Battle of the Ebro": the area of each term is proportional to its frequency while museums are color-coded.

in the museums. Another overlooked group is the "sack" draft ("lleva del sac" in Catalan or "quinta del saco" in Spanish), composed of veteran soldiers in their 30s and 40s with families (Matthews, 2012).

The under-representation of these groups as compared to mainstream narratives may be due to an attempt to overemphasise the internationalisation of the war, rather than highlighting its nature as a battle between a plural democracy and a military uprising. In fact, both CEBE and the COMEBE museums exhibit this issue. Although the COMEBE network addresses different themes, these museums focus on the cruelty of war and lack of guilt of both sides, not presenting it as an ideological struggle between fascism and democracy (Martín Piñol, 2011, 171). This narrative approach aligns with the discreet design of Battle of the Ebro monuments, which lack a central point of remembrance (González Ruibal, 2020, 215). Memory expert Faber describes this peculiar memory model as an "exception" that is reminiscent of the Franco era (Faber, 2018, 122).

This attempt to depoliticise the conflict explains why museum narratives tend to use the term "fascist" only to refer to Mussolini's troops. In the same way, it is denied the qualification of "genocide" that some scholars defend for Franco's repression (Baquero, 2019; Preston, 2012; Míguez Macho, 2012). Similarly, there is no reference to the classification of Francoist repression both during the war and the dictatorship as crimes against humanity, a position long advocated by judges—such as Baltasar Garzón in the unsuccessful 2008 trial and María Servini in the Argentine lawsuit—as well as by associations and academics (Ferrándiz Martín, 2022, 77–78). In 2014, UN reports criticised Spain for failing to acknowledge these crimes within international human rights and transitional justice frameworks (Barreiro Mariño, 2017). This political equidistance also has material consequences: for example, in the nearby Memorial of *Les Camposines* there is a columbarium where the human remains of combatants from both armies have been placed together

since 2009 (Sospedra and Hernàndez, 2022).

5.3. Memory policies

The narrative of these museums is influenced by their opening dates, with most established post-2007 following the introduction of Spain's Historical Memory Law and the creation of the "Memorial Democràtic" in Catalonia. These laws, which were soon criticised as "insufficient"(Cuesta Arzamendi and Odriozola Gurrutxaga 2018), were the basis for the conception of the narratives of the Ebro museums. Thus, the original exhibitions focused on presenting the "evident evils of the war and the equidistance between the two sides" (Sospedra-Roca et al., 2023, 466).

The COMEBE network remains equidistant, though temporary exhibitions seek to expand its narrative. In contrast, the CEBE and Faió/Fayón museums, both founded by associations, have updated their displays. While CEBE retains a neutral stance, Faió/Fayón has taken a more political approach by explicitly condemning the 1936 military coup and engaging with memory politics. It is also pioneering in integrating archaeology and mass grave exhumations into its exhibits—an innovation among Ebro museums, which previously addressed these topics only through temporary events. However, this shift away from neutrality has faced strong opposition from Spain's far-right movement (Rodríguez-Temiño and Almansa-Sánchez, 2021). The museum has suffered budget cuts following the repeal of the democratic memory law by the far-right *Vox* party in Aragon (Canales, 2024), while staff have reported difficulties with visitors sympathetic to Francoist ideology.

5.4. Collectors and looters

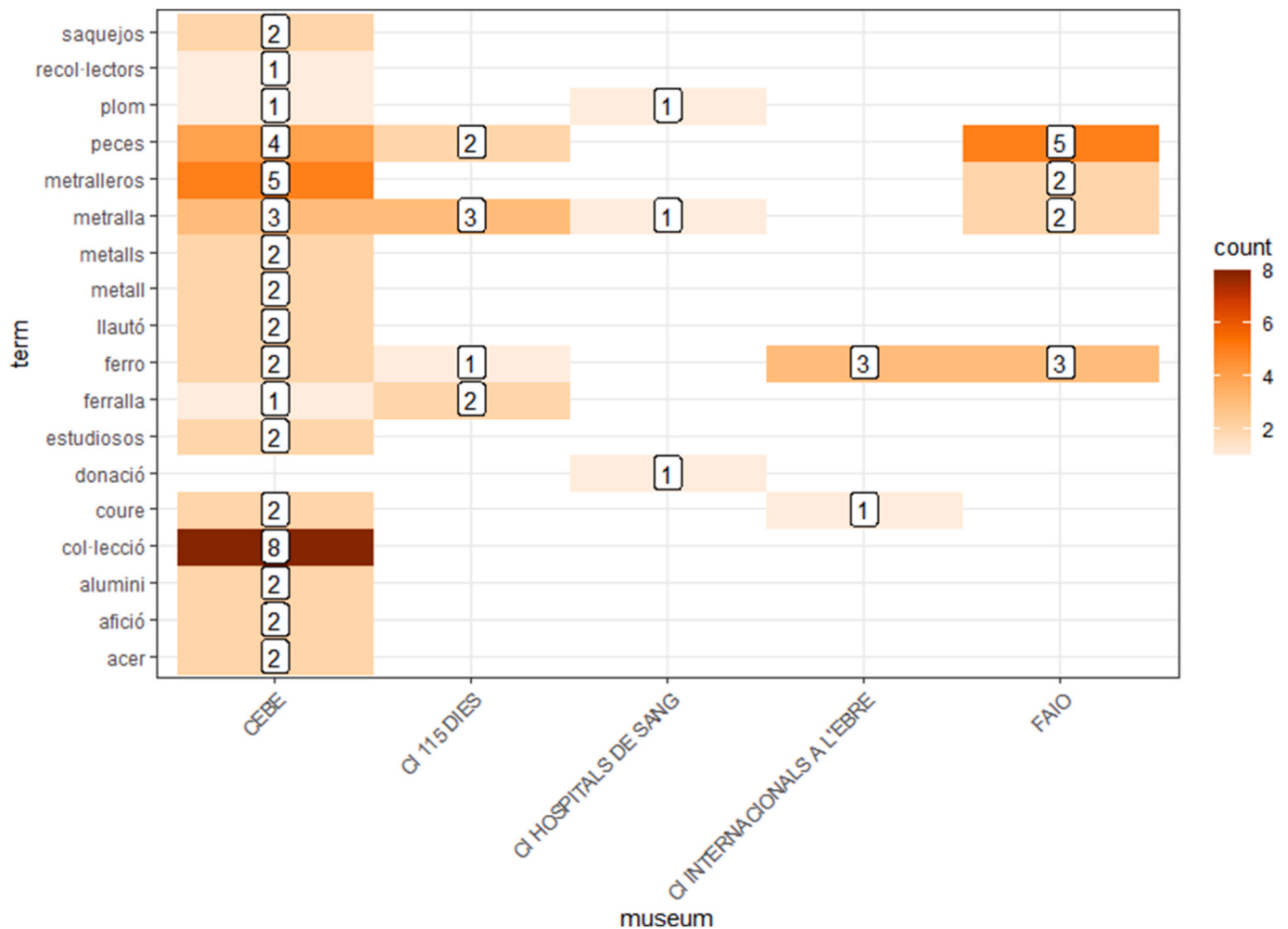All six museums highlight the looting of material remains after the

Fig. 8. Heatmap showing the presence of keywords related to looting in the different museums analysed.

battle and up to present day. Although both the *CI 115 dies* and the Faió/Fayón centres highlight the post-war economic impact of this activity on families, the CEBE museum takes a different approach, seemingly justifying the activity and the museum's own origins. Although CEBE's collection originate from a time when looting was not illegal, current heritage legislation clashes with the normalisation and even glamorisation of such actions.

The root of the problem is that the Battle of the Ebro, like the rest of the country's battlefields, lacks comprehensive legislative protection; only the areas associated with archaeological research (the area excavated or immediately affected by the intervention) are protected. Therefore, a battlefield in its entirety is not considered as an archaeological site. This is a result of the limited tradition of both contemporary archaeology and conflict heritage in the Spanish academy. This situation will not change soon following the refusal of the drafters of the new Cultural Heritage Law of Catalonia to accept an amendment arising from the citizen participation process that called for the battlefields. This amendment followed the models in force in other countries, to be recognised as specific heritage sites and, consequently, subject to protection (Gracia Alonso, 2024).

However, this legislation opens the door to include regulations on metal detector use, possibly prohibiting private use due to the damage caused to archaeological sites (Castro, 2022, 27). The Battle of the Ebro remains have been frequent targets of looting and continues to be a chronic problem. In fact, Spanish Civil War expert González Ruibal suggests that most materials recovered from the Ebro battlefields result from looting rather than archaeological projects (González Ruibal,

2020, 210). As new legislation advances, questions arise about how Ebro museums will address this ongoing challenge, particularly the CEBE museum, given its ties to the practice and its current exhibitions.

5.5. The future possibilities of topic modelling

In an increasingly data-driven world, data corpora are expanding in both scale and complexity (Murshed et al., 2023). Until recently, the analysis of large datasets posed significant methodological challenges for the Humanities; however, technological advancements now enable more effective engagement with these datasets. In the specific context of discursive studies on the Ebro museums and war more broadly, research had thus far been limited to qualitative approaches.

The computational framework presented here is a possible solution to the challenge of ever-expanding textual corpora of heritage narratives. Specifically, its use has facilitated: (1) to quantify the extent to which the dynamics observed in the fieldwork were effective, such as the treatment of looting; (2) to identify and measure less obvious patterns, including the degree of representation of the civilian population and (3) the relation between museum origin and political narratives. Additionally, the same corpora was used to explore the role of the battlefield landscape within museum narratives using geotextual analysis (Rubio Campillo et al., 2025).

As machine learning and natural language processing continue to evolve, these approaches can provide deeper insights into large textual corpora, uncovering hidden patterns and trends with greater accuracy (Jaworska, 2024). The use of this technique in the discursive analysis of

museums can have a positive impact by making visible the under-representation of certain groups, historical figures or other elements. This type of research can ultimately contribute to transforming these practices in line with the democratic values of today's society.

6. Conclusions

Digital Humanities offer numerous innovative ways to explore heritage issues. This study has applied computational text analysis to examine the narratives and contentious aspects of six museums centred on the Battle of the Ebro, the most significant military confrontation of the Spanish Civil War. The integration of topic modelling into museum discourse analysis marks a key methodological advancement as it enables the quantification of interpretative trends and the identification of overlooked narratives. Its application can promote more inclusive and democratically aligned curatorial practices.

Results show an emphasis on the international aspects of the conflict, masking an institutional intent to make the discourse equidistant. Museums often present a homogenised view of the two opposing sides, neglecting the diverse movements within the Republicans and Francoists. There is also an under-representation of certain participants, such as the civilian population. Looting is not considered taboo and is addressed by most museums, though its portrayal sometimes conflicts with heritage laws by justifying or romanticising this practice.

In summary, the Ebro museums reflect the material outcomes of heritage legislation, and the political narratives developed over the past 80 years around this traumatic wartime event. It is also demonstrated the conscious strategy of depoliticising the conflict, which proved politically useful in times past under the premise of the Spanish transition's "exceptionality". However, over the past two decades, civil society demands have progressively gained political ground. Therefore, these equidistant views are no longer sufficient in the current context of revisionism and legislative backtracking on historical memory in Spain.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.daach.2025.e00429.

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