Elsevier LaTeX template☆

Elsevier[1]

Radarweg 29, Amsterdam

Elsevier Inc[a,b], Global Customer Service[b,]*

[a]1600 John F Kennedy Boulevard, Philadelphia
[b]360 Park Avenue South, New York

Abstract

This template helps you to create a properly formatted LaTeX manuscript.

Keywords: `elsarticle.cls`, LaTeX, Elsevier, template
2010 MSC: 00-01, 99-00

1. The Elsevier article class

Installation. If the document class *elsarticle* is not available on your computer, you can download and install the system package *texlive-publishers* (Linux) or the LaTeX package *elsarticle* using the package manager of your TeX installation, which is typically TeX Live or MikTeX.

Usage. Once the package is properly installed, you can use the document class *elsarticle* to create a manuscript. Please make sure that your manuscript follows the guidelines in the Guide for Authors of the relevant journal. It is not necessary to typeset your manuscript in exactly the same way as an article, unless you are submitting to a camera-ready copy (CRC) journal.

Functionality. The Elsevier article class is based on the standard article class and supports almost all of the functionality of that class. In addition, it features commands and options to format the

- document style
- baselineskip
- front matter
- keywords and MSC codes
- theorems, definitions and proofs
- lables of enumerations
- citation style and labeling.

2. Front matter

The author names and affiliations could be formatted in two ways:

(1) Group the authors per affiliation.

(2) Use footnotes to indicate the affiliations.

See the front matter of this document for examples. You are recommended to conform your choice to the journal you are submitting to.

☆Fully documented templates are available in the elsarticle package on CTAN.

*Corresponding author
Email address: `support@elsevier.com` (Global Customer Service)
URL: `www.elsevier.com` (Elsevier Inc)

[1]Since 1880.

3. Introduction

4. Background

Our principal case study examines the variation of the amphorae production located in *Baetica* (currently Andalusia, south Spain). During the Roman Empire, this ancient province became an important support for the production and distribution of olive oil to the rest of the Empire from Ist to IIIrd centuries (Remesal) For this reason, a large-scale infrastructure of amphorae production was developed to supply the provinces of the Roman Empire, being important during military campaigns (remesal concierto, monfort, temin y kessler).

Baetica had also a strong connection thought rivers which allowed to develop an important trade network around the Mediterranean (Remesal, Vargas). More than 80 pottery workshops were currently located along the Guadalquivir river and its tributary Genil (citar Berni, Remesalin and Enriquito)(Fig). However, the area has currently experimented multiples geographical changes due to the anthropic action and the dynamic of the rivers (Enrique y Remesal).

The majority of amphorae identified in this area belong to *Dressel 20* typology divided into different sub-typologies (Martin-Kilcher, Berni bibliografia). This amphora type was used mostly to transport olive oil for around 300 years in order to satisfy the high demand of Roman Empire Remesal ingles) (EXTENDERSE?). It means that olive oil was an important product in the roman empire, being frequency used in different aspect of the roman daily life such as consumption, lighting and hygiene (Temin?)

The important demand is also showed by the fact that amphorae Dressel 20 were identified with several marks about its provenance (remesal and xavi). However, the meaning of the stamps is not clear: it could be an agent identified as a olive oil producers or an agent identified as a pottery factory. In any case, this paper will be only focused to the study of evolution of the amphorae (Rubio, Remesal sellos) CAMBIAR??

5. Material and methods

We analyse a dataset of 470 amphorae collected from 5 different workshops excavated. The workshops were located in Malpica (Palma del Río, Córdoba), Cerro del Belén (Palma del Río, Córdoba), Parlamento (Sevilla), Villaseca (Córdoba) and Las Delicias (Écija, Sevilla). We created a database where were selected 80-90 samples of each pottery workshops. The choice of these workshops corresponded to two reasons. First, most of the workshops located were not excavated being unlikely the study of archaeological material. seria mejor hablar de que no han cambiado en tres siglos!

Second, the workshops were selected from different spaces in order to analyse the different shape patterns depending on the distance of each workshop.

5.1. Field methods

Eight different measurements were taken for each amphorae sample of the 5 workshops studied. The measurements were done by one person using different tools: caliber, square and bevel for taking the measurements and profile gauge for drawing the pottery shapes.

The measurements were focused on the rim sherds whose fragments were the most preserved on the archaeological sample. Moreover, rim sherds work as an useful indicator of variability in the case of amphorae (poner bibliografa berni?). Handles measurements were excluded from the study because the study sample was low. The measurements were divided into exterior diameter, inside diameter, rim height, rim width, shape width, rim inside height, rim width and protruding rim (Fig).

In our study, we have only selected five variants according with three centuries (Dressel B: I; Dressel C: I-II; Dressel D: II; Dressel E: III, Dressel G: III) defined by Berni (bibliografa de Berni) and Martin Kilcher (Martin Kilcher). The rest of variants were excluded from our analysis by having enough not material for the sample.

Finally, the sample selected were tested using statistical method such as Principal Component Analysis and Discriminant Analysis to explore these metrical differences.

puedo hablar de la varianza de clasificaciones que hay

5.2. Principal Component Analysis

PCA (podra poner biblio de Shennan y el de Jollife (2002) de Principal Component Analysis)

We used Principal Component Analysis (PCA) to simplify a large number of variables into a smaller number of variables. This method allows to create a reduced number of "new variables" which contain all the relevant information of the previous variables without losing relevance. The firsts principal components are expressed as the result of the most variance of the all information from the original variables. The information is expressed as the result of most variation retained in the first principal components. (Jollife, 2002)

In our study, this method allowed us to reduce our dataset with 8 variables as measurement into 2 variables.

5.3. Discriminant Linear Analysis

The performed results with PCA were analyze with Lineal Discriminant Analyse (LDA). LDA was used to find a combination among them to define the groups as well as possible. In spite of being similar to PCA, LDA allows to identify and discriminate the variables which allow to distinghs each group and know how many variables are necessary. In our case, LDA was used to explore a better separate training set from the results of the most relevant principal components.

All data were collected and performed in LibreOffice 4.2.8.2 and analysed in R version 3.2.4. statistical

language, using packages MASS (COMPLETAR)

6. Results

Several multivariate methods such as PCA and DLA were used to quantify the differences on the pattern production among workshops. 5 workshops were chosen, following criteria described above.

6.1. Principal Component Analysis

The analysis of PCA produces a set of values for each variable observed. Variables show how much variability exists in the dataset grouped by each principal components. The results, indicated in the Table, show most variability in the firsts principal components than the rest (mostrar el que ms con el analisis).The most differences were focus on the (poner donde ms estuvieron enfocadas)

The patterns observed in the first 2 Principal Components were plotted to visualize the degree of isolation by distance among workshops. The results, shown in Fig., suggested than amphorae from closer workshops tend to be more similar than amphorae made in furthest workshops. In particular, the Fig shows how the four closest workshops show variation on PC1 (i.e. Beln, Delicias, Villaseca and Malpica) while Parlamento display a distinctive pattern than the rest of workshops on PC2 values.

6.2. Discriminant Analysis

Tengo que decir que uso principales componentes antes que analisis discriminante para hacer un training

Discriminant Analysis was used to interpret the results of the PCA. We generate a Confusion Matrix to quantify the degree of confusion among workshops. It generates a matrix where higher value are the results of an incorrect classification.

The results of Confusion Matrix showed than workshops with more troubles to be distinguished such Malpica and Beln shared a minor spatial distance than the rest (see Fig). Therefore, in our study, similar amphorae making techniques processes are strongly correlated with the spatial distance.

6.3. Spatial Analysis

We compared morphometric and spatial distance by performing peer-to-peer analysis between all workshops. We calculated the geographical distance between each site and the distance among pottery measures, calculated using the previous results. (FIG) shows that the pottery distance is correlated with the spatial distance of workshops.

Desarrollar y decir cual est ms cerca de quien y el bug que hay

7. Discussion and Conclusion

8. Bibliography styles

There are various bibliography styles available. You can select the style of your choice in the preamble of this document. These styles are Elsevier styles based on standard styles like Harvard and Vancouver.

Please use BibTEX to generate your bibliography and include DOIs whenever available.

Here are two sample references: [**?** **?**].

References