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## ARQUB R Scripts

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## Introduction

These R scripts are in-house code written to perform the usual analysis on archaeometric compositional data according to the procedure used in the ARQUB (GRACPE) research group at the Universitat de Barcelona.

These scripts produced Figures 3, 5 and 7 A in the paper by Ots, M. J., Buxeda i Garrigós, J., Madrid i Fernández, M., Cahiza, P. A., Small-scale pottery production and distribution in the southern confines of the Inca empire. An archaeometric insight to define the provincial style, submitted to *Archaeological and Anthropological Science* (December 2023).

These scripts need the installation of the following R packages: **compositions**, **devEMF**, **lattice**, **latticeExtra**, **plotrix** and **MASS**.

The author of these scripts is Jaume Buxeda i Garrigós.

The scripts are distributed with a GPL-3.0 license.

The comments in the scripts are in Catalan. The scripts are in progress and are provided here without warranty of any kind, express or implied. In no event shall the author or copyright holder be liable for any claim, damages or other liability. If you find any problem or bug, please report it to the author, and he will try to fix it.

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## inicialCurt

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### Description

Calculates the variation matrix, the total variation and the information entropy and produces several graphs to summarise all this information.

### Usage

```
xvar <- inicialCurt(x, talls = c(0.3, 0.5, 0.9), nom = "Dades", nonum = 0, idioma = 1)
```

### Arguments

x	composition or dataset of compositions
talls	vertical dotted lines expressing different $tv/\tau_j$ values. Components to the left of the dotted line are below those values. If only the value 0 is given, no dotted lines will be displayed
nom	gives the default title of "Data" (according to the selected language). This default title can be changed to something relevant to the case study. If there is a title, it will automatically provide the number of cases ( $n$ ). "NA" will exclude the title and the number of cases
nonum	indicates the columns with non-numeric variables that will be excluded. By default, it is 0, indicating that all variables should be used
idioma	by default: 1. Indicates the language of the compositional evenness graph and variation matrix: 1, Catalan; 2, Spanish; 3, English; 4, French

### Details

This script calculates the variation matrix as explained in the paper by Buxeda (1999), and it performs all possible bivariate graphics with the values  $\tau_j$  on the x-axis and the values  $\tau_{ji}$  on the y-axis ( $j = 1, \dots, i - 1, i + 1, \dots, S$ ) and their correlations, and the compositional evenness graph. The latter is automatically saved in emf and pdf formats in the current directory with the name "uniformitat" (uniformitat.emf and uniformitat.pdf). The script calculates the total variation ( $tv$ ) as a measure of compositional variability in the dataset and the information entropy ( $H_2$ ) or Shannon index (Shannon 1948) as a measure of evenness in contributing to the compositional variability for all retained components (Buxeda and Madrid 2017). The compositional evenness graph is inspired by the rank/abundance graph used in biodiversity studies (see, for example, Magurran 2004).

This script uses the script *evariationmatrix2* to calculate the variation matrix, the script *entropia02* to calculate the information entropy, and the script *etiqueteselements* to produce the components labels in the compositional evenness graph.

### Value

A list of three with the variation matrix (MVC), and the probability (Probabilitat) and entropy (Entropia) used in the calculation of the information entropy and its percentage over the maximum attainable.

### Examples

```
Inkavar <- inicialCurt(Inka, nom = "CWA Provincial Inca Pottery", nonum = c(1:3), idioma = 3)
Inkavar <- inicialCurt(Inka, nom = "CWA Provincial Inca Pottery", idioma = 3)
```

This will produce the Figure 3 of the paper. The first example assumes that the first three variables will not be used.

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## ACPacomp

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### Description

## References

- [1] Buxeda i Garrigós, J. (1999) Alteration and contamination of archaeological ceramics: the perturbation problem. *Journal of Archaeological Science* 26: 295–313. <https://doi.org/10.1006/jasc.1998.0390>
- [2] Buxeda i Garrigós, J., Madrid i Fernández, M. (2017) Designing Rigorous Research: Integrating Science and Archaeology. In Hunt, A. (ed.) *The Oxford Handbook of Archaeological Ceramic Analysis*: 19–47. Oxford University Press, Oxford. <https://doi.org/10.1093/oxfordhb/9780199681532.013.3>
- [3] Magurran, A. E. (2004) *Measuring Biological Diversity*, Blackwell Science Ltd., Oxford.
- [4] Shannon, C. E. (1948) A Mathematical Theory of Communication. *The Bell System Technical Journal* 27: 379–423, 623–656. <https://doi.org/10.1002/j.1538-7305.1948.tb01338.x>