

# **SignBase**

## **A collection of Geometric Signs in the Paleolithic**

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# Acknowledgements

URPP Language and Space



University of  
Zurich<sup>UZH</sup>

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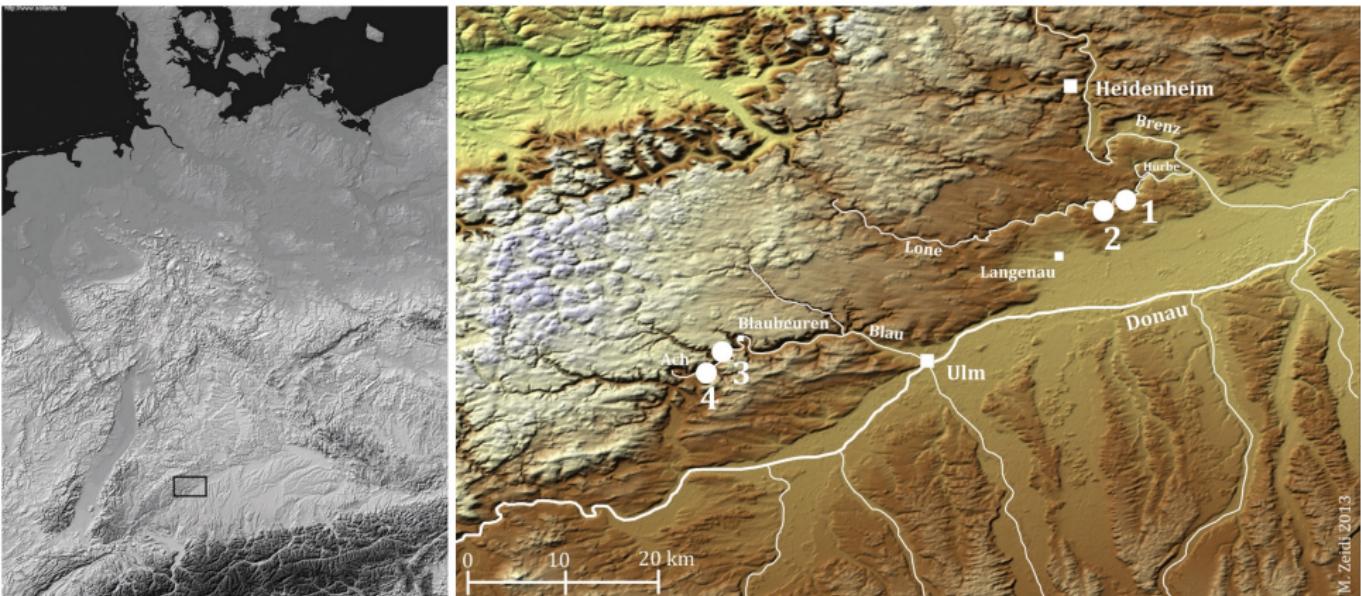
EBERHARD KARLS  
**UNIVERSITÄT  
TÜBINGEN**



# Introduction

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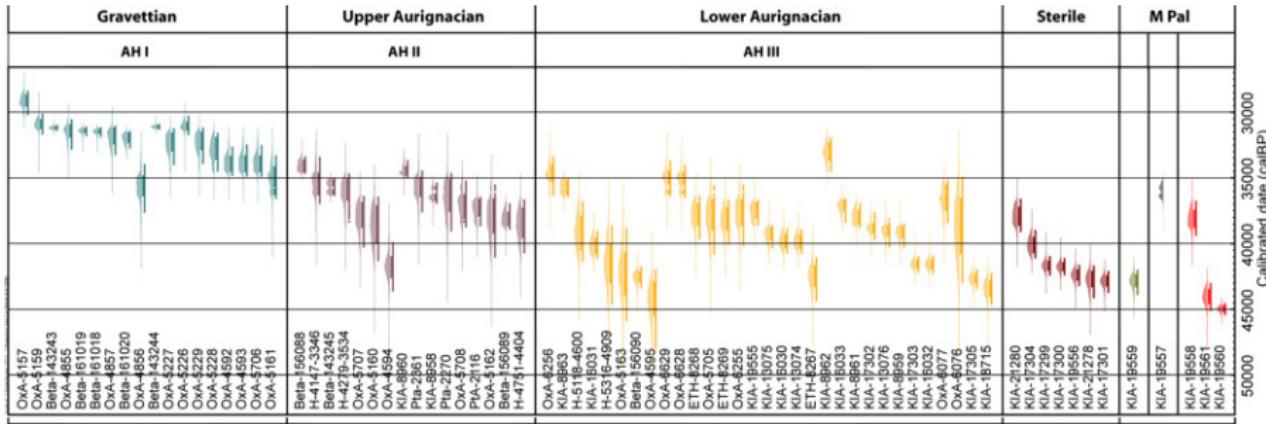
# The Swabian Jura



- 1) Vogelherd Cave, 2) Hohlenstein-Stadel, 3) Geißenklösterle, 4) Hohle Fels

Dutkiewicz, Wolf, & Conard (2017). Early symbolism in the Ach and the Lone valleys of southwestern Germany.

# The Aurignacian



Higham et al. (2012). Testing models for the beginnings of the Aurignacian and the advent of figurative art and music: The radiocarbon chronology of Geißenklösterle.

# Geometric Signs in the Aurignacian



1



2



3

4

# Historical Note

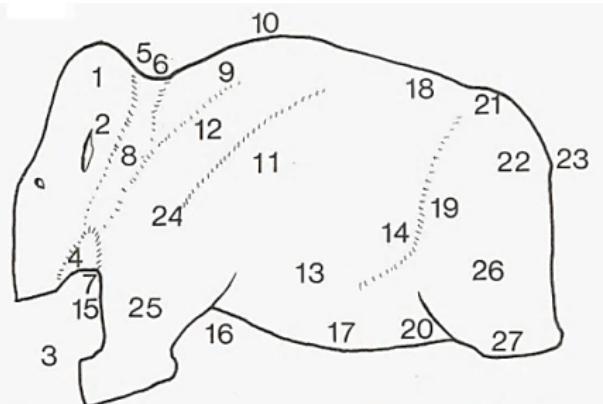


Abb.21 Körperregionen der Tierfiguren (1 Gehirnteil mit Scheitelgegend, 2 Schläfen- und Ohrengegend, 3 Nasengegend, 4 Mundregion, 5 Genick, 6 Kamm, 7 Kehlkopfregion, 8 Vorschulter, 9 Brustrücken, 10 Widerriß, 11 Seitenbrust, 12 Schulterarm, 13 Rippengegend, 14 Rippenbogen, 15 Vorderbrust, 16 Unterbrust, 17 kraniale Bauchregion, 18 Lendenrücken, 19 Flanke, 20 kaudale Bauchregion, 21 Kreuz, 22 Gesäß, 23 Schwanzgegend, 24 Schulterblattgegend, 25 Vordergliedmaßen, 26 Oberschenkelregion, 27 Hintergliedmaßen).

Hahn (1986). Kraft und Aggression: Die Botschaft der Eiszeitkunst im Aurignacien Süddeutschlands?

Tabelle 3

Zeichen in den Inventaren

Zeichen	Vogelherd V	Vogelherd IV	Vogelherd o.S.	Geissenklösterl. II b	Geissenklösterl. II a	zus.
X	49 19 %	5 2 %	24 56 %	—	—	78 11 %
-	43 17 %	40 16 %	12 28 %	26 27 %	5 6 %	127 17 %
,	97 38 %	157 64 %	—	48 50 %	—	302 41 %
/	14 6 %	20 8 %	3 7 %	—	47 53 %	84 12 %
I	40 16 %	23 9 %	4 9 %	31 32 %	34 39 %	133 18 %
\	8 3 %	—	—	—	8 1 %	8 1 %
v^	2 1 %	1 0,4 %	—	—	2 2 %	5 0,7 %
zus.	253 100 %	246 100 %	43 100 %	96 99 %	88 100 %	736 100 %

# The Swabian Objects



Arbeit am Mammut VH im Archäopark VH



Arbeit am Löwenkopf VH im Landesmuseum Württemberg Stuttgart

# Ewa's Doctoral Thesis

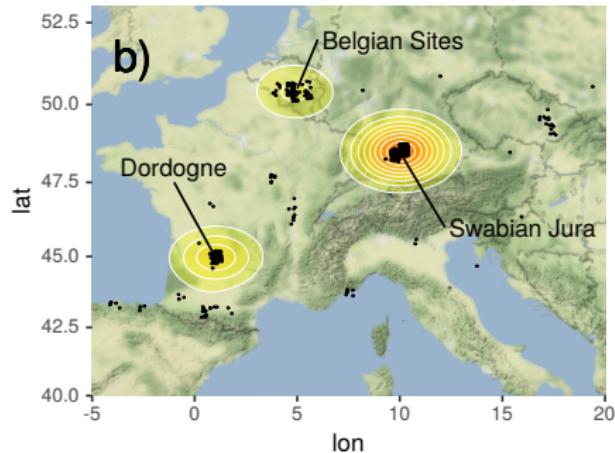
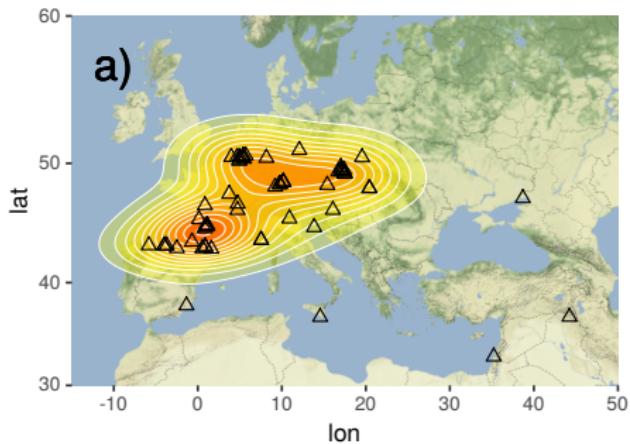


Dutkiewicz (forthcoming).  
Zeichen. Markierungen, Muster  
und Symbole im Schwäbischen  
Aurignacien. Kerns Verlag  
Tübingen.

# Data

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# The Sites and Objects

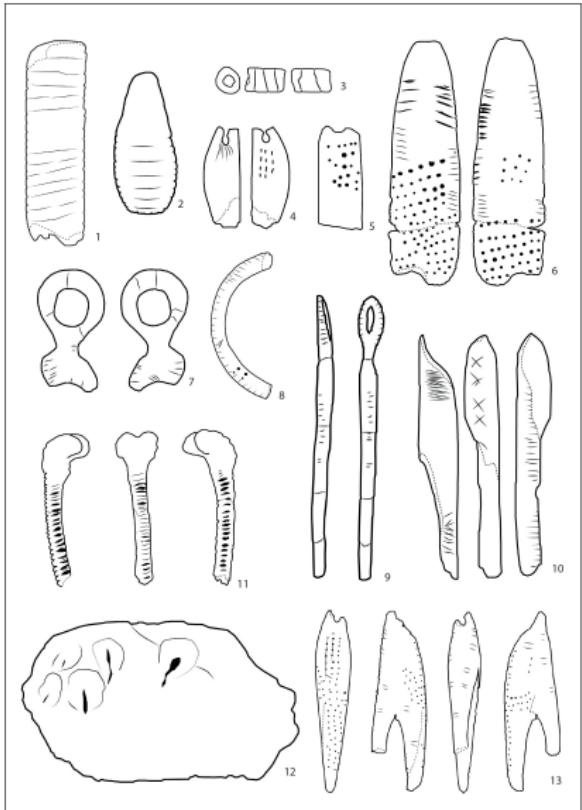


- a) 65 Aurignacian sites which yielded mobile objects
- b) 531 objects carrying geometric signs

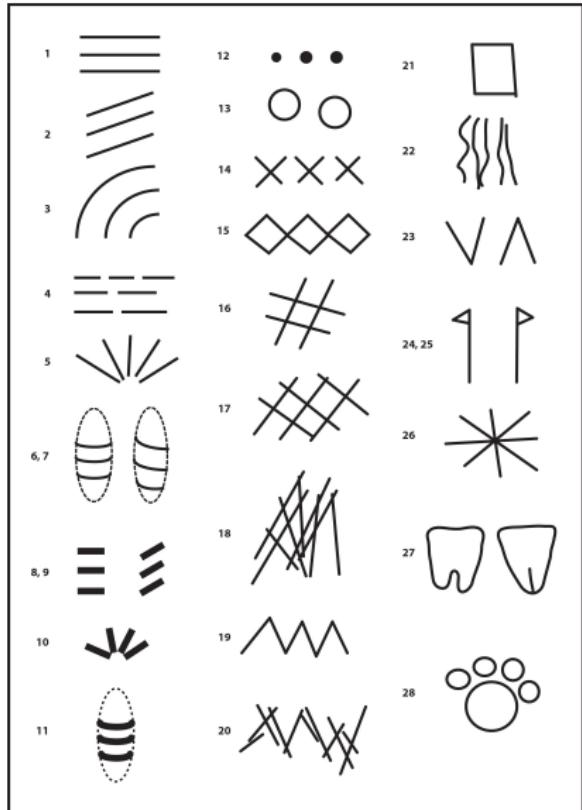
Dutkiewicz, Russo, Lee, & Bentz (forthcoming). SignBase, a collection of geometric signs on mobile objects in the Paleolithic.

# Geometric Signs

## Example Objects

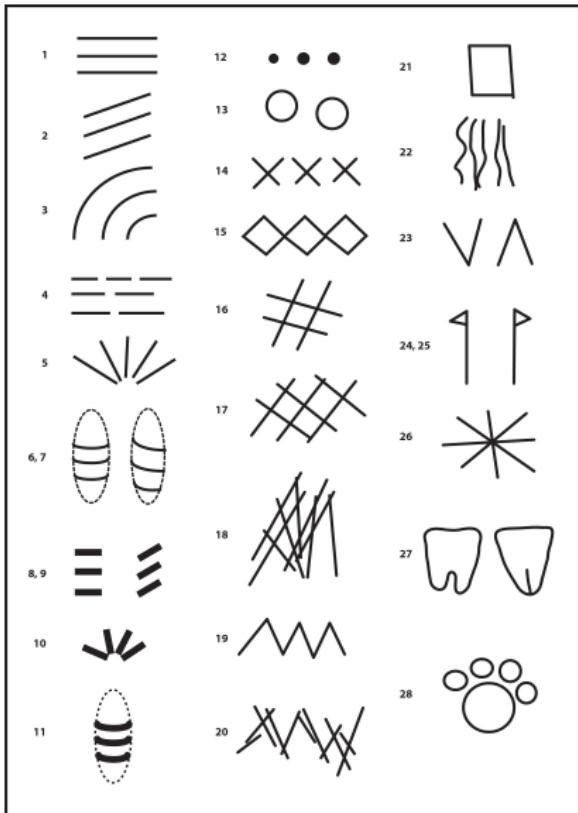


## Sign Type Scheme



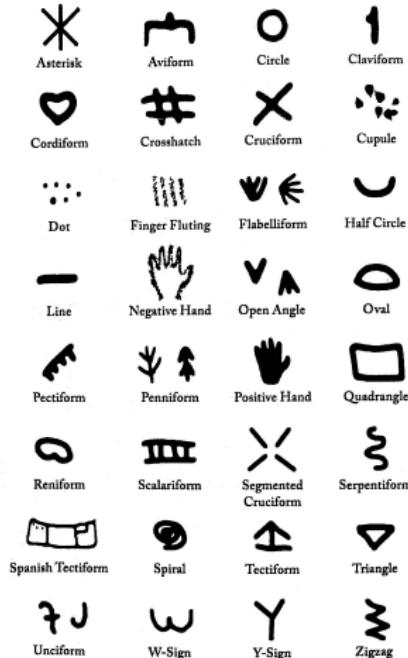
# Geometric Signs

## SignBase (Mobile Objects)



Von Petzinger (2016). The first signs. (Cave Art)

## The Geometric Signs of Ice Age Europe



# Microsoft Access Interface

frm\_SignBase\_Main

**SignBase**

object number: gkl0025  
object name: 58-264 Adorant  
site name: Geissenklosterle  
techno-complex: Aurignacien  
layer: II  
date BP min-max: 30625 ± 796 - 35700 ± 700  
dating method: C14  
excavation year: 1979  
material: ivory  
carrier: statuette  
length\_mm: 38  
width\_mm: 14  
depth\_mm: 5  
preservation: almost complete  
short description:  
general\_literature: Hahn J. 1977; Hahn J. 1986; Dutkiewicz E. 2017: Taf. 8a-8b

picture

picture\_reference: Dutkiewicz E. 2017: Taf. 8a-8b

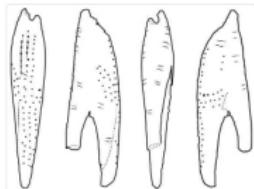
sign sequence + number:  
dot\*13\* \_dot\*10= \_dot\*12= \_dot\*13= | notch\*13= | notch\*13= |  
notch\* 7= | notch \*6= | radnotch\*4= | obnotch\*4= \_obline\*2= |  
obnotch\*3=br

Navigation icons: back, forward, search, etc.

line	cross	vulva
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
obline	<input checked="" type="checkbox"/>	rhombus
radline	<input type="checkbox"/>	rectangle
dashline	<input type="checkbox"/>	hashtag
circumline	<input type="checkbox"/>	grid
concenline	<input type="checkbox"/>	hatching
notch	<input checked="" type="checkbox"/>	v
obnotch	<input checked="" type="checkbox"/>	zigzag
radnotch	<input checked="" type="checkbox"/>	zigzagrow
dashnotch	<input type="checkbox"/>	star
circumnotch	<input type="checkbox"/>	maccaroni
crossnotch	<input type="checkbox"/>	pin
dot	<input checked="" type="checkbox"/>	pinleft
cupule	<input type="checkbox"/>	circle
circle	<input type="checkbox"/>	spiral
spiral	<input type="checkbox"/>	circumspiral
circumspiral	<input type="checkbox"/>	

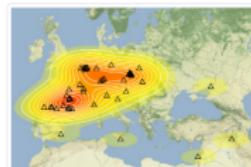
## Welcome to SignBase!

SignBase is an open access database for geometric motifs on mobile objects in Prehistory. Its focus lies on finds of the Eurasian Paleolithic and African Middle Stone Age. In these time periods, geometric motifs – also referred to as signs, patterns, or marks – are abundant in parietal art as well as on mobile objects. The term ‘geometric’ denotes simple non-figurative forms such as dots, lines, and crosses, as well as more complex patterns. This includes frequent semi-abstract depictions such as vulvae, but excludes figurative depictions of animals, humans, etc. Decorated mobile objects are mostly made of osseous material, like ivory, bone or antler, while also featuring other organic and inorganic materials.



The relevant artifacts come from stratified archaeological contexts and are assigned to the particular techno-complexes. The objects are the core elements of the database, carrying a unique identifier. With this identifier comes information about geographic and archaeological provenience, the type of object and material, size and preservation, literature references, as well as a picture if available. The geometric motifs on each object are described in detail using a specifically developed encoding. The database aims to enable quantitative comparative studies on the development of graphical expressions before the emergence of writing systems.

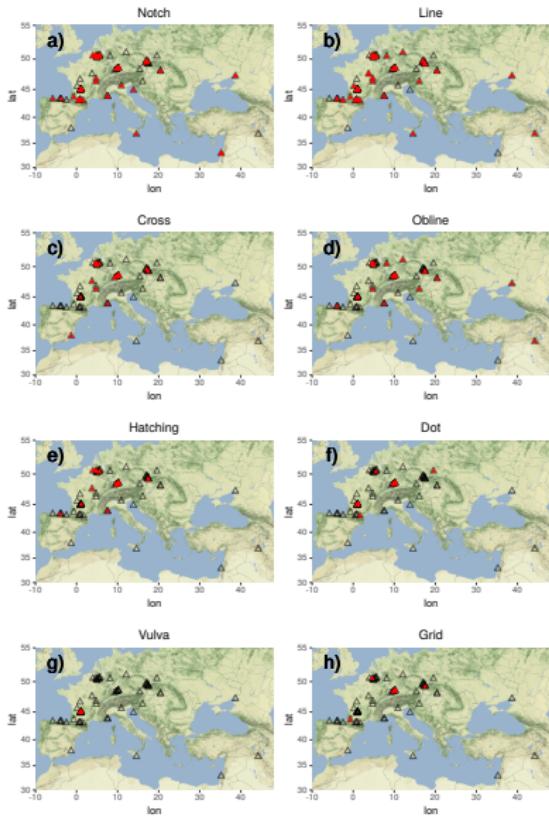
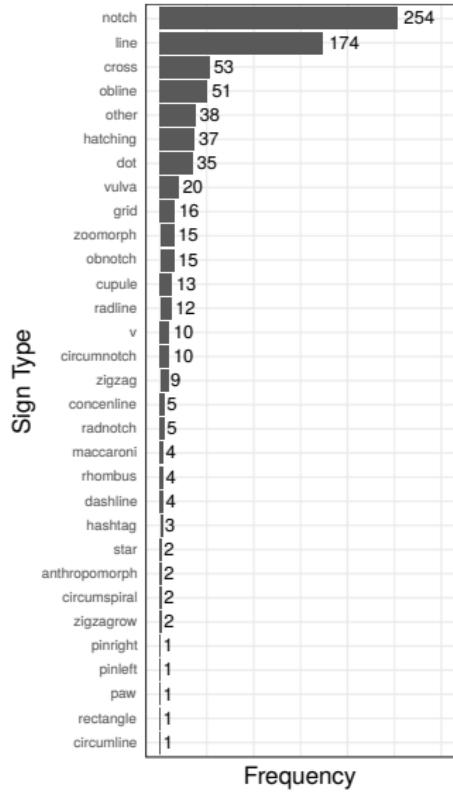
SignBase gives latitudinal and longitudinal information for each object, and hence allows analyses of geographical distribution and geographic clustering of signs. Densities of sites with geometric signs, or densities of particular sign types give an overview of the abundance and distribution of signs. In the long run, this might be linked to population turn-overs, and respective cultural entities of the Paleolithic.



# **Descriptive Statistics**

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# Sign Type Distributions



## Preliminary Clustering Analyses

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# Sign Type Vectors

110100000101000000001000000000

$S^{hfc0006} = \{\text{line, oblique line, dashed line, dot, cross, v-shape}\}$

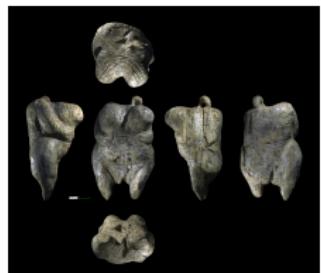
hfc0006



11100000010000100000000000001000

$S^{hfc0015} = \{\text{line, oblique line, radial line, dot, hatching, concentric line}\}$

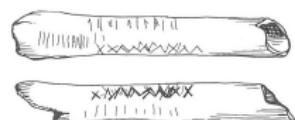
hfc0015



100000000001000010001000000000

$S^{spy0023} = \{\text{line, cross, zigzag row, v-shape}\}$

spy0023



## Jaccard Distance

Given two sets  $\mathcal{A}$  and  $\mathcal{B}$  the Jaccard distance  $d$  is defined as

$$d = 1 - \frac{|\mathcal{A} \cap \mathcal{B}|}{|\mathcal{A} \cup \mathcal{B}|} \quad (1)$$

As an example for hfc0006 and hfc0015 we have

$$d = 1 - \frac{|\mathcal{S}^{hfc0006} \cap \mathcal{S}^{hfc0015}|}{|\mathcal{S}^{hfc0006} \cup \mathcal{S}^{hfc0015}|} = 1 - \frac{3}{9} \sim 0.67 \quad (2)$$

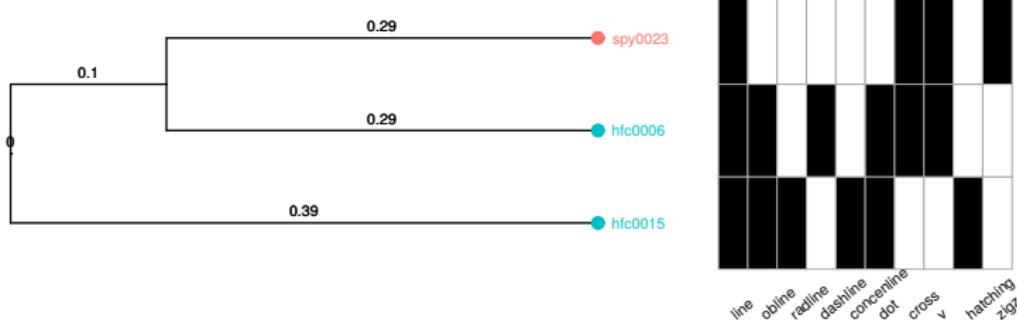
## Distance Matrix

For hfc006, hfc0015, and spy0023 we then get a distance matrix with pairwise Jaccard distances:

$$D = \begin{bmatrix} 0 & .67 & .57 \\ .67 & 0 & .89 \\ .57 & .89 & 0 \end{bmatrix} \quad (3)$$

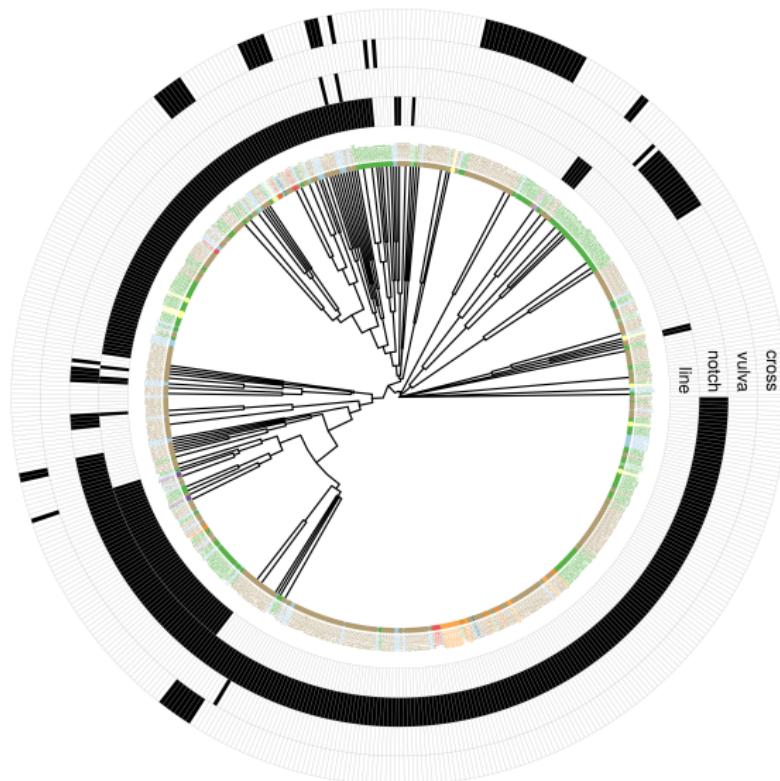
# UPGMA Tree: Simple Example

The *Unweighted Pair Group Method with Arithmetic mean* is a so-called agglomerative bottom-up clustering method, which uses a distance matrix  $D$  to merge clusters with the smallest distance.



- absent
  - present
- 
- Belgium
  - Germany

# UPGMA Tree (516 Objects)



absent  
present

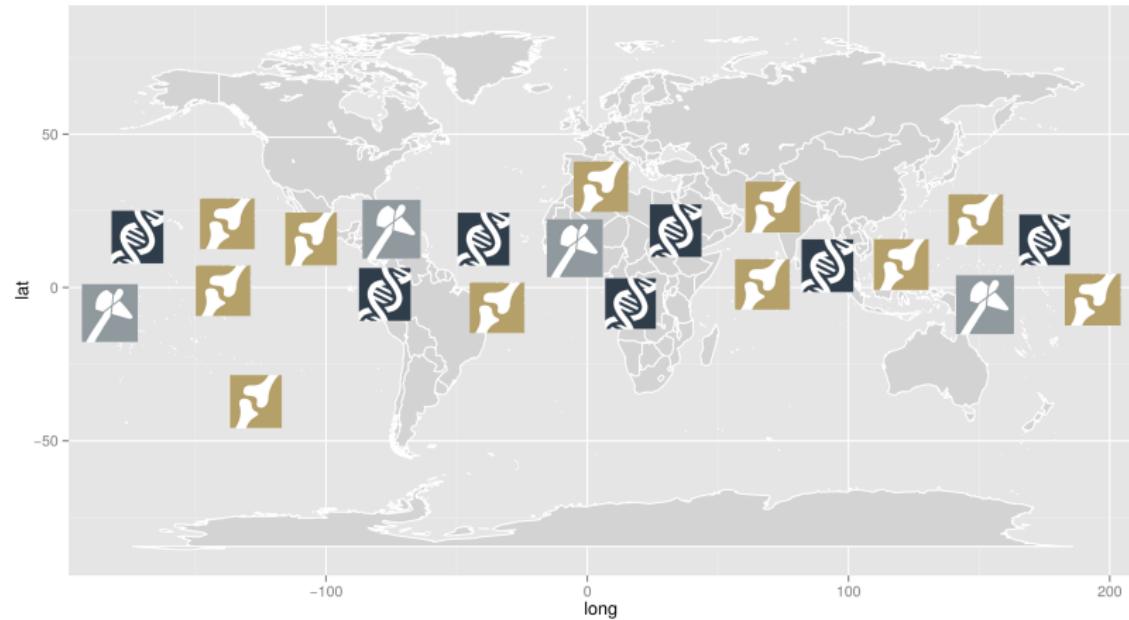
- Belgium
- Croatia
- Czech Republic
- France
- Germany
- Hungary
- Iraq
- Israel
- Italy
- Poland
- Russia
- Spain

# Conclusion

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- SignBase currently contains **531 objects** of **65 Aurignacian sites**.
- These objects carry around **30 different sign types** and many thousands of sign tokens.
- Some sign types are **ubiquitous** (e.g. notch, line), others are more **geographically confined** (e.g. dots, crosses).
- There is currently no evidence for strong geographic clustering of sign type vectors, i.e. sign type inventories.

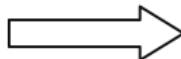
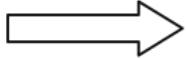
# Thank You



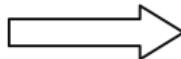
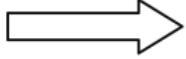
## Appendix

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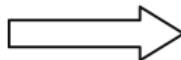
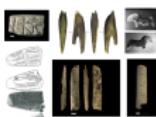
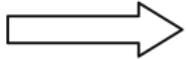
# Coder Agreement



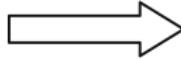
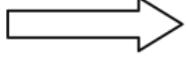
```
0100010001001001001000000  
010011000100100010001000000  
0100010001000000100100000101  
000000010010010010001111  
0000000111001001001001000000  
01000100010010010010011100000  
0100000010001001001001000000
```



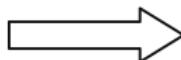
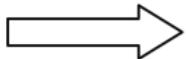
```
0100010001001001001000000  
010011000100100010001000000  
0100010001000000100100000101  
000000010010010010001111  
0000000111001001001001000000  
01000100010010010010011100000  
0100000010001001001001000000
```



```
0100010001001001001000000  
010011000100100010001000000  
0100010001000000100100000101  
000000010010010010001111  
0000000111001001001001000000  
01000100010010010010011100000  
0100000010001001001001000000
```



```
0100010001001001001000000  
010011000100100010001000000  
0100010001000000100100000101  
000000010010010010001111  
0000000111001001001001000000  
01000100010010010010011100000  
0100000010001001001001000000
```



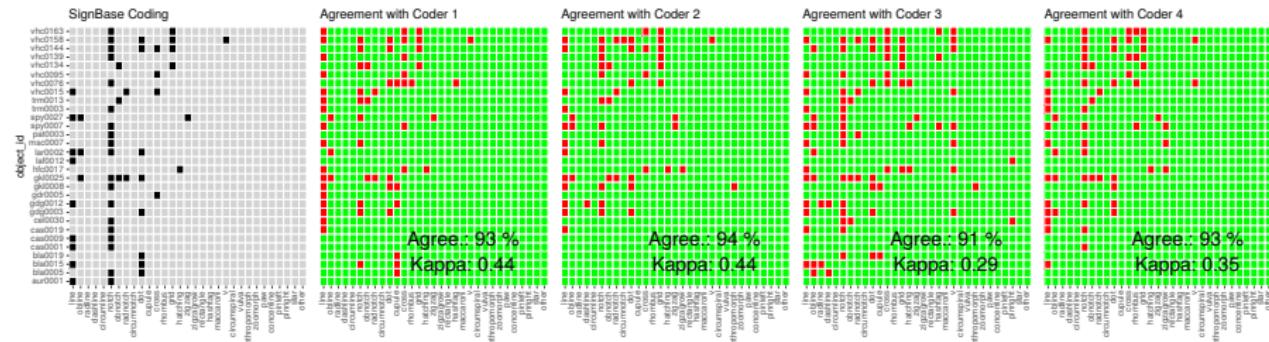
```
0100010001001001001000000  
010011000100100010001000000  
0100010001000000100100000101  
000000010010010010001111  
0000000111001001001001000000  
01000100010010010010011100000  
0100000010001001001001000000
```

Choose 5 experts

30 random objects

Evaluate Agreement

## Coder Agreement



# Iconicity



# The Lion Man



Dutkiewicz (forthcoming). Zeichen. Markierungen, Muster und Symbole im Schwäbischen Aurignacien. Kerns Verlag Tübingen.