

# **From burial data to chronology and social interpretation via computer-aided statistics**

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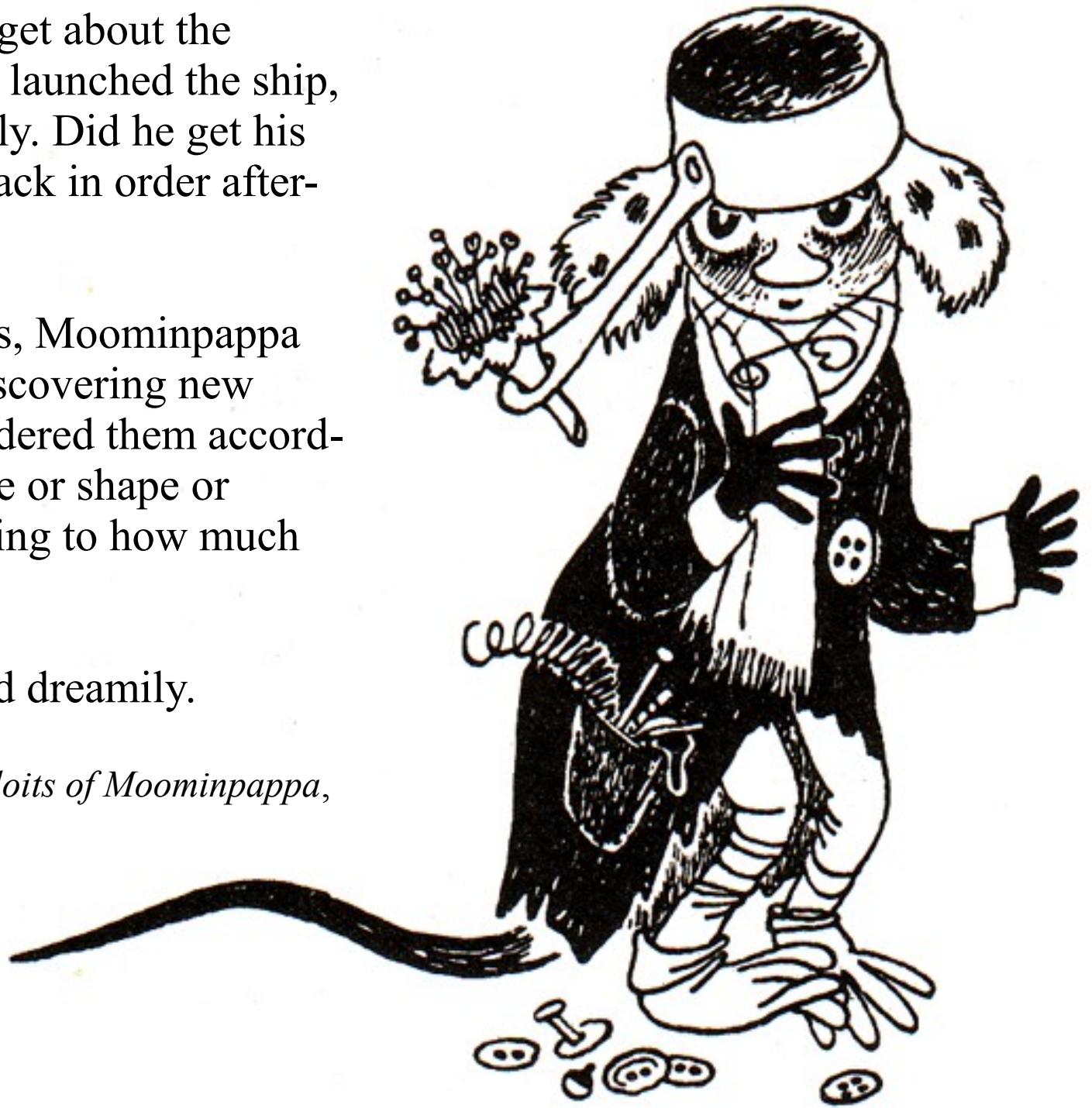
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- [scienceblogs.com/aardvarchaeology](http://scienceblogs.com/aardvarchaeology)
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How could you forget about the Muddler when you launched the ship, Sniff said accusingly. Did he get his button collection back in order afterwards?

Oh yes, many times, Moominpappa replied. He kept discovering new button systems. Ordered them according to colour or size or shape or material, or according to how much he liked them.

Amazing, Sniff said dreamily.

Tove Jansson, *The Exploits of Moominpappa*, ch. 3 (1968).



Let's take a few 1st millennium  
furnished cemeteries of roughly the  
same age, covering maybe 300 years.

We'll divide the burials and finds into  
*groups*.

Arrange the groups into *series*.

1. Split by gender (seriation)
2. Split each gender by chronology (seriation and correspondence analysis)
3. Investigate each chronological gender group for sub-gender clustering (correspondence analysis)
4. Calculate status scores for artefact types and structural elements
5. Investigate religious/ethnic indicators in relation to gender, sub-gender, chronology and status score.

First we create a *matrix* with one line per grave and one column per artefact type and structural element.

	<b>C</b>	<b>D</b>	<b>E</b>	<b>N</b>	<b>O</b>	<b>P</b>	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>1</b>	*			*	*				
<b>2</b>	*	*			*			*	
<b>3</b>	*			*					*
<b>4</b>	*			*	*				
<b>5</b>		*	*					*	
<b>6</b>			*			*	*		
<b>7</b>			*			*	*		
<b>8</b>		*	*		*			*	
<b>9</b>	*				*				
<b>10</b>	*			*					*
<b>11</b>	*			*	*				
<b>12</b>	*			*	*				
<b>13</b>					*			*	
<b>14</b>		*	*			*			

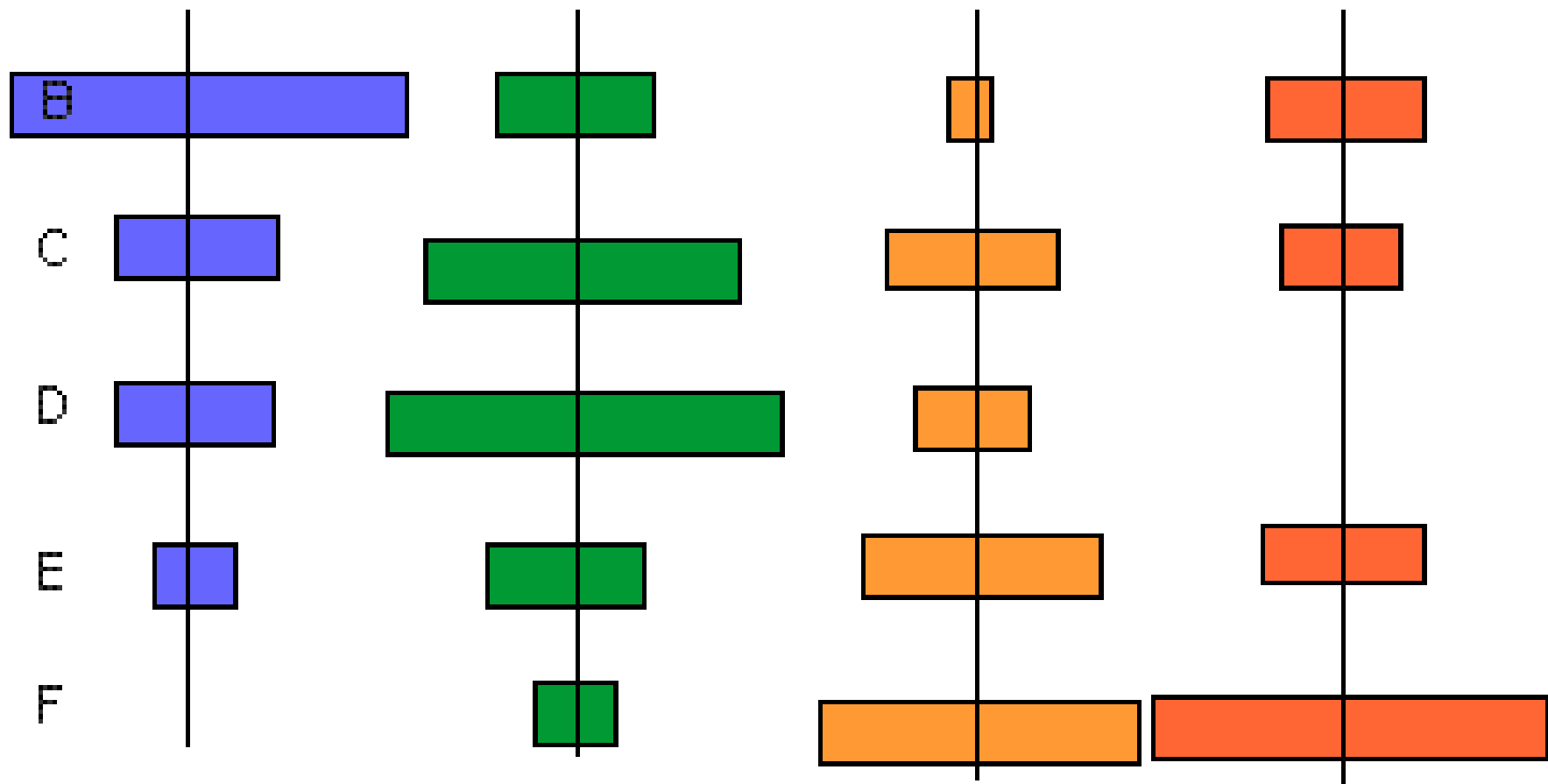
## Unsorted incidence matrix

1–14 are burials (or other closed finds). CDE: three types of pottery. NOP: three types of comb. XYZ: three types of knife.

	<b>Z</b>	<b>N</b>	<b>C</b>	<b>O</b>	<b>Y</b>	<b>D</b>	<b>E</b>	<b>P</b>	<b>X</b>
<b>10</b>	*	*	*						
<b>3</b>	*	*	*						
<b>11</b>		*	*	*					
<b>1</b>		*	*	*					
<b>12</b>		*	*	*					
<b>4</b>		*	*	*	*				
<b>9</b>			*	*					
<b>2</b>			*	*	*	*			
<b>13</b>				*	*				
<b>8</b>				*	*	*	*		
<b>5</b>					*	*	*		
<b>14</b>						*	*	*	
<b>7</b>							*	*	*
<b>6</b>							*	*	*

## Seriated matrix

Type C seems older than type D-E, and those two appear to be the same age. (Works equally well if 1-14 are individual *objects* and CDE etc. are typological traits.)



Frequency seriation. Battleship diagram. Also easily dealt with in software. Just input find counts instead of 1/0 in the matrix.



Units

GurkaA

GurkaB

StenA

StenB

TomatA

TomatB

3 In GurkaA

Avlång

Blank

Grön

Types

Avlång

Blank






Grön











Röd






SEL

MODE

OUT

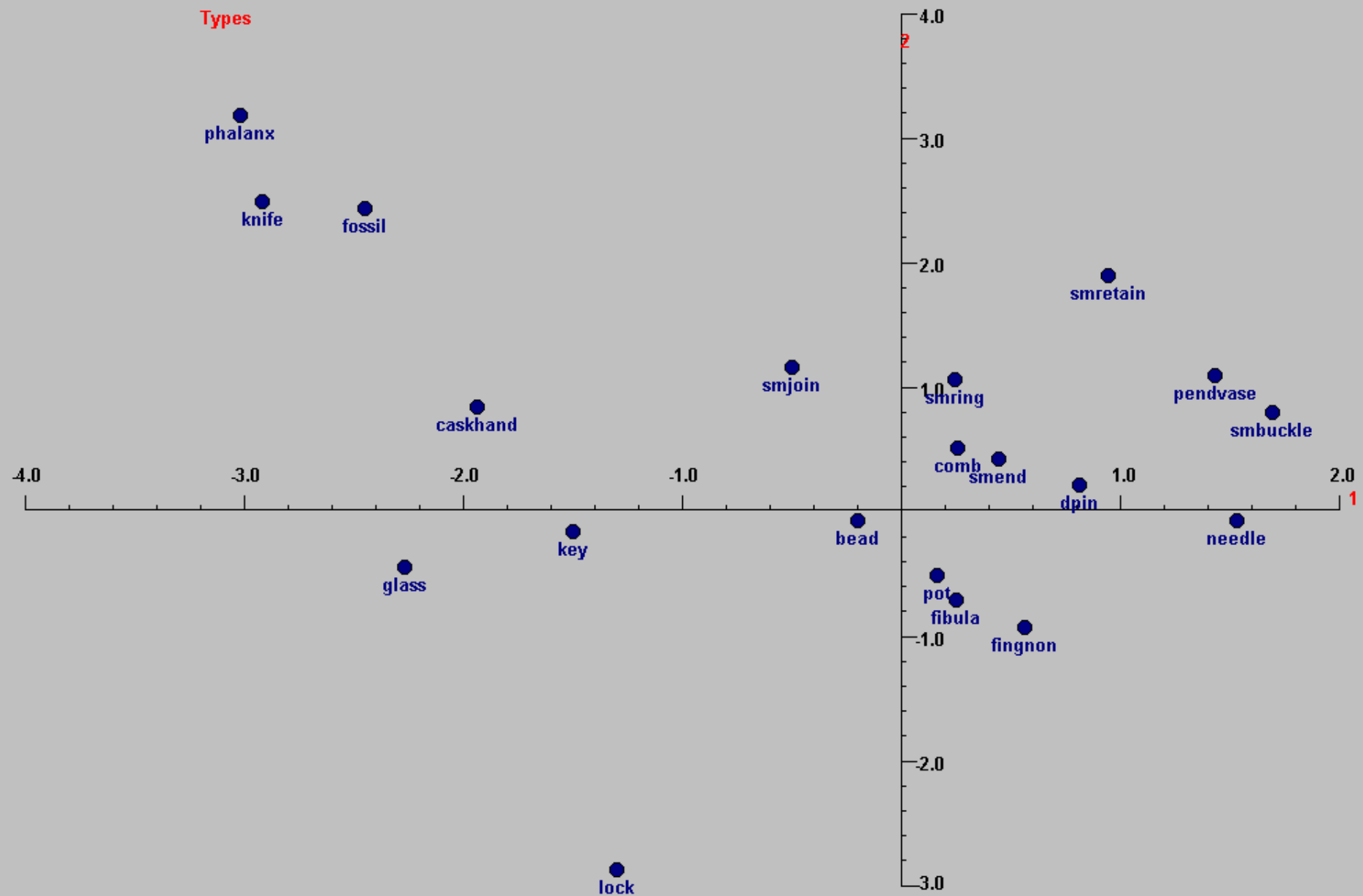











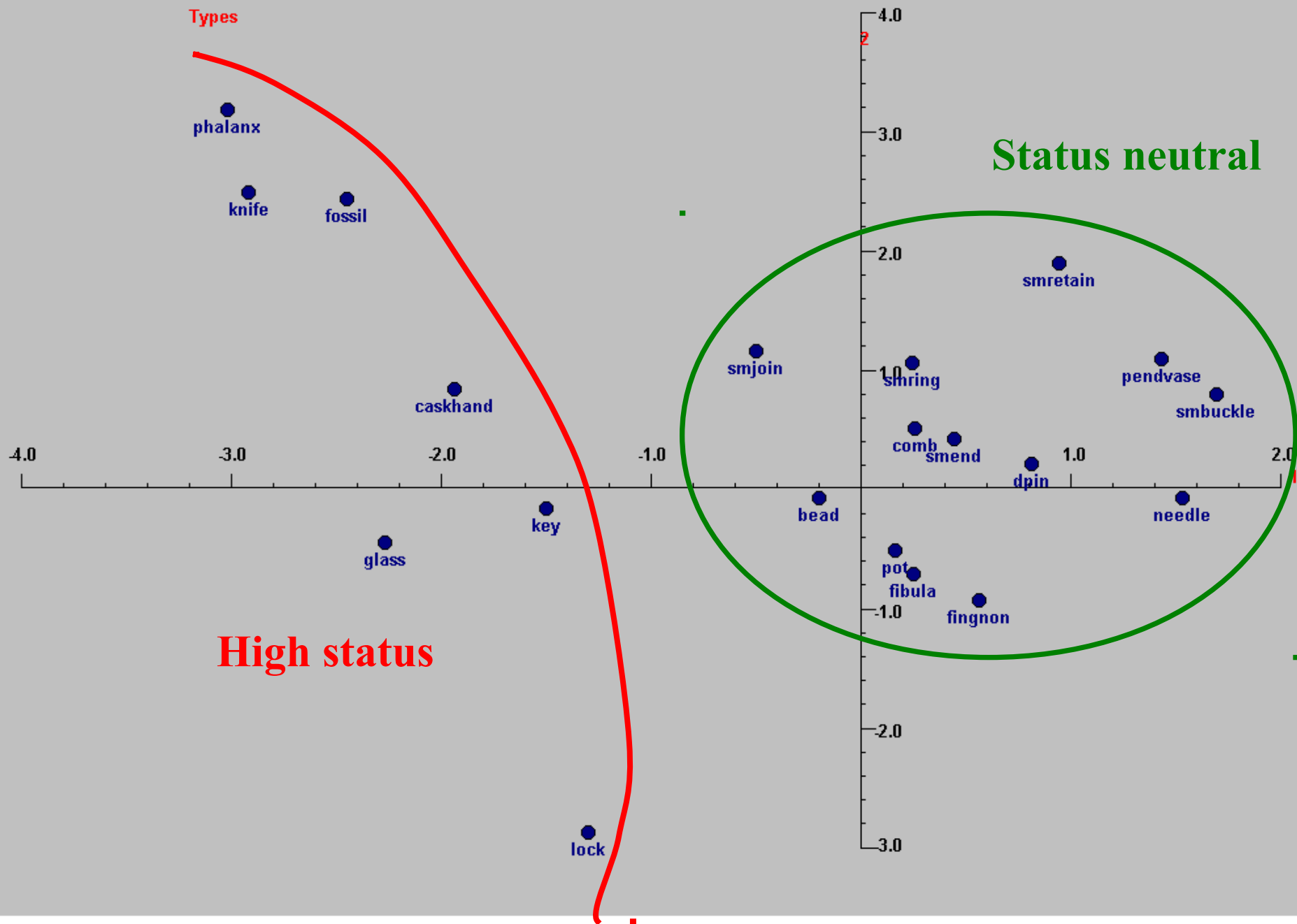
Before we can start looking for chronological patterning, we need to identify gender patterning. Seriation is good for this too.

There may be surprises!  
  
(Migration Period burials from Gotland. Gender-neutral object types removed to highlight the gender dichotomy.)

1VVVV11VVVV11VVVV111VVVVVVVV1VV1111VVVV1VVSVV				9WWW9rWWW99WWW9r9WWW9WWW9WWW9999WWW9WwWW			
6GGGG6eGGGG56GGGG6e6GGGGGGGG5GG3546GGGG5GG1GG				7111073000008700010737100111111711177710111101a10			
:6669:999409::58483:9:685403701:17:::71085:18n11				3162845414470203938341895749236011200183559042d01			
7 3 10 2 8 a 2 0322 1 s							
b							
caskhand	XXXX X			caskhand	100% F		
key	XXX X X			key	100% F		
lock	XXXX X X			lock	100% F		
fossil	X X			fossil	100% F		
fingnon	X XX X X X			fingnon	100% F		
needle	X X X			needle	100% F		
pendvase	X X			pendvase	100% F		
dpin	XX X XX X XXX X XX			dpin	100% F		
fibnon	X XX X XXXXXXXXXX X xX X			fibnon	89% F		
bead2-	X X XX X X XXXXX XXXXx X			bead2-	94% F		
smretain	XX X XXXX X XX XX X X			smretain	86% M		
clasp2-	Xx XX X XX X XXX X			clasp2-	90% M		
arrow	X X X X			arrow	100% M		
smbuck2-	xX X X XXXX XX X			smbuck2-	100% M		
rivjoinb	X X X X X X X X			rivjoinb	100% M		
gaming	XX X XX XXXXX X			gaming	100% M		
clasp<2	X XX XX X X			clasp<2	100% M		
combhndl	X XXXX XXXXXXXXXX			combhndl	100% M		
stapring	XXX XXXXX XX			stapring	100% M		
spatha	X X X X			spatha	100% M		
shield	X X X X			shield	100% M		
lanjav	X X			lanjav	100% M		
1VVVV11VVVV11VVVV111VVVVVVVV1VV1111VVVV1VVSVV				9WWW9rWWW99WWW9r9WWW9WWW9WWW9999WWW9WwWW			
6GGGG6eGGGG56GGGG6e6GGGGGGGG5GG3546GGGG5GG1GG				7111073000008700010737100111111711177710111101a10			
:6669:999409::58483:9:685403701:17:::71085:18n11				3162845414470203938341895749236011200183559042d01			
7 3 10 2 8 a 2 0322 1 s							
b							
FFFFFFFFFFFFFFFFFFFF22MMMMMMMMMMMMMMMMMMMMMMMM							

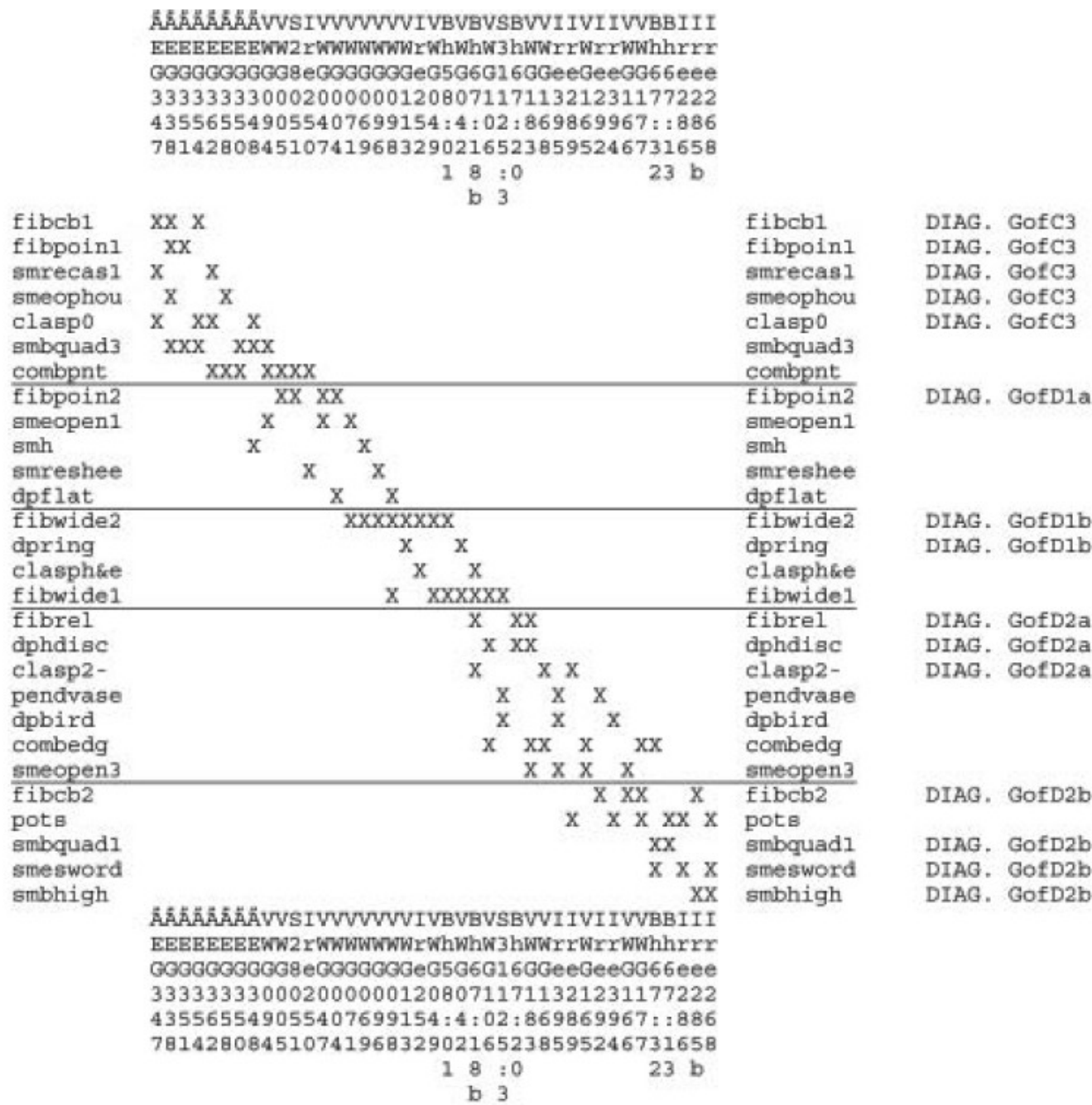


Correspondence analysis. Object types in Migration period female graves from Gotland.



Correspondence analysis. Object types in Migration period female graves from Gotland.

Seriation diagram.  
Object types in female graves from Gotland, AD 310-540. Chronologically neutral object types removed.  
Seriation divided into five phases with diagnostic types.  
  
A phase with no diagnostic types is not real!





## **Social status**

Four basic ways to quantify burial investment. All permit that you collect data both on portable artefacts and on structural elements in the grave.

1. Number of objects (only scores graves)
2. Number of object types (only scores graves)
3. Rarity of object types (scores graves and object types)
4. "Status score": An object type gets a high score if it is included in many burials with a high number of objects/types. Scores graves as well. (Implemented in the BASP software.)

## **Religious / ethnic identity**

Having identified groups and series in our material, and having decided on other grounds that certain object types or structural features are likely to be religious / ethnic markers, we can investigate which markers go with which groups.

Proceed with caution. For instance, early Christian symbols on Gotland concentrate in Viking Period high-status female graves. But all types of pendant display this pattern. Almost all early Christian symbols on Gotland are pendants. And so are almost all late pagan symbols!



## **Useful software**

BASP: [www.uni-koeln.de/~al001/basp.html](http://www.uni-koeln.de/~al001/basp.html)

Capca: [www.archaeoinfo.dk](http://www.archaeoinfo.dk)

CRAN-R: [cran.r-project.org/web/packages/seriation](http://cran.r-project.org/web/packages/seriation)

R / Quick-R: [www.statmethods.net](http://www.statmethods.net)