

On a Method for Generating a Word Pool for the Description of Steering Feel

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Vision

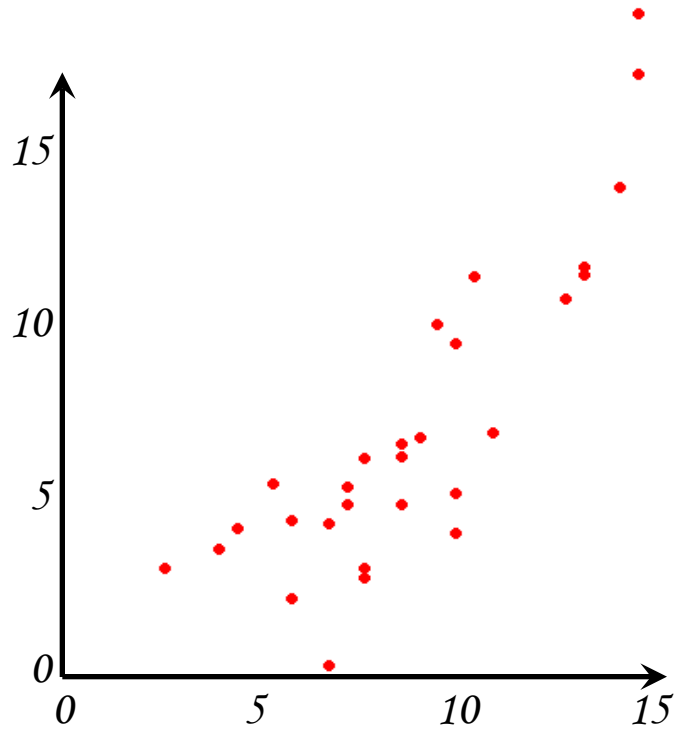
Handling

$$\begin{array}{ccc}
 \psi & K_{US} & I \\
 i & M_{SW} & \delta_{SW} \\
 \omega_z & a_y & \beta \\
 & \alpha &
 \end{array}
 \Rightarrow$$

Steering Feel

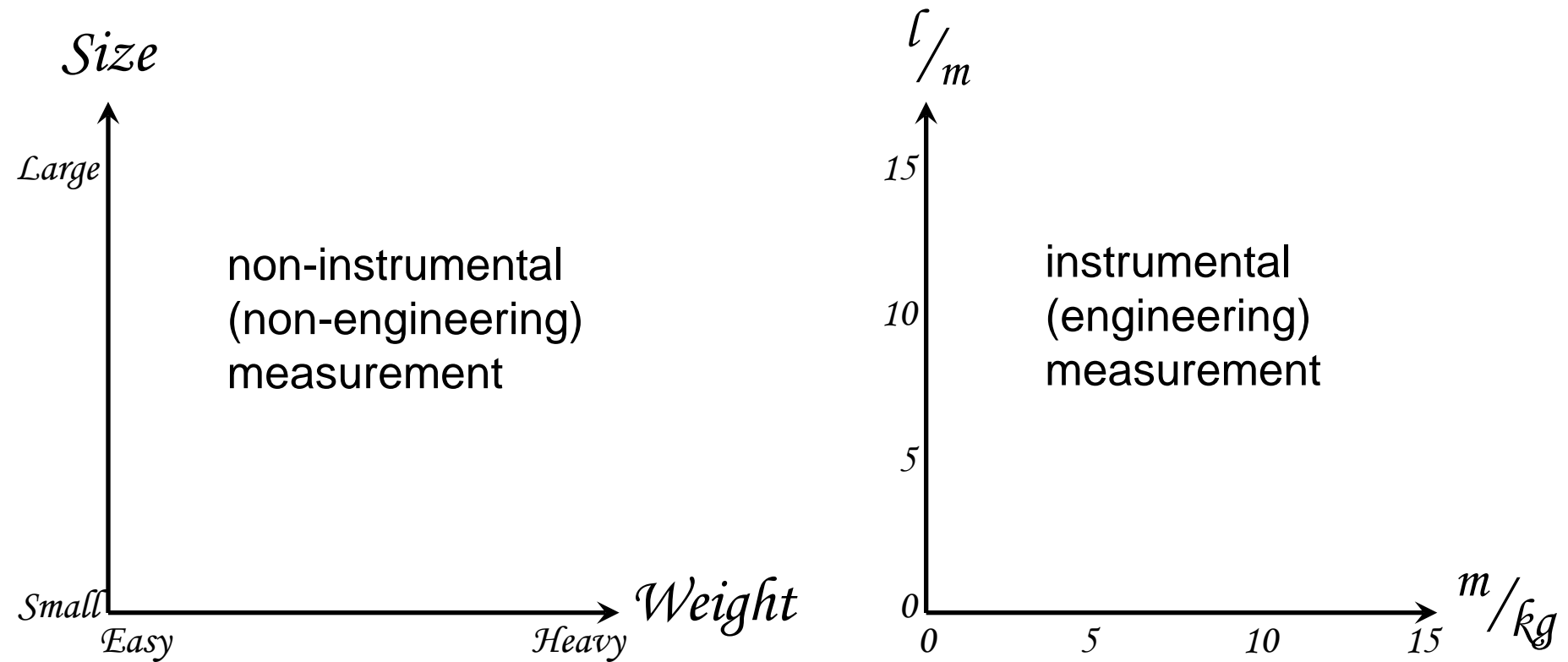


How to measure steering feel?



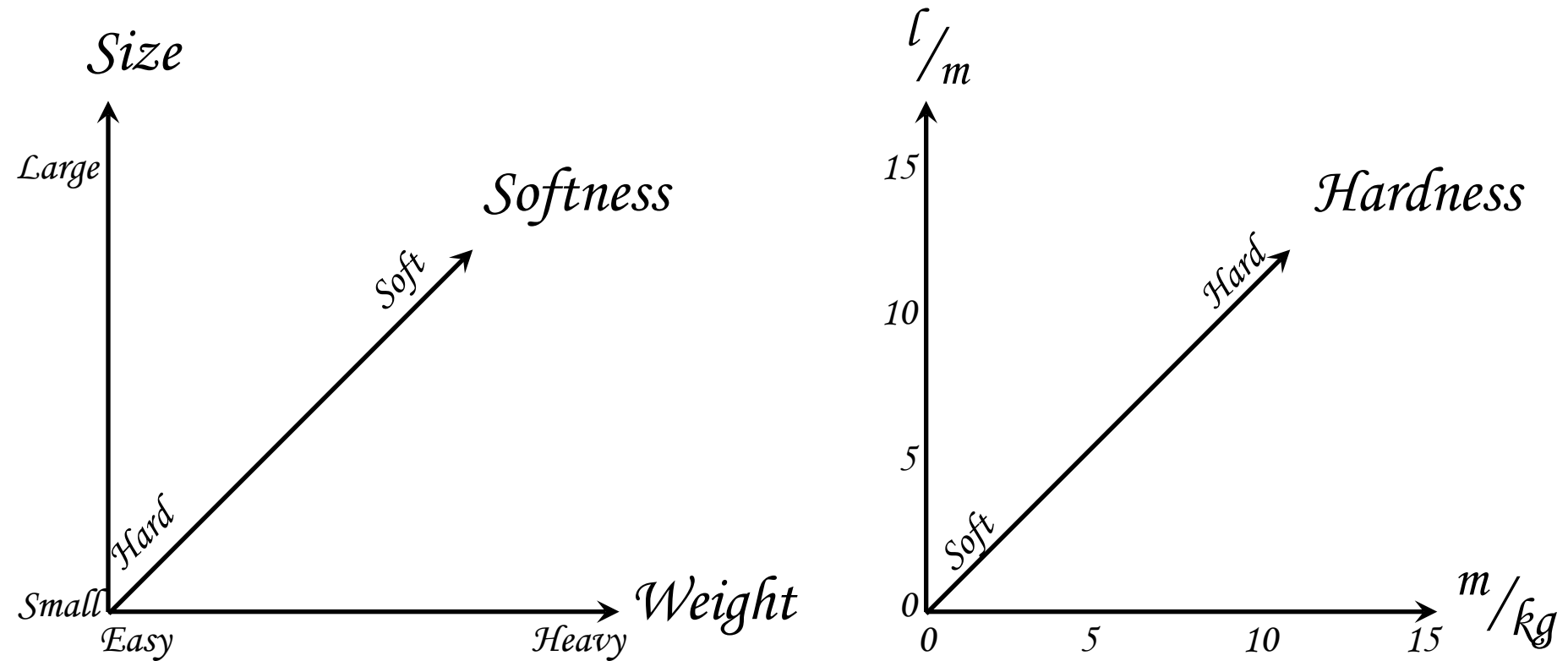
Source: Scania

How to measure non-instrumental values? What are orthogonal dimensions of perception?





How to measure non-instrumental values? What are orthogonal dimensions of perception?



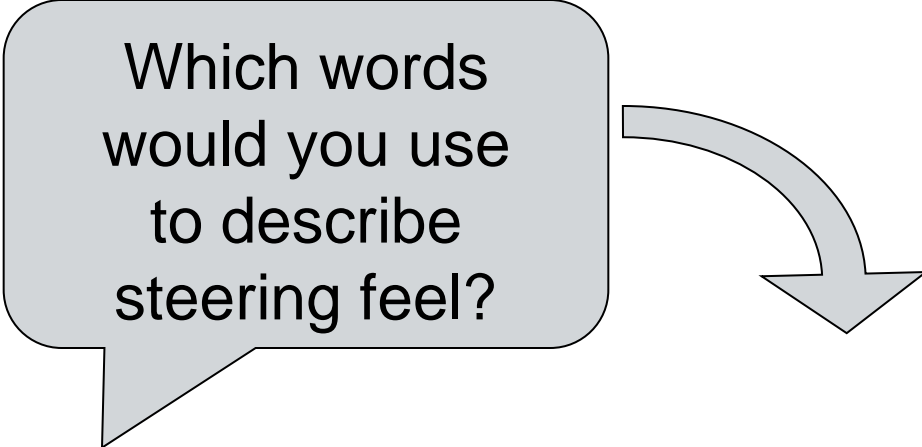
Hypotheses

- 1. Steering feel of road vehicles experienced by the driver will arise in orthogonal dimensions!**
- 2. The dimensions that describe steering feel**
 - consist of characteristic words!**
 - will be valid for (nearly) all drivers!**

Method:
- Collecting words

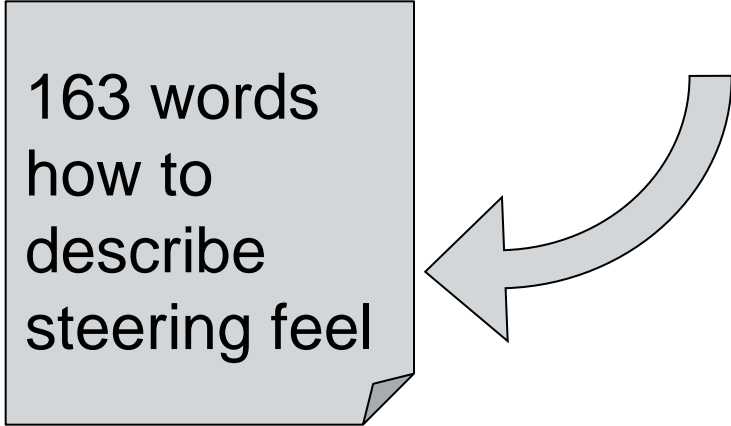
Collecting words

Which words
would you use
to describe
steering feel?



n=60

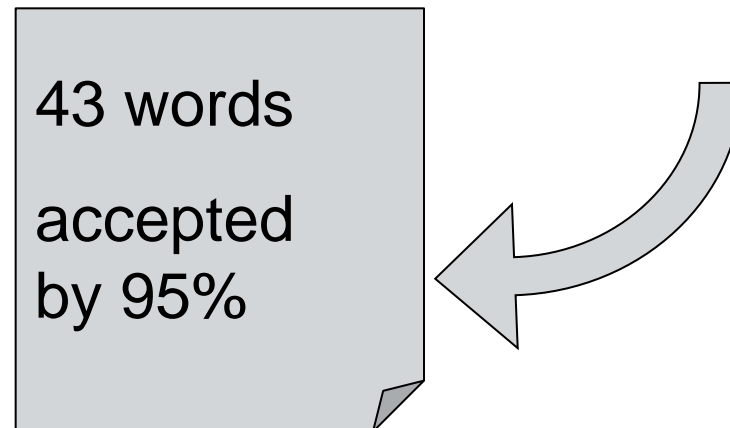
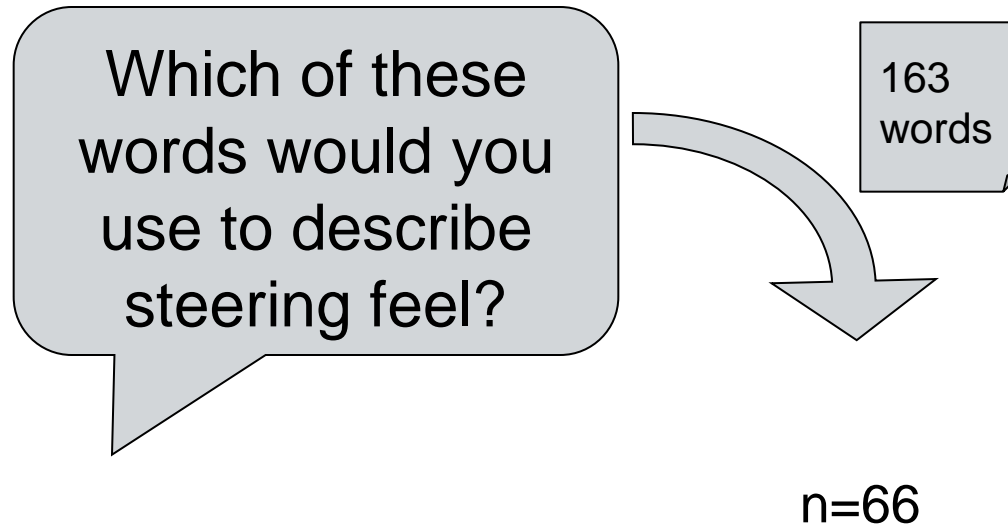
163 words
how to
describe
steering feel



Method:

- Collecting words
- Filtering words

Filtering words



Method:

- Collecting words
- Filtering words
- Grouping words

Grouping words

Which of these words do you think have high affinities?

43 words

$n=12$

$\bar{M}_n^{43 \times 43}$

Σ

Matrix of affinities

Affinity 0 = not at all 1 = low 2 = low 3 = high	(in)direct	distinct	(in)exact	erratic	delayed	play	stabbing	comfortable	controlled	rate-stabile	(in)sensitive	resistance	(im)precise	pulsing	reactive
(in)direct		0	2	0	1	0	0	0	2	1	0	0	1	0	0
distinct			1	0	0	0	1	0	0	0	0	0	2	0	0
(in)exact				0	0	1	1	0	0	0	0	0	2	0	0
erratic					0	0	0	0	0	0	3	0	0	0	0
delayed						1	1	1	0	2	0	0	0	0	0
play							1	0	0	0	0	0	0	0	0
stabbing								1	0	0	0	0	0	0	0
comfortable									0	0	0	0	0	0	0
controlled										1	0	0	0	0	0
rate-stabile											0	0	0	0	0

Method:

- Collecting words
- Filtering words
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Grouping words

Which of these words do you think have high affinities?

43 words

$n=12$

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Matrix of distances

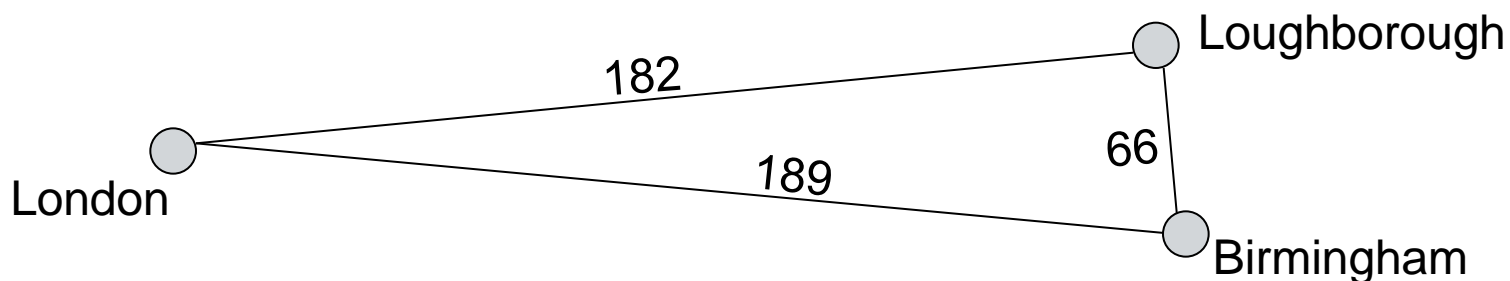
32 = maximum distance minimum affinity 0 = minimum distance maximum affinity	indirect	distinct	(in)exact	light as a feather	erratic	(dis)obedient	delayed	play	stabbing	comfortable	controlled	force-requiring	rate-stabile	(in)sensitive	resistance	(im)precise	pulsing	reactive	...
indirect		5	5	27	20	16	12	21	31	24	17	29	22	11	29	11	31	16	14
distinct			3	26	13	13	9	15	29	24	14	28	24	15	26	9	28	17	16
(in)exact				29	15	12	17	15	29	22	7	29	16	20	30	1	29	23	20
light as a feather					25	26	32	32	32	25	28	3	31	23	8	31	32	28	27
erratic						15	26	14	26	20	15	31	12	18	32	12	25	25	24
(dis)obedient							18	20	23	19	13	25	20	23	29	12	30	20	22
delayed								12	30	24	22	32	26	23	32	17	32	16	13
play									21	21	23	32	23	21	31	18	32	23	19
stabbing										19	26	26	29	28	27	24	15	30	29
comfortable											20	21	18	24	22	21	21	23	23
controlled												28	16	21	29	11	30	22	24
force-requiring													31	24	7	27	31	26	29
rate-stabile														21	30	22	29	25	25
(in)sensitive															27	15	30	9	15
resistance																29	26	30	26
(im)precise																	30	22	20
pulsing																		30	30
reactive																			13
...																			

Short
distance

Long
distance

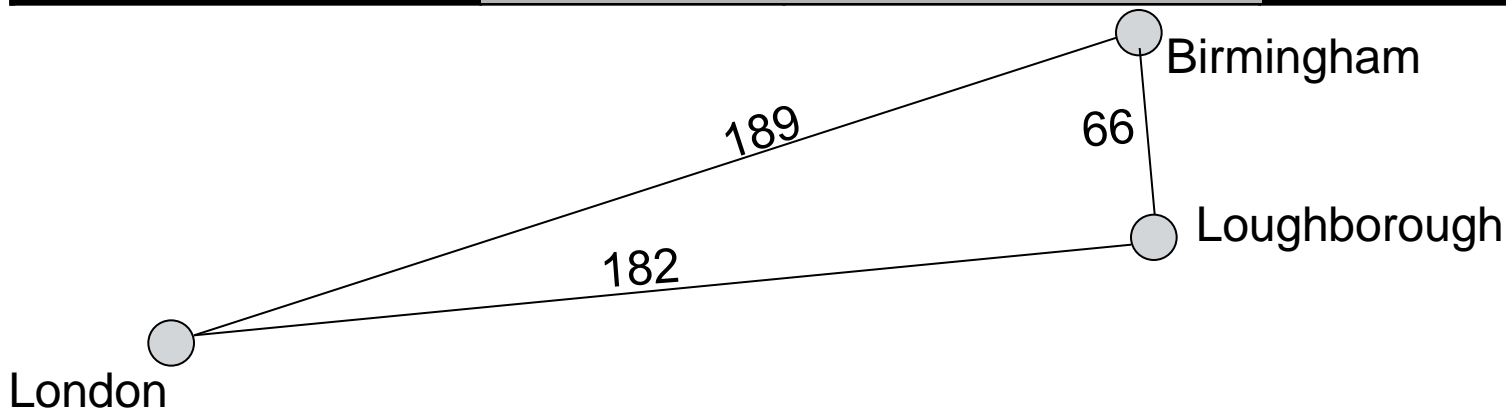
Excursus

Matrix of distances			
	London	Loughborough	Birmingham
London	0	182	189
Loughborough		0	66
Birmingham			0



Excursus

Matrix of distances			
	London	Loughborough	Birmingham
London	0	182	189
Loughborough		0	66
Birmingham			0

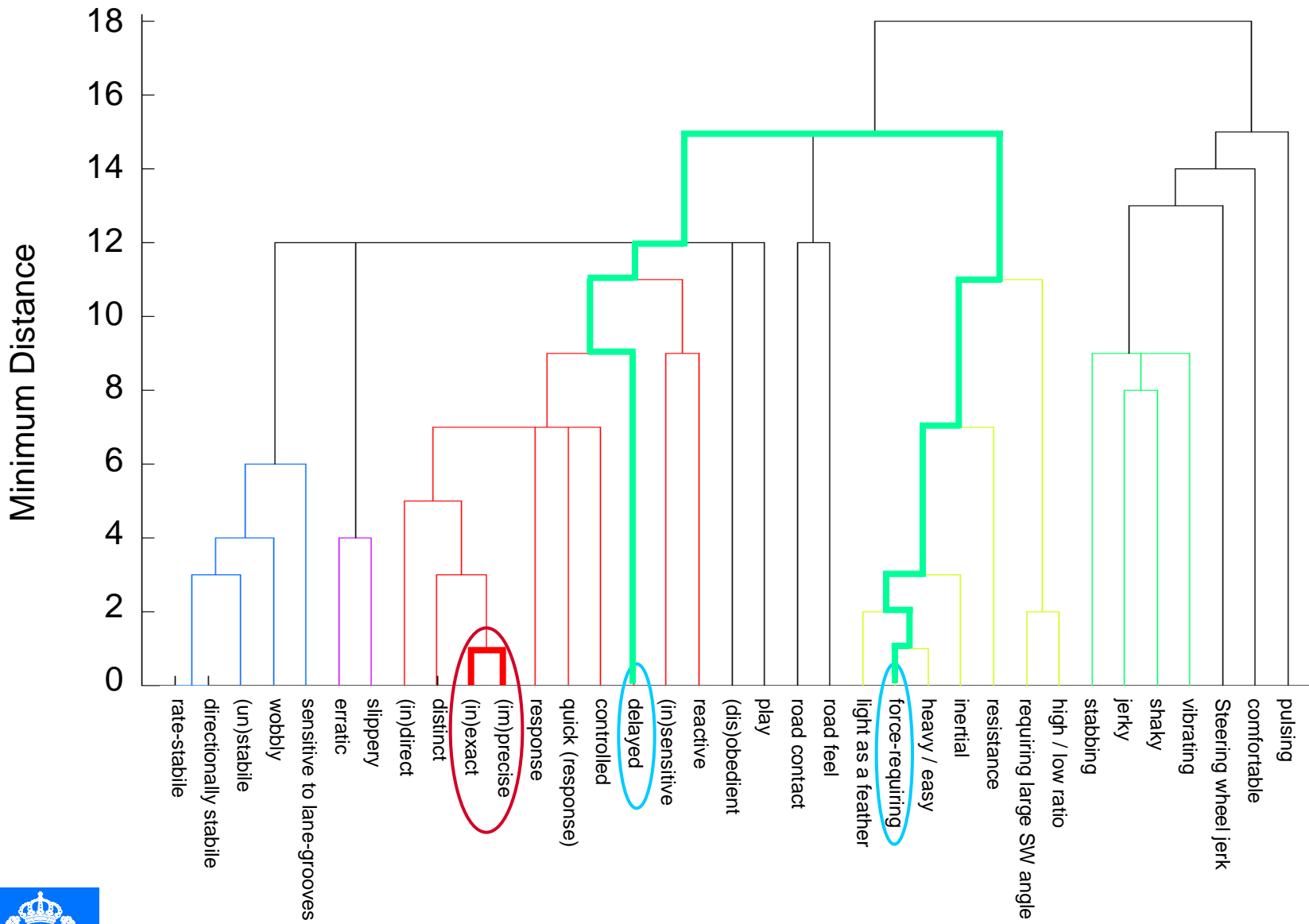


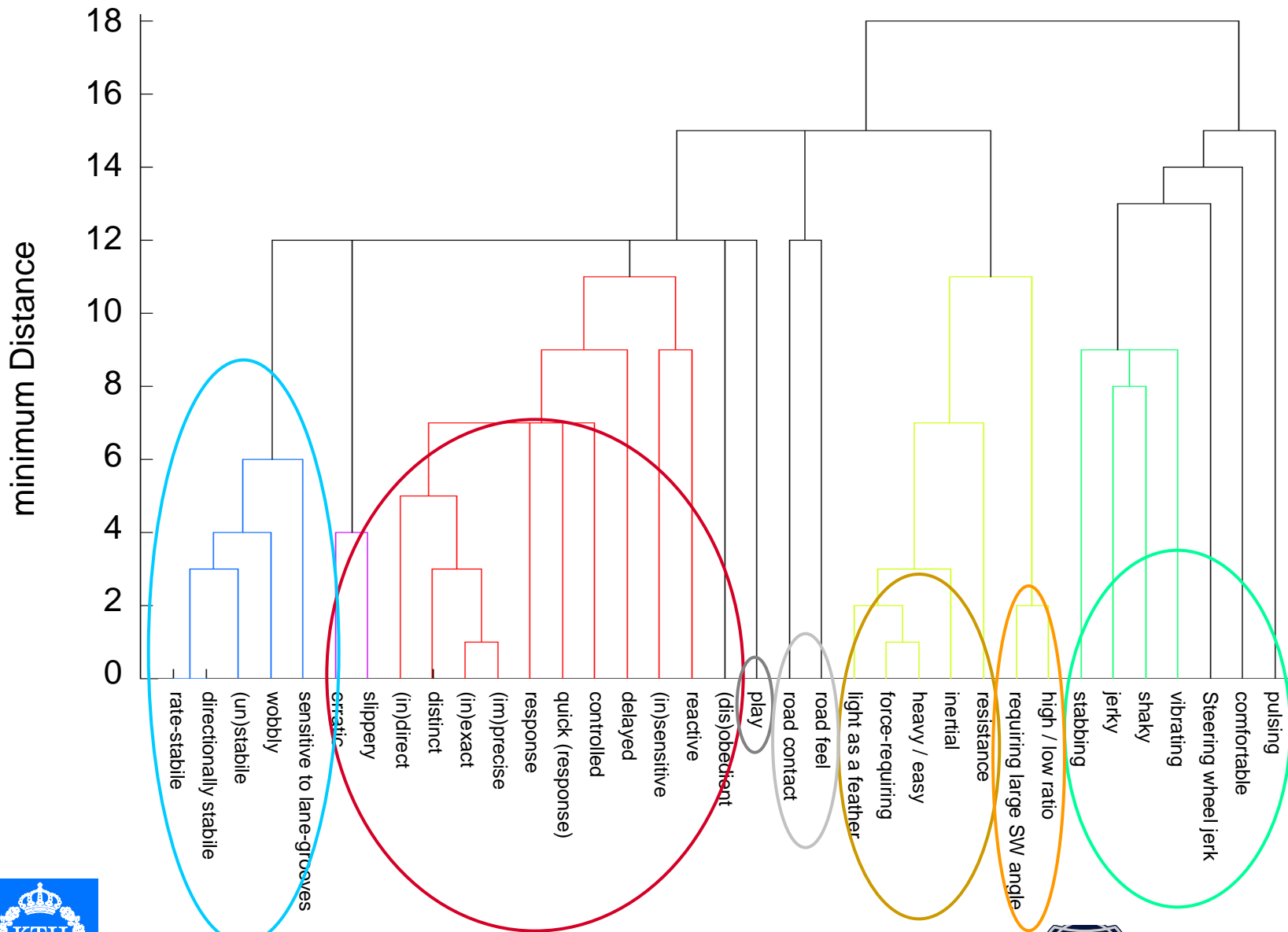
Matrix of distances

32 = maximum distance minimum affinity 0 = minimum distance maximum affinity	indirect	distinct	(in)exact	light as a feather	erratic	(dis)obedient	delayed	play	stabbing	comfortable	controlled	force-requiring	rate-stabile	(in)sensitive	resistance	(im)precise	pulsing	reactive	...
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light as a feather					25	26	32	32	32	25	28	3	31	23	8	31	32	28	27
erratic						15	26	14	26	20	15	31	12	18	32	12	25	25	24
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...																			

Short
distance

Long
distance





Results

Dimensions	Related words	
Stability	(un)stable directional stable sensitive for lane-grooves	rate stable wobbly
Response	controlled (in)direct flapping quick precise	delayed distinct obedient reactive (un)exact

**Results are only valid in Swedish
as long as the process was not done with other
native-speakers!**

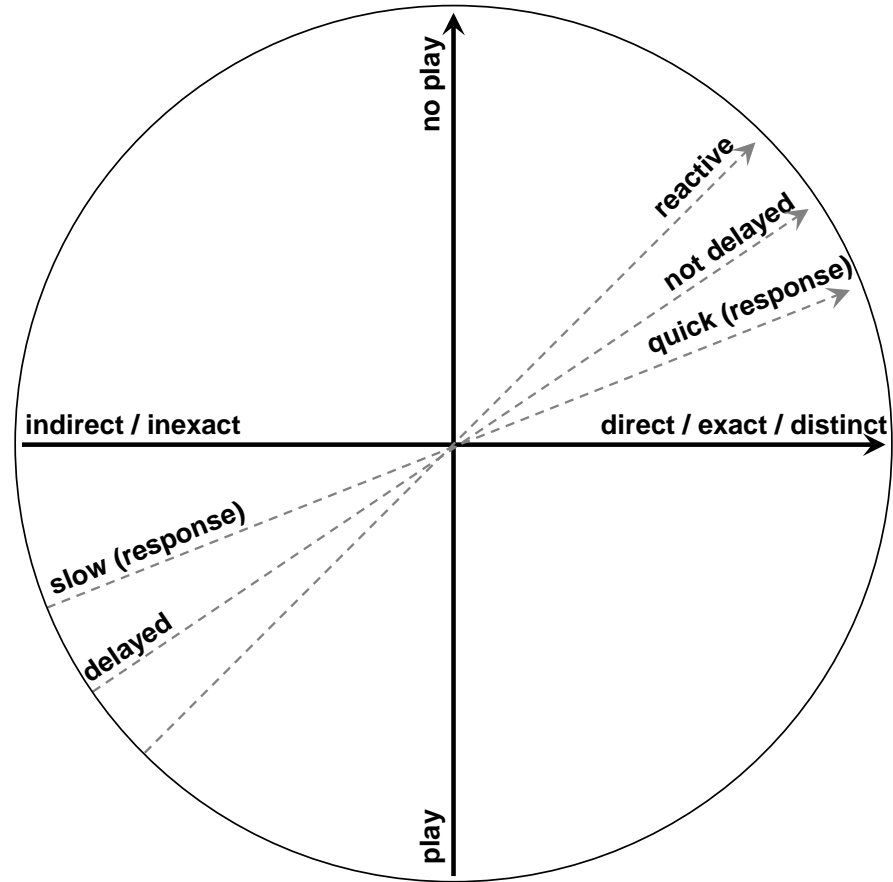
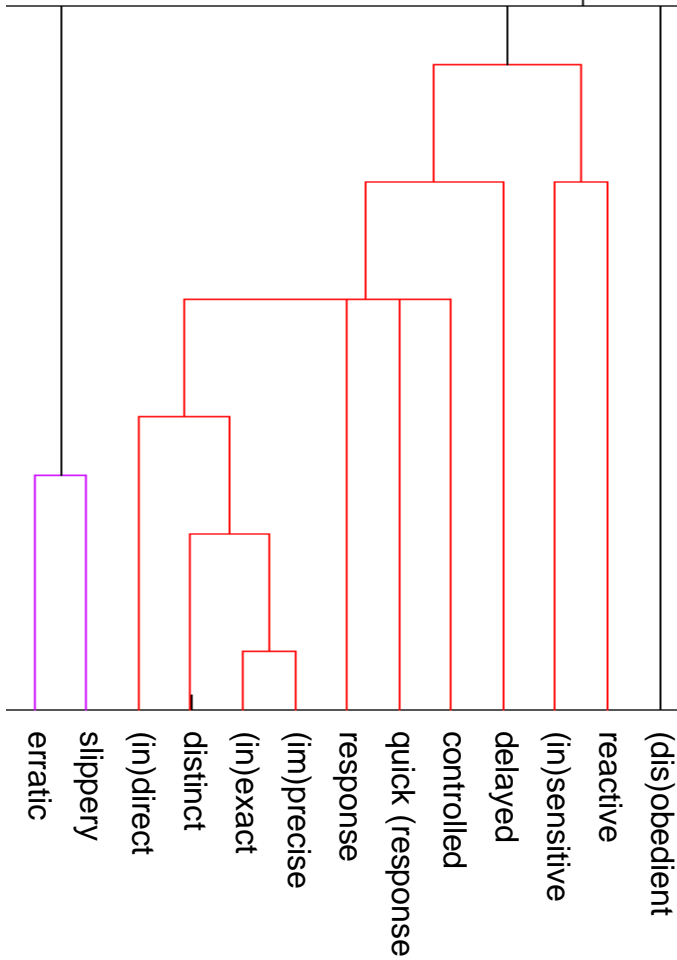
Jerk (Comfort)	jerky shaky steering wheel jerk	pulsing stabbing vibrating
Steering wheel return	steering wheel return	

The "real" life

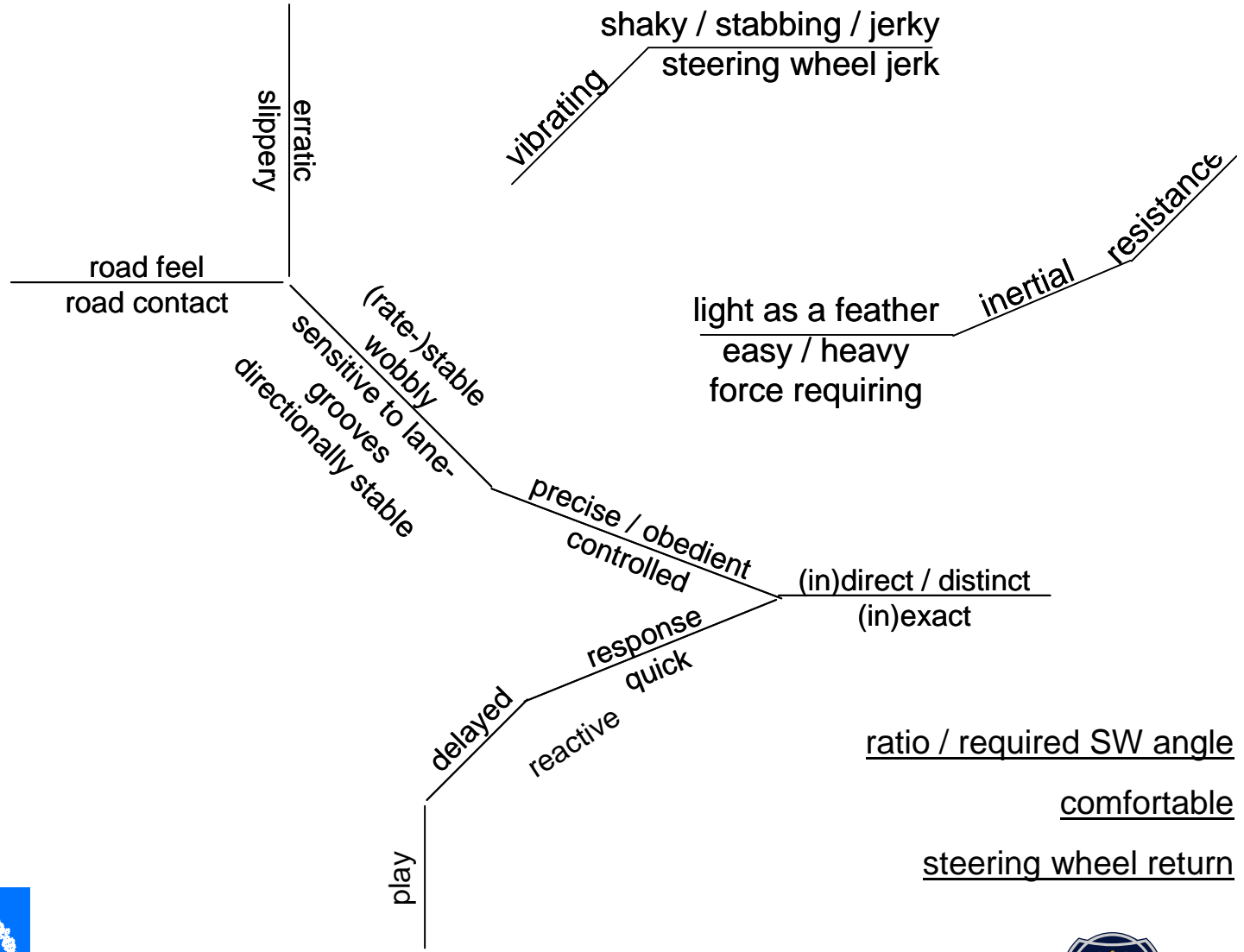
- 5 dimensions used
- 4 successful
- 1 showed a weakness



The "real" life



Manual dimensioning



Results & Conclusions

- **A Word Pool had been created by a double interrogation**
- **The Word Pool can be divided into Dimensions by means of MDS**
- **There are more than only orthogonal dimensions**

- **Do not trust in Mathematics blindly!
There is some work to be done manually!**



Thank you for your attention!

Questions?

Thanks to Scania, KTH and IVSS

