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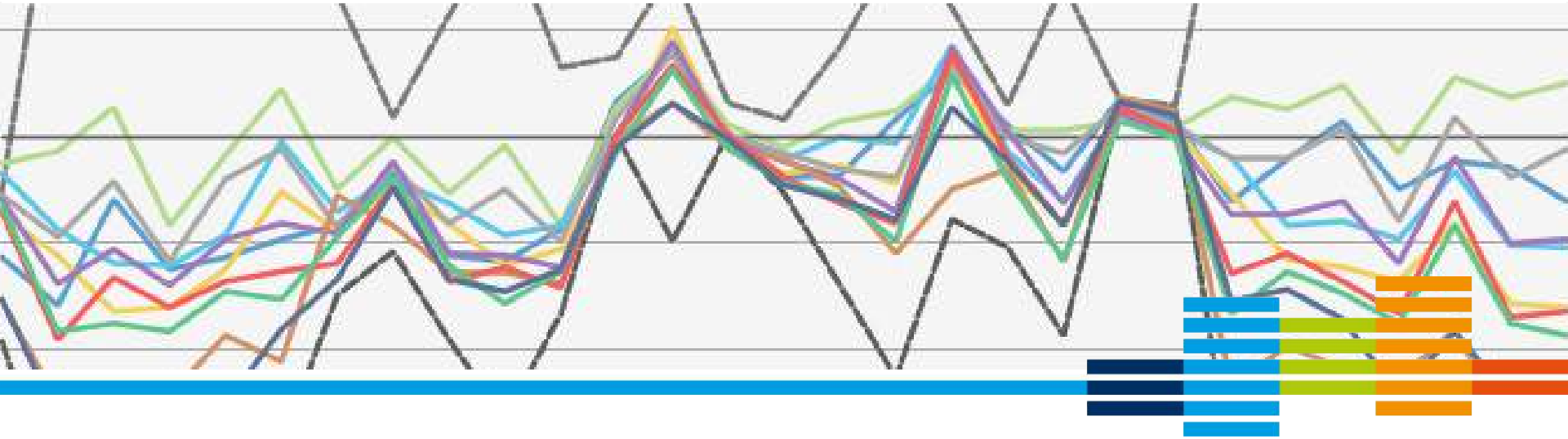

Determination of hedonic odour effect based on polarity profiles

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9th IWA Odour & VOC/Air Emission Conference

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Lecture content

1. Method of Polarity profiles
2. Example: Industrial bakery
3. Conclusion and notes

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Exposure – Effect Relationship

- Odour pollution was measured in the neighbourhood of plants and the degree of annoyance of the residents was investigated.
- Unpleasant / neutral odours: with increasing odour frequency, the number of residents who feel very strongly annoyed increases.
- Pleasant odours: do not show a strong nuisance effect

Method of polarity profiles

- To determine clearly pleasant odours from plants, the method of polarity profiles can be used (VDI 3940 part 4).
  → hedonically definite classification of facility odours
- According to No. 5 Annex 7 TA Luft, these clearly pleasant odours can be weighted with a weighting factor of 0.5 in ambient air.
  → the odour pollution is halved
- The decision about this is made of the relevant authority.
- This method is also used to generate the new animal specific weighting factors of Table 24 Annex 7 TA Luft.
- A polarity profile is an instrument utilised for the multidimensional measurement of attitudes to an odour.
- It is possible to quantify the various dimensions of qualities and emotions evoked when smelling an odour.

Method of polarity profiles

According to VDI 3940 part 4

The method consists of 2 working steps:

1. Polarity profiles for the concepts of “fragrance” an “stench”
   (simply based on the imagination of a fragrance or stench)
2. Polarity profile of the respective facility odour on site

The emitted facility odour can be evaluated as “hedonically clearly pleasant” if the odour can be assigned to the concept “fragrance”

Criterion: **- correlation to the representative fragrance > 0.5**
- correlation to the representative stench < -0.5

Method of polarity profiles

According to VDI 3940 part 4

Name: _____ **Odour quality:** _____

Location: _____ **Date:** _____

Describe the current odour stimulus with reference to the following pairs of opposites.

Sniff the air and familiarize yourself with the odour. Then start to describe the odour. To this end, immediately tick off the number in each line that comes closest to your association. Some of the adjectives are employed figuratively rather than literally. The more the right-hand characteristic applies, the further to the right you place your tick, and the more the left-hand characteristic applies, the further to the left you place your tick. You should choose the "0" in the middle as infrequently as possible. If you have the feeling mid-way that you can't remember the odour, you can sample the odour again.

It is only your subjective impression that counts here. Proceed intuitively, swiftly and without premeditation.

1.	strong	3	2	1	0	1	2	3	weak
2.	coarse	3	2	1	0	1	2	3	fine
3.	depressing	3	2	1	0	1	2	3	uplifting
4.	robust	3	2	1	0	1	2	3	delicate
5.	heavy	3	2	1	0	1	2	3	light
6.	old	3	2	1	0	1	2	3	young
7.	wild	3	2	1	0	1	2	3	gentle
8.	exciting	3	2	1	0	1	2	3	calming
9.	rough	3	2	1	0	1	2	3	smooth
10.	dark	3	2	1	0	1	2	3	light
11.	savoury	3	2	1	0	1	2	3	sweet
12.	interesting	3	2	1	0	1	2	3	boring
13.	cold	3	2	1	0	1	2	3	hot

Method of polarity profiles

According to VDI 3940 part 4

For evaluation, the 29 numeric values fro sheet are recorded as minus figures on th plus figures on the right-hand side

The arithmetic mean is calculated:

- M_j: arithmetic mean value of all weighted values fo
- n: number of panel members
- j: polarity; pairs of adjectives
- $R_{x,j}$: numeric value of panel member for polarity j
- HF_j: hedonic factor score for polarity j

Table 1. Hedonic factor scores

Polarity *j*	Pairs of adjectives		Factor scores HF_j
1	strong	weak	0,69
2	coarse	fine	1,37
3	depressing	uplifting	1,46
4	robust	delicate	1,27
5	heavy	light	1,19
6	old	young	1,26
7	wild	gentle	0,95
8	exciting	calming	0,66
9	rough	smooth	0,98
10	dark	light	1,19
11	savoury	sweet	0,86
12	interesting	boring	–0,38
13	cold	hot	0,90
14	awake	tired	–0,21

The similarity of the polarity profile of the facility odour to the representative profiles of the concepts of “fragrance” and “stench” is calculated with the Pearson product-moment correlation

Method of polarity profiles

According to VDI 3940 part 4

Table A1. Raspberry odour – original data

		panel member 1	panel member 2	panel member
strong	weak	–2	–2	–2
coarse	fine	3	2	1
depressing	uplifting	3	2	1
robust	delicate	3	2	2
heavy	light	3	2	1
old	young	3	2	1
wild	gentle	–1	1	2
exciting	calming	–2	–1	1
rough	smooth	1	1	2
dark	light	1	2	2
savoury	sweet	3	3	1
interesting	boring	–2	–2	–1
cold	hot	0	2	1
24	contented			discontent

Table A3. Correlation of the representative fragrance and stench profiles with the profile of raspberry odo

		Representative stench M_{gj}	Representative fragrance M_{dj}	Raspberry mean value M_{lj}
strong	weak	–1,92	–0,51	–0,12
coarse	fine	–3,47	2,79	3,20
depressing	uplifting	–3,83	3,35	3,04
robust	delicate	–3,08	2,21	2,43
heavy	light	–2,84	1,75	2,58
old	young	–2,87	2,37	2,84
wild	gentle	–1,48	1,35	1,19
exciting	calming	–1,08	0,18	0,39
rough	smooth	–1,90	1,14	1,55
dark	light	–2,65	2,00	2,38
savoury	sweet	–1,65	0,64	2,01
interesting	boring	0,01	0,75	0,67
cold	hot	–0,98	1,56	1,05
awake	tired	0,03	0,32	0,32
shallow	deep	–0,53	0,17	–0,09
quiet	loud	–1,40	0,84	0,89
soft	hard	–2,26	1,76	1,70
spicy	mild	–0,77	1,22	0,83
dull	sharp	–1,04	0,30	0,18
playful	serious	–1,86	1,44	1,45
empty	full	0,30	0,35	0,26
passive	active	0,25	0,29	0,30
fresh	stale	–3,15	2,94	2,42
contented	discontented	–2,70	2,51	2,41
harmonious	disharmonious	–3,43	3,18	2,63
mild	pungent	–3,05	2,05	2,02
peaceful	aggressive	–2,90	2,18	2,29
beautiful	ugly	–3,83	3,57	3,13
pleasant	unpleasant	–3,91	3,77	3,63
		$\overline{M_g}$: –2,00	$\overline{M_d}$: 1,60	$\overline{M_l}$: 1,64
	Correlation:	Representative	stench:	–0,90
	Correlation:	Representative	fragrance:	0,93

Method of polarity profiles

According to VDI 3940 part 4

Graphic representation

The fragrance raspberry fulfils the criterion for clearly pleasant odours according to No. 5 Annex 7 TA Luft and can be weighted with a factor of 0.5 in ambient air.

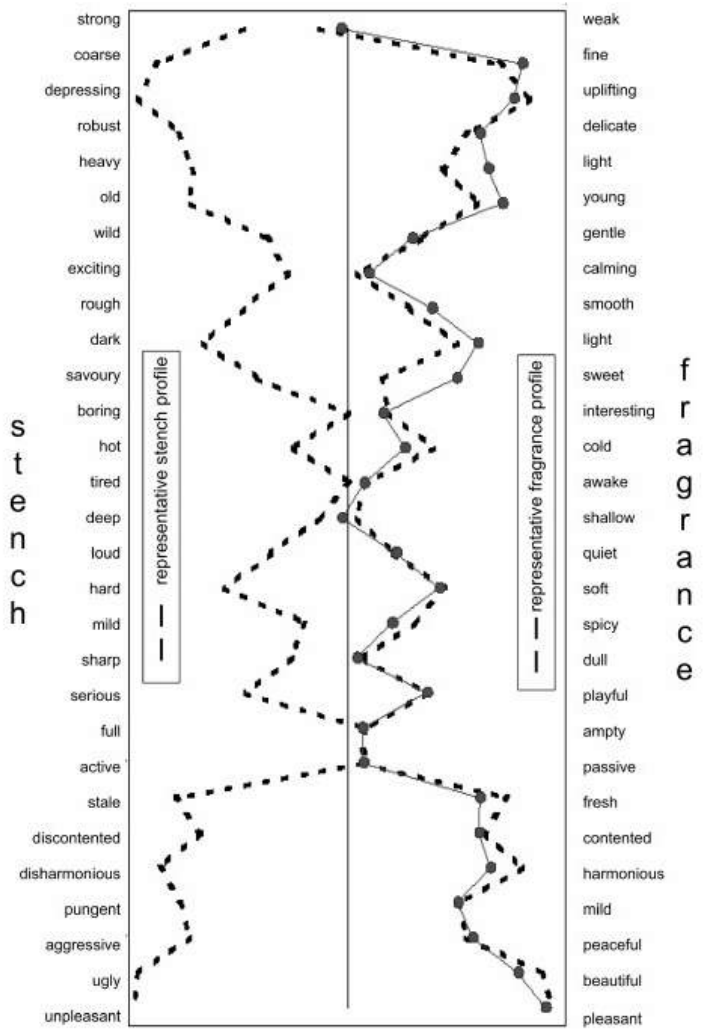
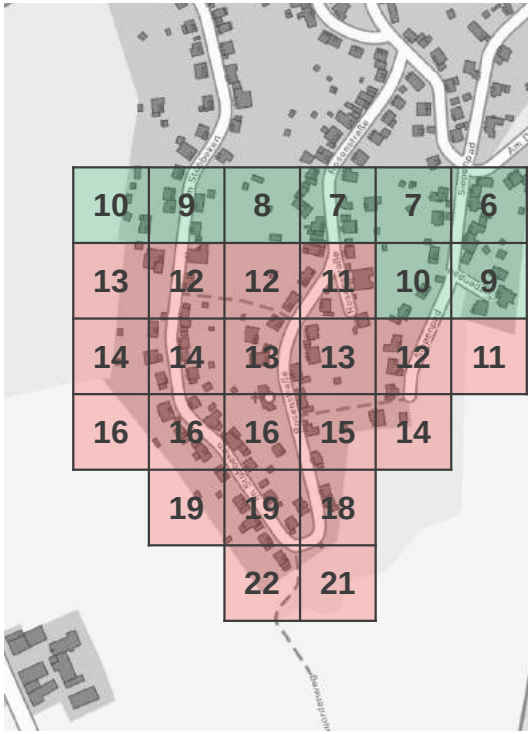


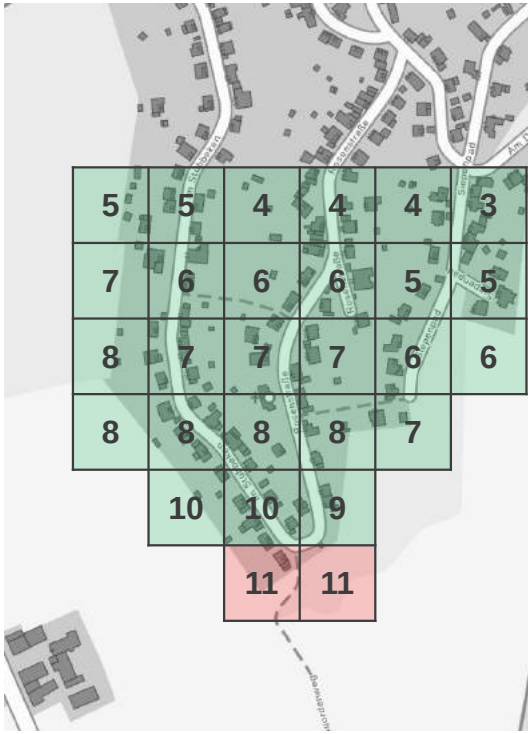
Figure A3. Graphic representation of raspberry odour polarity profiles (continuous line), representative stench and representative fragrance (broken lines)

Method of polarity profiles

Effect



without factor



with factor (0,5)

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Example: Industrial bakery

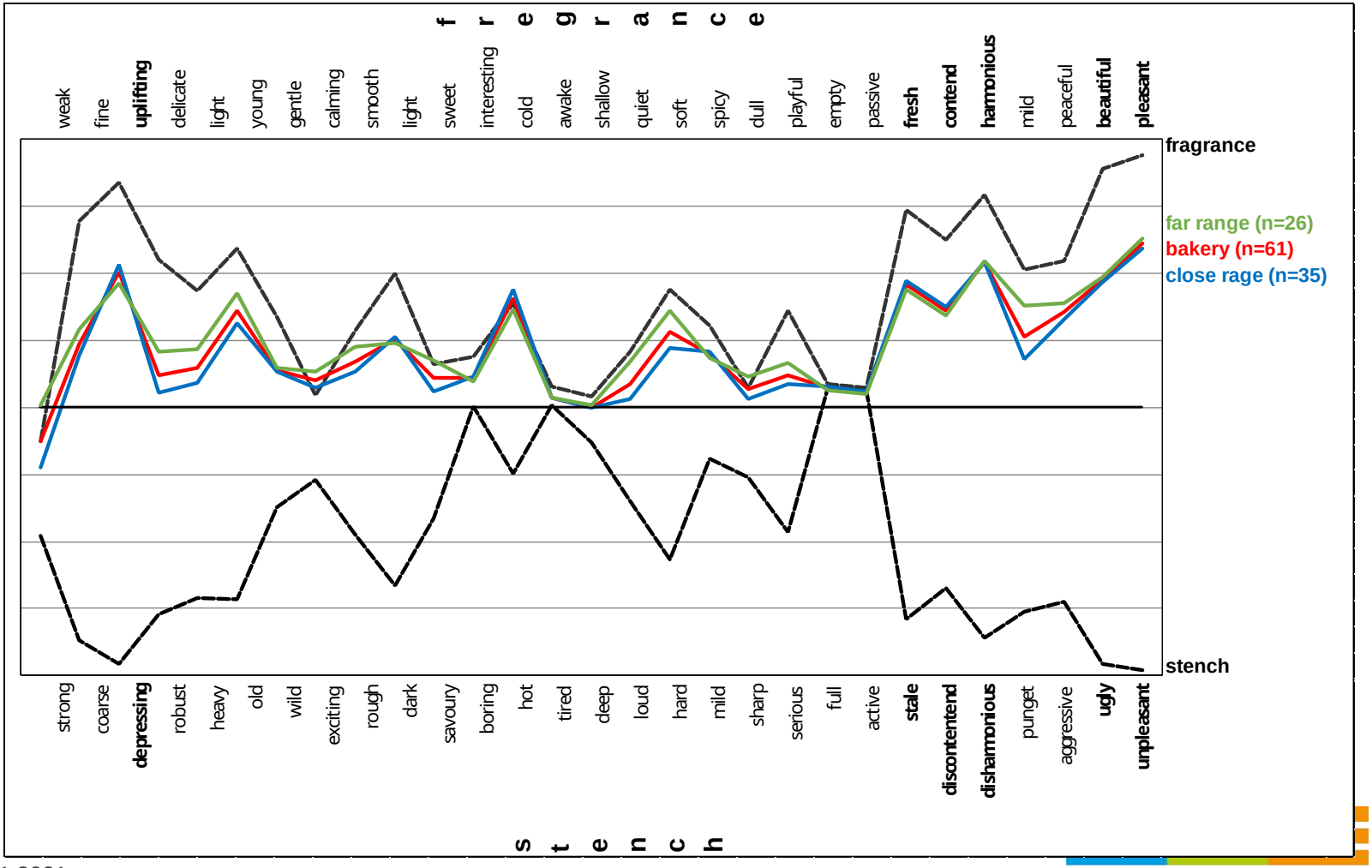
- There are 3 different sources of odour:
  - Waste gas vapours from the baking line
  - Cooling exhaust air
  - Room air

→ Only one odour quality in ambient air: that smells like “bread” and “yeast / sourdough”

Example: Industrial bakery

Example: Industrial bakery

Results



Example: Industrial bakery

Results

	Correlation fragrance	Correlation stench
bakery	0.91	-0.71
Close range	0.88	-0.62
Far range	0.92	-0.81
criterion	0.5	-0.5

- The criterion for classification as a hedonically clearly pleasant odour according to VDI 3940 part 4 is fulfilled.
- According to Annex 7 TA Luft, the odour of the industrial bakery can be weighted with a factor of 0.5 (No. 5 Examination in individual cases)

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Conclusion

- With the help of the method of polarity profiles (VDI 3940 part 4), it is possible to determine hedonically clearly pleasant odours.
- The decision whether a hedonic factor of 0.5 can be applied is up to the authority.

Notes

- Only odours detectable in ambient air are to be assessed.
- It should be checked whether the distance to the facility or the intensity of the odours have an influence on the hedonic tone
- If a facility emits several odour qualities, which are noticeable in ambient air, these must be assessed individually.

Thank you for your attention

Questions?

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