

BRANGE EFFECTS IN HEDONIC EVALUATION OF OLFACTORY STIMULI

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Abstract

With the aim to explore range effects in psychophysical scaling of hedonic qualities initially in Single Stimulus Experiments 25 odours have been examined towards their placement on a Category anchored Visual Analogue Scale ranging from extremely pleasant to extremely unpleasant. On the basis of the resulting rank-ordered set of odours 4 stimulus series were compiled, each containing 13 stimuli. 3 series served as range-conditions, containing either the 13 most pleasant, neutral or unpleasant stimuli, while a control series covered the whole hedonic range. The stimulus series were each presented to 10 subjects to be evaluated using the same scale as in the Single Stimulus Experiments. In contrast to observations in other sensory continua such as loudness or pitch, systematic influences of the stimulus ranges on hedonic ratings were not found. The mere fact that odour stimuli are presented in series, however, seem to influence the hedonic judgments

Range effects in psychological scaling are observed as steepening of the psychophysical function with decreasing stimulus ranges and vice versa flattening of the psychophysical function if the range of the physical stimuli is extended. In psychophysical experiments range effects are invited, if the range of the scale used does not match the range of the experimental stimuli or if the range of the stimuli presented is not congruent to subjects lifelong experiences with similar stimuli as being condensed in so called “stabilized Bezugssysteme” (reference frames) as described by Witte, 1966. In these situations subjects loose orientation in the experimental situation. In an attempt to regain orientation subjects switch from the process of describing the magnitude of stimulus attributes into a “process of finding one’s bearings” as described in the Orientation theory (Heller, 1980; Heller, 1990) until orientation in the experimental situation is achieved and a reference frame for experimental stimuli is established. In the transition period between both more stabile stages the scaling mode switches from just describing the magnitude of each single stimulus presented to judgments driven by comparisons between the magnitudes of successive stimuli.

On FechnerDay 1988 we presented data obtained in pitch scaling experiments using pure tones out of different ranges which suggest that scale values in experimentally truncated series follow a linear compromise between “bezugssystem”-based descriptions as given in every day life and a strictly range driven judgment similar to Parduccis range principle. Similar results as in pitch scaling have been obtained using different ranges of sound pressure of white noise (Fig. 1). The aim of this explorative study was to examine whether similar range effects can be observed in scaling the hedonic value of olfactory stimuli as well.

We are very grateful to Dag Piper and Britta Scheideler at Symrise AG in Holzminden who kindly provided us with the experimental stimuli.

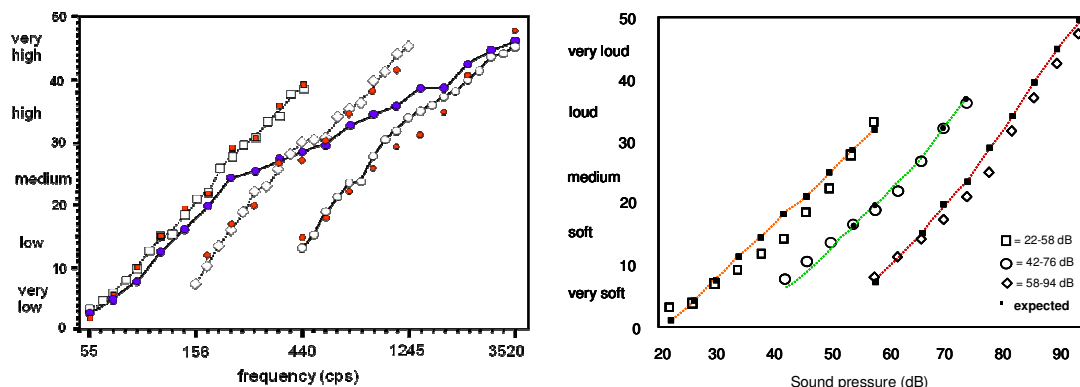


Fig.1: Range effects in pitch and loudness scalings. Pitch: Ranges of 4 geometrically spaced pitch series: 55- 3520 Hz, 55- 440 Hz, 156- 1254 Hz and 440- 3520 Hz were presented. The smaller filled symbols indicate expected values. Series in loudness scalings: 22 – 58 dB, 42-76dB, 58-94dB

Method

From a total of 70 samples 25 odours have been so selected as to be representative for the lifelong hedonic smell experiences (stabilized Bezugssystem) with the chosen stimuli preferably equally spaced on the hedonic continuum (Fig. 2). The stimuli were produced by Symrise AG specifically for experimental use. The odors are presented at a solution of 20% via sniffing sticks of 10 cm length and 0,7 cm diameter. Solvent is propylene glycol. There are no signs on the sticks regarding the containing odor.

Single Stimulus, Single Judgment Experiment

In order to get a basis of pleasantness or unpleasantness judgements not influenced by preceding stimuli or judgements for each of the 25 odours 10 students on their way to a lesson were stopped and asked to rate the pleasantness of one single stimulus. The stimulus presented was chosen at random. Judgments were given using a Category anchored Visual Analogue Scale as shown in Fig 2. The measures were given by moving a slider onto the appropriate position of the scale. Invisible to the subject the experimenter got a corresponding scale value in a range between 1,0 = “very pleasant” and 18,5 = “very unpleasant (Fig. 2, lower part).

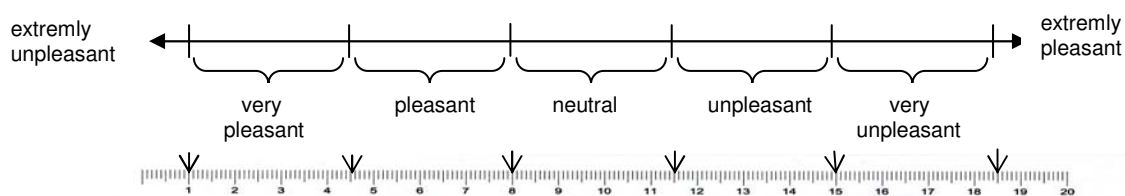


Fig 2. Category anchored Visual Analogue Scale. The scaling position set by a movable slider was transformed in numbers as seen in the lower part, which was not visible for the subjects

Scaling Stimulus Series

The 25 stimuli used in the single stimulus experiments were ranked with regard to their hedonic values and 4 stimulus series were compiled: The P-Series included the 13 most pleasant stimuli, the U-Series the 13 most unpleasant and the N-Series 13 middle stimuli. For Series F about every second stimuli was chosen beginning with the most pleasant to the most unpleasant stimulus (Tab1). The same scale as in the Single Stimulus experiments was used. Each stimulus series was scaled by 10 subjects whereby each subject was allowed only to take part in a single experimental session. Series stimuli were presented 3 times to in randomized order. The heads of the blindfolded subjects were fixed in a chin rest. The sticks containing the odours were fixed 2 cm in front of the nostrils. The subjects were asked to take short and frequent sniffs if a countdown starting at 3 stopped at Zero. Soon after the sniffs were taken the sleep mask was taken off and the subject moved the slider to the part of the scale representing the hedonic value of the odour. The inter-stimulus-interval was 60 sec at minimum. 45 subjects (17♂ and 28♀; mean age = 23,2 years, sd = 4.4) took part in the experiments. 10 subjects in each of the above described conditions and 5 subjects in preliminary experiments testing the experimental procedure.

Results

The average results (arithmetic means and standard deviations) obtained in the single stimulus experiments and in the scaling of the 4 series are shown in tab1.

Tab. 1. Arithmetic means with standard deviation for pleasantness of odours obtained in single stimuli experiments and in stimulus series of different ranges

| Stimuli | Single stimuli | | "Unpleasant" range | | "Pleasant" range | | "Neutral" range | | "Full" range | |
|-----------------------|----------------|-----|--------------------|-----|------------------|-----|-----------------|-----|--------------|-----|
| | mean | sd | mean | Sd | mean | sd | mean | sd | mean | sd |
| Orange | 6.9 | 1.1 | | | 7.5 | 2.2 | | | 6.0 | 2.6 |
| Vanilla | 7.0 | 3.6 | | | 4.3 | 1.9 | | | | |
| Meteorite* | 7.6 | 2.5 | | | 8.4 | 2.9 | | | 4.9 | 3.0 |
| Grapefruit | 8.1 | 3.3 | | | 8.7 | 2.2 | | | | |
| Baby powder (Penaten) | 8.3 | 4.2 | | | 7.8 | 2.2 | | | 4.6 | 2.0 |
| Cypress oil | 8.4 | 2.1 | | | 10.3 | 3.1 | | | | |
| Peppermint oil | 8.5 | 2.6 | | | 7.6 | 3.4 | 4.6 | 1.5 | 4.6 | 1.4 |
| Liquorice | 8.9 | 4.9 | | | 9.5 | 4.1 | 8.2 | 3.0 | | |
| Channel No 5 | 9.0 | 4.8 | | | 7.8 | 3.0 | 6.2 | 3.3 | 6.0 | 3.4 |
| Spruce needle oil | 9.2 | 4.8 | | | 9.2 | 3.6 | 7.1 | 3.2 | | |
| Black pepper oil | 10.8 | 3.3 | | | 11.5 | 3.1 | 9.7 | 3.4 | | |
| Ginger oil | 11.0 | 3.1 | | | 10.9 | 2.5 | 7.6 | 2.4 | | |
| Fluveö* | 11.3 | 3.1 | 7.4 | 1.4 | 11.4 | 3.0 | 10.4 | 3.3 | 9.2 | 3.5 |
| Tainted fish | 11.6 | 3.5 | 8.9 | 2.3 | | | 10.4 | 2.8 | | |
| Gras | 11.6 | 3.8 | 6.9 | 2.4 | | | 6.8 | 3.1 | 9.7 | 2.9 |
| Used frying fat | 12.4 | 1.7 | 9.4 | 1.9 | | | 11.3 | 2.0 | | |
| Bread crust aroma | 12.6 | 3.2 | 8.6 | 2.4 | | | 10.3 | 5.2 | 9.2 | 5.5 |
| Peanut flavour | 13.0 | 2.2 | 9.0 | 2.4 | | | 10.9 | 2.4 | | |
| Fresh yeast | 13.2 | 2.3 | 14.1 | 2.2 | | | 14.9 | 2.3 | 13.7 | 3.3 |
| Green tea | 13.3 | 1.7 | 8.6 | 2.2 | | | | | | |
| Tobacco smoke | 13.6 | 1.1 | 12.9 | 2.2 | | | | | 14.2 | 2.6 |
| Tobacco butts | 14.1 | 1.4 | 10.8 | 1.9 | | | | | 12.1 | 1.8 |
| Smoke | 14.1 | 2.0 | 13.3 | 1.9 | | | | | | |
| Caramel | 14.3 | 1.8 | 7.1 | 2.1 | | | | | 7.6 | 5.3 |
| Vomit | 16.2 | 1.7 | 15.9 | 2.5 | | | | | 17.8 | 1.7 |

In Fig.3 are the results obtained in series of different ranges (ordinate) compared to the results obtained in single stimulus experiments (abscissa). The small symbols on the dashed lines indicate the expected results according to the modelled expectations described above.

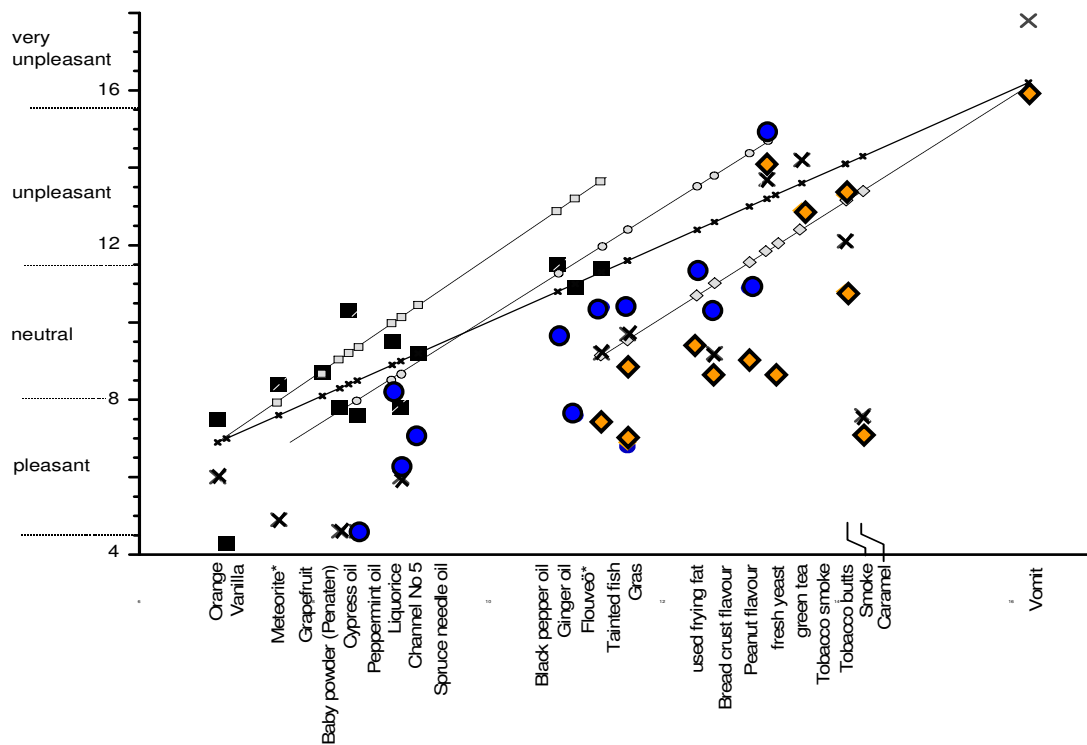


Fig.3: Scale values obtained in series of different ranges (ordinate) related to results obtained in single stimulus experiments. ■ = P-series, ● = N-series, ◆ = U-series, X = F-series.

As seen in Fig. 3 there are neither range effects nor any fit to the proposed model whatsoever. The data obtained in the P-Series are reasonable in line with the Single stimulus judgments. When embedded in series U, N and F most of the stimuli are judged more pleasant than evaluated as single stimuli. Exceptions are the judgments for fresh yeast, tobacco smoke, smoke and vomit, which received about the same hedonic judgments in every condition. Another “exclusive” stimulus is Caramel which was rated being unpleasant in the Single stimulus experiment and being pleasant when presented in a series. These result remained stable when Caramel as single stimulus was presented to another 15 subjects. It seems that some odours, not only Caramel, “change” their hedonic value when presented in the context of other odours.

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