

OP&P Product Research

Where consumer and product meet.

PRODUCT RESEARCH

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Bridging the Gap between R&D and Marketing

The Ideal Profile Method

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making better products

- the food industry must constantly improve and innovate it's products
  - ➢ in order to fulfil the ever-changing needs of the consumer
  - ➢ and in order to stay ahead of the private labels
- the life cycle of most products has become shorter and shorter, which increased the need for fast and efficient product development

Successful products need to be appropriate to the market position, charismatic and meet the consumer's needs, wants & dreams.

Above all they need to reinforce the consumer's perception of the brand.



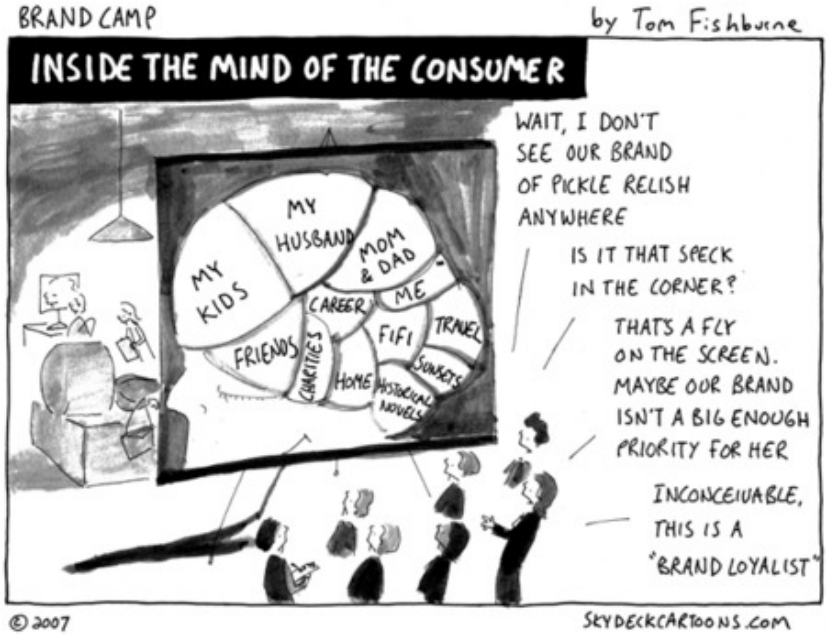




what kind of information do we need?

- the most important aspect is insight in the mind of the consumer
  - ➢ which product would be preferred, which product would have maximum liking?
  - ➢ essential in this respect is the representativeness of the consumers, we only want to know how our target group likes the product
- obtaining this kind of information from consumers is traditionally the subject matter of market research

➢ so we need to find out how our target group likes our product and what drives liking





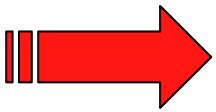
what drives liking?, the underlying model

- liking is maximized when all sensory attributes are ideal or Just About Right
- when an attribute deviates from ideal, liking will be lowered
- the ideal is a reference and should be stable over products and people or clusters of people
- however, the effect of a deviation from ideal depends on the relevance of that attribute for liking

- in other words: liking (A_j) is a weighted linear combination of the deviations from ideal (i.e. the perceived attribute intensity minus the ideal intensity)

$$A_j = -\sum_{i=1}^{n} b_i \left| X_{ij} - I_i \right|$$

- *where:*
  A_j is the averaged consumer liking judgment for product *j*
  b_i is the relative importance of deviations on attribute *i* for consumer's overall liking
  X_{ij} is the consumer perception of product *j* on attribute *i*
  I_i is the ideal level of attribute *i* that would generate maximum liking



liking (A) is maximized if $|X_{ij} - I_i| = 0$

reference: Engel, Blackwell & Miniard, 1995

what other information do we need?

- we have to know what to change in order to adjust our products in such a way that we minimize the differences from ideal ($|X_{ij} - I_i|$)

  ➢ what are the perceived and ideal intensities for the relevant sensory attributes?

- there are many different methodologies to obtain information about the (sensory) properties of the products and to compute or measure the ideal levels

  - similarity scaling and napping
  - PickAnyThatApplies scaling
  - Flash profiling
  - Free choice profiling
  - QDA
  - Spectrum, and many more
  - Prefmap regression
  - JAR scaling
  - Ideal Profile Method (OP&P)

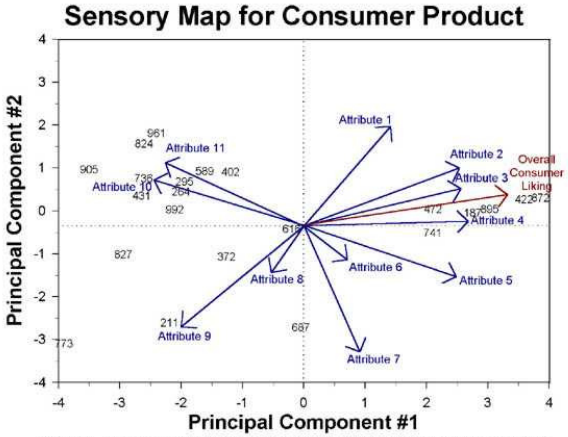
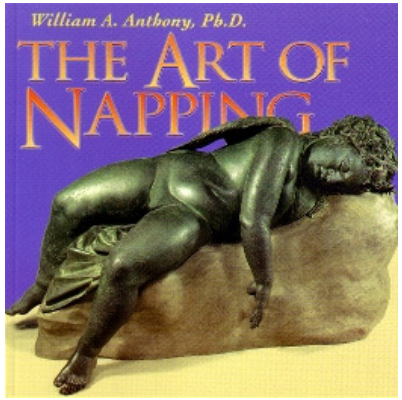


Figure 1. Sensory map of principal component 1 versus principal component 2 for a consumer product with 22 different samples. Arrows represent descriptive attributes (in blue) and overall consumer liking (in grey). The 3-digit codes represent the samples. Data presented only as an example.



sensory characterization of products

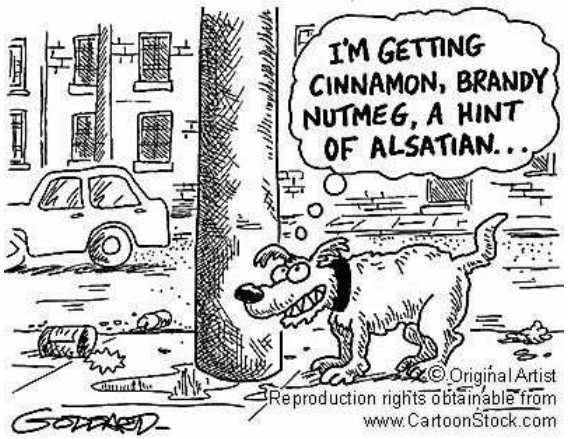
- how do the different products or objects differ?
- which perceptible sensory characteristics describe the products?

➢ this question is answered differently by sensory professionals and market researchers

➢ the sensory professional will prefer to use trained or expert tasters

➢ market researchers will prefer use consumers from the target group

➢ it is even possible to use chemico-physical or other, non-sensory data





who, how and why?

- consumers, trained tasters, experts, flavourists, anyone can profile products







- but the question is: are they any good?

- formally, panel results (whether trained or untrained, expert or consumer) should fulfil three criteria (Husson and Pagès, FQP 12, 2001, 291-296):

1. Consensus.
2. Reproducibility.
3. Discriminability.

- we can check whether our data meet these criteria

to sum up

- we need liking information about products: **A**
- we need sensory information about the same products: **X**
- we need information about the deviations from ideal: **X-I**
- we need information about the relevance of individual attributes for liking: **ß**

different methodologies

- there are different alternatives to obtain the required information:
  - expert profile combined with consumer liking (classical sensory)
  - JAR scales (the market research approach)
  - Ideal Profile Method (combining sensory and market research)

⇒ we prefer to obtain this information from the final target group: the consumers because:

1. The consumer is the final judge.
2. Using consumers is faster and more cost efficient.
3. Consumers can give both hedonic and objective sensory information.

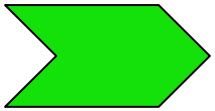
- we will focus on the ***Ideal Profile Method*** because it measures **A**, **X** and **I** directly

for a comparison of these methodologies see:

van Trijp, Punter, Mickartz and Kruithof, The quest for the ideal product: comparing different methods and approaches; FQP, 2007, 18, 729-741

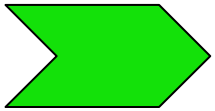
principles of the Ideal Profile Method

- consumers profile the products on 20-40 sensory attributes and 6-10 acceptance aspects
- for each attribute, they rate the perceived intensity and the preferred or ideal intensity (this is done for each product)



this results in a perceived and ideal profile for each product

- the underlying sensory dimensions are extracted from the intensity ratings by means of PCA on the total data set (products and subjects)



this results in a smaller number of combined attributes or dimensions

- regression of overall liking on the factor scores shows the regression weights (relative importance of the different dimensions for liking)
- these are used to calculate the importance of the deviations from ideal for the different attributes

a practical example: perfumes

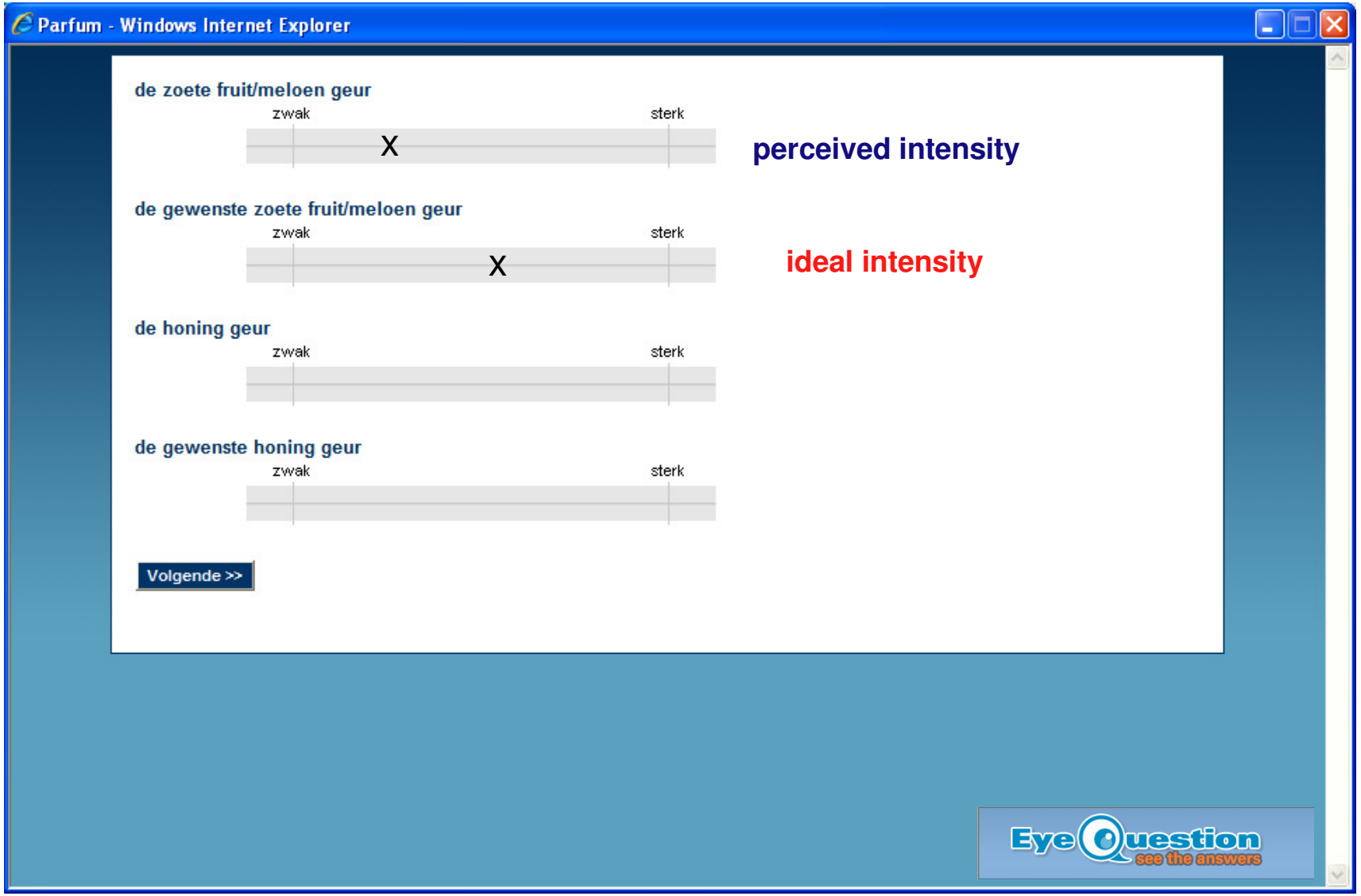
- why perfumes?
  - this was part of a larger study in collaboration with the AgroCampus Rennes involving both perfume experts and students
  - part of the results have been presented at the 9th Sensometrics meeting, Canada 2008 (workshop A-1, How reliable are the consumers?, Worch, Lê and Punter)
  - here the results from the Dutch consumers are presented

- consumer study set up:
  - 12 different Luxury perfumes, 2 perfumes have been replicated
  - 103 consumers (both males and females)
  - 21 intensity attributes, both for perceived and ideal intensity
  - 6 acceptance aspects and overall liking
  - a sequential monadic test (2 sessions), balanced presentation order
  - perfume was sprayed on a cotton pad in a Styrofoam cup with a lid (the cups were replaced every hour)

Angel (Eau de Parfum)
Cinéma (Eau de Parfum)
Pleasures (Eau de Parfum)
Aromatics Elixir (Eau de Parfum)
Lolita Lempicka (Eau de Parfum)
Chanel N°5 (Eau de Parfum)
L'Instant (Eau de Parfum)
J'Adore (Eau de Toilette)
J'Adore (Eau de Parfum)
Pure Poison (Eau de Parfum)
Shalimar (Eau de Toilette)
Coco Mlle (Eau de Parfum)



scale example



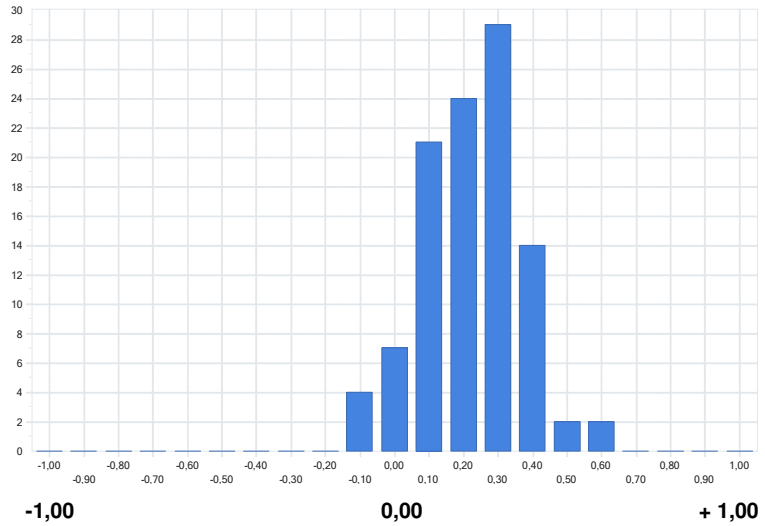
the results

- are they any good?

- let's check the
  1. Consensus.
  2. Reproducibility.
  3. Discriminability.

consensus, discriminability, reproducibility

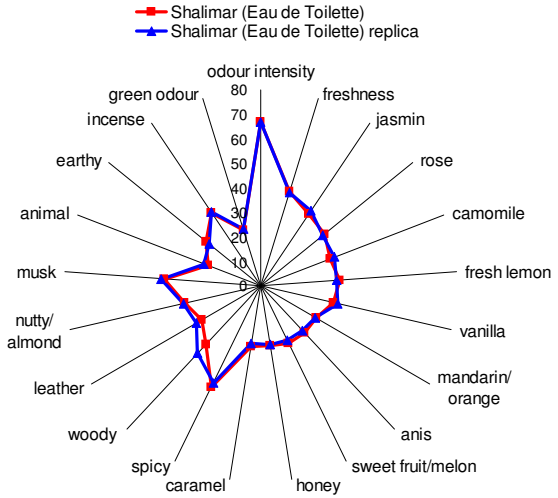
- consensus
  - the distribution of the correlations of each individual (i) with the group-(i) is shown on the right
  - almost all correlations are positive, so there is consensus between the judges



- discriminability
  - the consumers can significantly discriminate the 12 different products on all attributes except camomile

- reproducibility (only for the 2 replicates)
  - the consumers are reproducible on all attributes except woody

- their performance is not different from that of 12 perfume experts



sensory and ideal profiles

- the next step is to make spider plots for the average intensity ratings for each product and of the ideal ratings
- when the ideals do not differ significantly from each other over products, the average ideal is taken

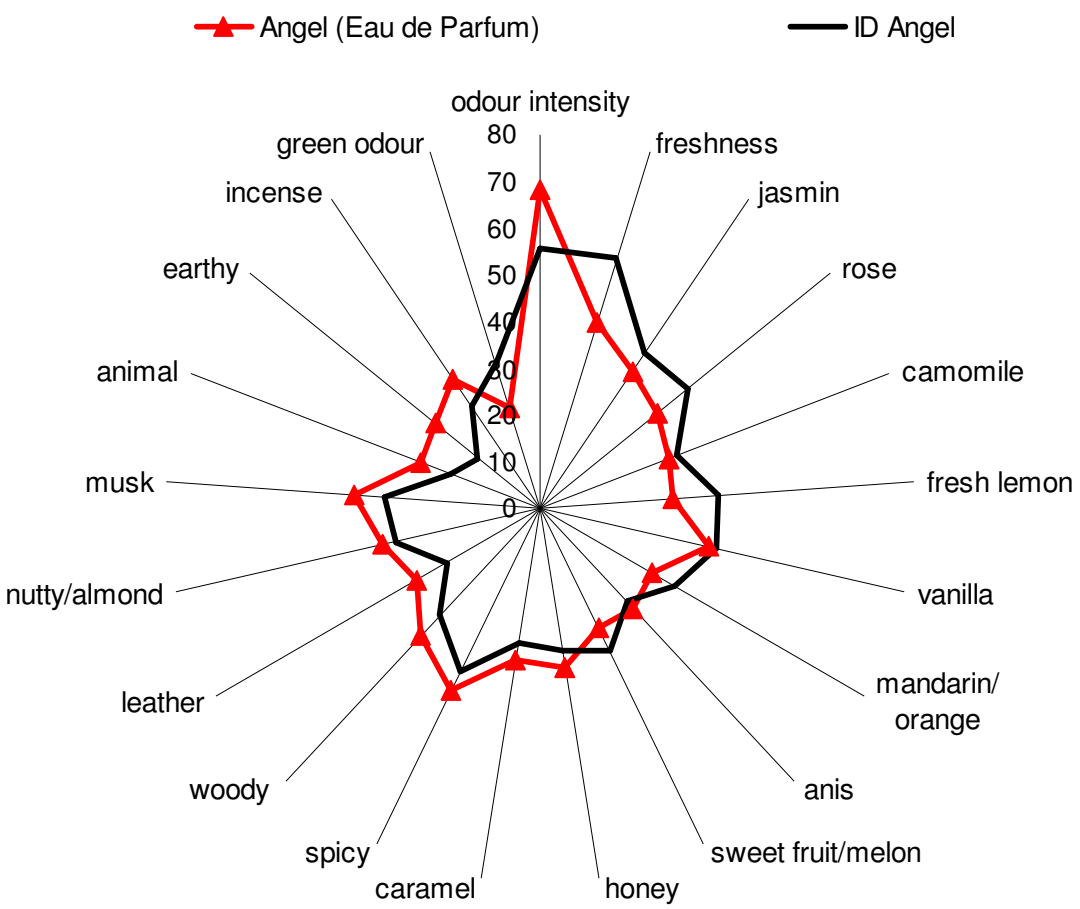
- this will show on which attributes the products differ from ideal ($|Xij - Ii|$), but it does not tell us how important this deviation is (we don't know βi)

- first we will inspect the profiles

the sensory and ideal profile for Angel

- the profile of Angel deviates clearly from ideal on most attributes
- the odour is too intense, it lacks freshness, flowers, citrus and sweet fruits and green odour
- it has too much honey, spicy, woody and leather notes and too much musk, animal, earthy notes and incense

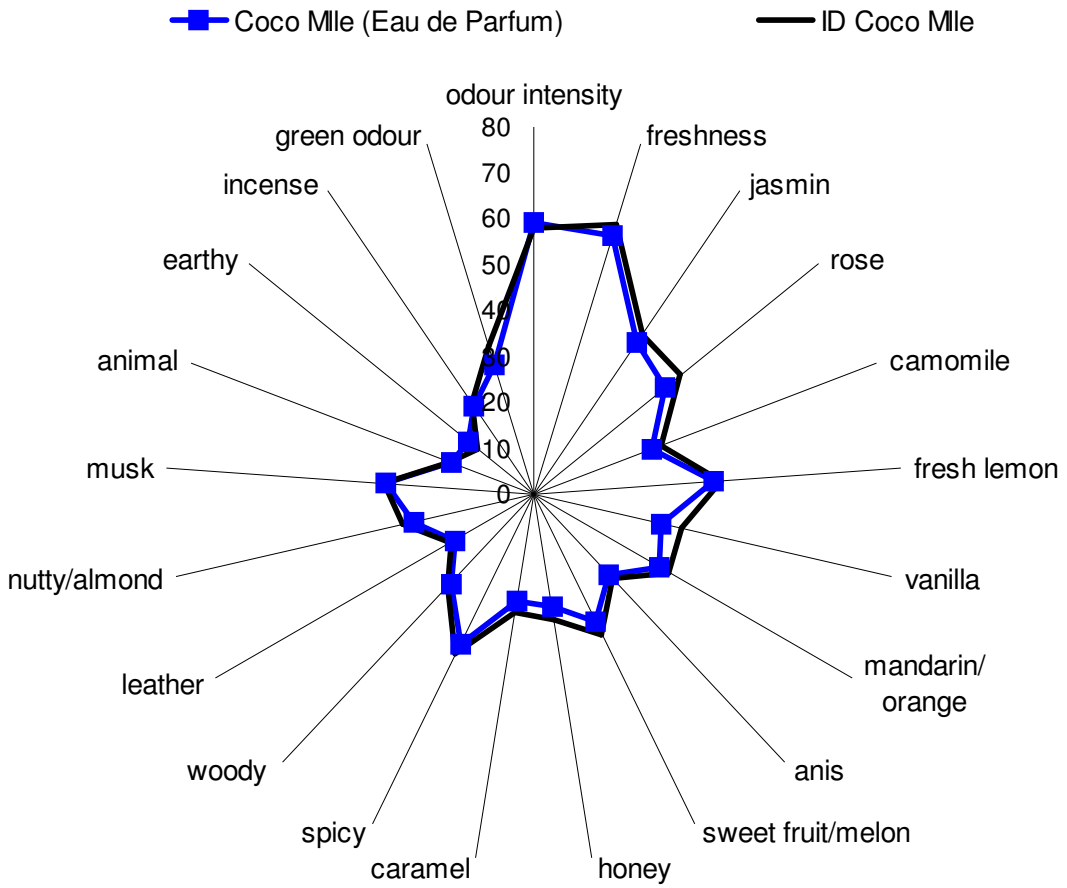
- the liking rating is very low (4,5 on a 9-point scale)



the sensory and ideal profile for Coco Mlle

- Coco hardly deviates from ideal
- the odour lacks some freshness, jasmine, rose, camomile and vanilla and some honey and caramel
- the differences from ideal are relatively small

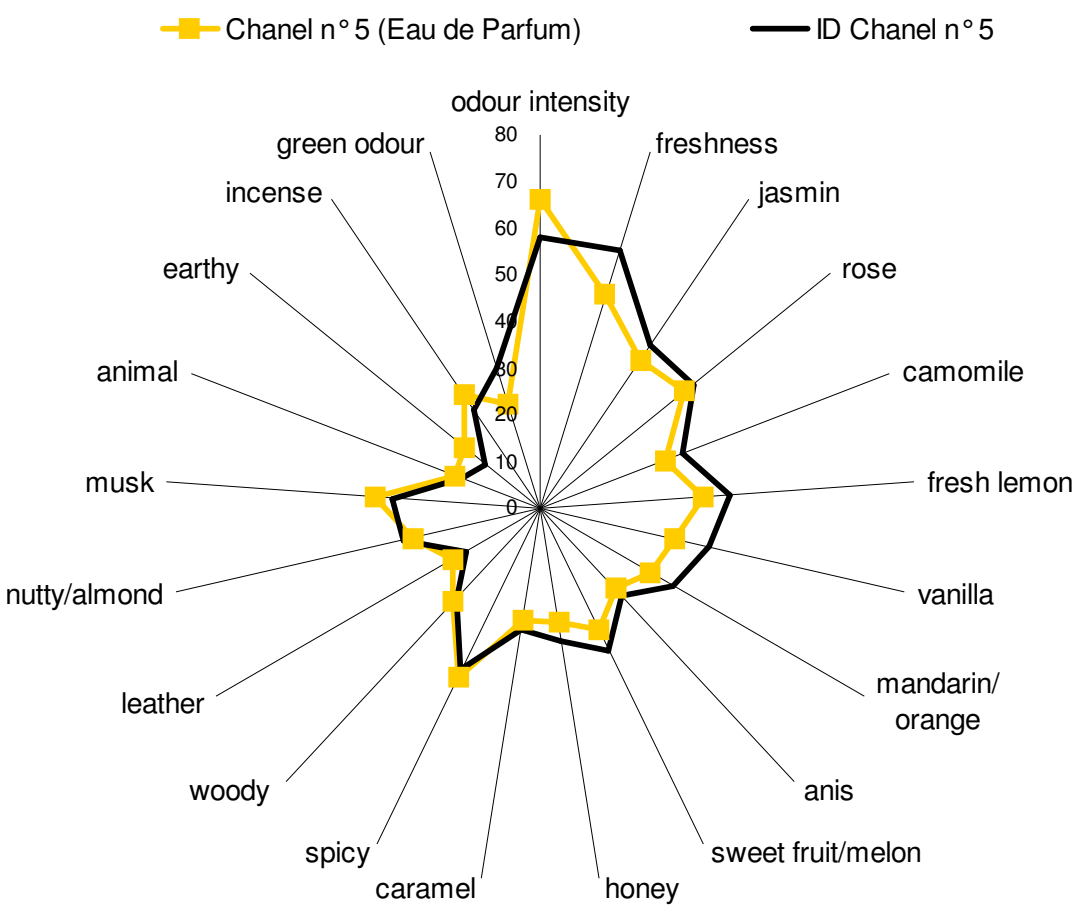
- the liking rating is one of the highest (6,5 on a 9-point scale)



the sensory and ideal profile for Chanel n° 5

- Chanel is too strong and lacks freshness, jasmine and camomile
- it lacks fresh lemon, citrus and vanilla
- it lacks sweetness and green odour and it is too spicy, musky and earthy

- the liking rating is in the middle(5,2 on a 9-point scale)



the importance of the attributes for liking

- next, we have to estimate the relevance of the different attributes for liking
- since we can not run a regression analysis on the individual attributes (they are not independent) we first extract the underlying dimensions

➢ step 1: the underlying perceptual dimensions are extracted (PCA with varimax rotation on the sensory attributes, either by product or by product and consumers)

➢ step 2: regression of overall liking on the factor scores to estimate the regression weights (β)

➢ step 3: compute the ß weights per attribute (ß weights for each factor * attribute factor loadings)

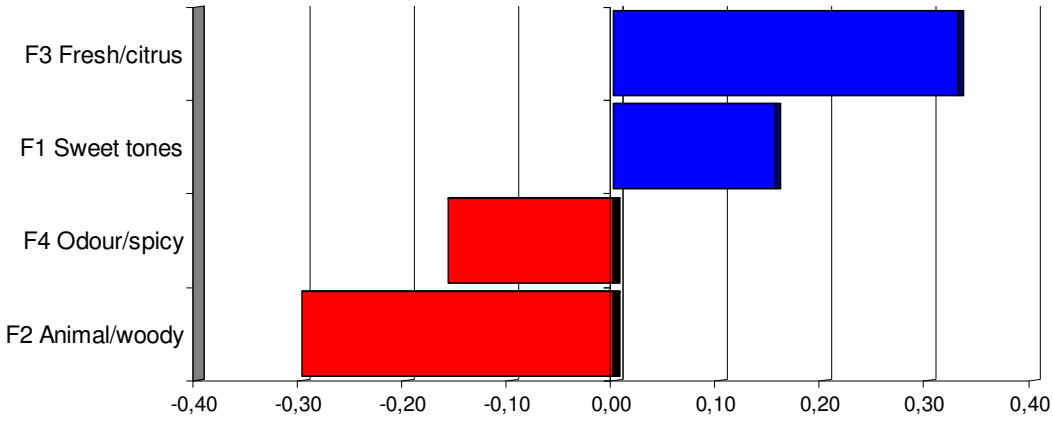
the underlying perceptual dimensions and β's

- PCA extracted four factors from the 21 intensity attributes (62% VAF):

F1 Sweet notes vanilla, caramel, honey, anis, sweet fruit/melon, camomile	**F2 Animal/woody** animal, earthy, leather, woody, musk, nutty/almond, incense
F3 Fresh/citrus fresh lemon/bergamot, freshness, green odour, mandarin, orange, rose, jasmine	**F4 Odour/spicy** odour intensity, spicy

- regression analysis of the liking ratings on the factor scores revealed the following drivers of liking (only significant ones, r=0,50; blue=positive and red=negative driver):

factor	ß weight
F1 Sweet tones	0,15
F2 Animal/woody	-0,30
F3 Fresh/citrus	0,33
F4 Odour/spicy	-0,16



computation of the contributions per attribute

- the regression weights (β) tell us how much each factor or Principal Component contributes to liking
- however, we need to know the contribution of the individual attributes to overall liking in order to estimate the effect of the deviations from ideal for each attribute

  - the next step is to compute the contribution for the individual attributes (β_i)
  - for each attribute within a factor, the contribution to overall liking is computed using the formula:

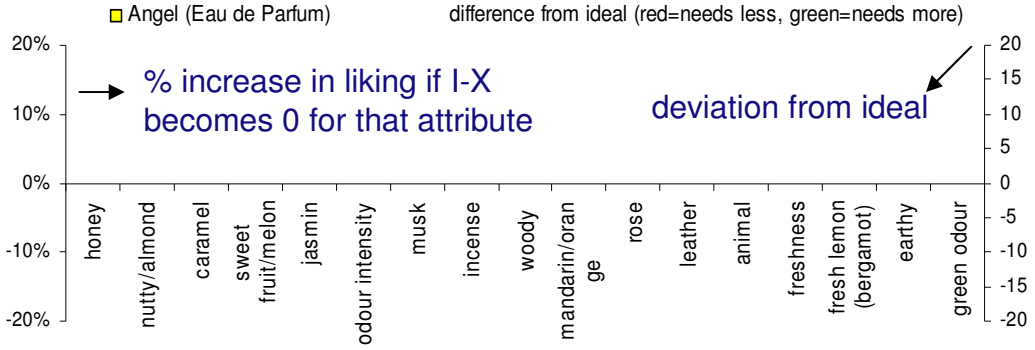
$$effect_attribute_j = \sum_{k=1}^{\#\,factors} factorloading_{jk} * \beta_k$$

in which k is the number of factors and j the number of attributes

deviation from ideal and the contribution to overall liking by attribute

- next, for each attribute and product the deviation from ideal (delta) is computed (X_{ip}–I_{ip})
- multiplication of delta with the "effect_attribute$_i$" gives the amount of change in overall liking for that product ***if*** that attribute would be ideal
- next, the relative change is computed (the percentage change in overall liking when the attribute gets an ideal rating)
- the resulting data are plotted for the most important attributes (per attribute the absolute difference from ideal and the relative increment of overall liking if that attribute is made ideal), this is done for each product
- we call this the fishbone plots

fishbone example



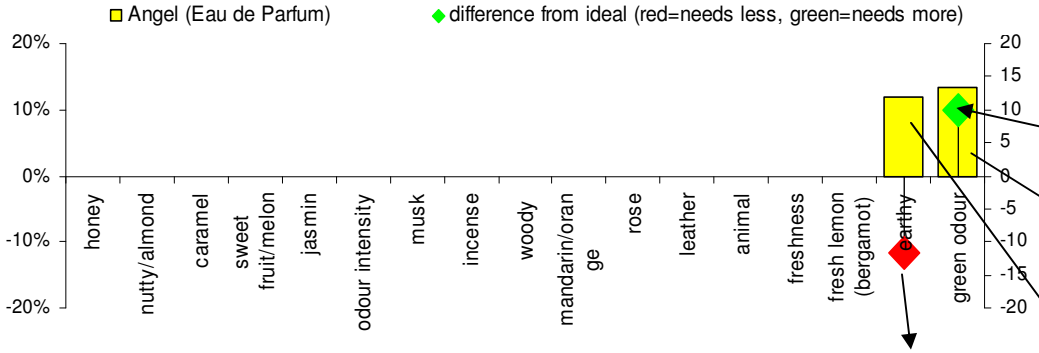
% increase in liking if I-X becomes 0 for that attribute

deviation from ideal

I – X> 0, we need more

I-X = 0, attribute is ideal

I – X< 0, we need less



when the green odour is increased with 10 points

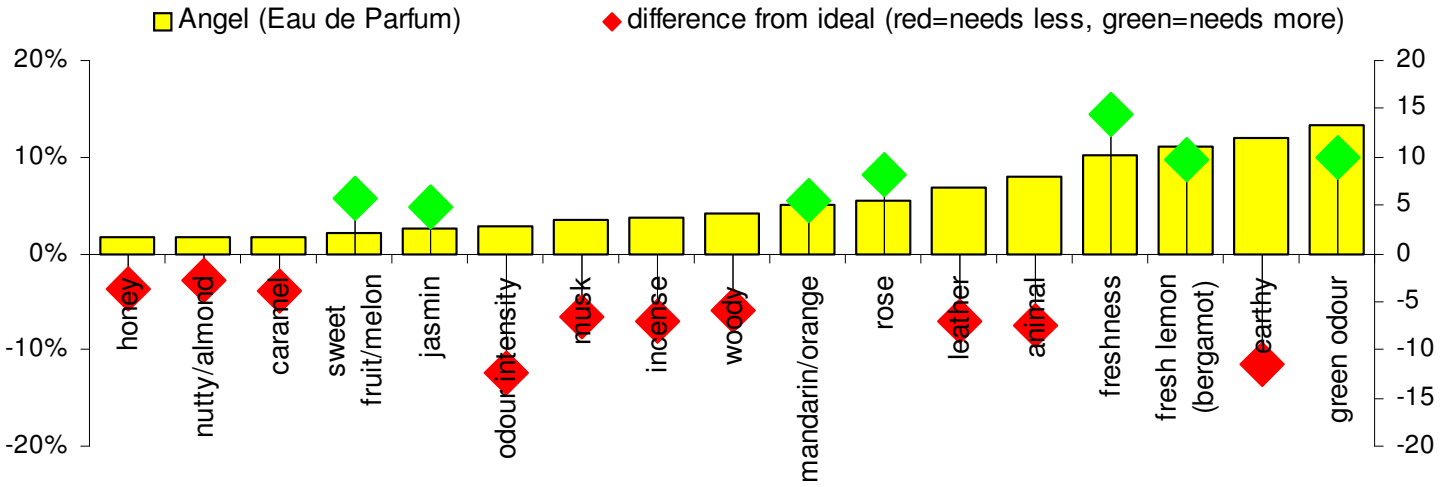
liking is increased with 13%

when the earthy odour is decreased with 12 points,

liking is increased with 12%

fishbone plot for Angel (liking 4,5 on 9-point)

the relative increase in liking (%, left axis, yellow bars) when the differences from ideal are reduced to zero (right axis, marked lines)

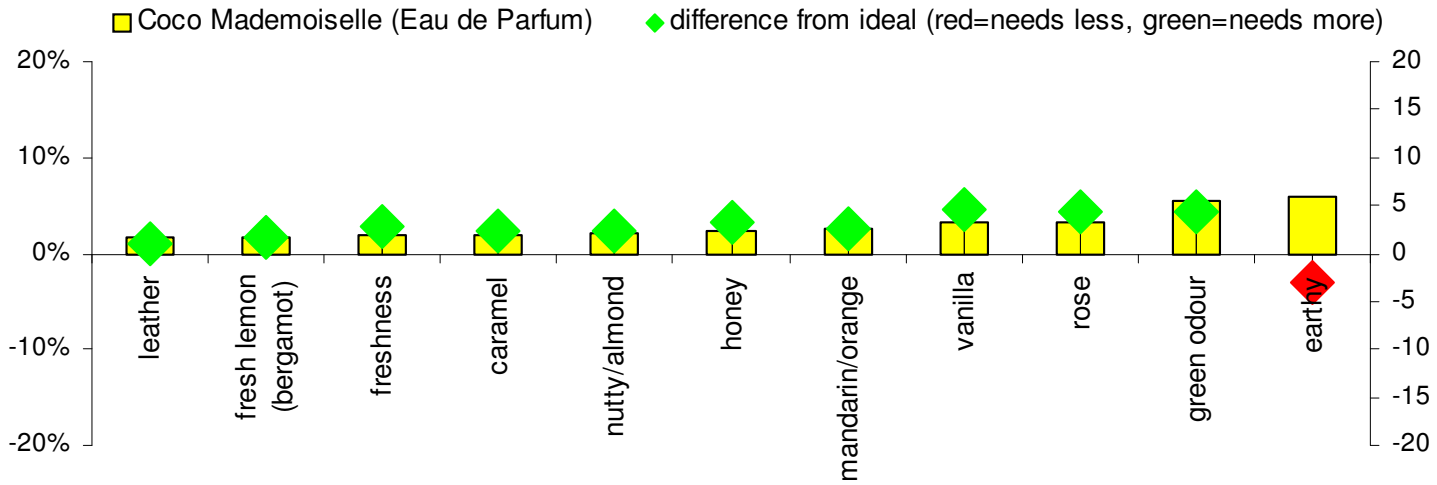


- decrease:
  - earthy, animal and leather notes
  - incense and woody notes
  - odour intensity and caramel, honey
- this increases freshness

- increase:
  - green odour, fresh lemon, citrus
  - rose, jasmin and fruit/melon
- this also increases freshness

fishbone plot for Coco (liking 6,5 on 9-point)

the relative increase in liking (%, left axis, yellow bars) when the differences from ideal are reduced to zero (right axis, marked lines)



- decrease:
  - earthy
- increase:
  - green odour, rose and vanilla

there is actually very little improvement possible,
the liking rating of 6,5 is the best possible under these circumstances:



it can be worse liking 2,2





it can be better liking 8,2

summary and conclusions

- the industry needs detailed information about consumer liking and about the best way to optimize their products
- consumer liking will increase when the difference between perceived and ideal attribute intensities become smaller
- so we need information about consumer liking and about the intensity of perceived and ideal product attributes
- to obtain perceived and ideal intensities many alternatives exist, among which the Ideal Profile Method (IPM)
- IPM uses consumers to obtain both liking and perceptual data directly

- analysis of the results shows a plot with the deviation from ideal for each attribute and the potential relative contribution to liking if that deviation would become zero

- with this information, R&D has a guideline for product optimization
- but keep in mind that we are not the product experts, the final interpretation has to be made by the experts themselves

references

- *The quest for the ideal product: comparing different methods and approaches; van Trijp, Punter, Mickartz and Kruithof; FQP, 2007, 18, 729-741*

- *Which value can be granted to sensory profiles given by consumers? Methodology and results; Husson, Le Dien and Pages; FQP, 2001, 12, 291-296*

- *Evaluation of the stability of the PCA products' maps in function of the data taken into consideration; Thierry WORCH & Pieter PUNTER, Agrostat, Bruxelles, January 2008*

- *How reliable are the consumers? Comparison of sensory profiles from consumers and experts; Worch, Le Dien, Punter; Sensometrics, Canada, July 2008*

- *papers can be downloaded from the website:* ***www.opp.nl***

thank you for your attention

- are there any questions?

