From sensory analysis to perceptive judgment:

some approaches to study food preference and eating behavior

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A central preoccupation

What is the role of senses in consumer judgment?
Perception

From philosophical debates to research *experimentations*
Eleonor Rosch, 1978

Categorisation is the cognitive process used to handle the world

**FURNITURE**

Super ordinate category / **generic**

- **TABLE**
  - Basic category
- **CHAIR**
- ...

Garden table

Subordinate category / **specific**

- Kitchen table
- ...

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**In sensory evaluation?**

**HOT DRINKS**

**COFFEE**

- Soluble coffee
- Filtered coffee
- Espresso coffee
- ...

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Perception
In sensory evaluation?

HOT DRINKS

COFFEE

Soluble coffee

Filtered coffee

Espresso coffee

…

Nescafé

Jacques Vabre

Maxwell house

Factory 1 Day 1

Factory 1 Day 2

Factory 2

Batch 1

Contemporary cognitive theories

Perception is the result of mental operations giving a meaning to sensory input

Bottom – up

J. Gibson

Ecological theory

Direct Perception

Top – down

J. Bruner, E. Rosch

Categorisation

Multimodal and semantic (categories, practices, memory)
Sensory evaluation

Which theoretical frame to use for designing studies and selecting the appropriate methodology?
Psychophysics approach: perception as a bottom-up process

OBJECT

Physical / Chemical Stimulus

SUBJECT

Sensory Response

Cognitive approach: perception includes top-down processes

Cognitive representations

Categories

SUBJECT

Sensory properties

OBJECT

Usage properties

Physico-chemical properties
A proposed conceptual frame for Sensory evaluation

There are two complementary perspectives associated in sensory evaluation

1. An Object-centered one
   - The formulation and process factors contributing to sensory quality
     What is the impact of any change in the recipe or the production of a food?
     ➔ *Experimental designs and products' analysis*
   
   - The physical and chemical mastering of « stimuli »
     What are the physical and chemical determinants of sensations?
     ➔ *Instrumental / sensory correlations*
   
   - The measurement of sensory properties
     What are the sensory properties of given samples – innovations, competitors …?
     ➔ *Description of sensory properties (trained panels)*
2. A Subject-centered one

- The correspondence between sensory panels’ & consumers’ perception
  - Do experts and consumers perceive a given set of products the same way?
    → Free sorting, categorization task
  - Do experts and consumers describe products with the same words?
    → Language studies

- Better understand consumers and inter-individual judgment differences
  - How do consumers structure their mind relatively to a given product category?
    → Language studies
  - What is the validity of CLT for predicting preference (and purchase)?
    → In situ testing

1. Free sorting
2. Language studies
3. In situ testing
Free sorting

With P. Faye (PSA Peugeot Citroen), P. Courcoux (ENITIAA), H. Nicod (Adriant)

Free sorting (categorization)


**oWhy ?**

- Similarity / dissimilarity judgments between objects are considered to be the fundamental processes to designate objects as members of categories
- To get relative perceptual positionning of samples from given consumers

**oWhat ?**

- 1. The sorting task consists in grouping samples from their similarities and differences. It allows evaluating large sets of products (without reasoning).

- 2. Perceptive dimensions are computed from the similarity matrix by multidimensional scaling (MDS)
How?

- **Products**
  - Samples from a given category (e.g., commercial vanilla milks)
  - Selection is crucial and homogeneous presentation is critical
  - Minimum 10–12 up to 20–30

- **Respondents**
  - Untrained subjects
  - Minimum 20–30 up to 150–200 for segmentation

- **Task**
  - “Group the samples according to their resemblance. You are free to choose the number of groups and the number of samples per group”

- **Analysis**
  - Individual sorting matrices (co-occurrence), then total matrix: samples grouped together are more “similar” than samples sorted in different groups
  - Multi Dimensional Scaling (stress <0.1, number of dimensions)

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**Consumers' tactile sensitivity, leathers**

18 black leathers

consumers' (N=200) MDS space

Expert (N=13) PCA space

Consumers and experts show comparable perceptive spaces (RV=0.87)

Faye et al. (2006)
Extensions

**oDescription**
- Linked to a vocabulary study for the groups’ description:
  - Each subject describes the groups he/she made
  - Illustrative correlation of the words occurrences with the MDS coordinates

**oPreference**
- Linked to a monadic hedonic study for preference mapping
  - Each subject gives hedonic ratings of each product
  - Modelling correlation of MDS coordinates with the hedonic ratings

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**Consumer perceptive map**

⇒ *2 dimensions configuration (200 consumers)*

- Stress: 0.028

Faye et al. (2006)
Preference Mapping with perceptive map

Class 1: Vector model – $R^2 = 0.92$

Axe 1 - Inertia 77.3%

Axe 2 - Inertia 22.7%

Based on the cognitive process of categorisation, free sorting gives access to Products' perception by consumers.

Comparison of perceptual spaces are then possible between individuals.
Language studies

with D. Dubois (CNRS), C. Hugol-Gential (Institut Paul Bocuse)

Language aims at communicating between people, both on objects and concepts. Somehow, we share a same language but...

**CONSUMERS**
- Numerous and diverse
- With various food practices
- Elicitation in free context

Their words
- Many ones
- Complex (sentences)
- Polysemic (several meanings)
- Idiosyncratic (personal)

Their concepts (categories)
- Built over a variety of cultural practices
- Related to function and usage
- Fuzzy and instable categories
- Associated to values

**EXPERTS**
- 12 to 15
- Selected and trained
- Standardized context

Their words
- Limited number (10–40)
- Simple forms (adjectives)
- Monosemic (1 consensual meaning)
- Collective learning

Their concepts (categories)
- Built through a collective learning
- In reference to a scientific knowledge
- Well-defined and referenced
- Aiming objectivity on products

Studies focused on concepts
To better understand (some) consumers’ relationships to a (given) food category: habits, values, usage...
Deep qualitative interviews linked to experience (during, right after or from memory)

Studies focused on products
To know how consumers perceive given products
Properties’ elicitation after tasting (monadic, sorting) + encoding

Nota: importance of familiarity and practice (to be defined according to each study) ➔ always with targeted consumers

A texture study
- 10 semi solid products: a wide range of texture (and appearance)
- 9 chefs + 9 consumers
- Texture description + Projective evocation
- Audiovisual recording
Lexicon

- Both experts and consumers use 3 types of descriptions

Specific adjectives

- Hedonic
  - Agréable

- Descriptive
  - Liquide
  - Homogène
  - Épais
  - Froid
  - Compact
  - Doux
  - Dur
  - Brillant…

Reference to an object

- Materials
  - Argile
  - Cirage
  - Pommade
  - Gel
  - Talc…

- Foods
  - Bonbon
  - Chocolat
  - Crème dessert
  - Farine…

Usage properties

- For cosmetics
  - Facile à appliquer

- For food
  - Friable
  - Cassant…

Meaning

The differences come on projective wording

Chefs are more technical and more accurate
Sample D

« ce serait vraiment quelque chose qu’on va chercher exceptionnellement à la ferme ou au marché, qui est fait qui est fait manuellement… avec beaucoup de goût et… et toutes les calories qui vont avec… »
(Consommatrice)

« C’est la meilleure crème au monde. C’est une crème, dès qu’on met le nez dedans on peut plus s’en passer. C’est une crème qui se cuit pas et on mange ça… C’est de la triple crème pratiquement. Elle est très douce et les suisses mangent ça dans le canton de la Gruyère. »
(Chef)

« Plus épaisse que la crème épaissie. Parce que là il y a, visuellement, là y a ces petites pointes dans la crème, on va voir… si ça fait un peu ça, le bec d’oiseau comme on dit, c’est de la crème montée pas trop montée »
(Chef)

Language consideration helps to develop more precise methodological protocols
1) to analyse products
2) to understand consumers
In situ testing
with D. Morizet, P. Fernandez, O. Wathelet
(Institut Paul Bocuse)

Why?
• To take top-down processes into account:
  1. Test products in real consumption situations
  2. Study choices and behaviors in real situation

What?
1. Quantitative test in situ
2. Observation & Qualitative test in situ

Body movements and glances

Close observation of gestures
Laboratory or real situation fieldworks have experimental bias. The point is to know which one is important to minimize

- In situ tests are appropriate for studying subjects in action, taking all contextual effects into account

To conclude
To keep in mind …

- Culture is not only a matter of countries.
  - People in a same region exhibit different practices, different values. They build their own references in memory.
  - They have personal cognitive categories.

- Beside the food, perceptive judgment is a top-down process
  - Consumers are influenced by:
    - the context,
    - the information,
    - the persons they share the meal with,
    - the price they paid the food
    - …
Select the appropriate method

Focus on **habits**
Gestures and practices
Observation
+ Tests in situ

Focus on **product**
Sensory or Hedonic scaling
+ Free sorting
+ Language

Focus on **mental categories**
Evocations and discourses
Language

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Which consumers?

Which food category?

Which context?

Conditions?

Which context?

Target group?

Which consumers?

Samples?
Thank you for your attention

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References
Psychology


Free sorting

**Language**


**In situ testing**

The research center’s systemic scope

Multiple disciplines are combined for both Basic & Applied Research
A unique combination of facilities and tools

o Experimental and modular facilities
- Restaurant + Kitchen

o High technical tools
- Culinary and hospitality know-how of the Institut Paul Bocuse
- Audiovisual recording (discourses, gestures, interactions, choices …)
- Biological analysis (Biomedical at CRNH; Neurosciences at NSCC…)
- Psychosocial and behavioral studies (questionnaires, interviews, focus groups, sensory …)
- Experimental design, statistics and modelling

AN EXPERIMENTAL RESTAURANT

Multiple set-up
- Design
- Furniture
- Plates dressing
- Light
- Space arrangement
- Sound
- Waiter’s uniforms
- Menu
- Price

Brasserie & Pub
- Table for 2
- Bar
- Music

Restaurant
- Self service
- Salad & sandwich bar
- Hot & cold meals
- Group set up
- Cashier

Gastronomic Restaurant
- Round tables
- Crystal chandelier
- Cotton cloth
- Classical music
- Service
AN EXPERIMENTAL KITCHEN

Classical and high technology equipments
- Multi-wave oven
- 4 induction
- 4 gaz
- Chill Therm
- Plancha
- Braisière
- Bain marie
- Fry

High diversity of foods
- Collective
- Traditional
- High range
- Thematic
- Family
- Rapid

ADVANCED TOOLS

FOOD & HOSPITALITY & SERVICE
Faculty and student resources from the Institut
Cuisine, pastry, bakery
Restaurant: Service, wine, arts de la table

OBSERVATIONS AND RECORDINGS
Numerical data
Restaurant and Kitchen: cameras / microphones
Feed back screen from the restaurant

LABORATORIES
Non-invasive biomedical tests (linked to CRNH ; hospital facilities)
Sensory tests: psychophysics, trained panels
Neurosciences (linked to Lyon University NSCC laboratory)

CUSTOMER STUDIES AND QUESTIONNAIRES
Qualitative: interviews, focus groups
Quantitative: questionnaires, choices
The research activity is part of a teaching faculty institute (BSc, MSc, PhDs)