Food Sensory Science

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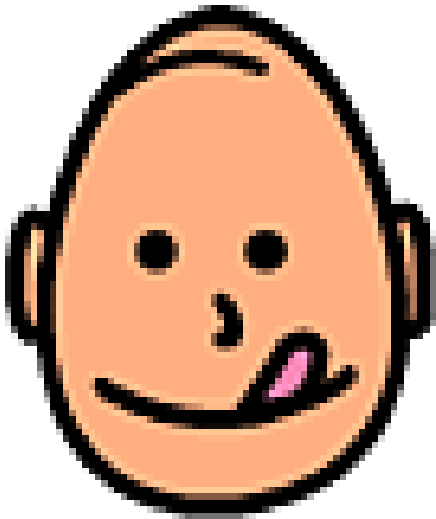

References (recommended)

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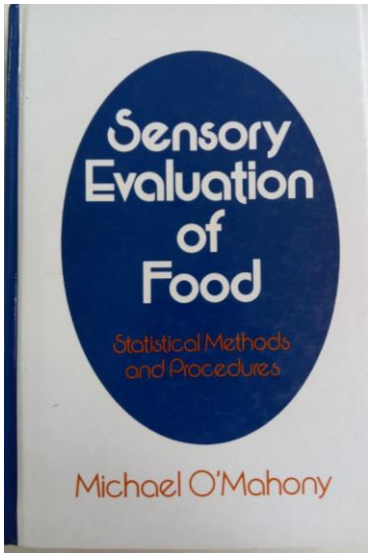
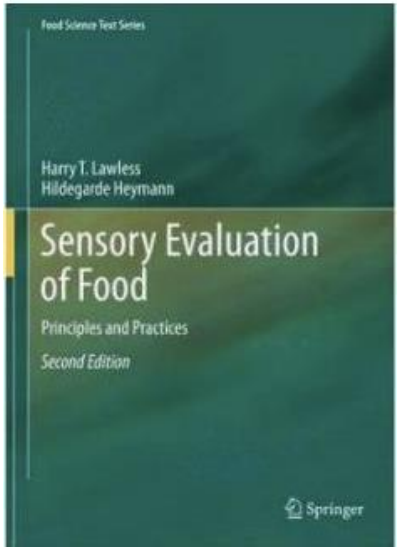
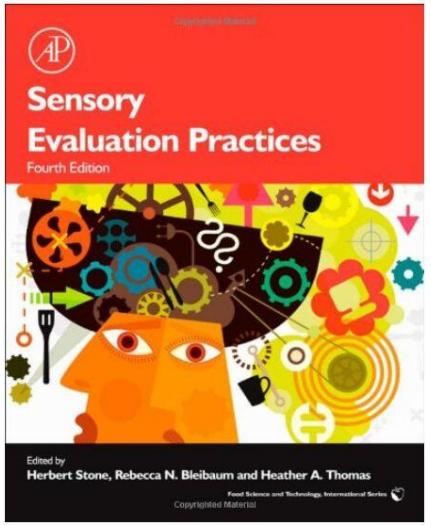
II. Sensory Evaluation of Food. Principles and Practices. H. T. Lawless & H. Heymann. Springer (2nd ed.), New York, 2010.

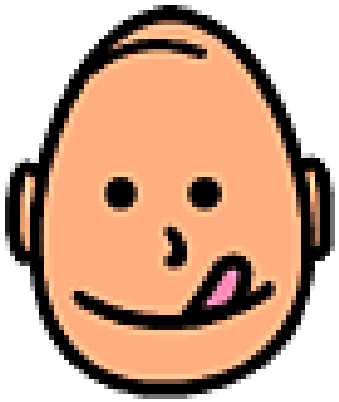
III. Sensory Evaluation Practices, H. Stone, R. Bleibaum, and H. A. Thomas. Elsevier/Academic Press (4th ed.), Amsterdam; Boston, 2012.







Chapter 1.
Introduction to Food Sensory Science

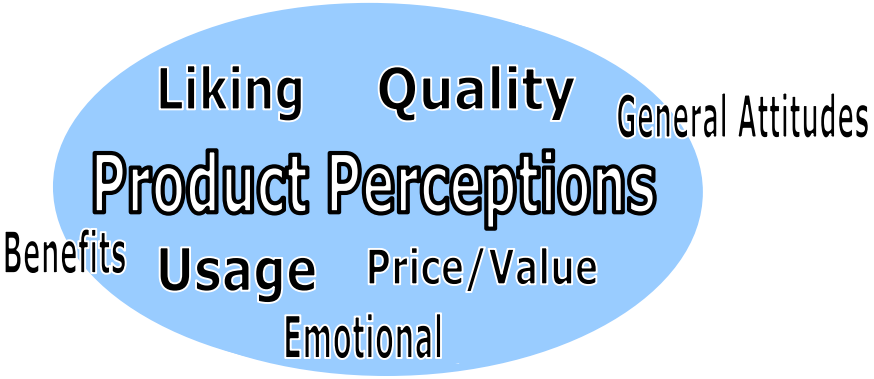


Sensory Science comprises a set of techniques for accurate measurement of human responses to foods and minimizes the potentially biasing effects of brand identity and other information influences on consumer perception."

- Lawless and Heymann
(Sensory Evaluation of Food)

Food Choice

- Effects of sensory properties
- Effects of society and culture
- Individual differences
- Food impression and Consumption behavior
- Marketing Guidance



Consumer Behavior Science

1.1 Why we need Sensory Evaluation ?

Sensory science can…

-find out what customers think about your products and services.

-find out if people can detect changes

-find out how your products perform compared to others

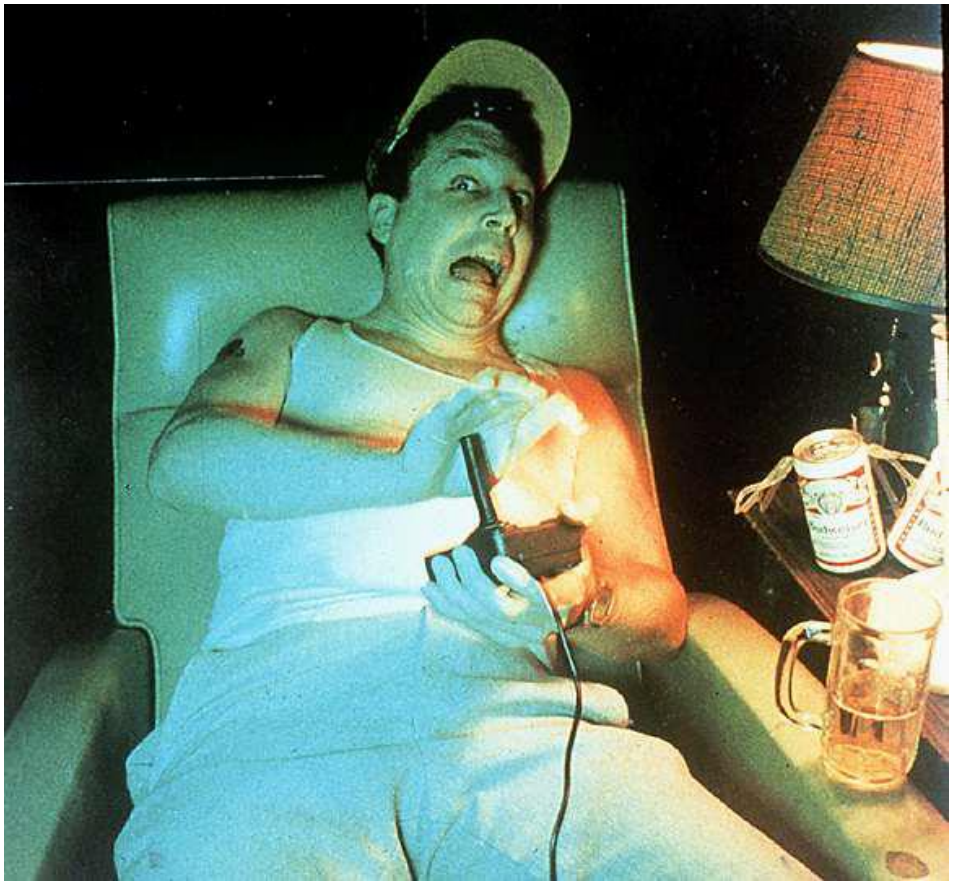
1.1 Why we need Sensory Evaluation ?

win in the market place

Uses of Sensory Evaluation

- **Consumer tests**
  - Do I like it?

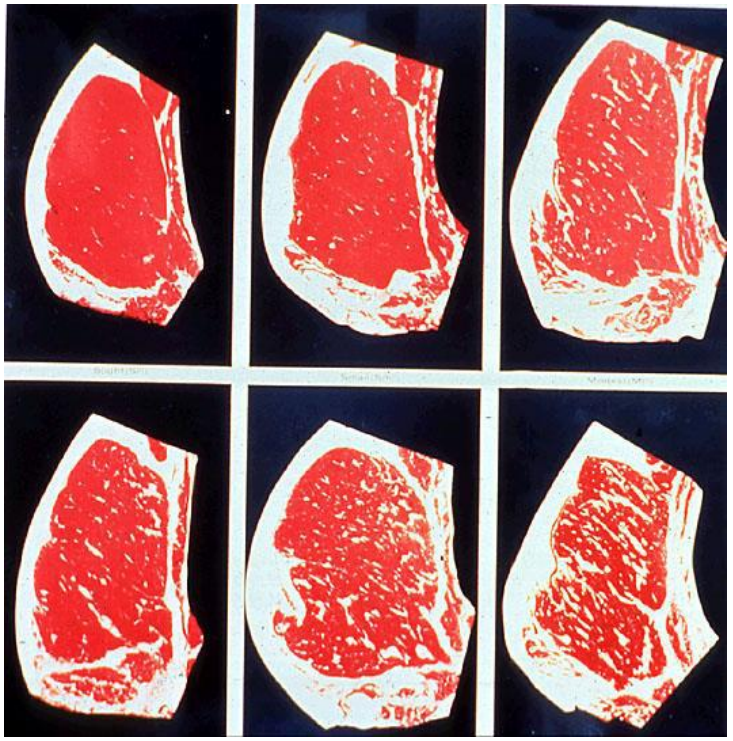
    How pleasant is it?



Uses of Sensory Evaluation

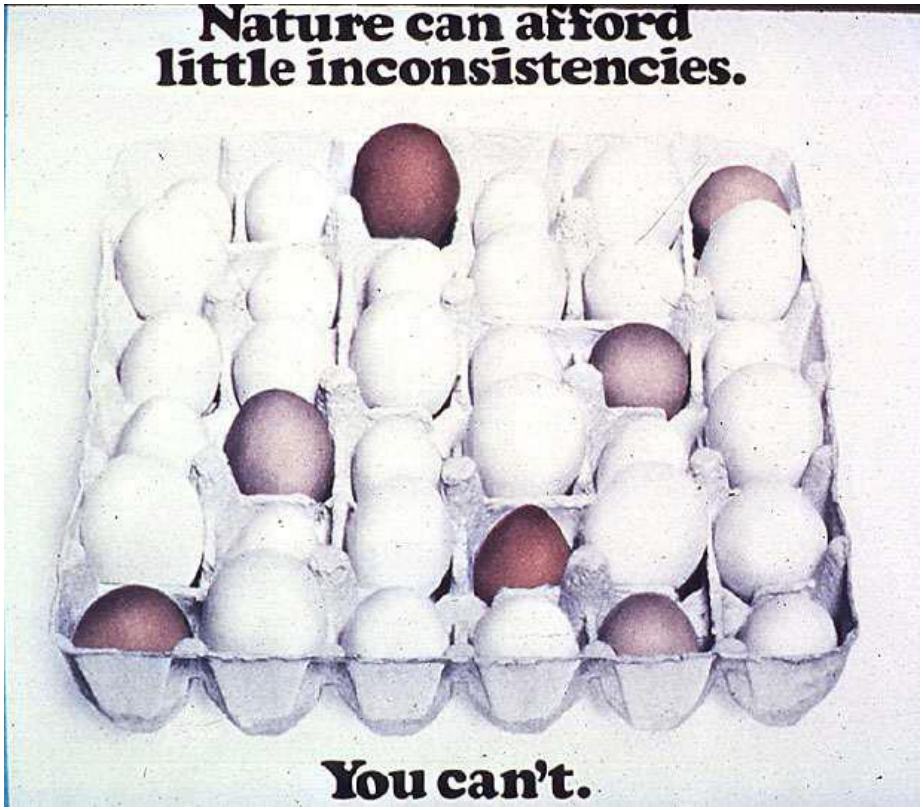
Grading

- Quality grading systems are used to determine the value of a product, and subsequently the final grade has a large impact on the selling price
- Eg. Eggs and Meat (degree of marbling)



Uses of Sensory Evaluation

- Quality Assurance
- Quality Assurance (QA) and Quality Control (QC) are responsible for identifying products outside of specifications.




The picture shows standards for buns and fries at MacDonald's R&D facility.

Uses of Sensory Evaluation

Correlate sensory and instrumental measurements

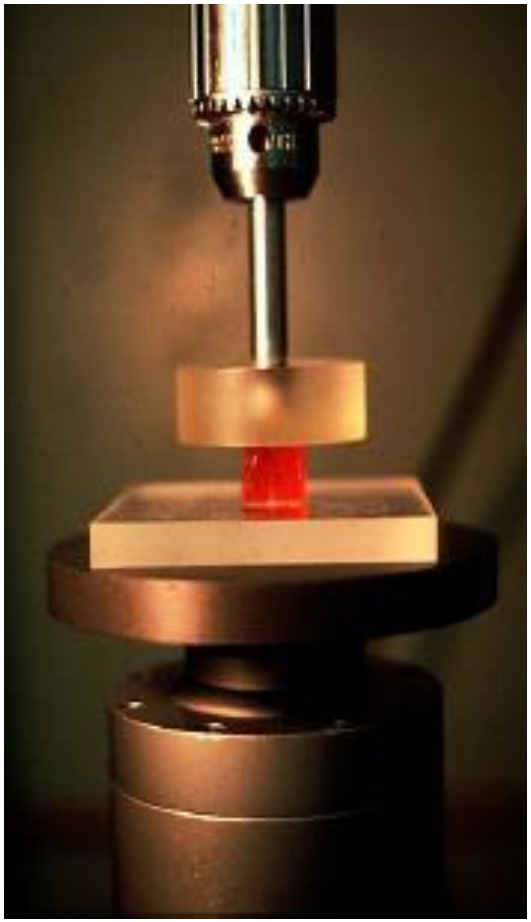
Trained sensory panels are expensive tools.

Instrumental means of sensory properties can be advantageous in the long run.

Complex combination of compounds (e.g. smell of strawberry consist of over 200 different volatile compounds)

Uses of Sensory Evaluation

- **Correlate sensory and physical properties**
  - Texture



Uses of Sensory Evaluation

Correlate sensory and instrumental measurements

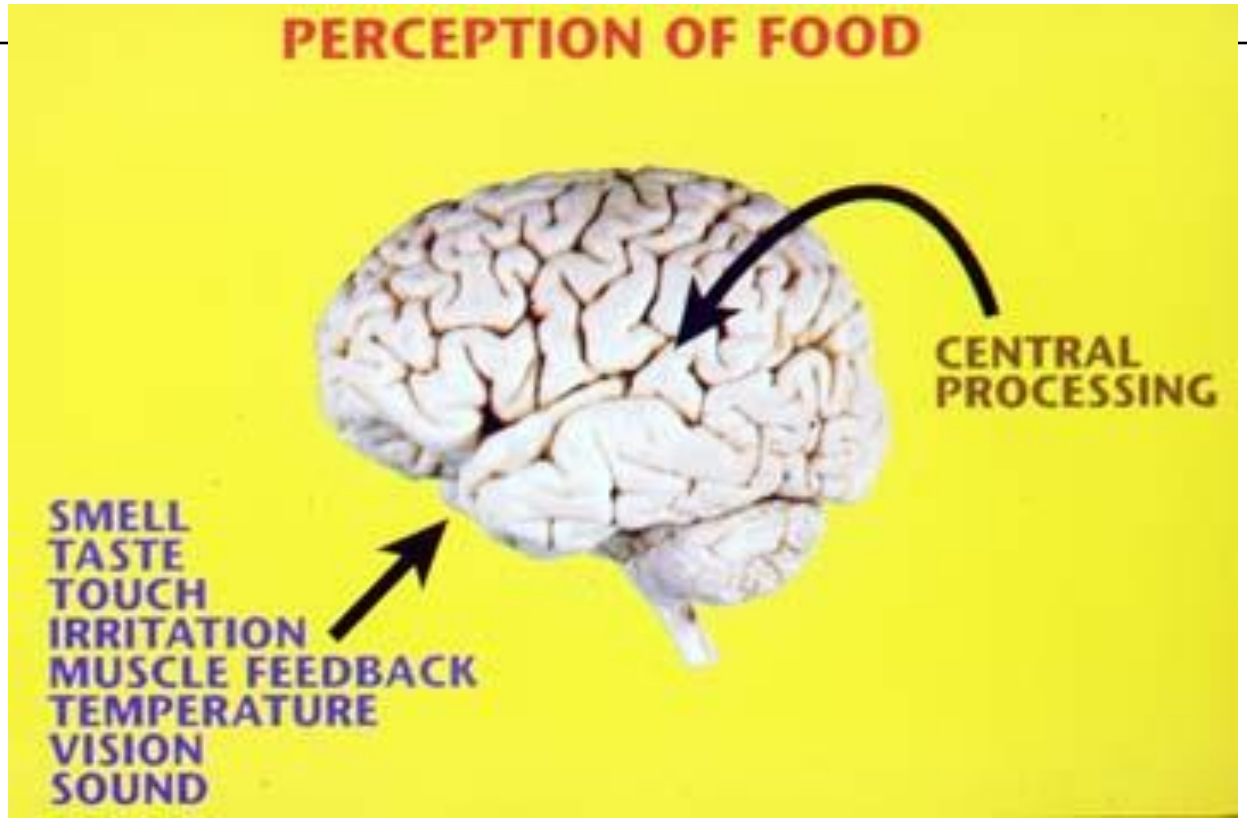
Flavor chemistry (GC-sniff)

Uses of Sensory Evaluation

- **Product reformulation**
- **New product Development**
- **Marketing**

……

1.2 Factors affected Perception of Food



physiological factors & psychological factors

1.2.1 Physiological Factors:

- Vision
- Olfaction
- Gustation

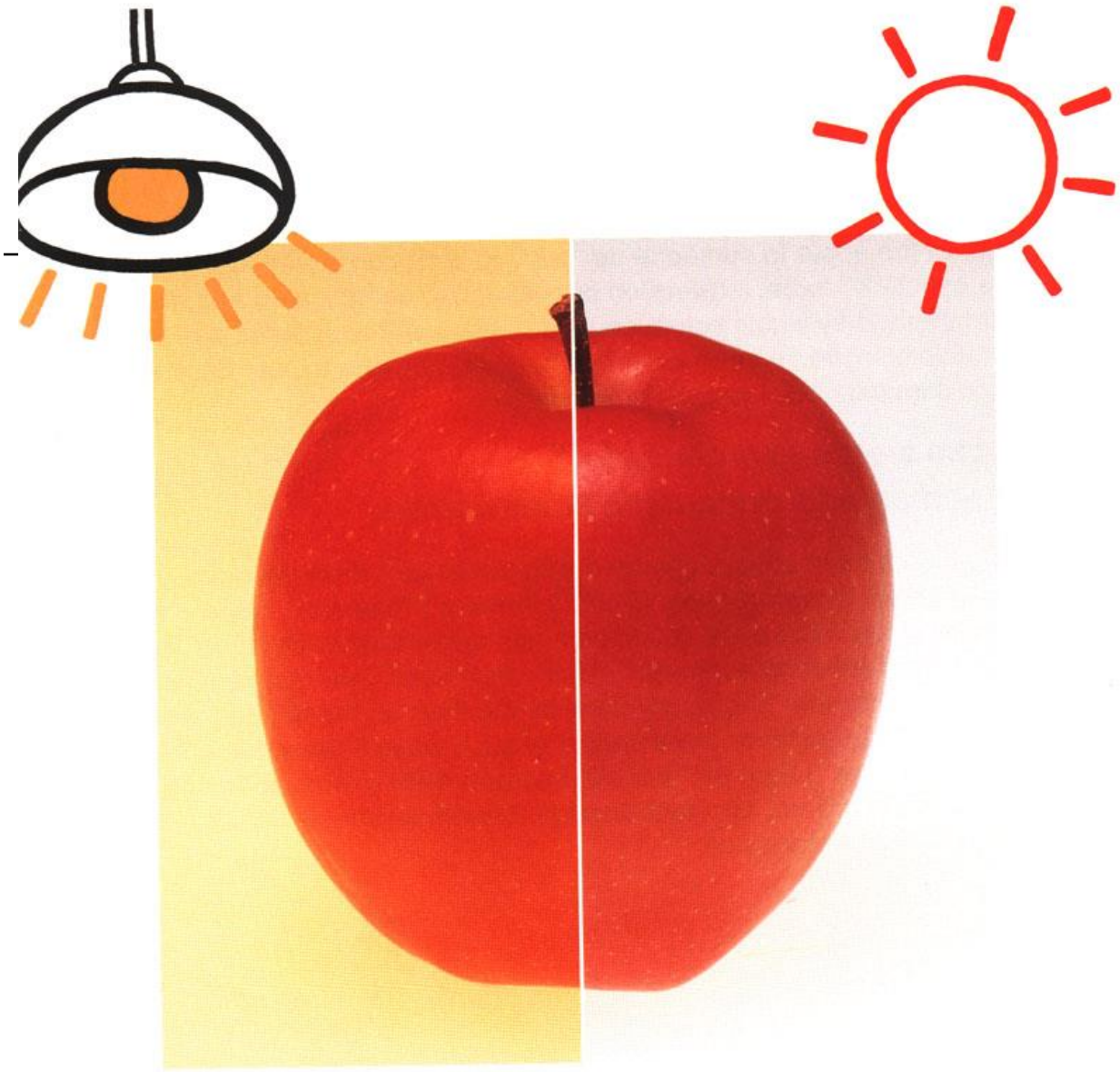
} Chemo-reception

- Tactile sense
- Audition

Vision: appearance

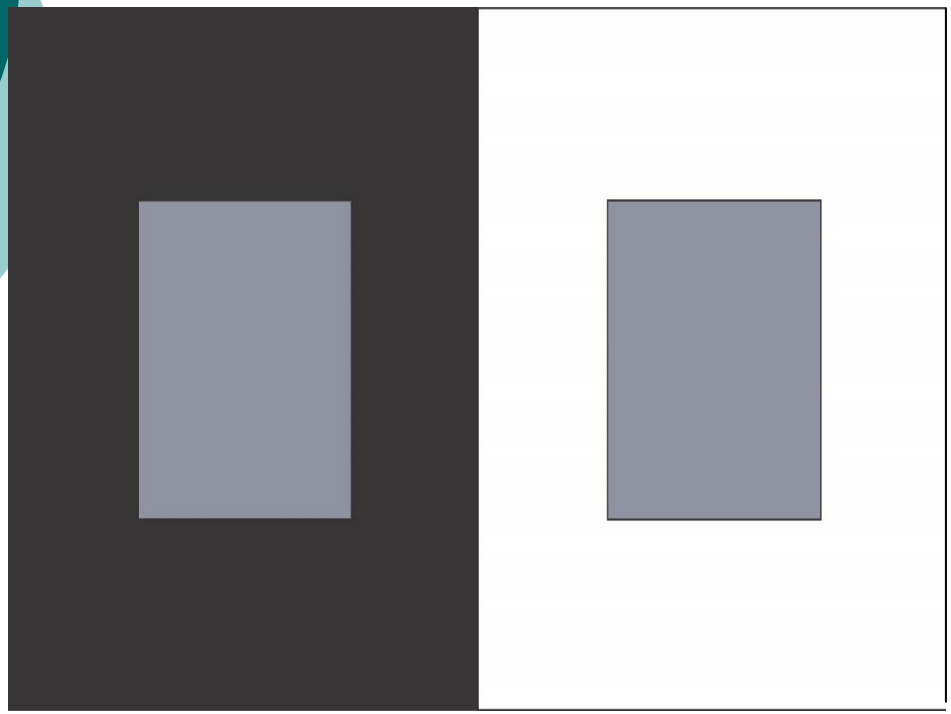
surface structure,color,shape

Visual perception is the ability to interpret the surrounding environment by processing information that is contained in visible light.



Source of Light

Background



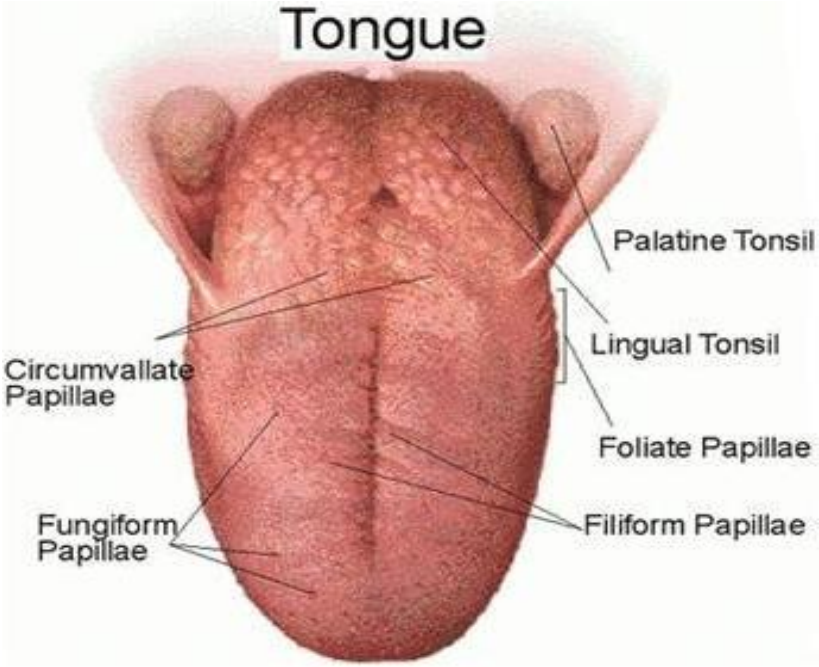
to assess the appearance of a wine, look at it with a white surface behind it – a white table cloth, or just a piece of white paper will do you are looking for clarity, and at the colour

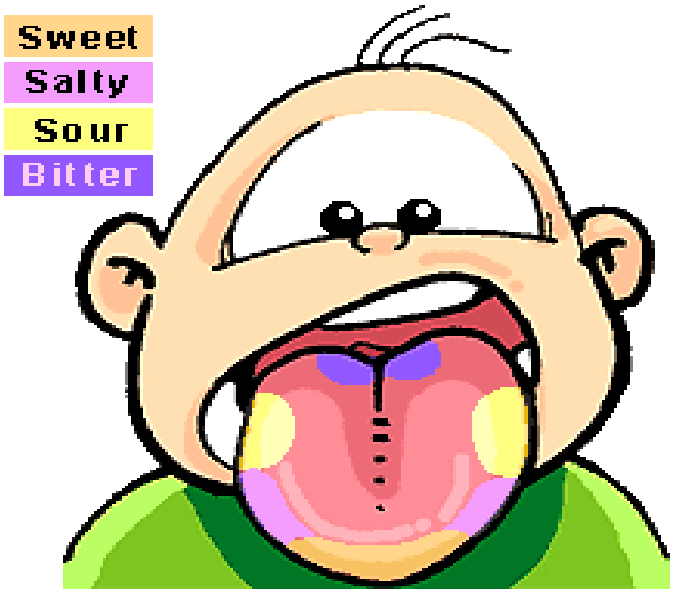
Gustation:

soluble taste substances

Gustation

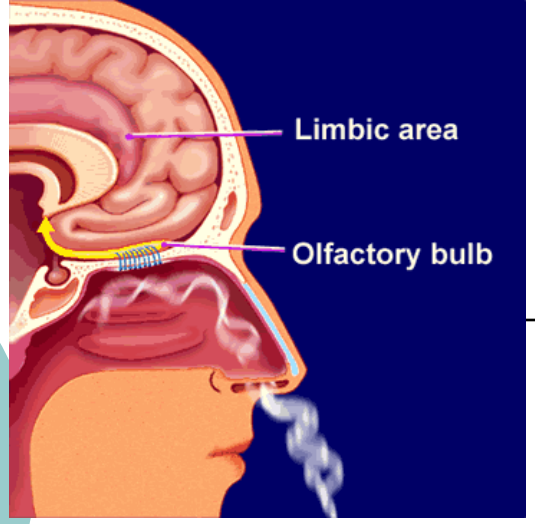
Taste is the sensation produced when a substance in the mouth reacts chemically with taste receptor cells located on taste buds.





4 basic tastes

Spicy is a sensation by inducing a trigeminal nerve reaction together with normal taste reception. It is similar to tactile sense when considering stimulating nerve endings.



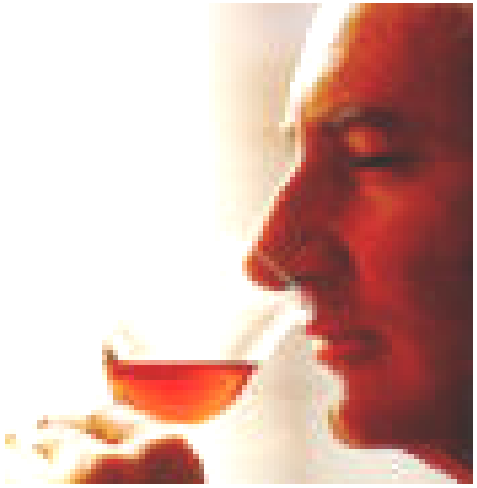
Olfaction:

volatile chemicals

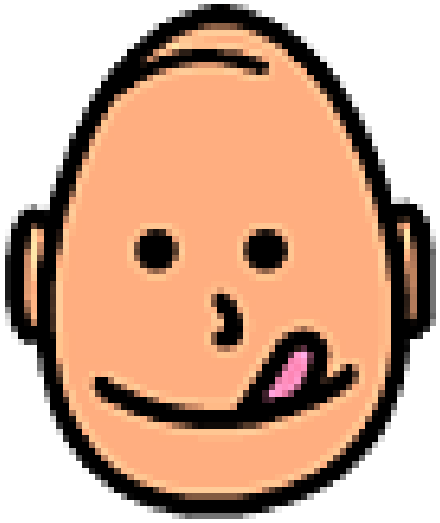
olfaction occurs when odorant molecules bind to specific sites on the olfactory receptors.

Olfaction

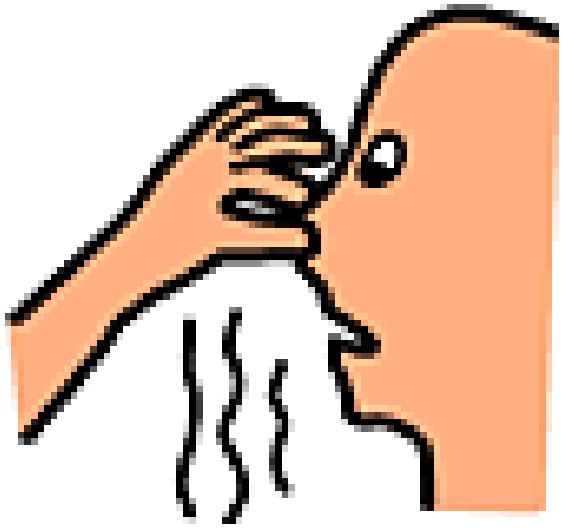
- Olfaction is more complicated than gustation and the sensitivity of olfaction is much higher than gustation.
- One can discriminate 1000billoin different ordors



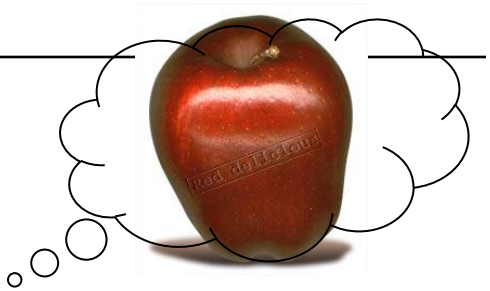
Flavor

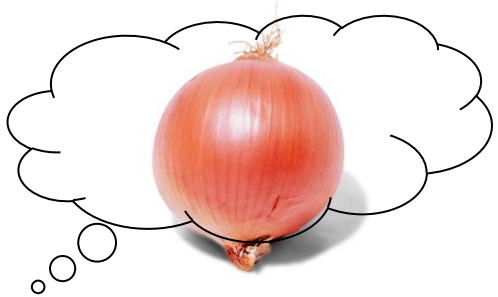


Smell + Taste



Taste

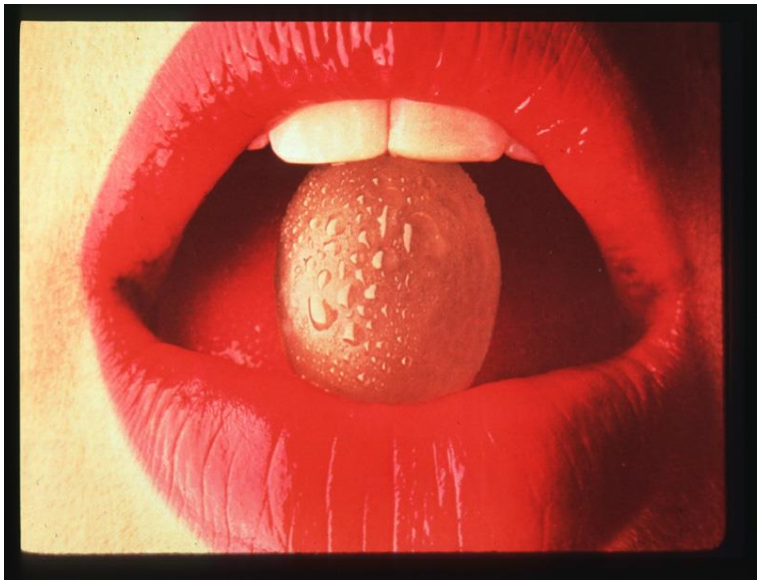




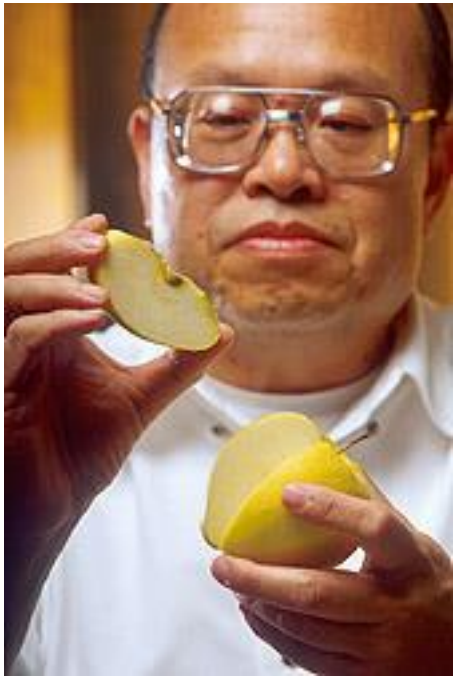
Flavor

Tactile sense – mouth feel and hand feel

structure of food, texture

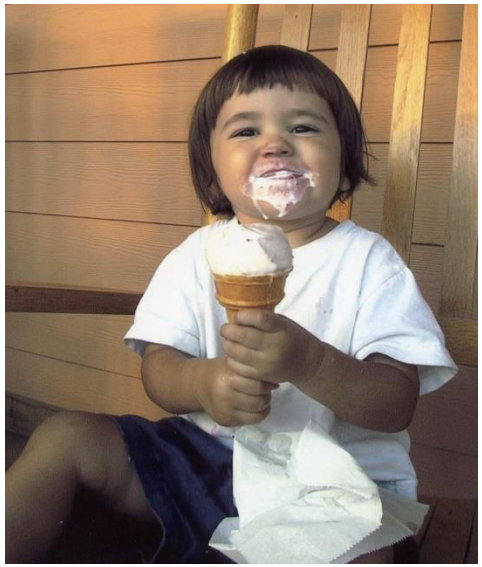


Audition – internal structure



Juicy Crisp

Thermoreception



- **Temperature**: the perception of ‘hot’ and ‘cold’
- Temperature is also important because it has an effect on the other senses.

Sense systems & sensory properties

视觉 Vision	看 seeing	Surface structure Color
嗅觉 Olfaction	闻 smell	Volatiles
味觉 Gustation	尝 taste	Water solubles
触觉 Tactile sense	触摸 touch	Surface structure
本体感受 Proprioception	肌肉反应 muscle feedback	Internal structure
听觉 Audition	听 hearing	Internal structure
痛觉 Nociception	刺激 irritation	Irritants
温度觉 Thermoreception	热，冷 hot, cold	Temperature

General principles for senses：

- Sense organs are not reacting to all the changes, only when the stimulation causing the change of senses is in a proper range. Over or under the proper range, any reaction from sense organs would not be occurring.

- Sensory threshold: the sensitivity to the strongest and weakest stimulus as well as the tiny change within the range.

Two types of sensory thresholds

- Absolute threshold: the range between the lowest level at which a stimulus can be detected and the highest level at which the sensation would be lost.

- Differential threshold: the level at which a change in a detected intensity can be perceived.

Weber Law：

$$K = \triangle I / I$$

△I: Intensity change ； I: starting intensity； K: Weber constant

Weber Law is only applicable for the moderate stimulation, otherwise, K is not constant.

When the intensity is low (close to the the threshold), K is quickly increasing.

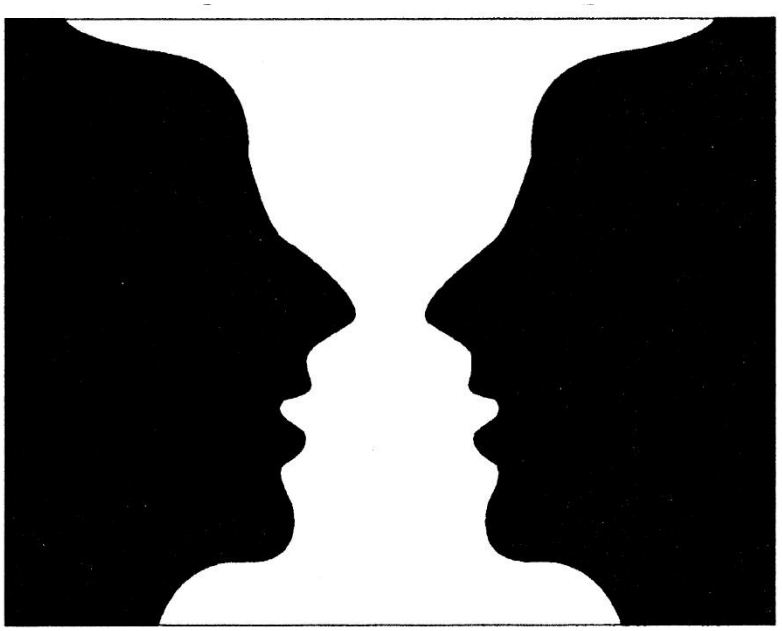
Miller modified function:

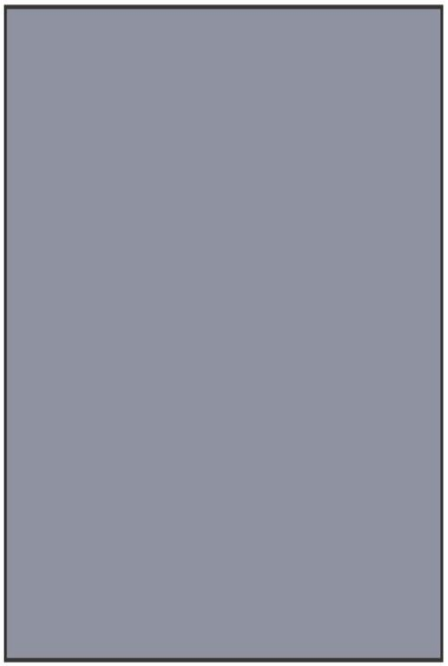
$$K = \triangle I / (I + Ir)$$

Ir: the additional intensity caused by series of factors, such as the interaction among different stimulation, the change of sensitivities, different liking, etc..

1.2.2 Psychological Factors

1. Humans' reaction to a particular stimulation is related to their previous experiences or other stimulation from the environment.

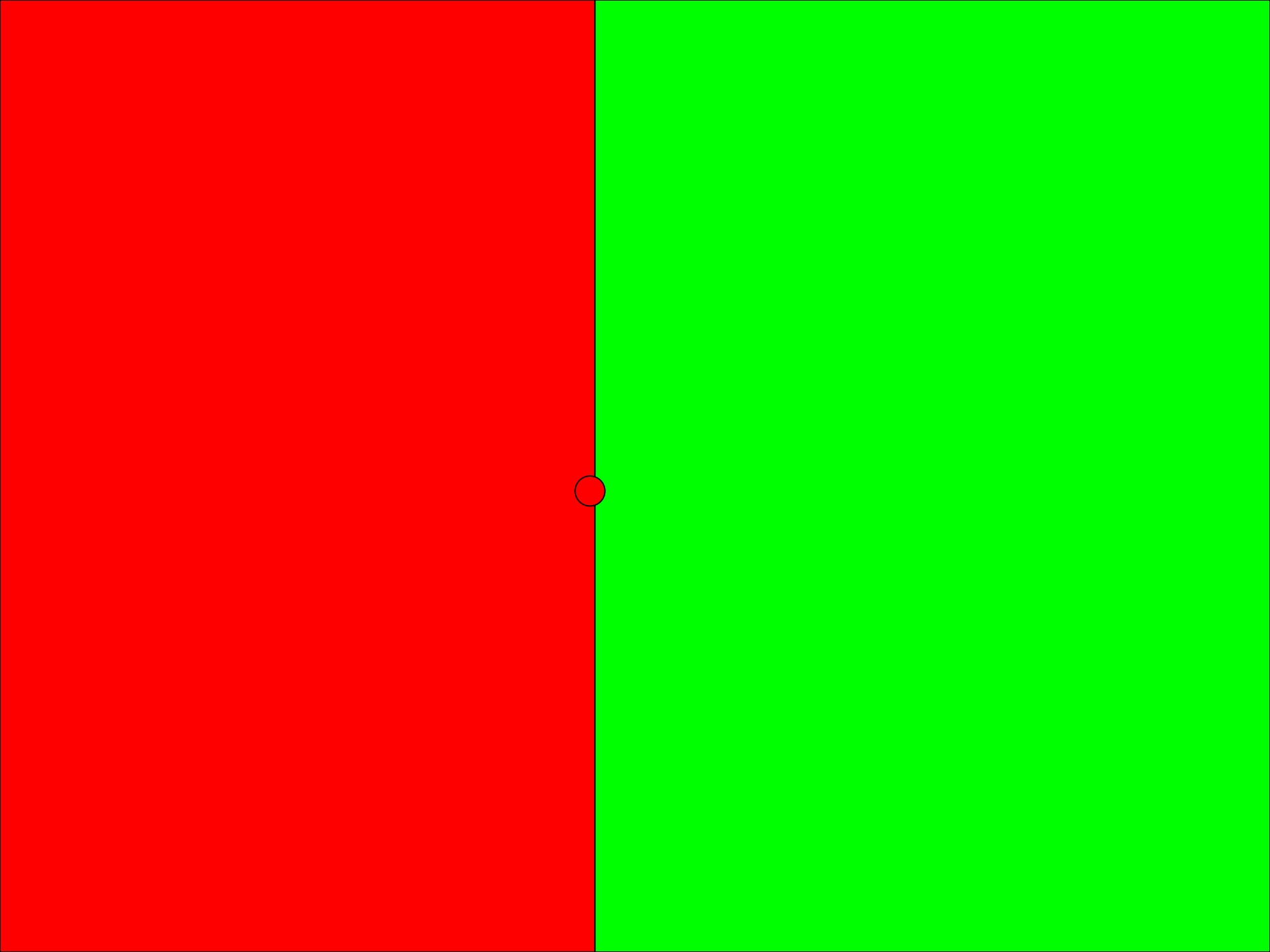


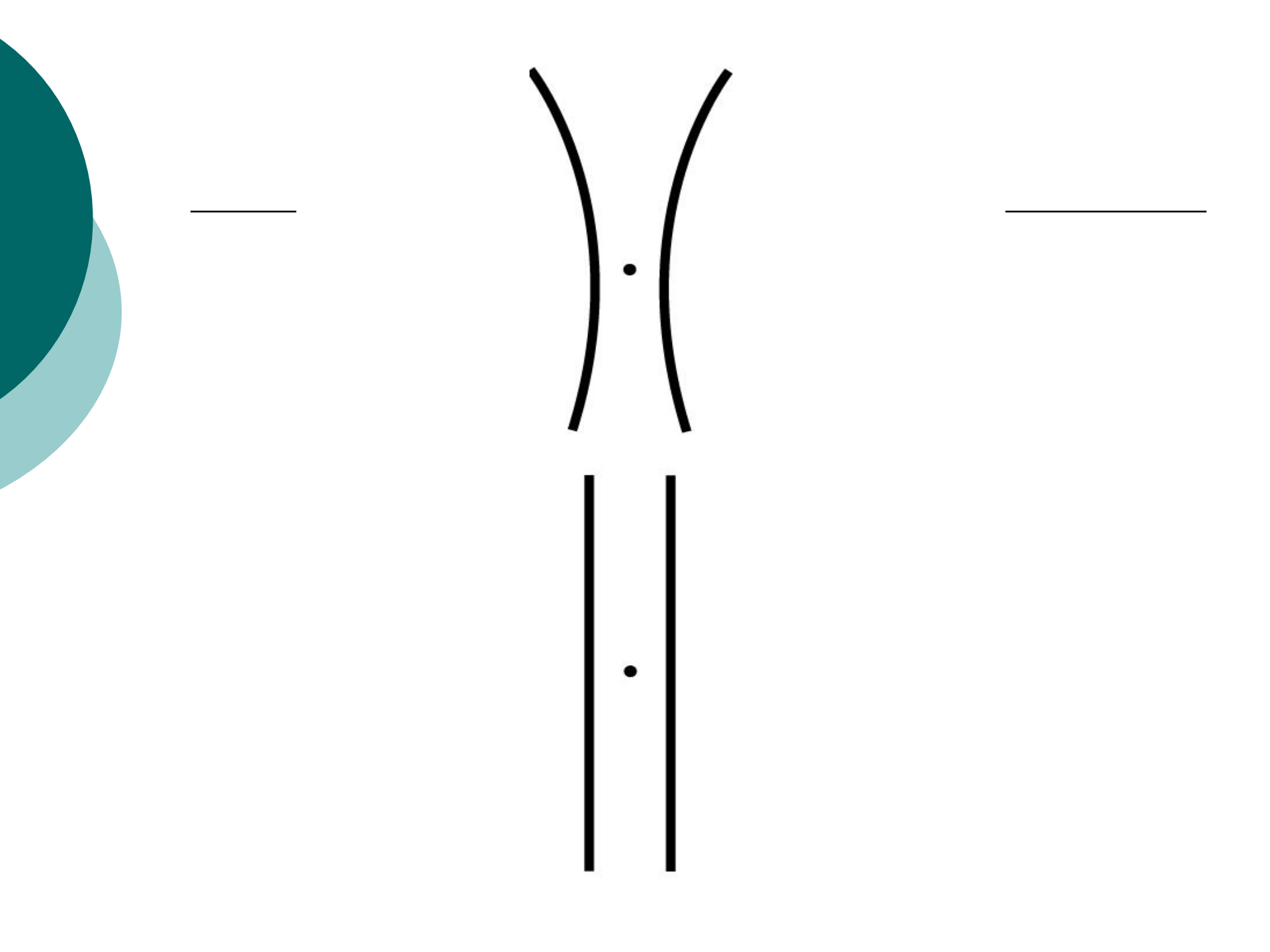


2. The differences between a sensory panel is unavoidable, which could be caused the differences with or within the individual physiological or psychological features.

3. During the sensory evaluation, the system error caused by the different judges' reaction could distort the data, which is hard to detect.

- **E.g. sensory adaption: the brain would not process the information from a constant stimulation,only there is a change happening to the stimulation.**





Design of a Sensory Test

- **Human subjects are:**
- Variable over time
- Variable among themselves
- Prone to bias
- Prone to fatigue and attention drift

- **To minimize these pitfalls:**
- Measurements must be repeated
- Number of judges or consumers must be high enough (power analysis)
- Biases (psychological and physiological) must be avoided or reduced

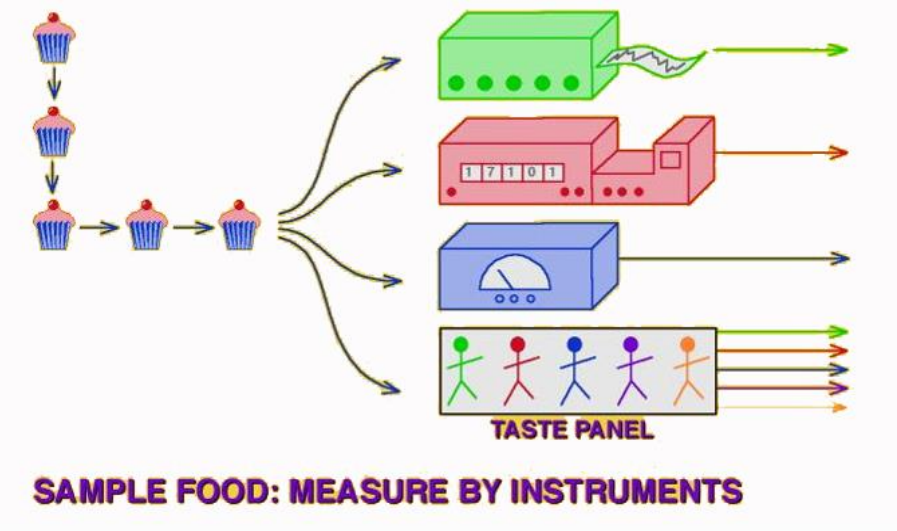
The validity of sensory evaluation depends on the explored testing methods and the testing procedures !

Sensory Methodology

- The focus of this course
- Analytical methods
  - Thresholds
  - **Discrimination tests**
  - Scaling
  - **Descriptive analysis**
- Consumer testing methods
  - **Quantitative methods**
  - **Qualitative methods**

Sensory Methodology

- **Sensory Evaluation -Analytical Tests**
  - Human sensations are considered as analytical instrument to measure sensory properties of food
  - Trained judges, controlled testing condition and standardized procedures for preparation samples

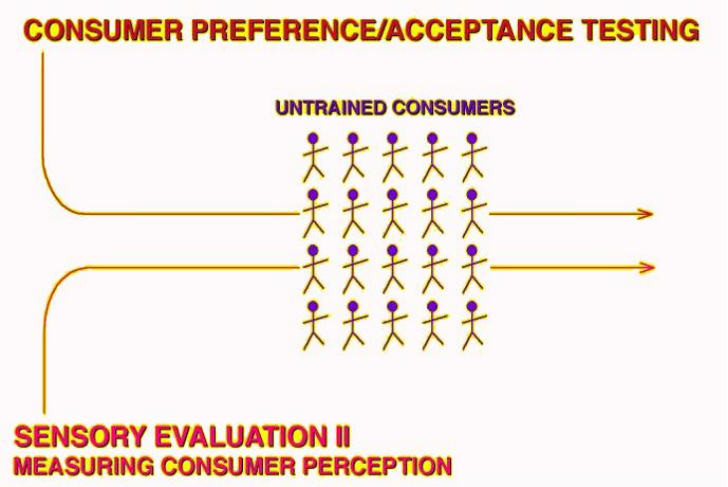


Sensory Methodology

- Examples of descriptive analysis methods:
- Flavor Profile
- Texture Profile
- Quantitative Descriptive Analysis
- Deviation from Reference
- Spectrum Method
- Free-Choice Profiling
- Time-Intensity / Dynamic Flavor Profile

Sensory Methodology

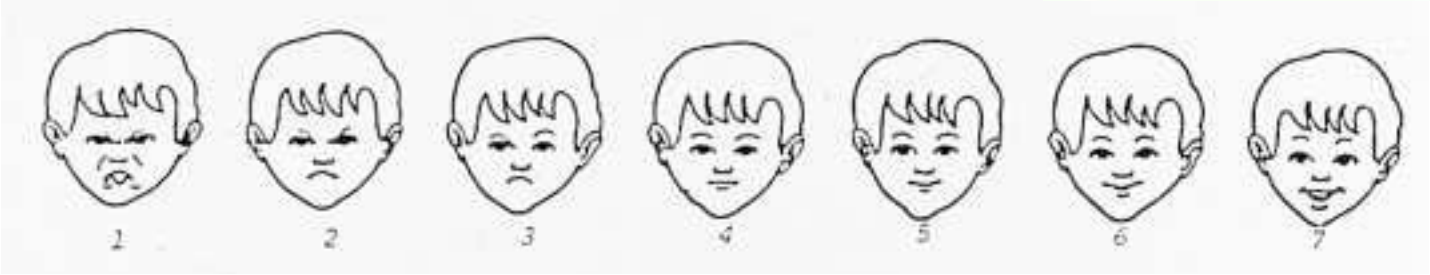
- **Consumer testing methods (Affective Tests)**
  - Measure consumers' likings
  - Untrained consumers, ordinary conditions



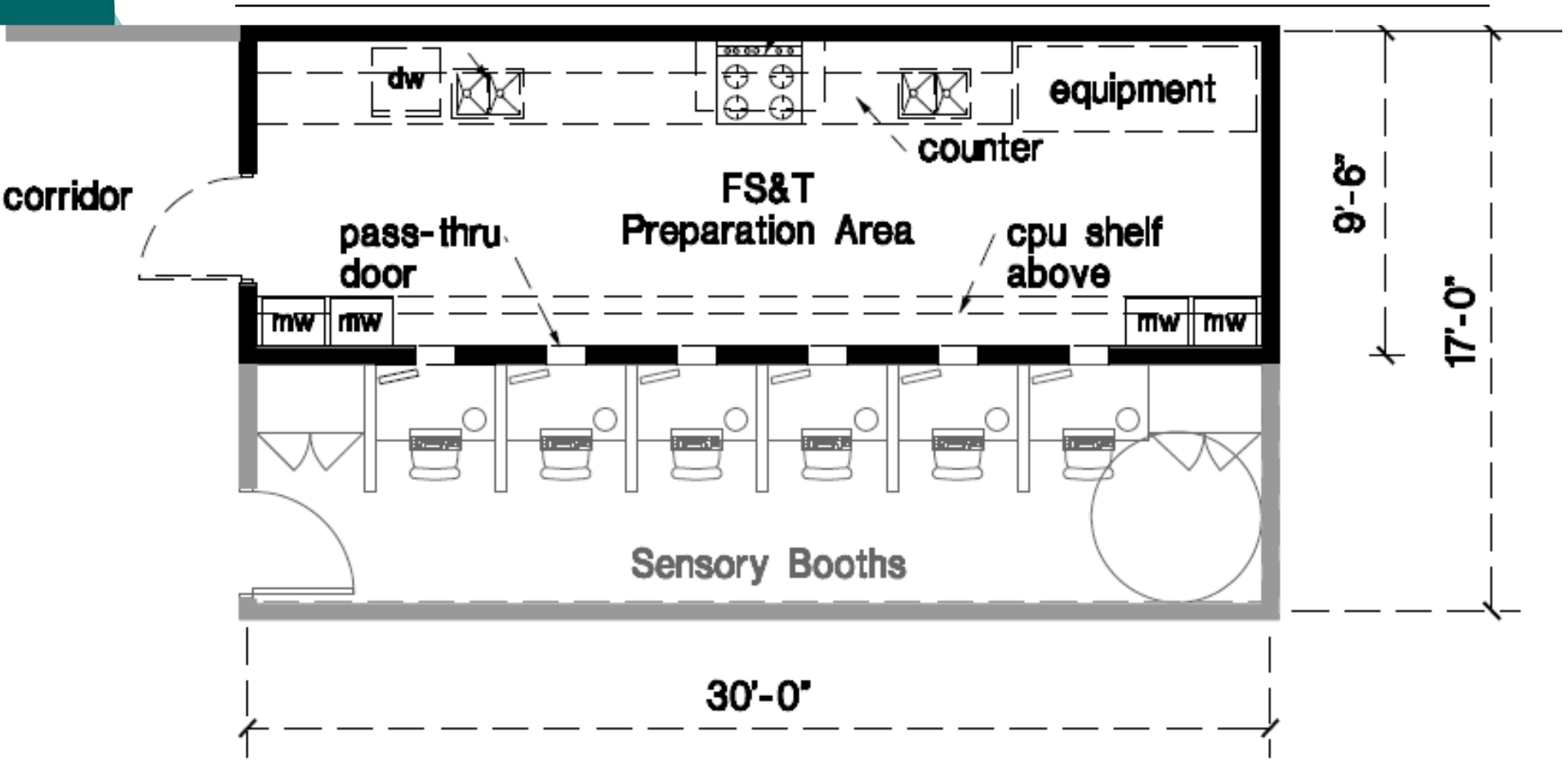
Sensory Methodology

- Consumer tests
- Hedonic ratings
- Just-right scaling
- Preference test
- Purchase intent scaling

9	Like extremely
8	Like very much
7	Like moderately
6	like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely



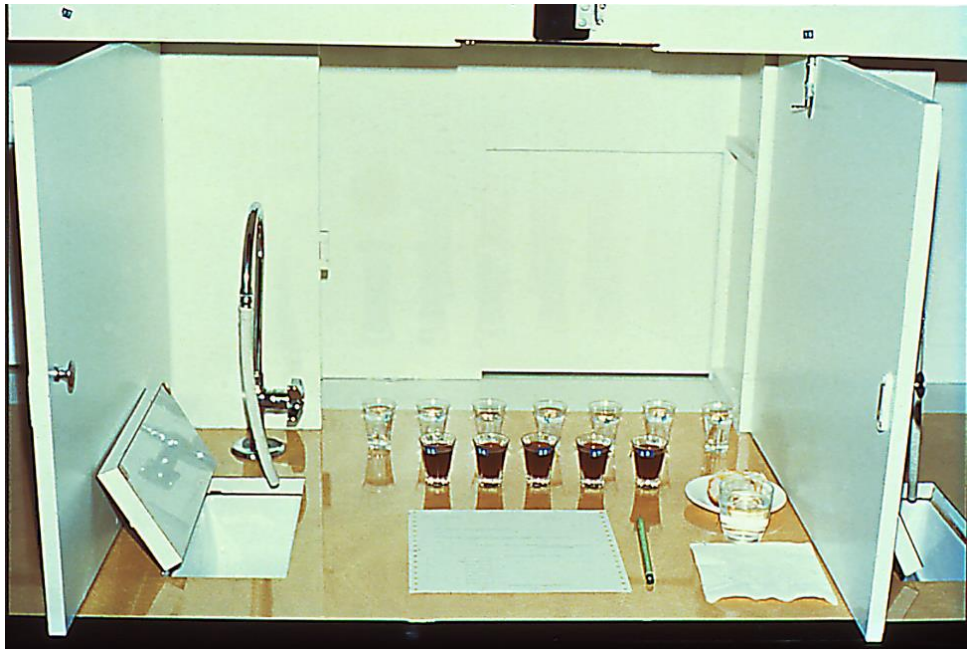
Analytical Sensory Facility

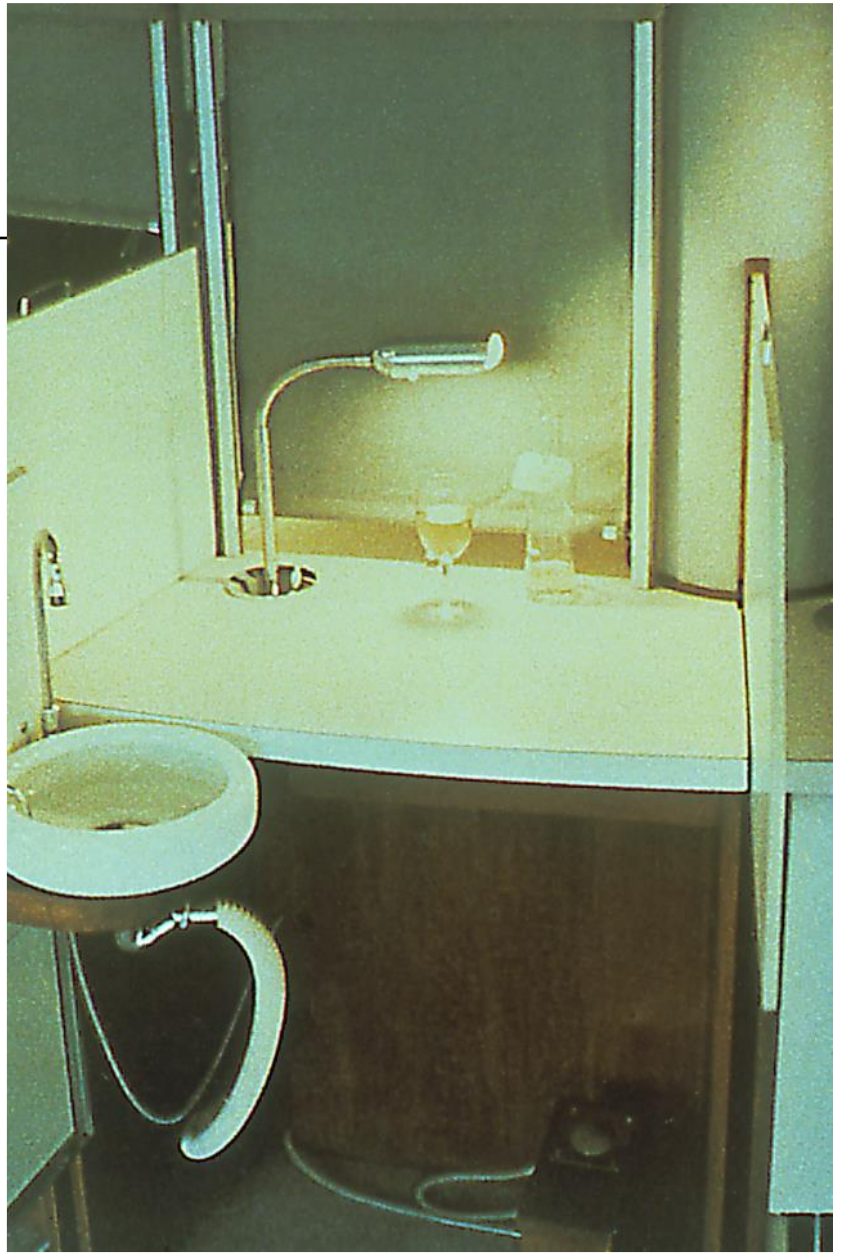


Sensory Booth Components

- Space for trays/samples, monitor, laptops, etc.
- Ventilation
- Temperature/humidity control
- Adjustable chairs
- Electrical outlets
- Booth divides
- Product delivery (hatches)
- Signaling system
- Spittoon/sink and faucet


QUIET SYSTEM





The National Food Labs

Michigan State University

Purdue University

University of Minnesota

Consumer Test

Consumer Test

Focus Group Facilities

Consumer testing

Consumer Testing