Beer Flavor and Troubleshooting

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Sensory Analysis

- Structured, methodical way to taste and evaluate beer
  - Measures components of beers
  - Determines presence and level of specific flavors
  - Usually trained, and maintains training
  - Impartial analysis of the beer
- Compare with organoleptic taster
  - Do I like it or not?
  - Perceptions clouded by personal opinion
  - Mostly drinking for enjoyment

Flavor

- Definition
  - *The total impression of taste, odor, tactile, kinesthetic, temperature, and pain sensation perceived through tasting.*

- No one element of this dominates the flavor of a beer

Taste

- Binding of certain compounds to receptors on tongue
- Five basic tastes
  - Sweet
  - Sour
  - Salty
  - Bitter
  - Umami – savory, response to MSG
- Tongue Map is a myth!
  - All flavors can be tasted on all areas of the tongue

Aroma

- A very large portion of flavor is transmitted by aroma
- Human nose is incredibly sensitive
  - Some compounds at parts per trillion level
- Volatile compounds bind to receptors in respiratory pathways
  - Hardwired directly into the brain
  - Many aromas will indirectly affect taste perception
- Receptors become saturated within 1-3 seconds, and may need 20 seconds to reset

Mouthfeel

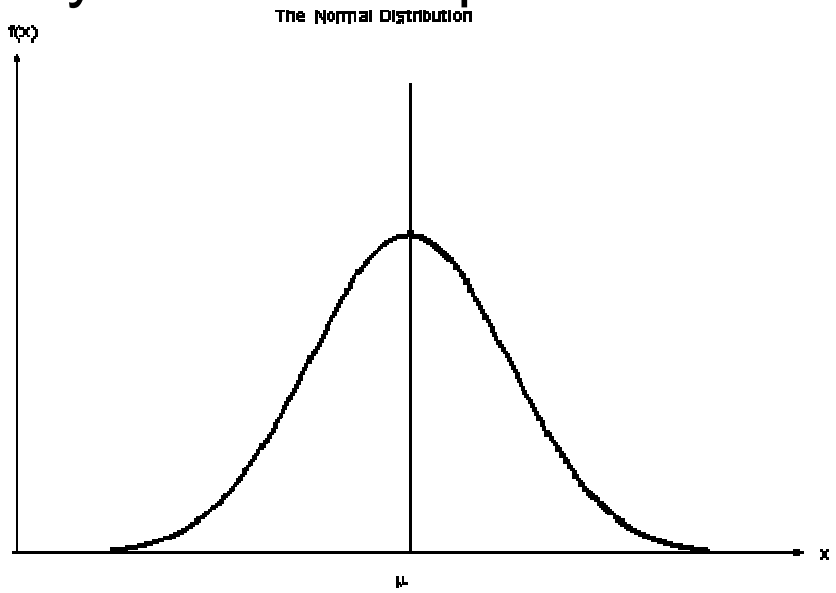
- Trigeminal sensation – tactile sense of taste
- A chemical irritation of the palate
- Carbonation
  - Prickle of dissolved carbon dioxide
  - Increased perception of bitterness
- Astringency
- Viscosity
- Spiciness

Meilgaard System

- Attempt to standardize detection across different flavors
  - How to compare low threshold with high threshold
- Flavor threshold
  - The lowest intensity at which a stimulus is perceptible
  - Ethyl acetate: 50 mg/L, Lightstruck 0.000004 mg/L
- Flavor unit (FU)
  - Ratio of a compound's concentration to its threshold
  - Can compare without using hard numbers
- "Beery flavors" - over 2 FU
- "Secondary flavors" 0.5 to 2 FU
  - Bulk of the distinguishing flavors for beer styles

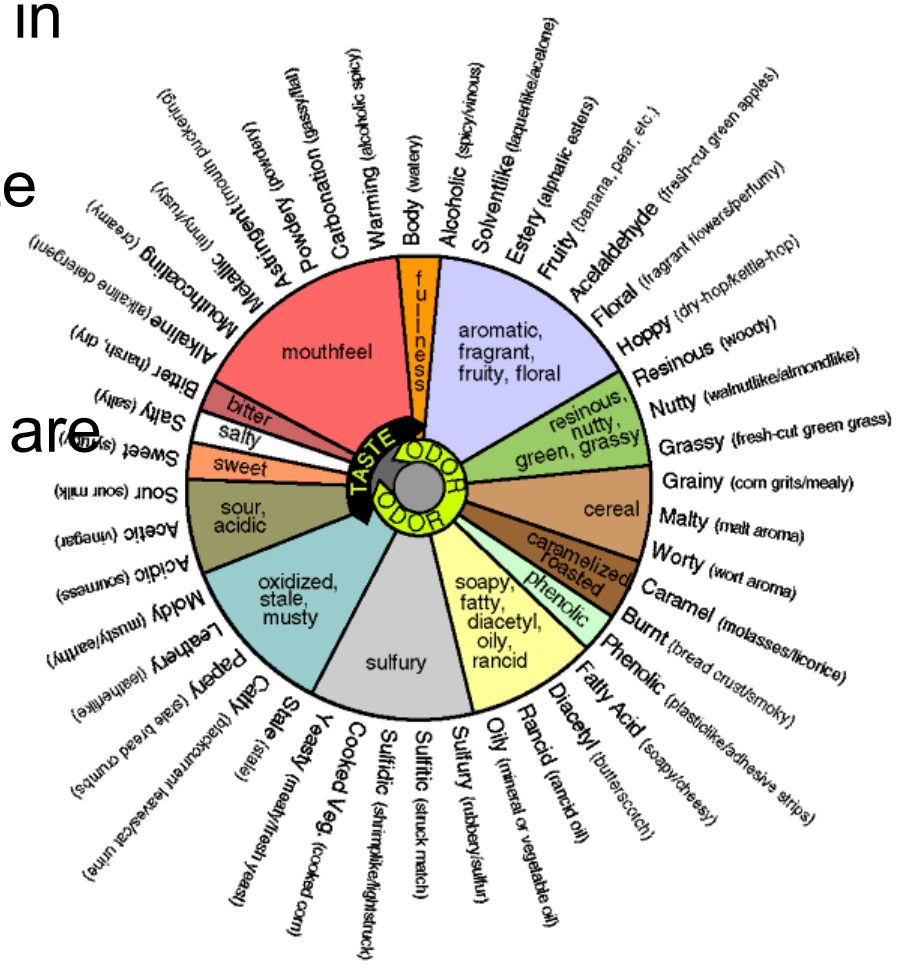
Flavor Thresholds

- Different tasters have different sensitivities
  - “Supertasters”
  - Usually a distribution to decide an average threshold
  - Can be different for each unique flavor
    - You may have blind spots!



Beer Flavor Wheel

- Introduced by Meilgaard in 1970s
- An attempt to standardize the language used to describe beer
- Most of the components are odors
- Very objective
  - Not “good” or “bad”



Flavors vs. Faults

- Our goal is to discern many different types of flavors
- A secondary task is to decide whether it is a fault in beer
- Many of these depend on the style of beer
  - E.g. phenolics in Belgian vs. Light Lager
  - Dictated by style guidelines

Acetaldehyde

- Perceived as “green apple”, “grassy”
- Noted in aroma, flavor
- Causes
  - Removal of yeast before complete fermentation
  - Oxidation of beer post-fermentation
  - Bacterial contamination
- Ever appropriate?
  - American Light Lagers (optional)

Diacetyl

- Perceived as “buttery”, “butterscotch”
- Noted in aroma, flavor, mouthfeel (slick)
- Causes
  - Premature removal of yeast
  - Low fermentation temperatures
  - Yeast strain choice
  - Bacterial contamination
- Diacetyl rest – temperature rise after fermentation
- Ever appropriate?
  - British ales (Scotch ales, bitters)
  - Bohemian Pilsner (optional)

Fruitiness

- Ester compounds formed by yeast
- Perceived as “banana”, “pear”, “apple”, “strawberry”, …
- Noted in aroma, flavor
- Causes
  - High fermentation temperature
  - Yeast strain choice
  - Yeast growth/health
  - High wort gravity
- Ever appropriate?
  - Most ales - especially British, Belgian

Solvent-like

- Fusel alcohols, or high levels of esters (ethyl acetate)
- Perceived as “hot”, “solvent-like”
- Noted in aroma, flavor
- Causes
  - Poor yeast health
    - Low pitch rate, under oxygenation
  - Contamination
- Ever appropriate?
  - Never desirable, may be in some old ales

Alcoholic

- Perceived as “spicy”, “vinous”
- Noted in aroma, flavor, mouthfeel (warming, prickly)
- Distinction between fusel alcohol and lots of ethanol
- Causes
  - High amount of fermentable sugars
  - High fermentation temperature
  - Poor yeast health
- Ever appropriate?
  - Fusel – NO
  - High ethanol – strong beers (Barleywine, Imperial Stout, Eisbock)

Phenolic

- Perceived as “clove”, “plastic”, “Band-Aid”, “smoky”
- Chlorophenols are the more “medicinal” type
- Noted in aroma, flavor
- Causes
  - Wild yeast contamination (strain choice)
  - Chlorine in water
  - Extracting from husks while oversparging
- Ever appropriate?
  - Chlorophenols – NO
  - Phenolics – Belgians, Weizens, Smoked Beers

Dimethyl Sulfide (DMS)

- Perceived as “cooked corn”, “cabbage”, “vegetal”
- Produced by conversion of SMM from malt
- Noted in aroma, flavor
- Causes
  - Insufficient uncovered boil time
  - Slow wort cooling
  - Bacterial contamination
- Ever appropriate?
  - Low levels in many lagers, especially American

Cardboard/Paper

- Perceived as “papery”, “stale”
- Noted in aroma, flavor, mouthfeel (tongue-coating)
- Causes
  - Oxidation of beer post-fermentation
  - Excessively old beer
  - Aeration of hot wort
- Ever appropriate?
  - Never appropriate

Sherry-Like

- Perceived as “dry sherry”, “almond”, “vinous”
- Noted in aroma, flavor
- Causes
  - Oxidation of higher alcohols post-fermentation
  - Age on beer
- Ever appropriate?
  - High gravity beers (Old Ale, Barleywine, Scotch Ale)

Sourness

- Perceived as “tart”, “sour”
- Noted in aroma, flavor, mouthfeel (sides of tongue)
- Causes
  - Lactic – clean sourness
    - Lactic acid bacteria
  - Acetic – vinegar-like
    - Acetobacter
  - Indicate sanitation problem unless desired
- Ever appropriate?
  - Lambic, Flanders red/brown, Berliner Weisse

Astringent

- Noted in mouthfeel (mouth puckering)
- Causes
  - Extraction of tannin from grains, hops
  - High levels of dark roasted malts
  - Contamination
  - Spice additions
- Ever appropriate?
  - Never desirable, observed in some stouts, IPAs

Sulfur

- Perceived as “rotten eggs”, “rubber”
- Noted in aroma, flavor
- Causes
  - Sulfur-containing amino acids in malt
  - Yeast degradation
  - Bacterial contamination
  - Presence in brewing water
- Ever appropriate?
  - No

Metallic

- Perceived as “tin”, “blood-like”
- Noted in flavor
- Causes
  - Contact with metal-containing materials
  - High iron levels in water
- Ever appropriate?
  - No