Ithaca 2018 Abstract Submission

Title
Neuro-Science of Wine Flavor

I want to submit an abstract for:
Conference Presentation

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Keywords
neuro-science, neuroscience, neuro-gastronomy, neurogastronomy, neuro-enology, neuroenology, neuro-linguistic programming, NLP, wine flavor

Research Question
How has the evolution of neuro-science in the last 6 years expanded our knowledge of wine tasting, wine smelling, mouthfeel, and how the brain creates wine smells?

Methods
Leverage research from US National Library of Medicine; National Institute of Health; PUBFACTS; Journal of Neuroscience; Neuroenology, 2017; I Taste Red, 2016; Tasty, 2015; Physiology & Behavior, 2014; and others.

Results
Neuro-Science is increasing our wine flavor knowledge of: mouthfeel, using our tongue to taste and smell, and NLP to remember what we smell, while enjoying the present moment! Skal!

Abstract
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At the same time, our population has also grown exponentially, from near extinction at 70,000 BC to 14,000,000 people at the time of written language to about 7.5 billion today. Consider that during the same 6,000 years from written language to today, our population has grown more than 500 times.

This combination of exponentially more people sharing exponentially more information is exploding our knowledge in technology and other areas, including wine. Wine's knowledge growth encompasses the application of at least at least 3 new scientific fields – Neuro-Linguistic Programming, Neuro-Gastronomy, and Neuro-Enology.

This paper's objective paper is to share the contributions of these 3 new neuroscience fields in advancing our knowledge of wine flavor, specifically:

1. Feel,
2. Taste,
3. Smell, and
4. The Brain.

FEEL

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• pressure
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There are also multiple sensors which measure mouthfeel (aka, mouthsense or texture).

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In 2017, additional scientific research helped reconcile some of these differences, but much work remains.

TASTE

We use primarily 3 senses in tasting wine: sweet, sour, and bitter.

In Neuro-enology, “training to be an expert in tasting wine depends to a great extent on training the tongue to deliver the wine to the wine-sensing organs of the mouth, together with delivering the volatiles to the internal nose.”

Taste buds are not only found on the tongue, but other places in the mouth to include the soft palate, upper esophagus, the cheek, and the epiglottis.

In Neuro-enology, Gordon M. Shepherd devoted a whole chapter to “Sip and Saliva.” In addition to the tongue, saliva impacts the taste of wine:
• Saliva begins the process of digestion of starches and fats, as much as 30% in the mouth. Specifically, amylase breaks starches down into simpler sugars such as maltose (sweet taste) and dextrin (bitter like unsweetened cocoa), which is then broken down further in the small intestine.
• Saliva also binds tannins which reduces bitterness by reducing the ability to reach the bitterness receptors & increases astringency (lower pH).
• Wine also increases the amount or flow of saliva in the mouth, which changes the perception of the wine in the mouth.
• These chemical changes in the mouth change the flavor of the wine as it moves through the mouth and longer it sits in the mouth.

In addition, taste receptors have been found in the gastrointestinal tract, kidneys, and brain. Enrique Rozengurt, a

biologist at UCLA found taste cells in the lower gut.

Thomas Finger, a neurobiologist at the University of Colorado, has also found taste receptors in our nose, stomach, lungs, and intestine. For example, when your intestine senses something bitter, it forces it out of the body, quickly – you may feel sick, vomit, have diarrhea or both. This happens unconsciously without any conscious decision-making. Bitter detection cells in the lung and nose can result in sneezing.

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This has led some to say we, “Taste with our whole body.”

Finally, your facial nerve functions in the conveyance of taste sensations from the anterior two-thirds of the tongue and oral cavity and also controls the muscles of facial expression. In short your face reveals what you are eating:
• Bitter Taste: eyes diminish
• Sour Taste: lips pursed, lips pressed, nostrils widen, mouth open
• Bitter & Salt Tastes: nose wrinkles

SMELL

Today, almost everyone agrees that smell trumps taste, but it was not until 2017 in “Neuroenology” that Gordon M. Shepherd detailed HOW retro-nasal smell in combination with taste creates flavor.

Remember, in Neuro-enology, “training to be an expert in tasting wine depends to a great extent on training the tongue to deliver the wine to the wine-sensing organs of the mouth, together with delivering the volatiles to the internal nose.”

The tongue plays a significant role in releasing volatiles by moving the wine slowly through the mouth and performing various functions:
• Anterior tongue starts by aerating the wine at the front of the mouth. Wine experts suck in air to maximize aeration and increase release of volatiles.
• Middle-tongue agitates the wine to various parts of the mouth and mixes with saliva to increase flavor intensity caused by the release of volatiles for retro-nasal smell. Wine experts will chew and swish wine to cover the necessary areas of the mouth.
• Posterior tongue holds the wine before swallowing so exhaling with wine at the back of the mouth increases to increase retro-nasal smell. Wine experts will exhale with the wine at the back of the mouth to increase release of volatiles to the olfactory bulb.
• After swallowing, we sense an aroma burst from the volatiles left coating the throat, with the first expirations providing the strongest stimulation of retronasal smell.
• Finally, we sense by continuing retronasal smell the lingering finish coming from the volatiles on the surface of our mouths and throats.”

Today, we now know that the nose shape and air flow impacts smell:
1. There are large differences in the shape and openness of our nasal cavity because of inter-individual differences,
2. The two sides of our noses are not identical with every 90 minutes our nasal congestion moves from one side to the other (in smelling wine, one should use whichever nostril is not congested showing that there are intra-individual differences),
3. Air flow lines through our nose are surprisingly rigid with the air entering at a precise site most anterior in the nostril to stimulate the olfactory receptors
a. tilting the glass at an optimum angle between 30 and 45 degrees is probably based on individual nose structure
b. some individuals can smell more with 2-3 quick sniffs, while others prefer a single deep breath
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“It is a wonder that we can reach any kind of agreement when assessing the aroma of wine!”

THE BRAIN

In 2017, Gordon M. Shepherd published: "Neuroenology: How the Brain creates the Taste of Wine." He sums his book in 1 phrase: "the taste of wine is not in the wine; the taste is created by the brain of the wine taster." In sum, big brains, big smell. Why? Because smell is processed in the brain and so larger brains designed for processing and memory can process and remember more smells.

However, smell is processed and remembered differently than our other senses of touch, sight, hearing, and taste. Smells (not sounds, sights, touch, nor taste) get routed through the olfactory bulb, the smell-analyzing region in your brain that’s closely connected to brain regions that handle memory and emotion. As a result, odors are especially effective as reminders of past experience, much more so than cues from other senses, such as sights or sounds

However, unlike our other senses which send their axons directly to the thalamus and in turn the neo-cortex; the olfactory bulb is responsible for smell and sends axons to the olfactory cortex, then the amygdala - our primitive brain which induces emotions such as pleasure, fear, anxiety, and sadness – before the amygdala connects to the thalamus, which connects to the neo-cortex.

Thus, compared to our other senses, articulating smells is more difficult because of the processing through the olfactory bulb, olfactory cortex, and amygdala before processing in the thalamus and neocortex, like our other senses.

It is the way that smell objects are represented in the brain that makes this task of Matching Smells and words are more difficult.

Prior to the 20th Century, wine was described as good or not. According to William Shakespeare, "Good wine needs no bush (advertising)."

In 1976, Ann Noble developed the Wine Aroma Wheel. Ann Noble’s Wine Aroma Wheel was a turning point in how we talk about wine.

Since then, wine descriptions have continued to become far more elaborate. These elaborate descriptions may help us decide in purchasing a wine, but there are downsides to this when we are tasting:
1. Language shapes what we perceive
2. Culture and our education and experiences influence how we describe and interpret wine descriptions
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Most importantly, Melani McBride’s research indicated that in our culture we move away from the sensory experience and go straight to the words. Instead, enjoy the taste, textures, smells, and flavors.

Remembering smell is also processed differently than the other senses, from the olfactory cortex directly to the amygdala and the hippocampus. So wine is not combined with the other senses immediately in the thalamus. To help remember wine smells, it helps to invoke Neuro-Linguistic Programming (NLP) tools and techniques and synesthesia to combine wine with the other senses.

Tim Gaiser, Master Sommelier and Wine Education Chair of Court of Master Sommeliers, recommends the following steps to distinguish and remember smells. All of these steps leverage to varying degrees Neuro-Linguistic Programming (NLP) tools and techniques. In addition, he leverages synesthesia to remember smells by combining with pictures (sight) and speech (hearing). Synesthesia can explain why our other senses affect what attracts us, including music and colors.

1. Get present and focus. Live in the present moment by Andy Shaw.
2. Smell the wine. Enjoy the smell and sense of discovery. Get curious and ask “What is there?”
3. Smell first for fruits. They are often the most dominant. Fruits: Citrus, berry, apple, plum
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a. Non-Fruits: Flowers, herbs, spices, lavender, grain, nuts
b. Earth/mineral: earth, dirt, rocks, leaves
c. Oak: French, American, Hungarian
6. Organize in a visual collage
7. Add wine label to the visual collage
8. Look up and to the left. Good place to move mental picture so it is locked in your memory

Bottom Line: Remember that both Melani Mc Bride and Tim Gaiser recommend to enjoy the smell!

File Upload (PDF only)

- Neuroscience-of-Wine-Flavor.pdf

Neuro-Science of Wine Flavor

By William Stefan

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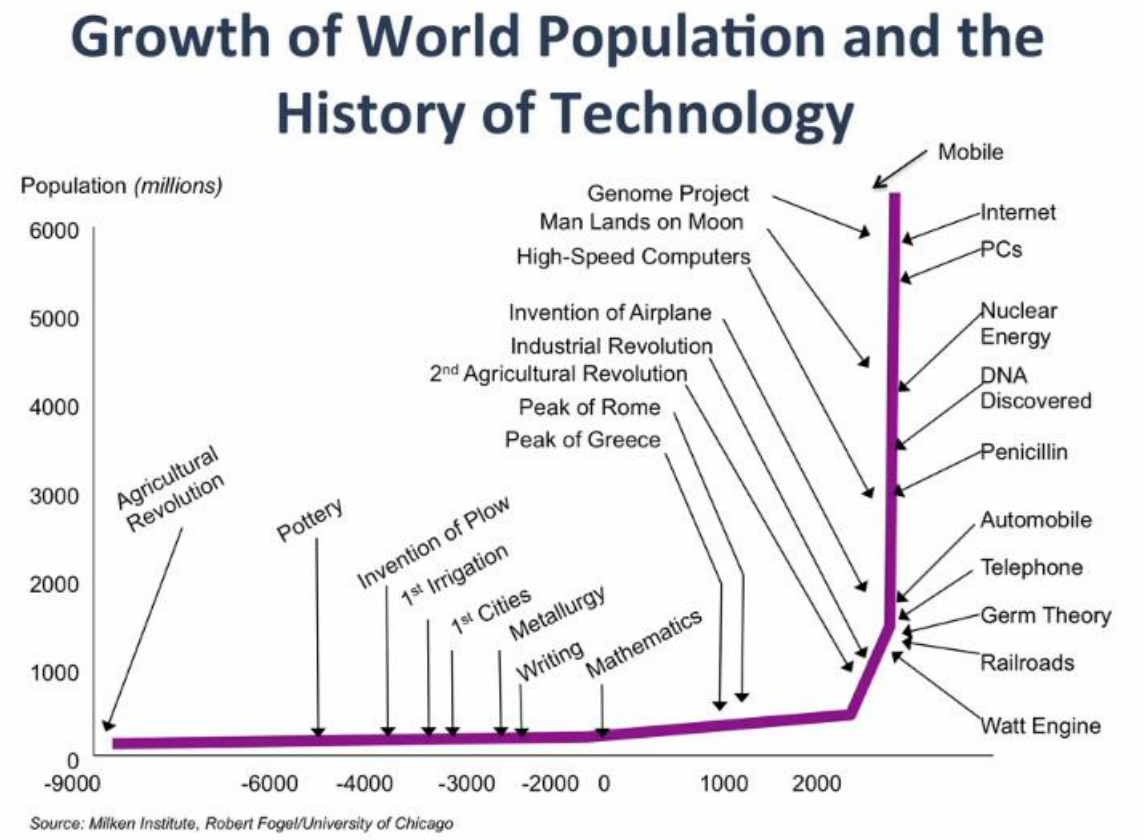

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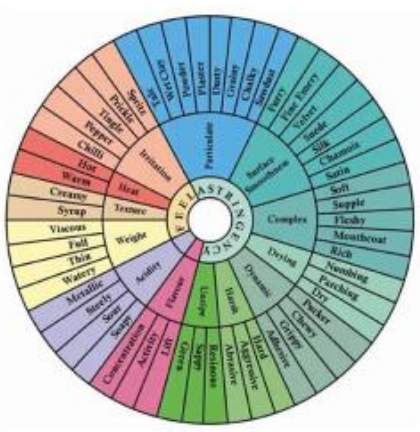
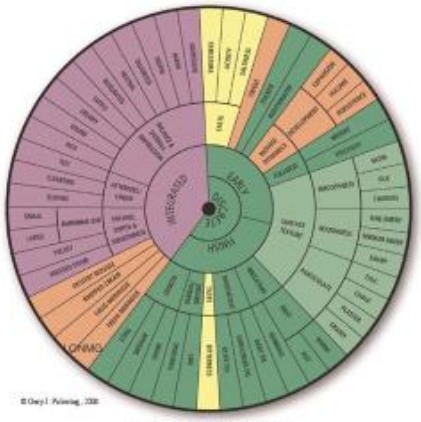
Red & White Mouth-Feel Wheels



Red Wine Mouth-feel Wheel
Terminology for Communicating the Mouth-feel of Red Wine
Source: Gawel, R.; Oberholster, A.; and Francis, I.L. (2000)
Australian Journal of Grape and Wine Research, 6(3), 203-207
© Australian Society of Oenology and Viticulture



The White Wine Mouthfeel Wheel:
A Lexicon for Describing the Oral Sensations Elicited by White Wine
Source: Pickering, Gary J. (2008)
Journal of Wine Research 19(1):51-67 · March 2008
© Gary J. Pickering

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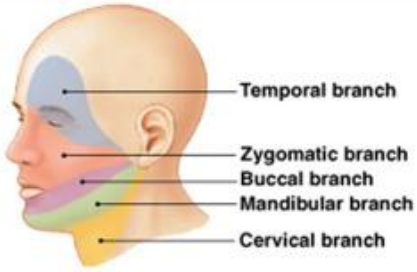
Originates in the pons

CN VII: Facial Nerve

5 Branches

1. Temporal
2. Zygomatic
3. Buccal
4. Mandibular
5. Cervical



- Function:
  - **Somatic Motor** to muscles of facial expression
  - **Parasympathetic (motor)** to lacrimal and salivary glands
  - **Sensory** taste to anterior 2/3 tongue

20

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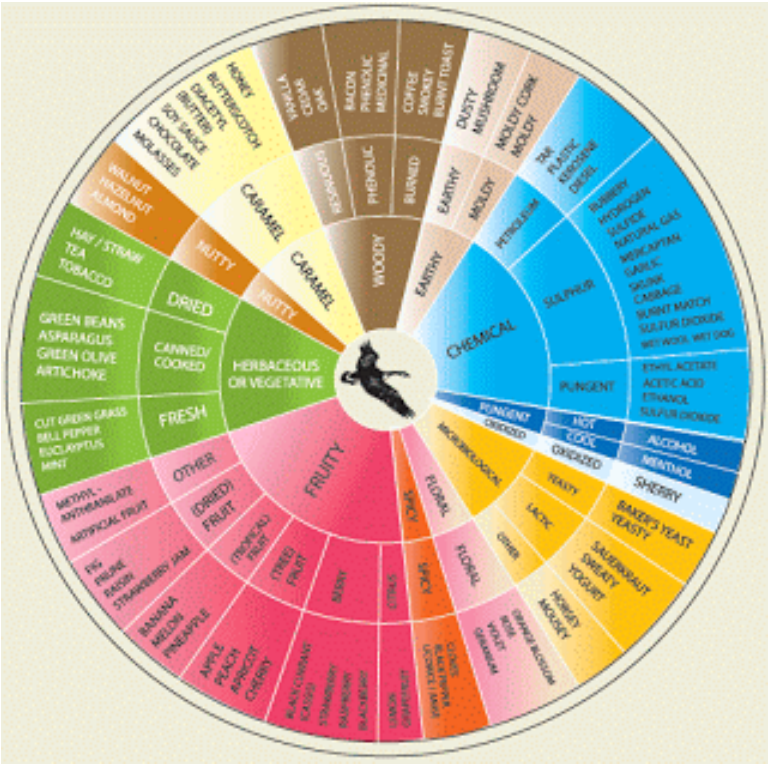

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6. Organize in a visual collage
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Tim Gaiser’s Steps to Distinguish & Remember Smells:

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What images appear in your eye’s mind when smelling a lemon?*	Is the picture still or moving?*
Where is the image located? Near? Far? Left? Right?*	Is it flat or 3 dimensional?*
Is it in color or black & white?*	Is it bright or dim?*
Is there a border round the image or not?*	Is it sharp focus or fuzzy?*
Can you feel with other senses, like touch, hearing noise?*	Is it moving like a motion picture?*
Train your nose to remember the smell by saying out loud what it is.*	Link a memory to the smell.*

4. Make a mental picture of the first thing you notice (such as apple?), put in visual collage or folder, then continue smelling.*
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* Neuro-Linguistic Programming Tools

Bottom Line: Remember that both Melani Mc Bride and Tim Gaiser recommend to **enjoy the smell**!