The Australian Wine Research Institute

Understanding wine quality: linking wine composition, sensory properties and consumer quality perceptions

by Markus Herderich
The Australian Wine Research Institute
@ Lieu de la Vigne - Assemblee Generale
11 March 2011

Acknowledgements

- Sakkie Pretorius
- Leigh Francis, Patricia Osidacz & AWRI sensory team
- Simone Mueller & Larry Lockshin, UniSA
- Jean-Pierre Megnin & Lien de la Ligne

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- WHAT is quality?
- WHO are we talking to?

- tools & case studies

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learning

genomics

sensory vs. marketing

wine & society

- WHAT is quality?


quality
absence
of faults
learning
composition
interactions


composition
interactions
quality
absence
of faults
learning


consumers
& preferences


biology
receptors
recognition
regulation

WHO are we talking to?

research tools

How can we relate consumer response to compositional measures?

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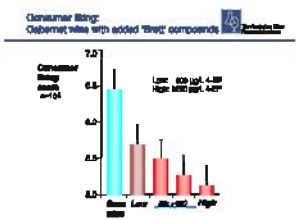
Commercial wines Correlative study	Base wine with added components	Experimentally produced wines: treatments imposed
• Most realistic • Large number of variables involved • Correlation or causation?	• Dependent on base wine used • Additions can unbalance the wine • Multiple sensory properties can still be affected	• Can be relatively small sensory differences • Highly standardised winemaking: less pleasant wines

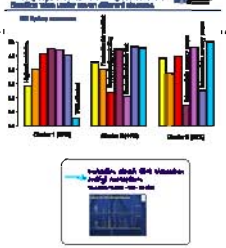
faults, off flavors & taints

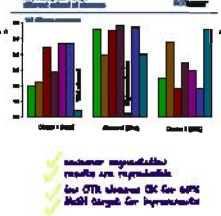
brett & 4EP

closures & reduced aromas



Australian domestic wine





composition and sensory

Consumer liking:
Cabernet wine with added 'Brett' compounds

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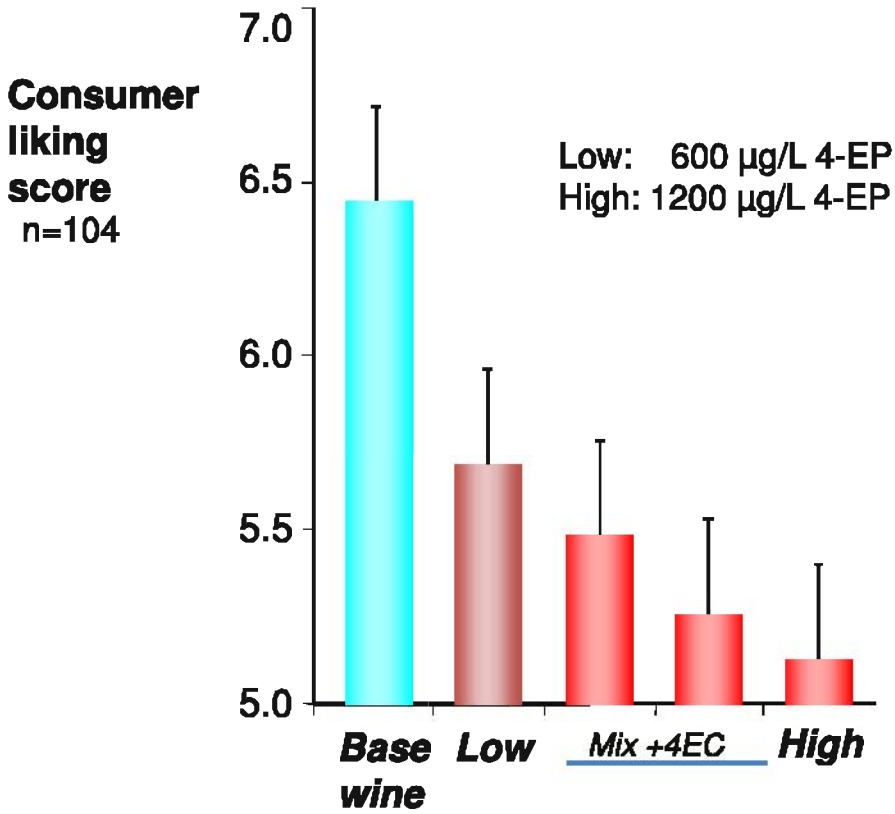

CATEGORY	SCREWCAPS	CORKS
Under $20 Whites	98.6%	1.4%
Under $20 Reds	96.7%	2.3%
Over $20 Whites	98.5%	1.5%
Over $20 Reds	83.2%	16.8%

Australian domestic win

Do consumers respond to closure related sensory differences?

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- Unoaked Clare Semillon two years in bottle
- 14 different closures
- Trained panel sensory profile for each wine





Three groups of consumers: liking scores for the Semillon wine under seven different closures

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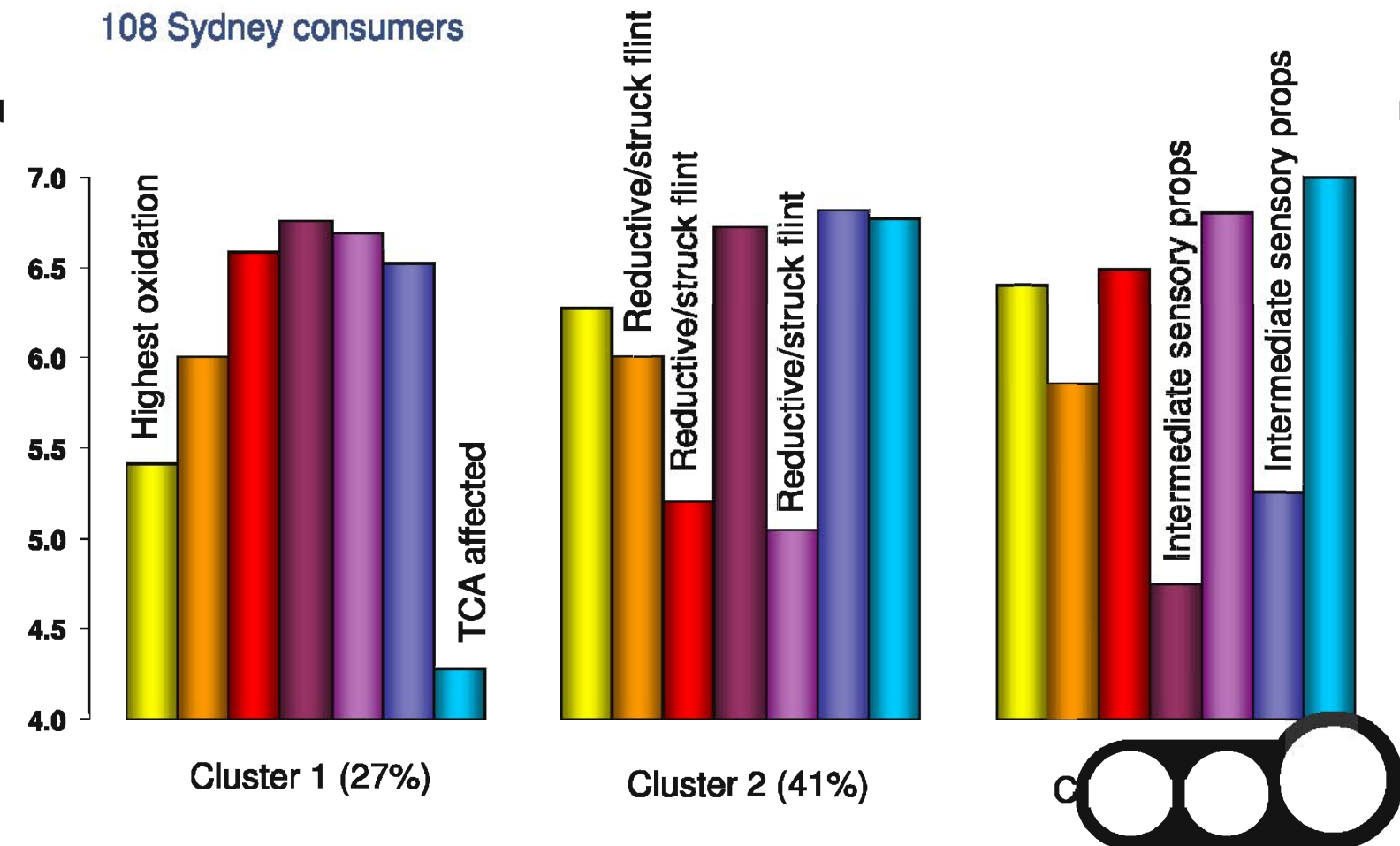
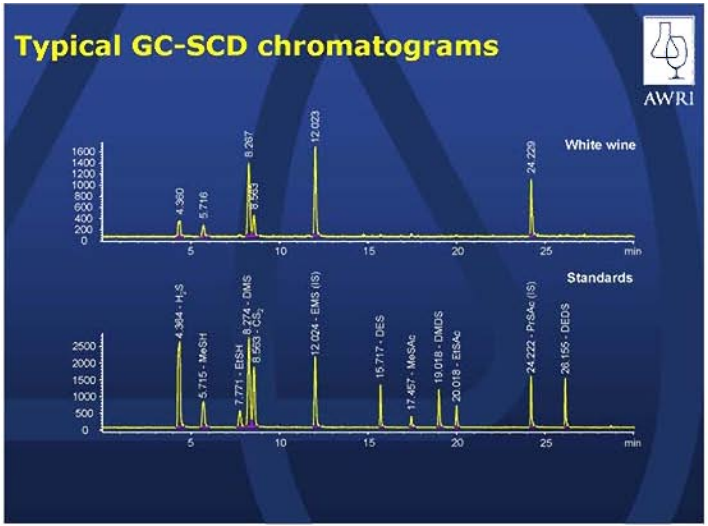


reductive struck flint character: methyl mercaptane

(large volume headspace - COC - GC-SCD)



Repeating the study: different subset of closures

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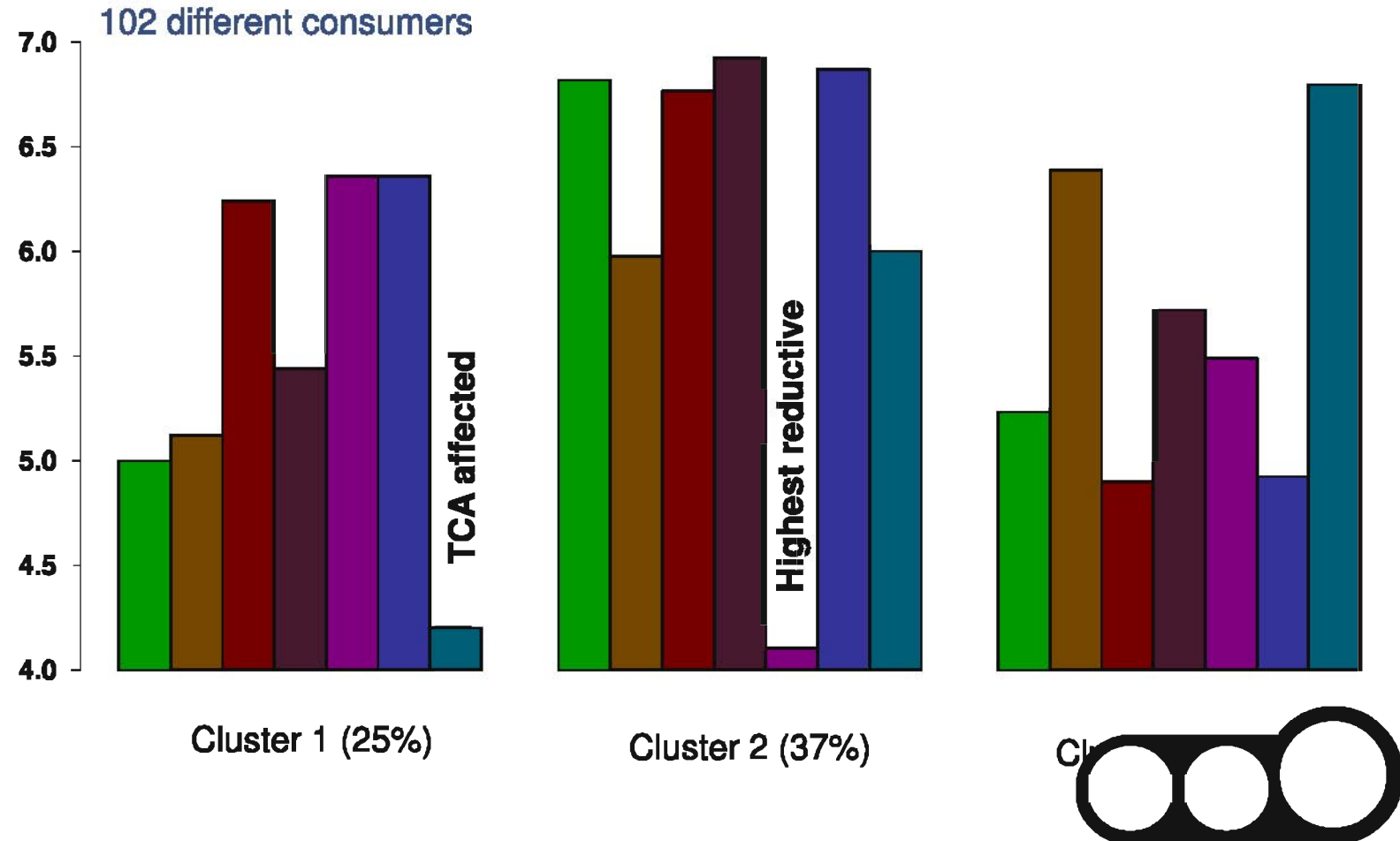

Cluster 1 (25%)

Cluster 2 (37%)

Cluster 3 (38%)

- consumer segmentation results are reproducible
- low OTR closures OK for 60%
- MeSH target for improvements

commercial white wine: sensory & composition

Relating consumer acceptance of white wines to phenolic related sensory and chemical attributes

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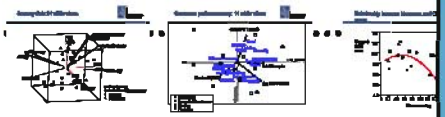
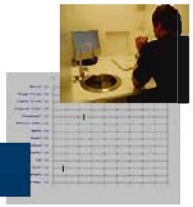
- 24 commercial white wines: Chardonnay, Riesling, Pinot Gris
- High sales examples, lower and higher levels of phenolics
- Residual sugar less than 4 g/L



Trained AWRI panel sensory profiles

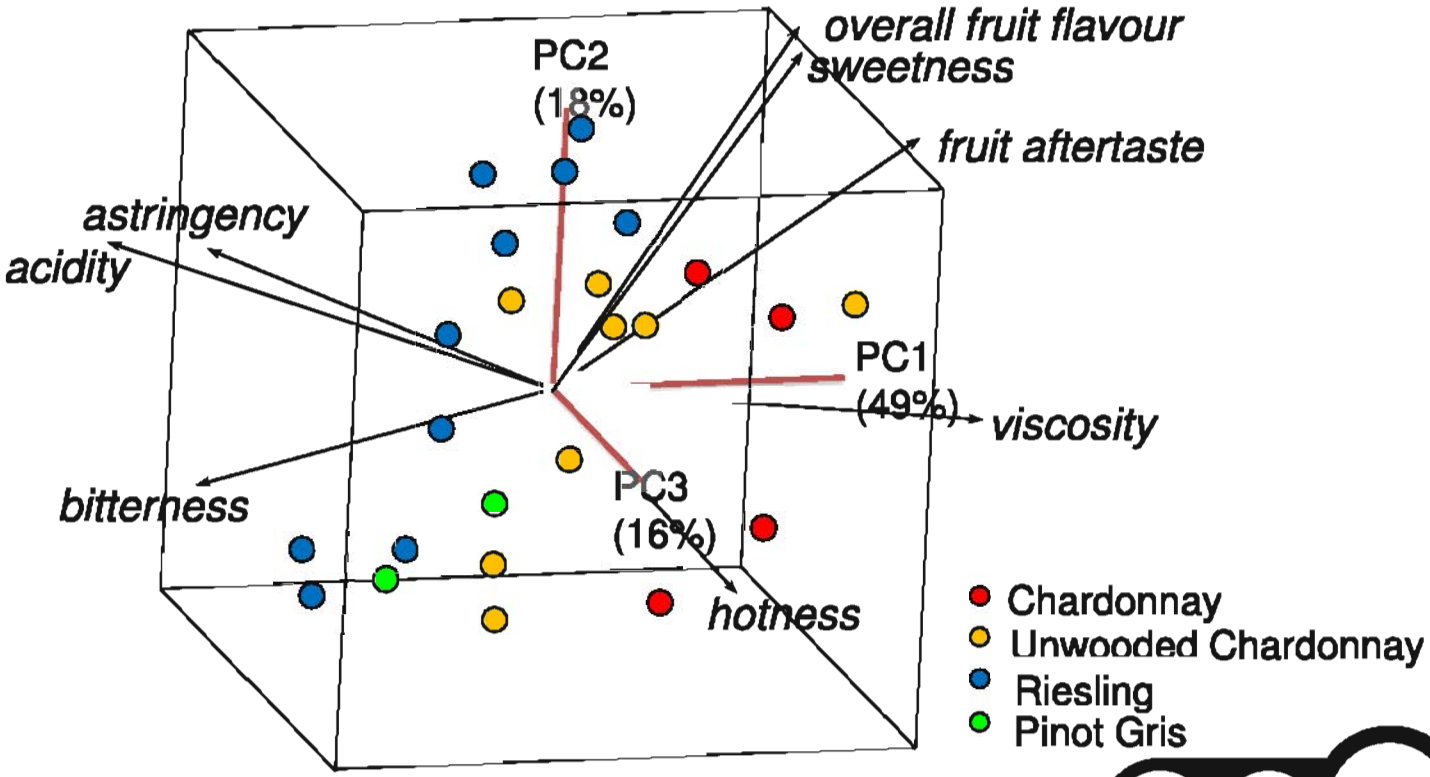


203 Sydney consumers: regular white wine drinkers

Compositional data

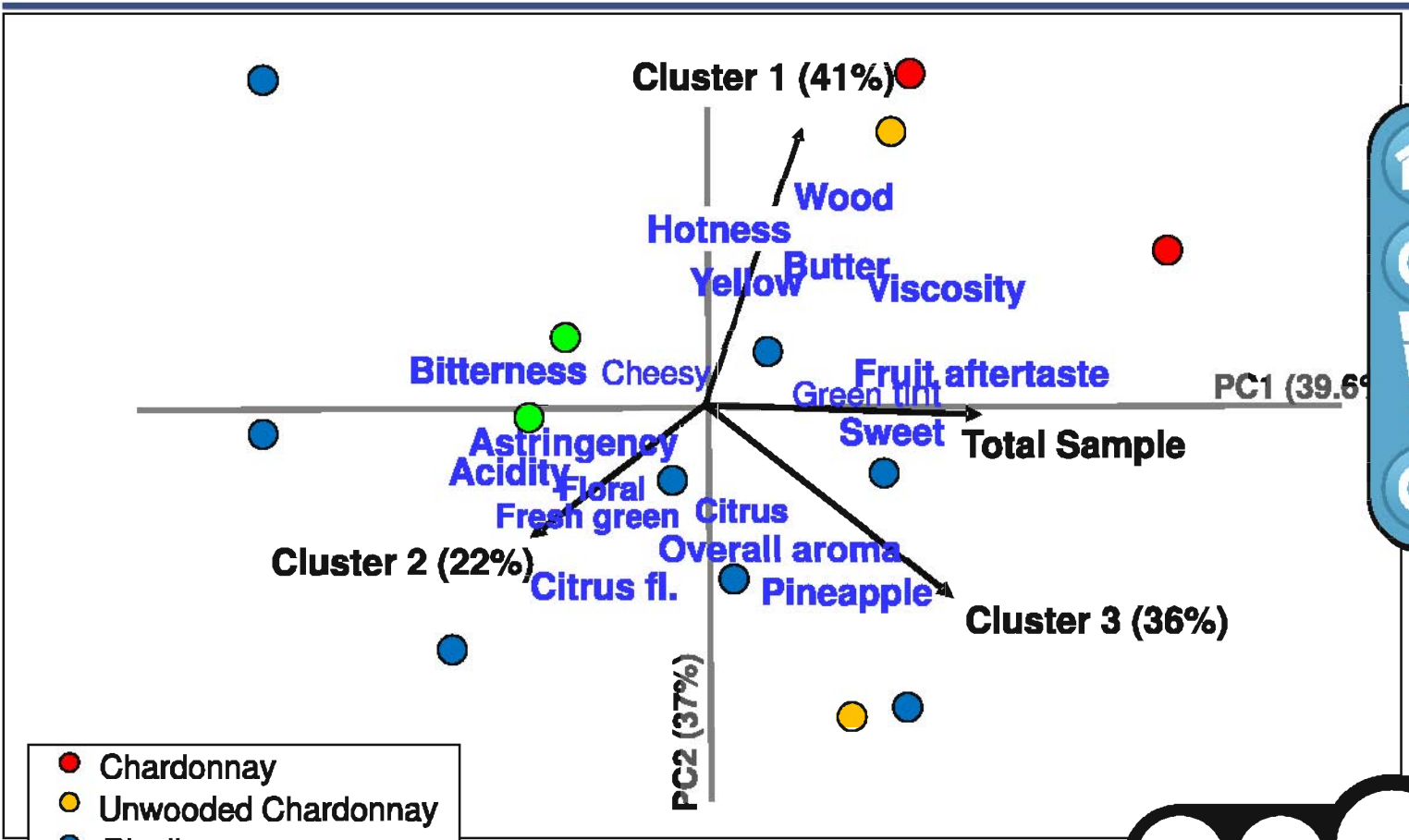
Sensory data 24 white wines

The Australian Wine Research Institute

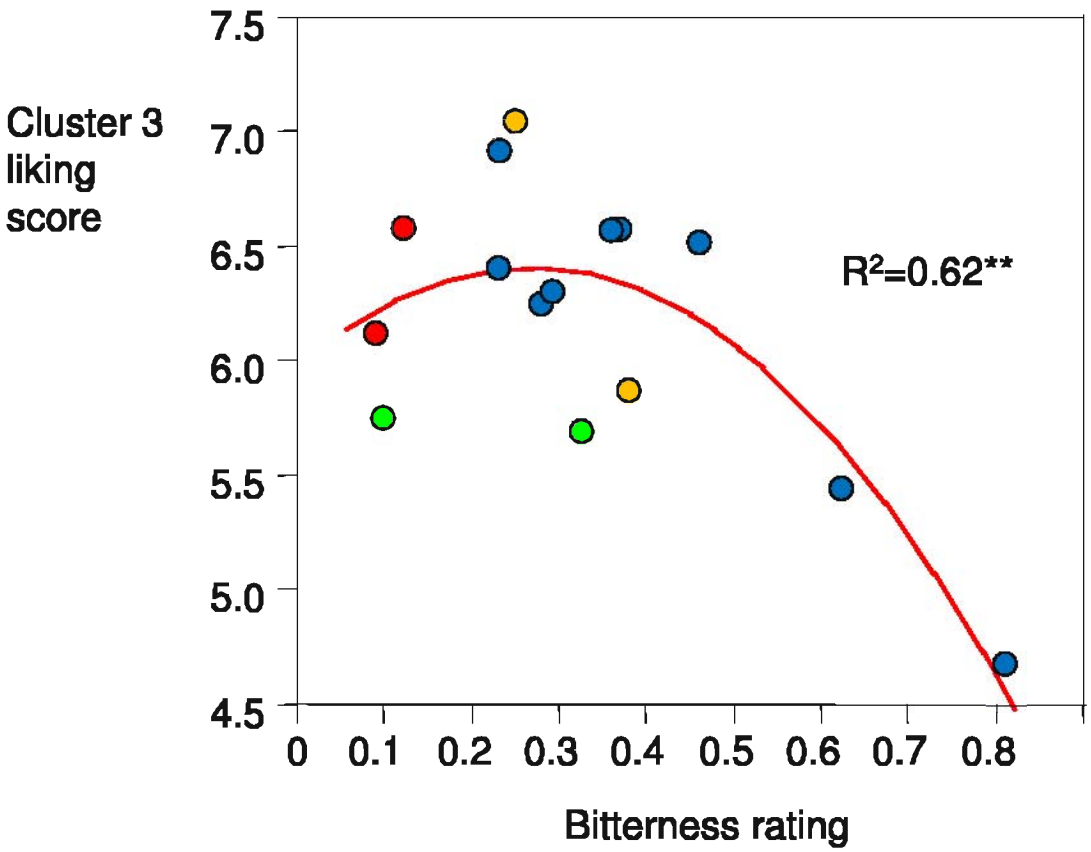


Consumer preference map: 14 white wines

The Australian Wine Research Institute

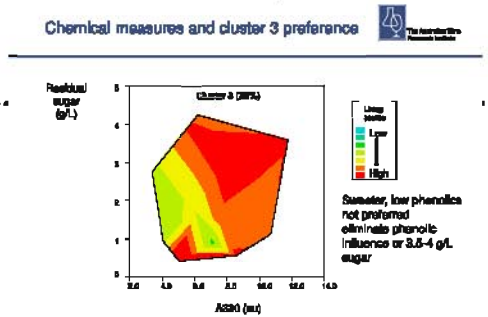


Relationship between bitterness and liking score



practical tools

practical tools for the winery



practical tools for the consumer

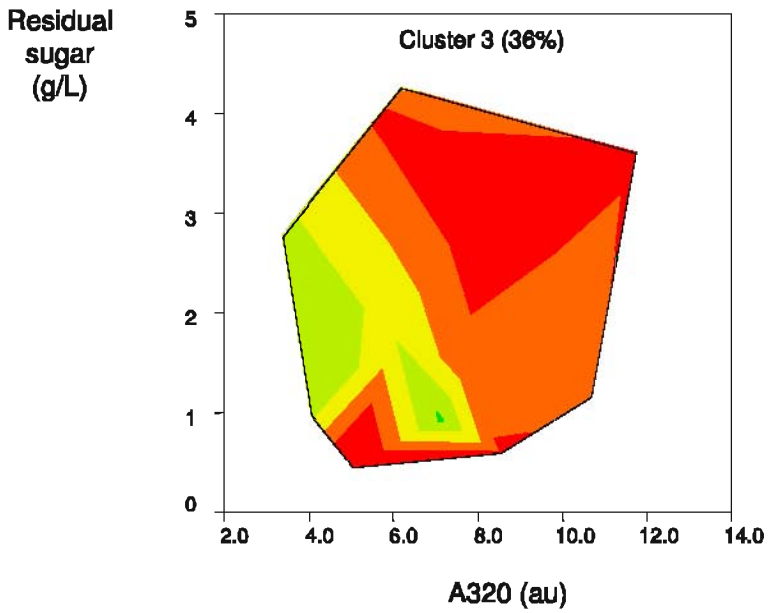
Pinot gris

Pinot grigio

practical tools for the winery

Chemical measures and cluster 3 preference

The Australian Wine Research Institute

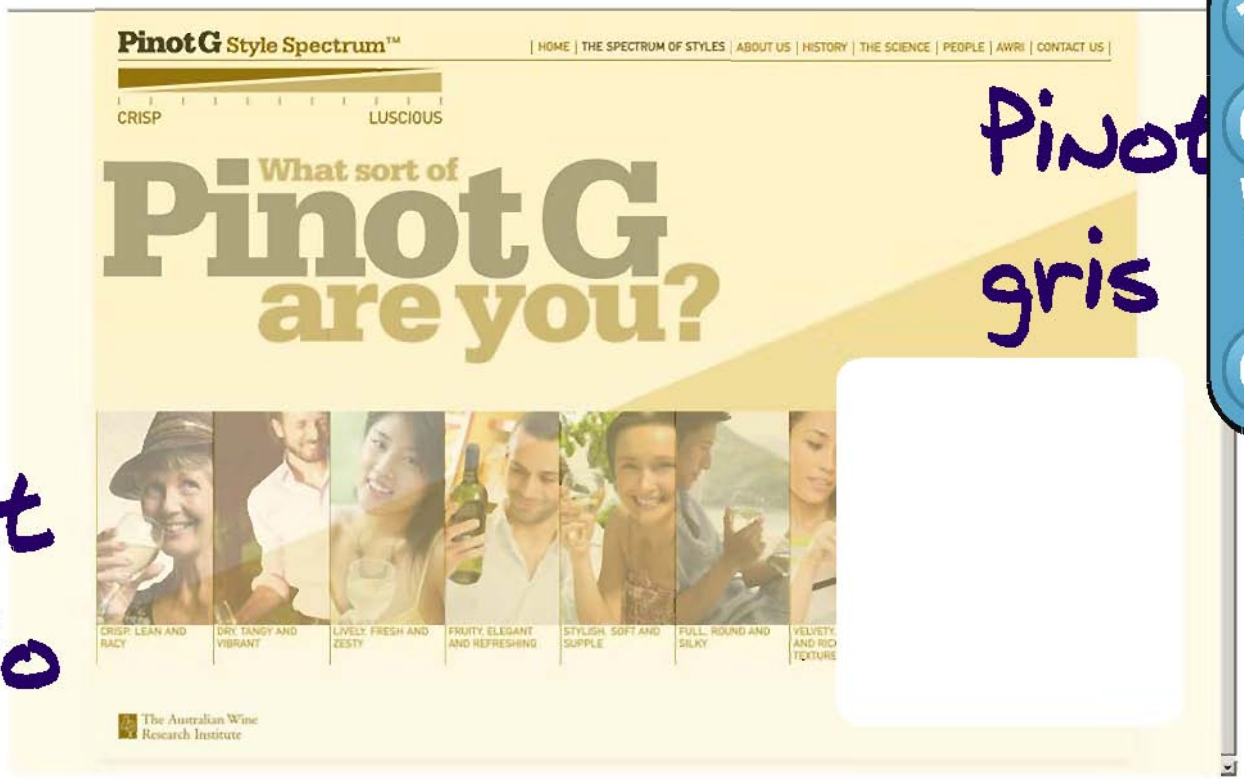


Sweeter, low phenolics not preferred eliminate phenolic influence or 3.5-4 g/L sugar

practical tools for the consumer

Pinot gris

Pinot grigio



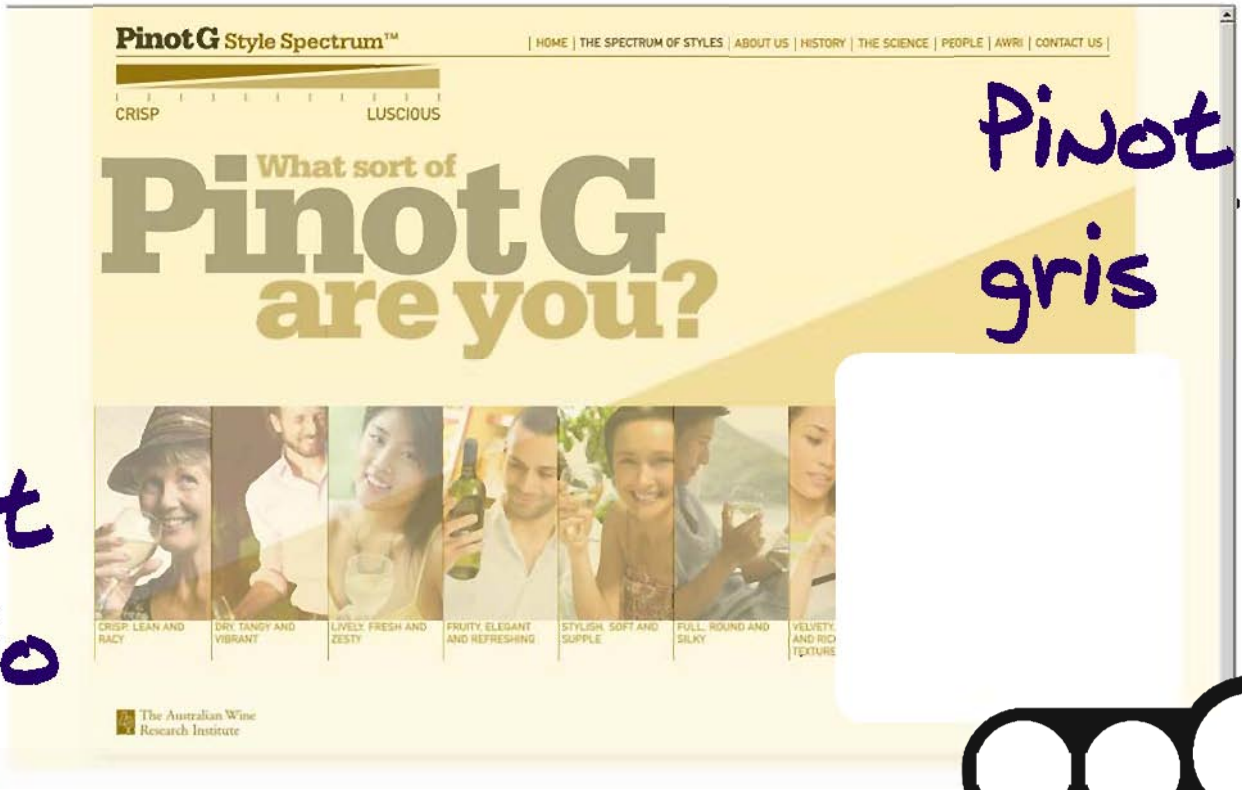
Pinot grigio

VELVETY, GENEROUS AND RICHLY TEXTURED

POWERFUL, RICH AND WARM

LUSCIOUS, OPULENT AND LUXURIOUS

practical tools for the consumer



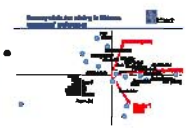
Pinot gris

Pinot grigio

commercial red wine

Comparing Chinese and Australian consumers' red wine preferences

- 22 widely varying commercial red wines: Cabernet and blends, Shiraz and blends, Merlot, Malbec, Sangiovese
- Australia, France, California, China, Argentina, Italy
- 2007- 2004 vintage
- $A8-20



Three types of testing on 22 red wines

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Trained Sensory Panel attribute intensity ratings

AWRI external panel: consumer based descriptive language

Consumer testing 14 wines

- 310 Beijing, Shanghai, Guangzhou consumers
- 210 Sydney and Melbourne consumers

Chemical measures

Sensory attributes relating to Chinese consumers' preferences

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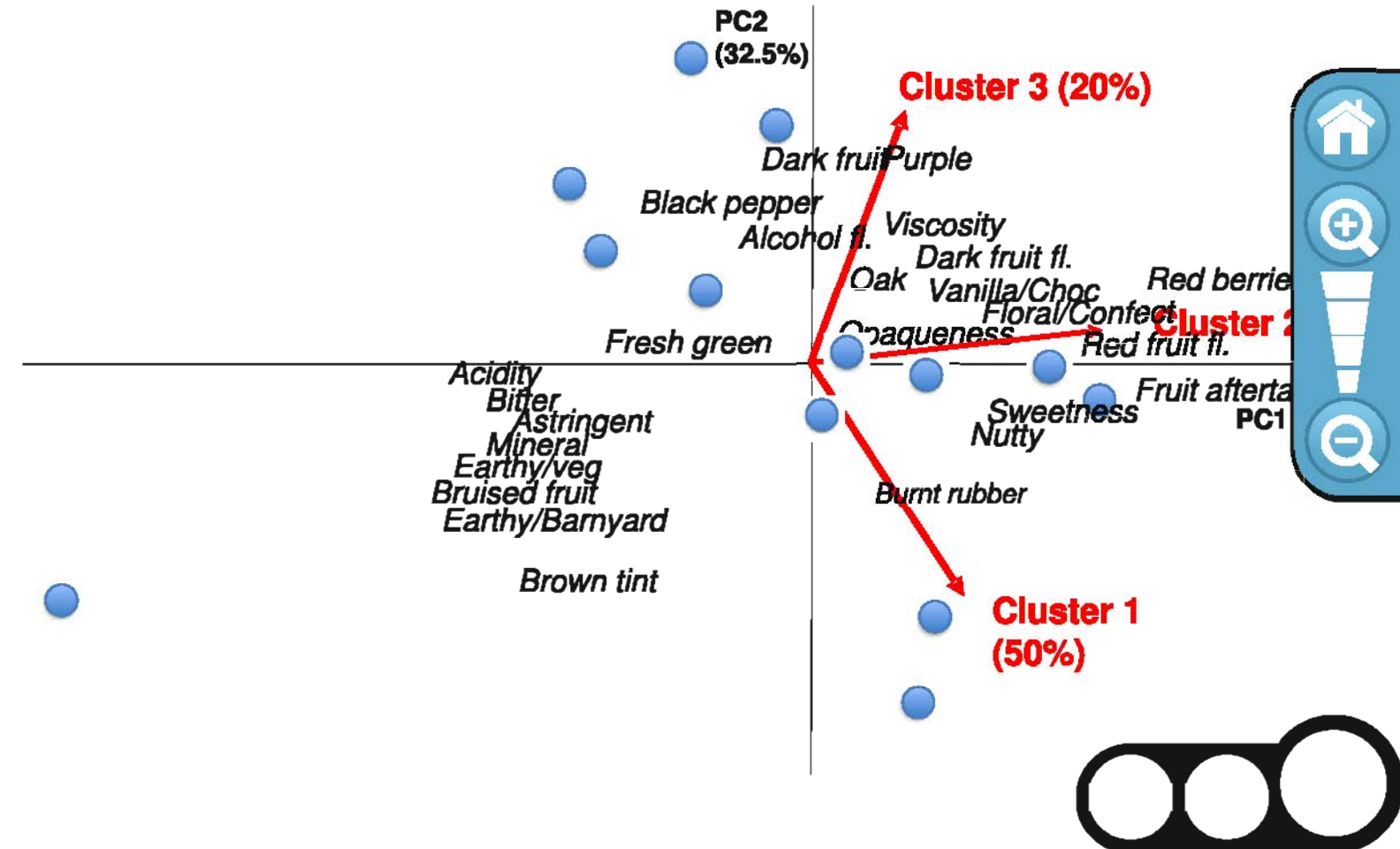

Chinese and Australian consumers: important sensory attributes

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China

Cluster 1 (50%)	Cluster 2 (30%)	Cluster 3 (20%)
fruit aftertaste, dark colour, sweetness, oak/wood, nutty	fruit aftertaste, red fruit fl., sweetness, floral/confectionary	fruit aftertaste, red fruit fl., dark fruit, purple, vanilla
alcohol, **dark fruit**, purple	bruised fruit, brown, earthy, mineral	acidity, bitterness, bruised fruit, brown, earthy, astringency

Australia

Cluster A (38%)	Cluster B (39%)	Cluster C (23%)
red berry/red fruit, sweetness, nutty	dark colour, purple, sweetness, viscosity, dark fruit, red berry/red fruit	dark colour, dark fruit, alcohol, oak, astringency, fresh green, acidity, bitterness
fresh green, acidity, bitterness	earthy, nutty, bruised fruit	sweetness, red fruit

composition and sensory

What chemical analyses relate to these key sensory properties?

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- 62 chemical measures: volatile aroma compounds (oak compounds, sulfur compounds, fermentation derived esters, alcohols, acids, methoxypyrazine, monoterpenes, norisoprenoids, rotundone, cineole, 4-EP…..), tannin, basic composition

- Additional 21 Australian Shiraz wines studied as part of the University of South Australia/AWRI collaborative project

UniSA | Ehrenberg-Bass institute for Marketing Science WINE MARKETING GROUP

PLS models: what are the most important predictive components for each sensory attribute?

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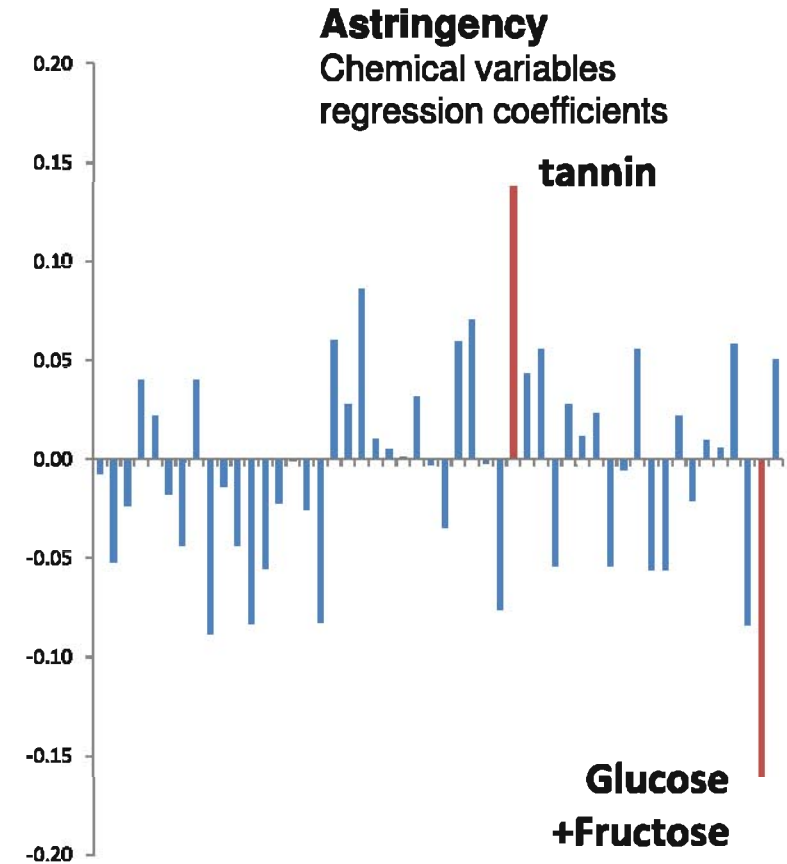
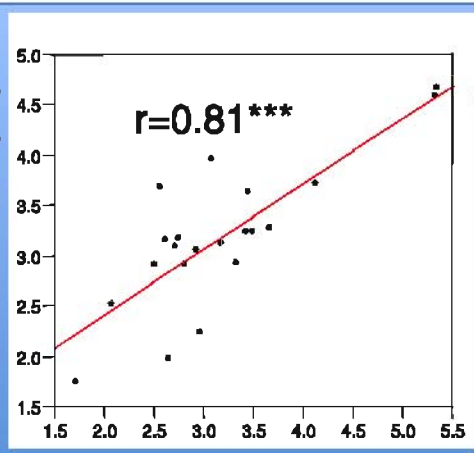


Astringency predicted by chemical data



Astringency measured by sensory panel

r=0.67** 21 Shiraz wines

Relationships between sensory properties and aroma compounds

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Red berry

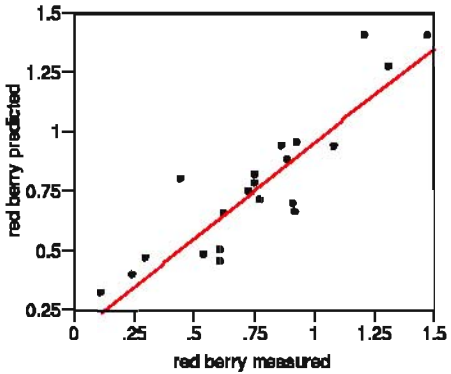
positive, enhancing

- 2, 3- Methyl butyl acetate
- *Hexyl acetate*
- 2-phenylethyl acetate
- *Damascenone*
- *Vanillin*
- *4-Methyl guaiacol*

negative, masking

- Acetic acid, *Ethyl acetate*
- *Eugenol, cis-* and *trans-oak lactone*
- 4-EP, 4-EG
- *DMS*
- *IBMP*
- *Ethyl 2+3 methyl butanoate*

r=0.90*** China study
r=0.78*** 21 Shiraz wines



‘Fresh green’ green beans/capsicum

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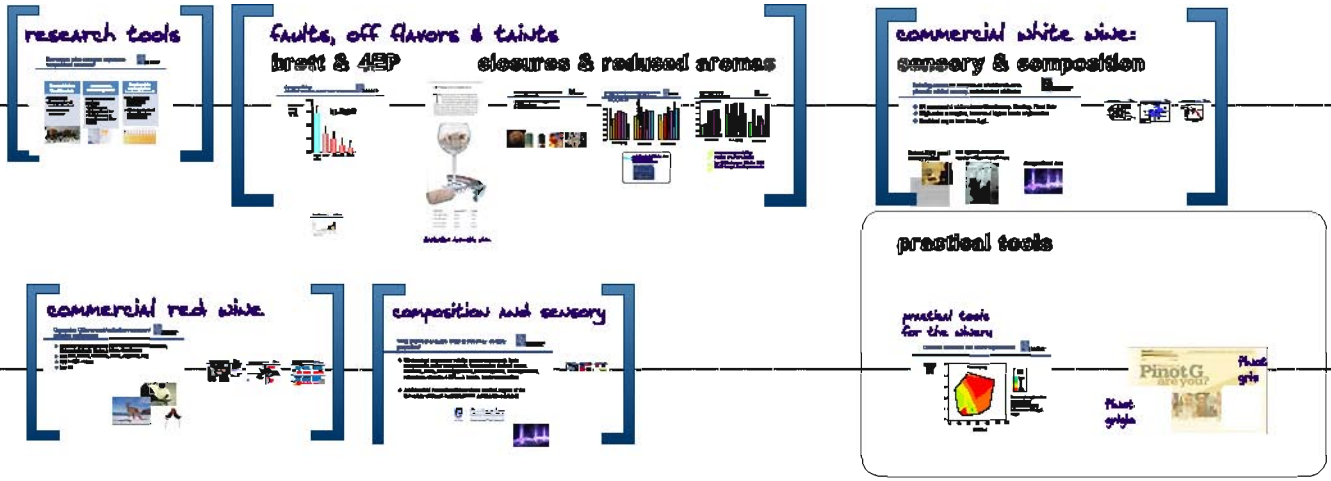
- **Positive,** enhancing
- IBMP

- **Negative,** masking
- Beta-ionone
- vanillin

China study r = 0.55





case studies

winemaking and packaging affect composition AND preferences
consumer segmentation is real and stable
wine drinking experience key factor
understanding composition is key for targeted improvements

Effect of repeated wine exposure on consumer preferences

Leigh Francis & Patricia Osidacz, AWRI; Mark Stevens SensoMetrics

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- where to next?

learning

matters!

• where to next?

genomics

micro arrays

human taste & olfactory receptors

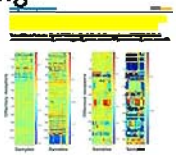
next gen sequencing

$1000 genome

personalised medicine

biology vs learning

- genes, SNPs, CNVs;
- regulation;
- signal processing

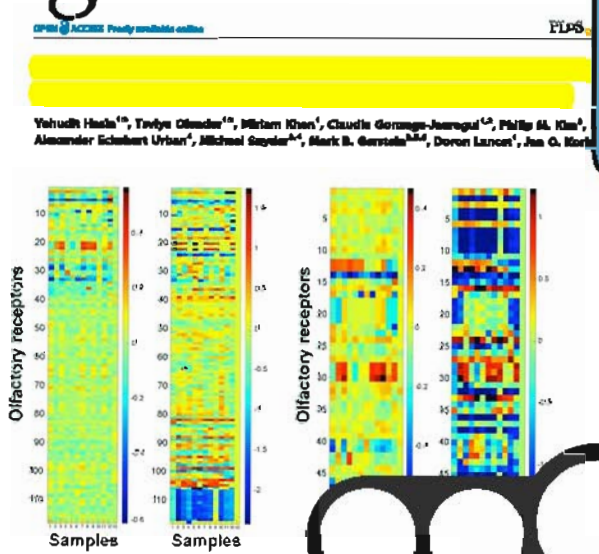


characterise panel members

understand & better target consumers

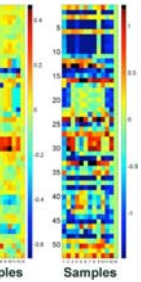
biology vs learning

- genes, SNPs, CNVs;
- regulation;
- signal processing



characterise panel members

Gonzaga-Jauregui[1,2], Philip M. Kim[3], erstein[3,5,6], Doron Lancet[7], Jan O. Korbel[2,7]*



Common Worldwide Variation Discovered In Human Taste Receptor Genes

Common Worldwide Variation Discovered In Human Taste Receptor Genes

Background: Differences in our sense of taste may have a profound impact on which foods we choose to eat, so it is important to understand the basis of these differences. Recent advances in chemosensory science have led to the identification of taste receptors, located on the surface of taste cells that reside on the taste buds on the tongue. These receptors bind to tastants released from food and initiate signals to the brain, where the specific taste is recognized. It has been known that the *T2R* gene family is involved in detecting bitter taste in humans. This gene family contains 25 different genes, encoding different receptors that allow humans to taste a wide variety of different bitter substances.

Advance: In studying the individual difference in bitter taste sensation, NIDCD intramural scientists discovered that all 25 human bitter taste receptor genes exist in a variety of different forms in the population. These genes encode for different receptor proteins. Evolutionary genetic analyses suggest the different forms of these genes have occurred in high frequencies in the population under the influence of natural selection. This implies that the different forms of each receptor functions to sense different bitter substances.

Implications: These findings reveal how inherited factors affect taste perception and food preferences in different individuals. These preferences can have major implications for dietary choices each person makes. Obesity and Type 2 diabetes are known to be caused by a combination of genetic and environmental factors. The variations found in taste receptor genes may represent a portion of the underlying causes of these disorders, and additional research is warranted. In addition, the discovery that different forms of a particular gene exist at high frequency in different populations may provide information about ethnic differences in food preferences and dietary choices, and may allow reveal more about health disparities between different groups of individuals.

Citation: Kim U, Wooding S, Ricci D, Jorde LB, Drayna D. Worldwide haplotype diversity, and coding sequence variation at human bitter taste receptor loci. Human Mutation 26: 199-204, 2005.

next gen sequencing

$1000 genome

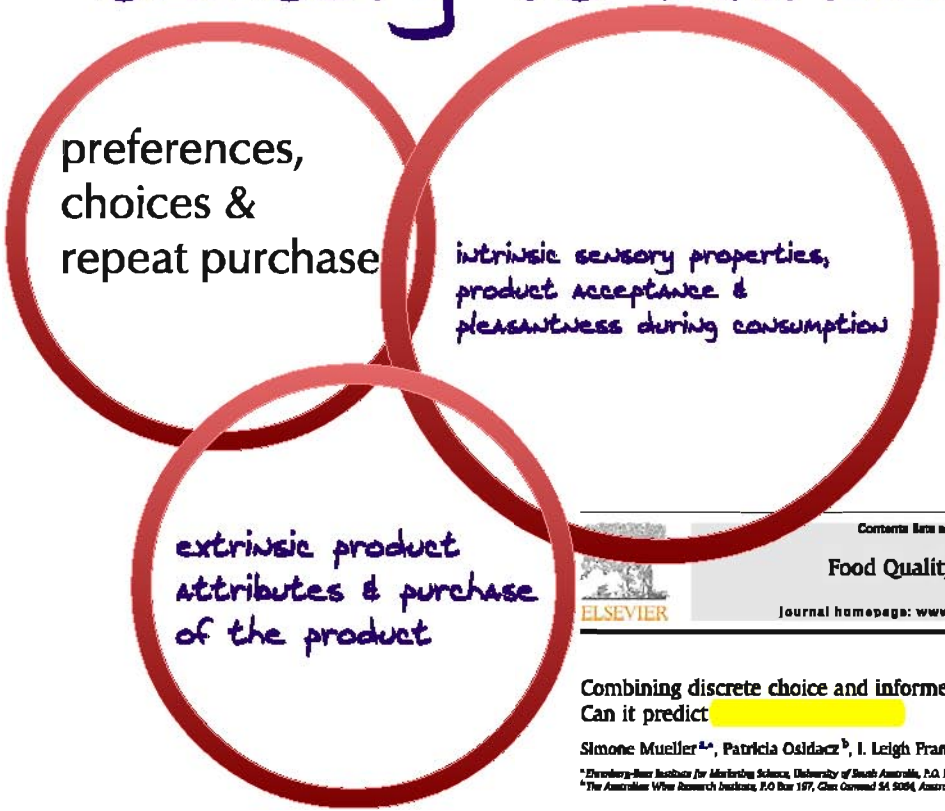
personalised medicine

characterise panel members

understand & better target consumers

Common Worldwide Variation Discovered In Human Taste Receptor Genes

sensory vs marketing



Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Combining discrete choice and informed sensory testing in a two-stage process: Can it predict

Simone Mueller[a,*], Patricia Osidacz[b], I. Leigh Francis[b], Larry Lockshin[a]

[a] Ehrenberg-Bass Institute for Marketing Science, University of South Australia, P.O. Box 2474, Adelaide SA 5000, Australia
[b] The Australian Wine Research Institute, P.O Box 197, Glen Osmond SA 5064, Australia

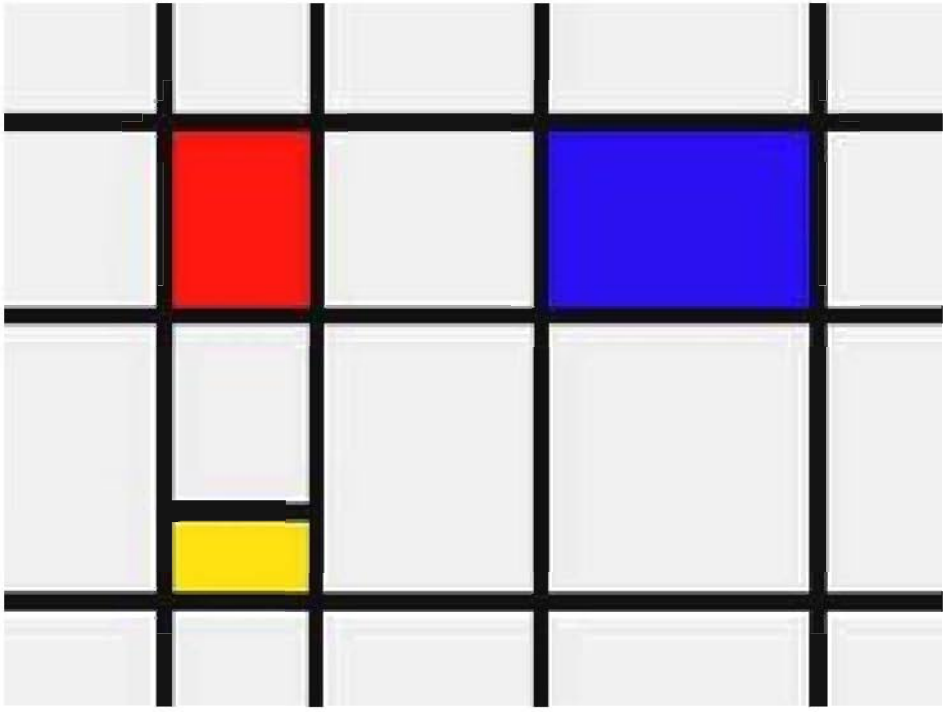
- where to next?

wine & society

sustainability

public health

next gen consumers



Piet Mondrian:
a painting is no longer
describing things we see,
self-expression of the artist

BUT:
a way of organising space
design, furniture, architecture, town planning

Sensory:

is no longer only describing the wine we produce & sell and drink, self-expression of the winemaker or marketing team.

BUT:

a way of connecting with

consumers,

future consumers,

and society