

A Sensory Journey from Local Roots to Global Innovation

Chris Findlay and John Castura
Compusense Inc.
Guelph, Ontario, Canada

How do we know where we are going
unless we know where we've been?



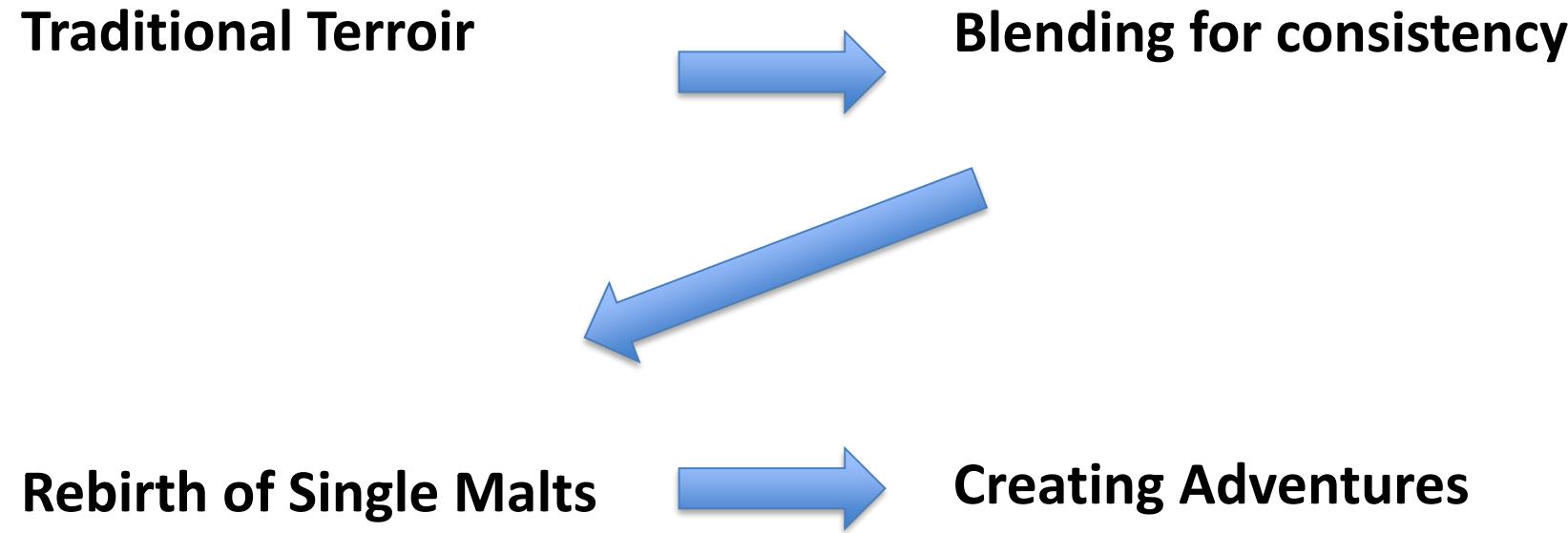
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The power of a map



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Evolution of Whisky Sensory Properties



2012 Whisky Study

Sensory Descriptive Analysis

Feedback Calibration training improves
whisky sensory profiling

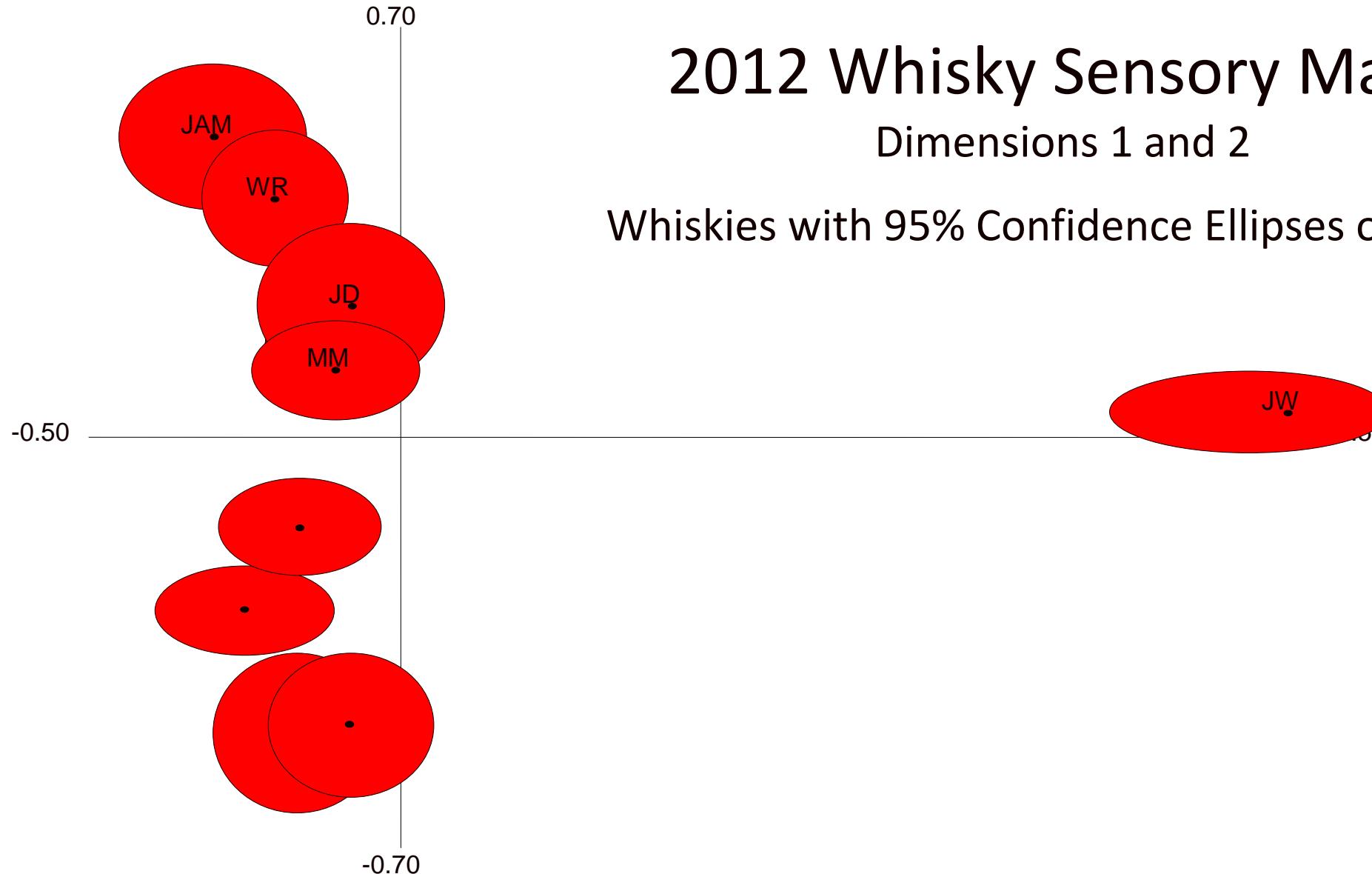


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2012 Whisky Sensory Map

Dimensions 1 and 2

Whiskies with 95% Confidence Ellipses overlaid

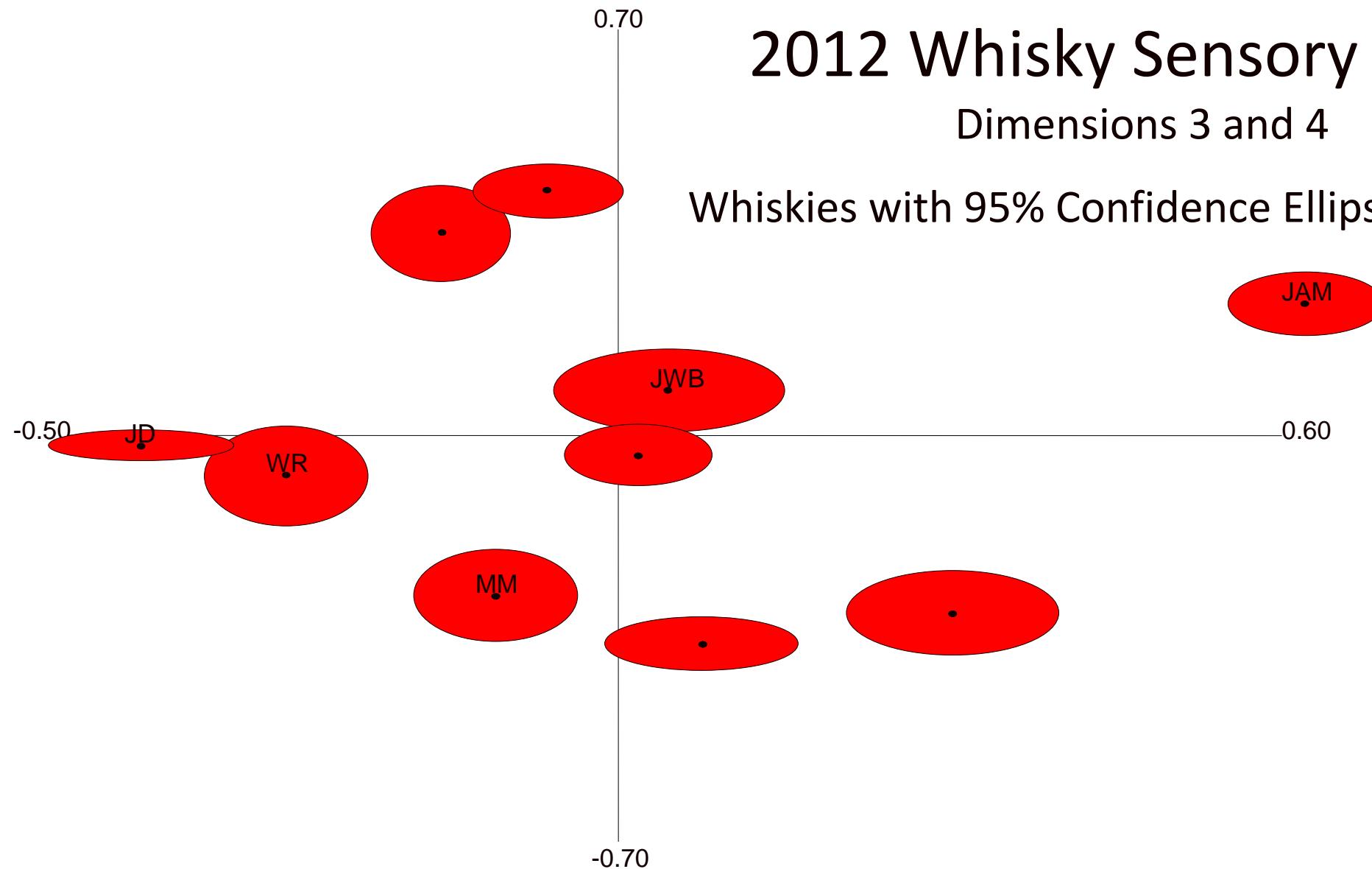


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2012 Whisky Sensory Map

Dimensions 3 and 4

Whiskies with 95% Confidence Ellipses overlaid



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2017

Descriptive Analysis of Whisky Aroma Using Feedback Calibration



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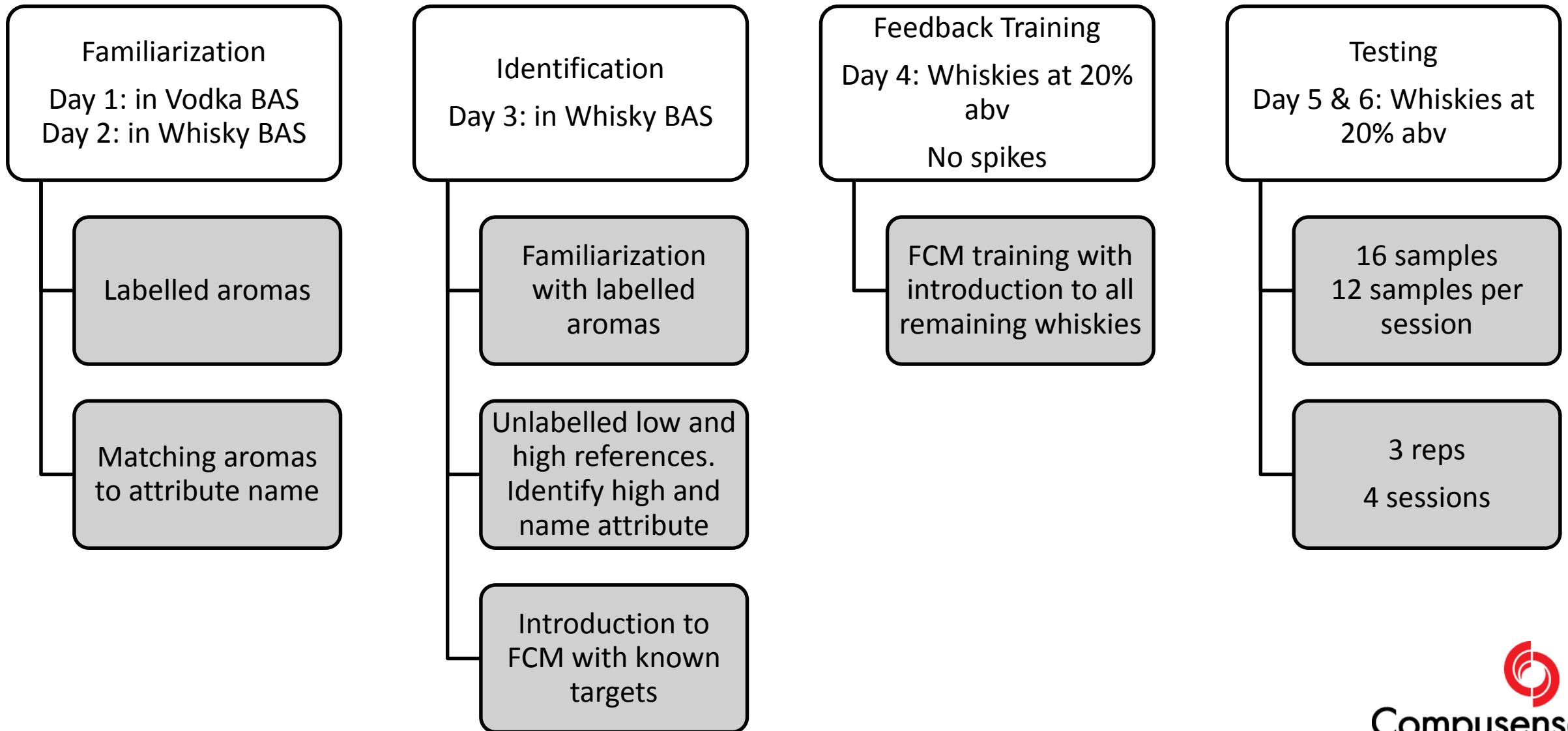
The Whiskies

	Product	Code	Designation	
1	Johnnie Walker Black	JB	12 year	Scotch
2	The Glenlivet	GL	12 year	Scotch
3	Glenfiddich	GF	12 year	Scotch
4	Glenmorangie	GM	Original	Scotch
5	Lagavulin	LA	8 year	Scotch
6	Jack Daniels	JD	Tennessee	Bourbon
7	Maker's Mark	MM	Kentucky	Bourbon
8	Jameson's	JA	Irish	Irish
9	Crown Royal	CR	Canadian	Rye
10	Woodford Reserve	WR	Kentucky	Bourbon
11	Alberta Premium	AP	Canadian	Rye
12	Basil Hayden	BH	Kentucky	Bourbon



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Training and testing schedule



Aroma Attribute Training

Examples of High and Low references for training

Attribute	Low reference	Spike	High reference
Phenolic	Colorado Whiskey	*Aroxa capsule: guaiacol	1 capsule in 100 mL Johnnie Walker Black
Malty	Jameson	Happy Home Malt Syrup	20 g in 30 mL Colorado CP
Grassy	Colorado Whiskey	Aroxa capsule: cis-3-hexenol	1 capsule in 100 mL Jameson
Floral	Colorado Whiskey	Aroxa capsule: beta-damascenone	1 capsule in 100 mL Jameson
Fruity	Colorado Whiskey	Aroxa capsule: ethyl hexonate	1 capsule in 100 mL Woodford Reserve
Solvent	Colorado Whiskey	Aroxa capsule: ethyl acetate	1 capsule in 100 mL Colorado Whiskey
Vanilla	Johnnie Walker Black	Aroxa capsule: vanillin	1 capsule in 100 mL Colorado Whiskey
Cedar	Colorado Whiskey	Cedar extract	5 mL stock solution in 30 mL Maker's Mark
Buttery	Johnnie Walker Black	Aroxa capsule: 2,3-butanedione	1 capsules in 100 mL Colorado Whiskey

*AROXA references courtesy of Cara Technology Limited, Leatherhead, Surrey
All sample whiskies were diluted to 20 % ABV

Aroma Attribute Means and ANOVA

2017 Test Whiskies

Attribute	p-value	LSD	Whiskies Identified by 2 letter code											
			JB	GL	GF	GM	LA	JD	MM	JA	CR	WR	AP	BH
Medicinal	< 0.01	3.5	16.2	15.0	14.5	14.6	19.6	13.4	15.1	14.1	14.7	13.8	19.5	14.0
Phenolic	< 0.01	3.4	17.6	15.4	14.1	13.7	20.8	14.3	14.4	13.6	13.7	13.8	14.2	15.4
Tobacco	< 0.01	2.6	9.3	7.1	7.9	8.6	16.2	8.5	8.1	6.7	7.7	8.8	7.9	8.6
Cooked Cereal	0.55	2.4	7.4	7.4	8.4	8.4	8.9	8.4	7.0	7.3	6.4	8.1	6.7	8.3
Malty	0.65	2.8	13.4	11.8	10.4	12.1	12.4	11.3	12.0	10.7	11.1	11.7	12.0	10.4
Grassy	< 0.01	2.3	7.7	5.7	7.2	7.5	8.6	7.2	7.5	9.0	5.5	7.9	7.9	9.6
Floral	< 0.01	2.6	12.7	14.1	14.8	16.1	7.6	15.1	15.2	13.4	14.0	14.8	9.3	15.2
Fruity	< 0.01	2.9	12.5	14.0	15.3	15.3	6.6	13.9	12.5	12.5	13.2	15.6	12.1	13.0
Solvent	< 0.01	3.0	12.4	11.6	12.9	12.1	12.6	12.7	14.3	10.6	14.7	14.2	17.7	11.7
Vanilla	< 0.01	2.6	9.1	9.4	9.5	11.5	5.0	9.8	11.1	8.8	12.2	13.3	11.3	9.5
Woody	< 0.01	2.5	10.4	9.3	8.6	8.6	12.4	10.8	9.6	8.0	9.0	12.1	8.3	13.4
Cedar	< 0.01	2.5	9.8	8.3	8.1	8.3	11.1	10.2	8.8	7.4	7.4	10.9	6.4	12.3
Buttery	< 0.01	2.0	7.5	6.1	8.1	7.1	4.5	8.6	6.5	6.8	8.4	7.4	9.1	6.7
Nutty	0.04	2.0	5.3	5.2	4.2	5.2	6.6	6.2	5.5	4.6	6.0	6.0	6.5	7.9

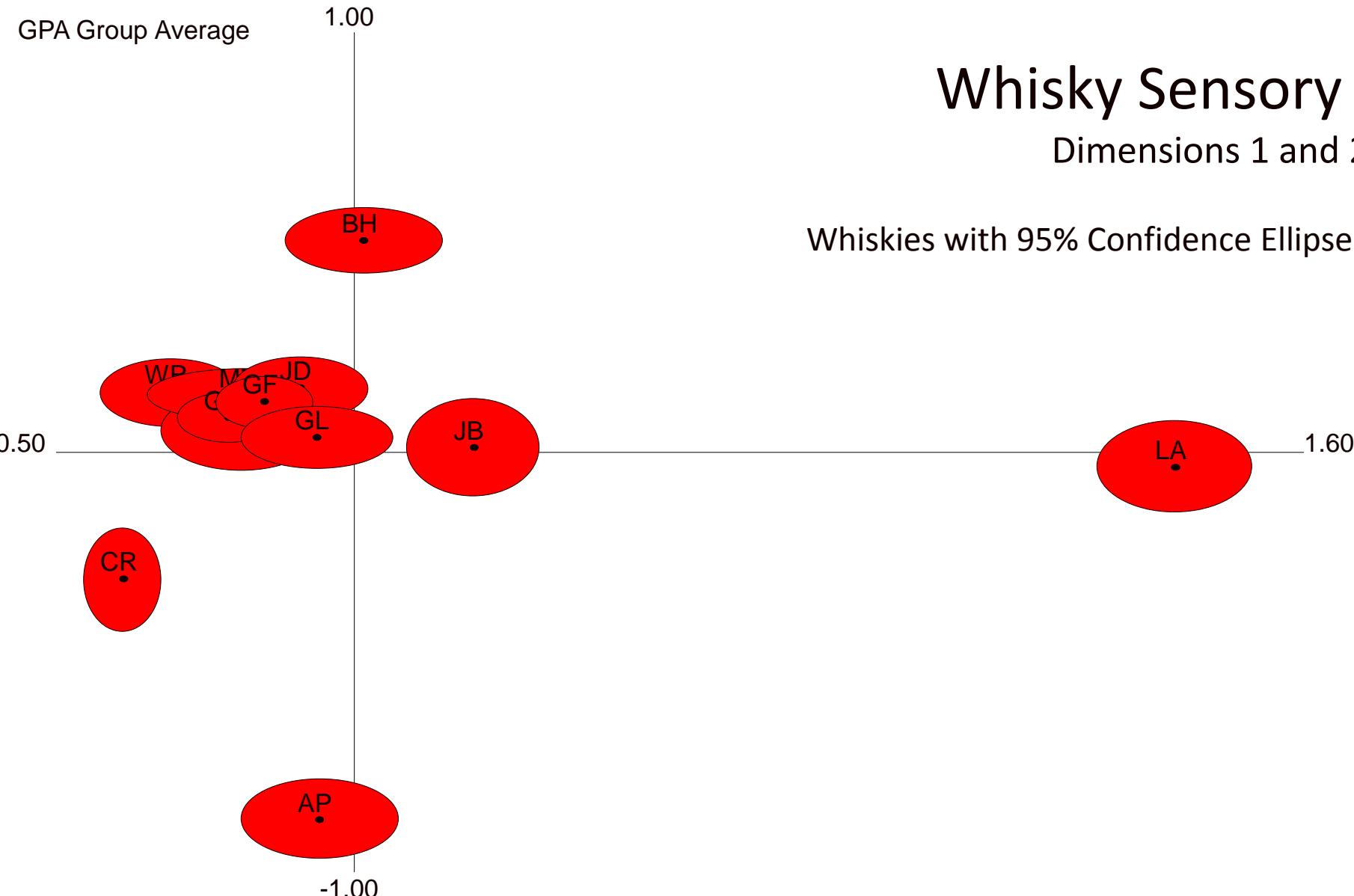
Means are based upon 3 replications per product. 13 trained panelists

All responses were collected on 100-point unstructured line scales

Attributes in grey are not significantly different (p>0.05)



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Whisky Sensory Map

Dimensions 1 and 2

GPA Group Average

Whisky Sensory Map

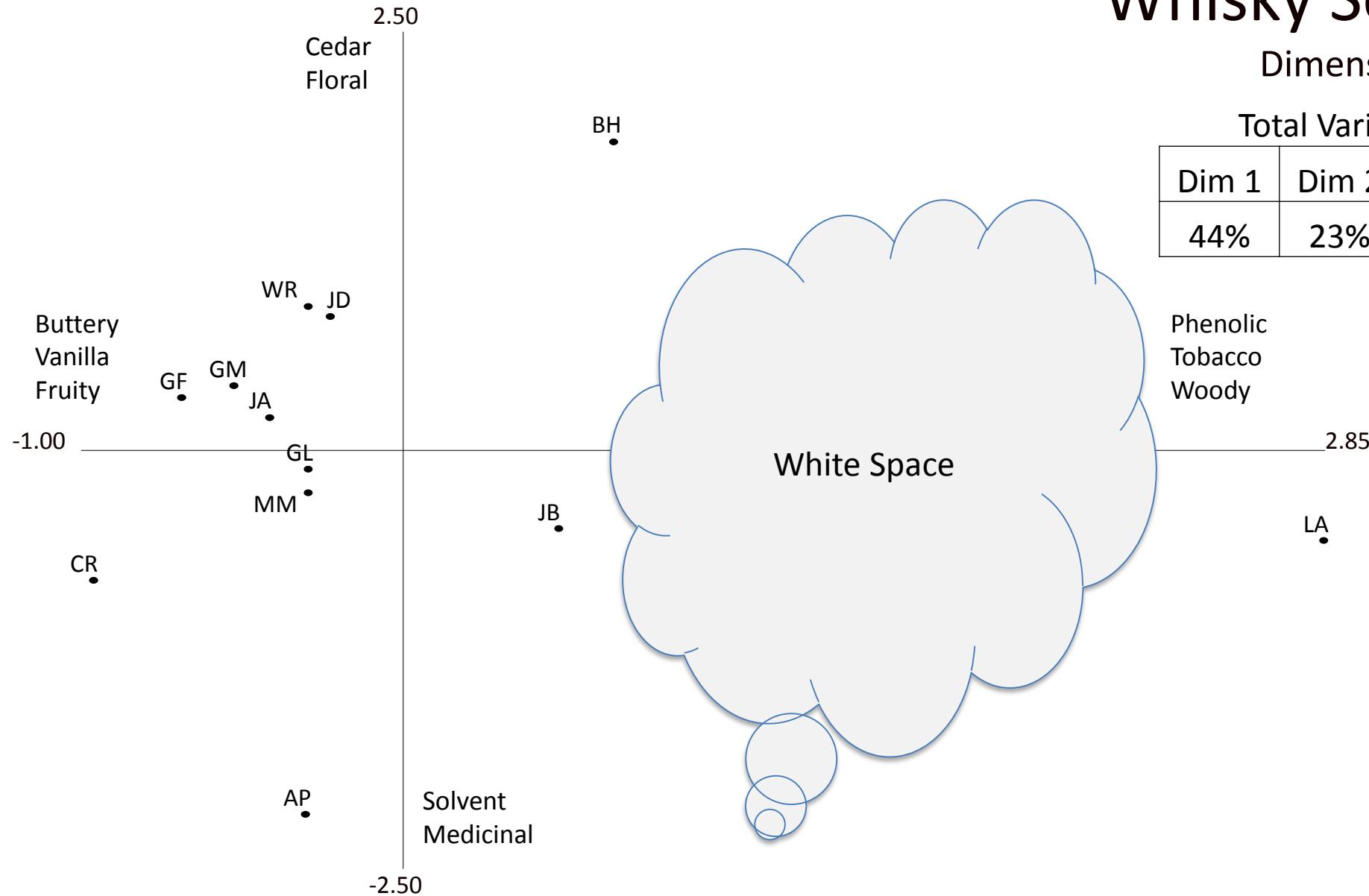
Dimensions 3 and 4

Whiskies with 95% Confidence Ellipses overlaid



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Principal Components



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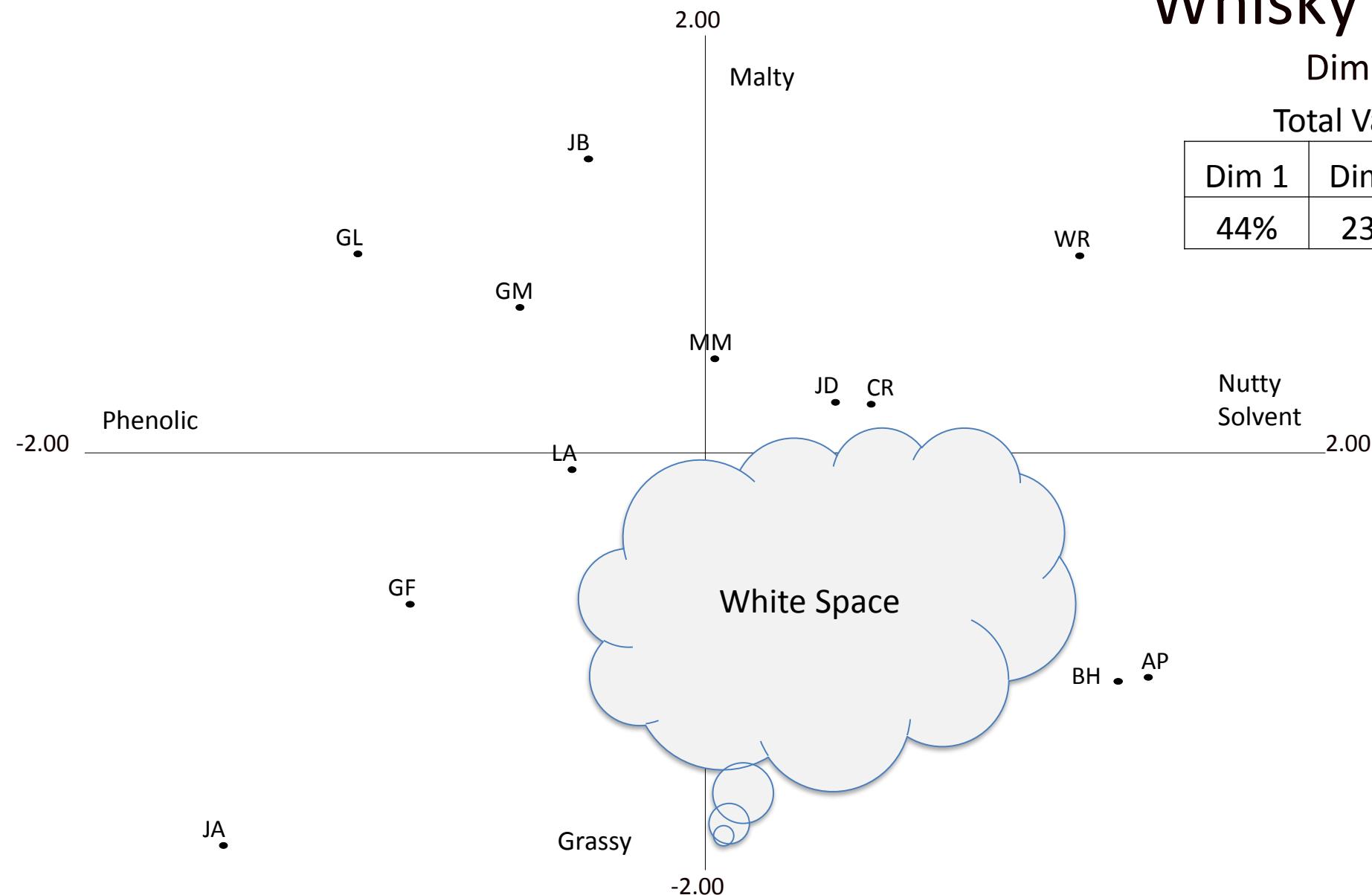
Principal Components

Whisky Sensory Map

Dimensions 3 and 4

Total Variance Explained

Dim 1	Dim 2	Dim 3	Dim 4
44%	23%	13%	8%



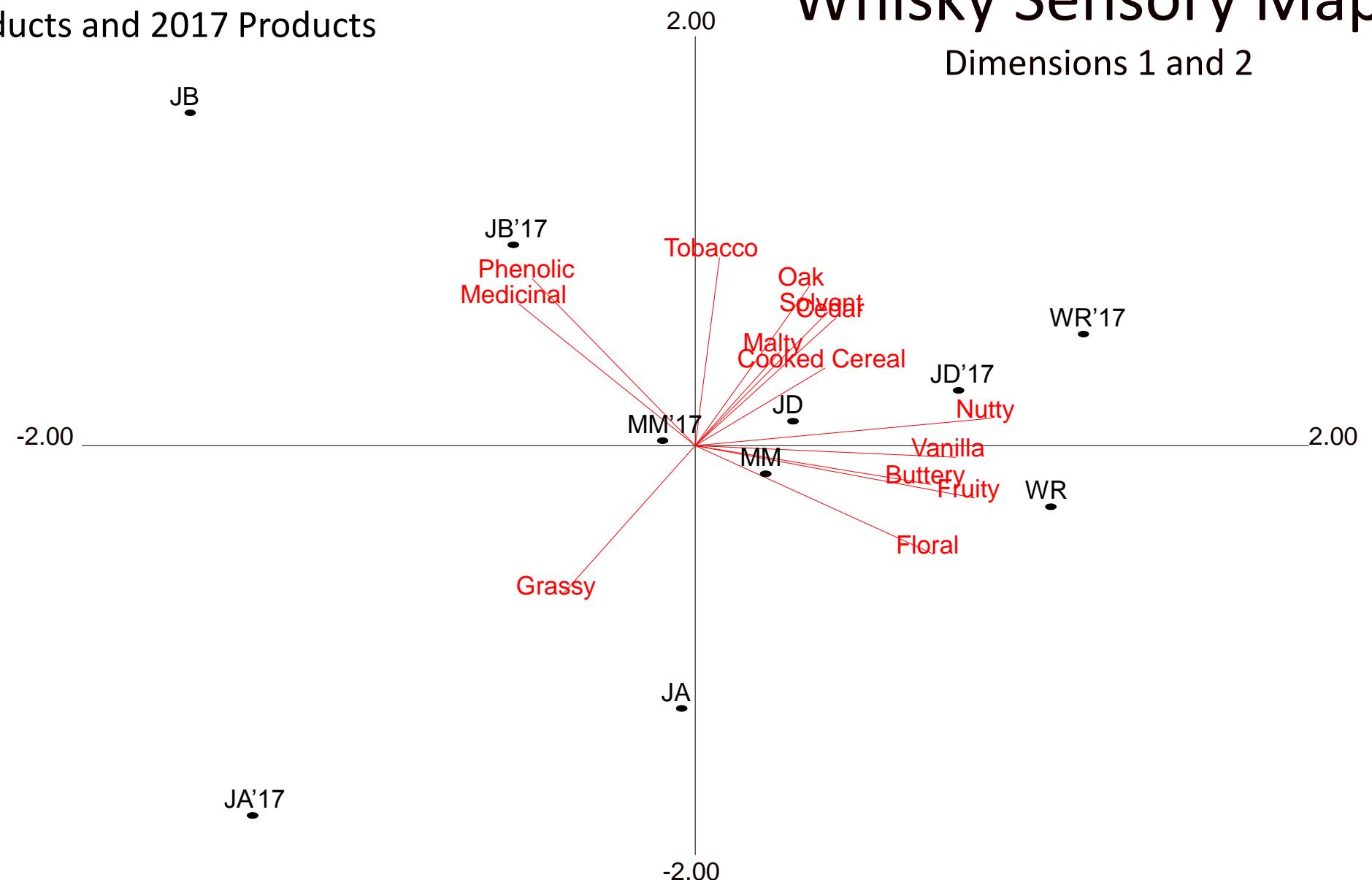
What do sensory maps provide?

- Reliable measurement of sensory properties
- Visualization of the impact of origin and treatment
- Exploration of opportunities to create new sensory based products
- Hypothetical products can be plotted on the map to understand their potential sensory positioning



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Principal Components
2012 Products and 2017 Products

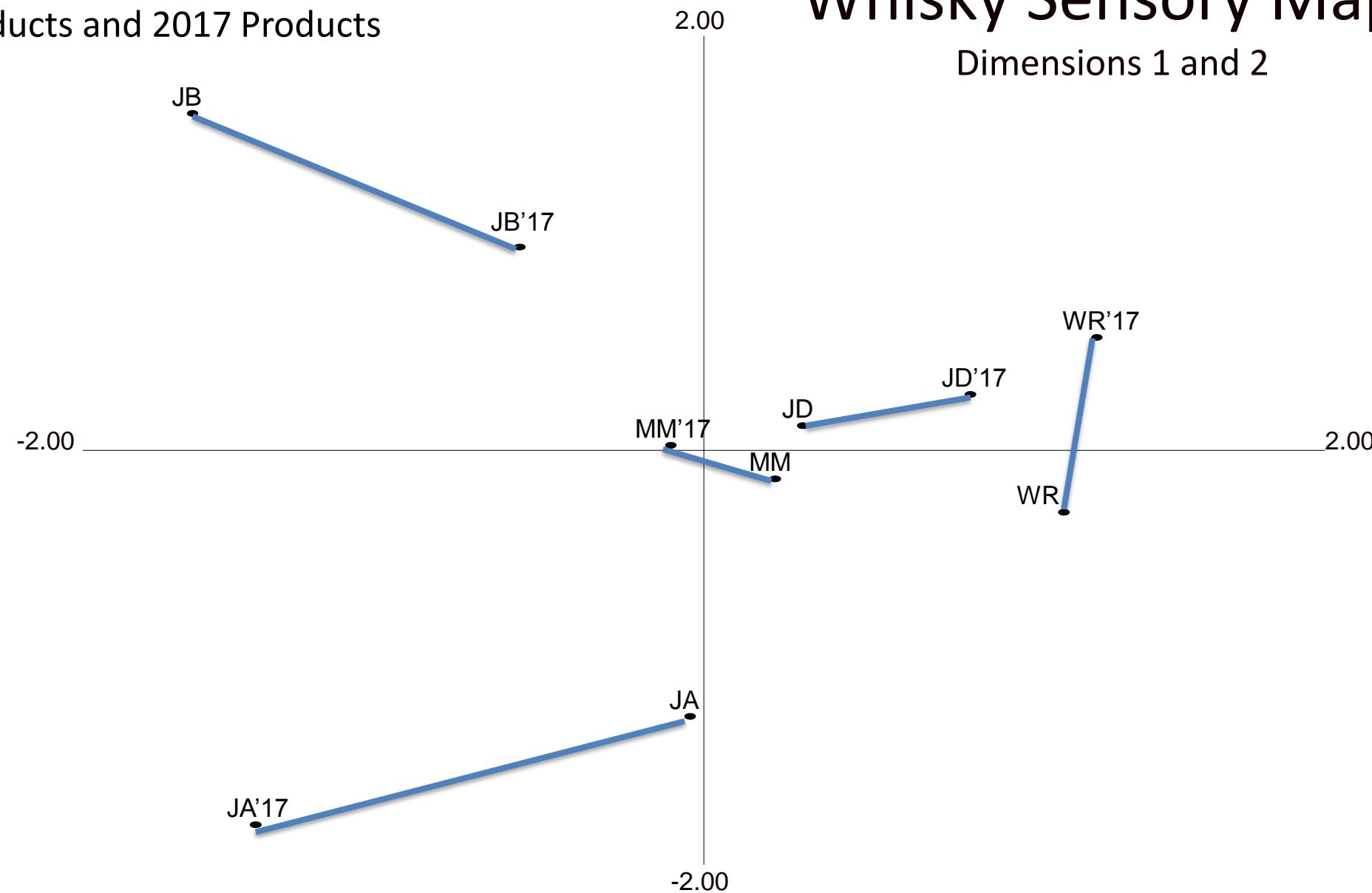


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Principal Components
2012 Products and 2017 Products

Whisky Sensory Map

Dimensions 1 and 2



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Whisky Text Descriptions

Language Analysis of
Producer, Retailer and Expert Reviewers



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Whisky text descriptions

Whisky	producer	MacLean	Jackson ¹ , Harris and Waymack ²	LCBO
Jameson	To the nose, a light floral fragrance, peppered with spicy wood and sweet notes. A perfect balance of spicy, nutty and vanilla notes with hints of sweet sherry and exceptional smoothness.	A malty smell. The grain is unruly and overwhelms the pot-still, leaving some citrus notes. There is a gently buzz of sherry, but nothing more.		Bright pale amber; subtle aromas of white flower, nectarine, tinned pears and clove; mellow and approachable. Flavours include spicy vanilla, wildflower honey, ginger and heather, with a gentle alcohol integration.
Johnnie Walker Black	Aromas of spice and raisins. Intense sweet vanillas that give way to orange zest. The finish is unbelievably smooth and layered with rich smoke, peat and malt.	A flagship, classic blend, recognizable by the smoky kick.		The nose and flavour are a wonderful combination of dry smokiness, with rich malt and peat overtones balanced by hints of cedar and fruit with trademark dark chocolate and vanilla sweetness.
The Glenlivet	Nose: fruity and summery. Flavour: Well balanced and fruit, with strong pineapple notes. Creamy, smooth, with marzipan and fresh hazelnuts.	The scent of fresh wood and soft fruit. A citrusy and heathery whisky.	Nose: remarkably flowery, clean and soft. Palate: Flowery and peachy with notes of vanilla. A delicate balance. ¹ Light in aroma, with a very subtly hint of heathery sweetness. Soft but firm body with tones of sherry, oak and heather. ²	Subtle aromas of orange zest, honey, cinnamon and cereal. Flavours repeat with a sweet vanilla element and a hint of smoke on the finish.
Lagavulin		Intensely smoky nose with the scent of seaweed and iodine. Sweetness in the mouth that dries to a peaty finish.	Increased malt and sherry tones that balance the sharp smokiness nicely. ²	A golden amber colour and wafts from your glass with intense smoky peat and iodine. The palate is full flavour, rich and smooth with peat, figs, dates, and vanilla followed by an enduring smoky and dry finish.
Crown Royal	Rich and robust, with slight hints of vanilla and fruit. Delicately smooth and creamy with hints of oak and the sweet flavour of vanilla.	Vanilla, oak, and fruit in the mouthfeel and taste.		The nose is lightly floral with corn, buttery/vanilla and peach aromas. On the palate look for light sweet peach flavour with wood spice on a dry finish.
Woodford Reserve				You'll be met with aromas of sweet vanilla, apricot, caramel and spice. Soft and quite rounded with delicate vanilla and caramel flavours followed by a long complex finish.
Basil Hayden	Nose: dried apricot, caramel, custard, green peppercorn and hay. Flavour: medium-bodied and warming, with flavours of white pepper, burnt sugar, dried white flowers and vanilla that finishes with a lingering herbal spice.			An aromatic sweet bouquet of banana, toffee, and light spice. The flavour is mellow and slightly smoky with a lively woody edge on a medium weight palate that finishes with a hint of hot cinnamon spice.

You'll be met with aromas of sweet vanilla, apricot, caramel and spice. Soft and quite rounded with delicate vanilla and caramel flavours followed by a long complex finish.



Whisky Text Description Sources

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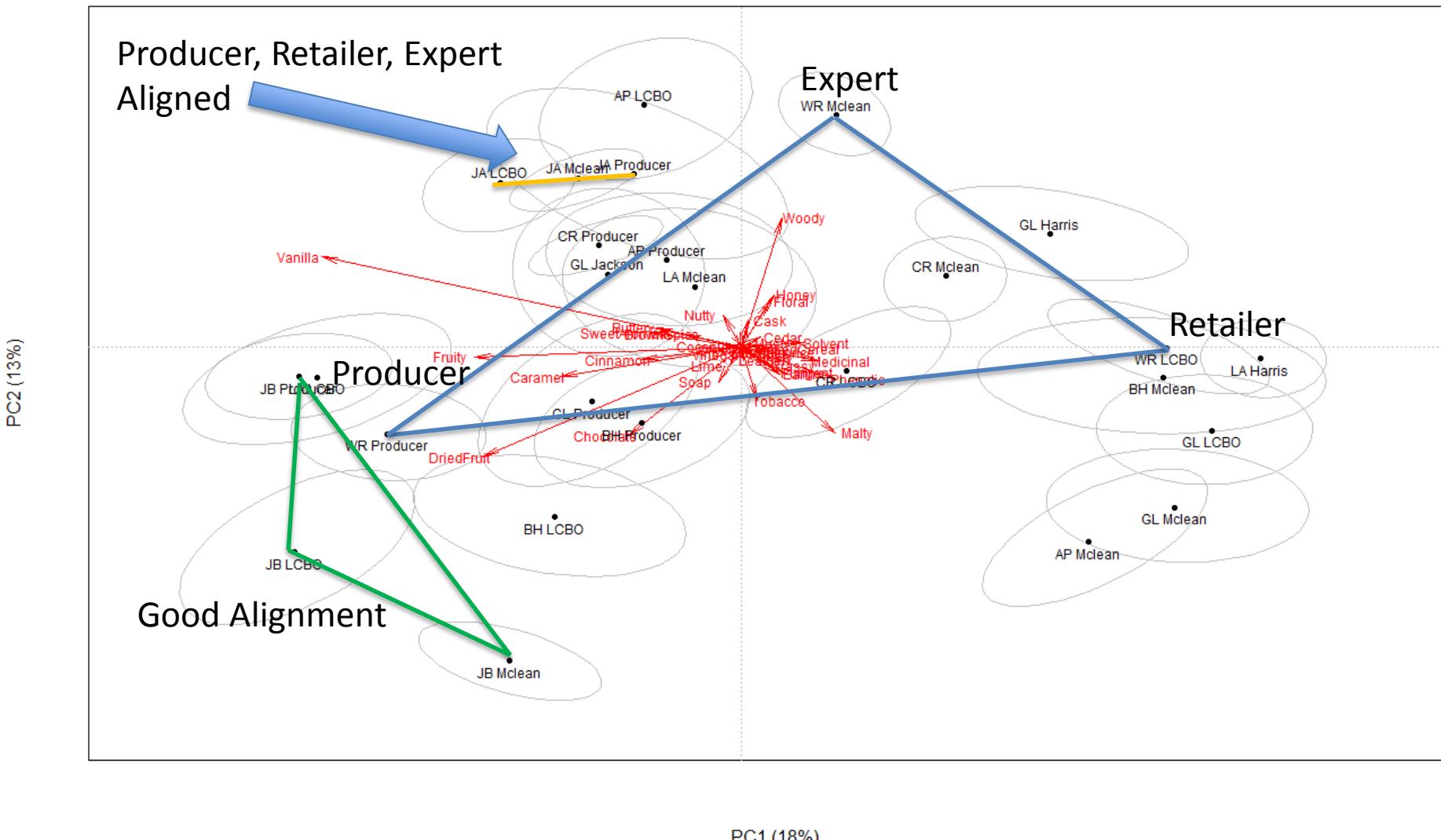


CATA terms used to evaluate text

Medicinal	Phenolic	Tobacco	Cooked Cereal
Malty	Grassy	Floral	Fruity
Solvent	Vanilla	Woody	Cedar
Buttery	Nutty	Pungent	Leathery
Old Potato	Dill	Dried Fruit	Cask
Lime	Black Licorice	Sweet Aromatic	Chocolate
Honey	Caramel	Brown Spice	Cinnamon
Coconut	Rubber	Vinegar	Earthy
Musty	Dusty	Soap	Olives



Descriptive Text Mapping



What about the descriptions?

- Is there alignment of descriptive language?
- Consumers may be confused by written descriptions



How do we know where we are going
unless we know where we've been?

Now we can!



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Conclusions

- Map sensory performance
- Text descriptions must be consistent
- Consumers expect that promises will be delivered
- Explore the sensory “White Space”



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Thank You



compusense.com

+1 519 836 9993 – Worldwide

1 800 367 6666 – Toll free in North America

info@compusense.com