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Agrocampus Ouest, Rennes, France

Transitioning from Proportion of Distinguishers to a More Meaningful Measure of Sensory Difference

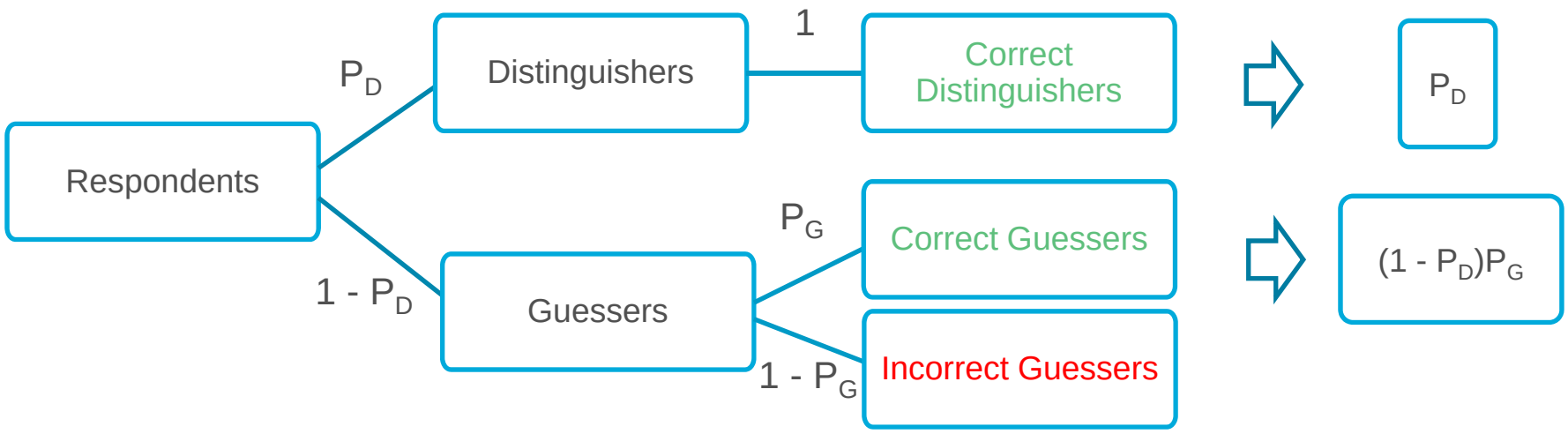
Virginie Jesionka, SKIM, Rotterdam, The Netherlands

John M. Ennis, The Institute for Perception, Richmond, USA

Benoit Rousseau, The Institute for Perception, Davis, USA

Proportion of Distinguishers

- Commonly used model
- Easy to understand and explain



$$P_C = P_D + (1 - P_D)P_{Guess}$$

$$P_D = \frac{P_C - P_{Guess}}{1 - P_{Guess}}$$

Two Triadic Methods

Triangle Test

Unspecific

"*Which product is the most different from the other two?*"

3-AFC

Attribute specific

"*Which product has the strongest sensory magnitude?*"

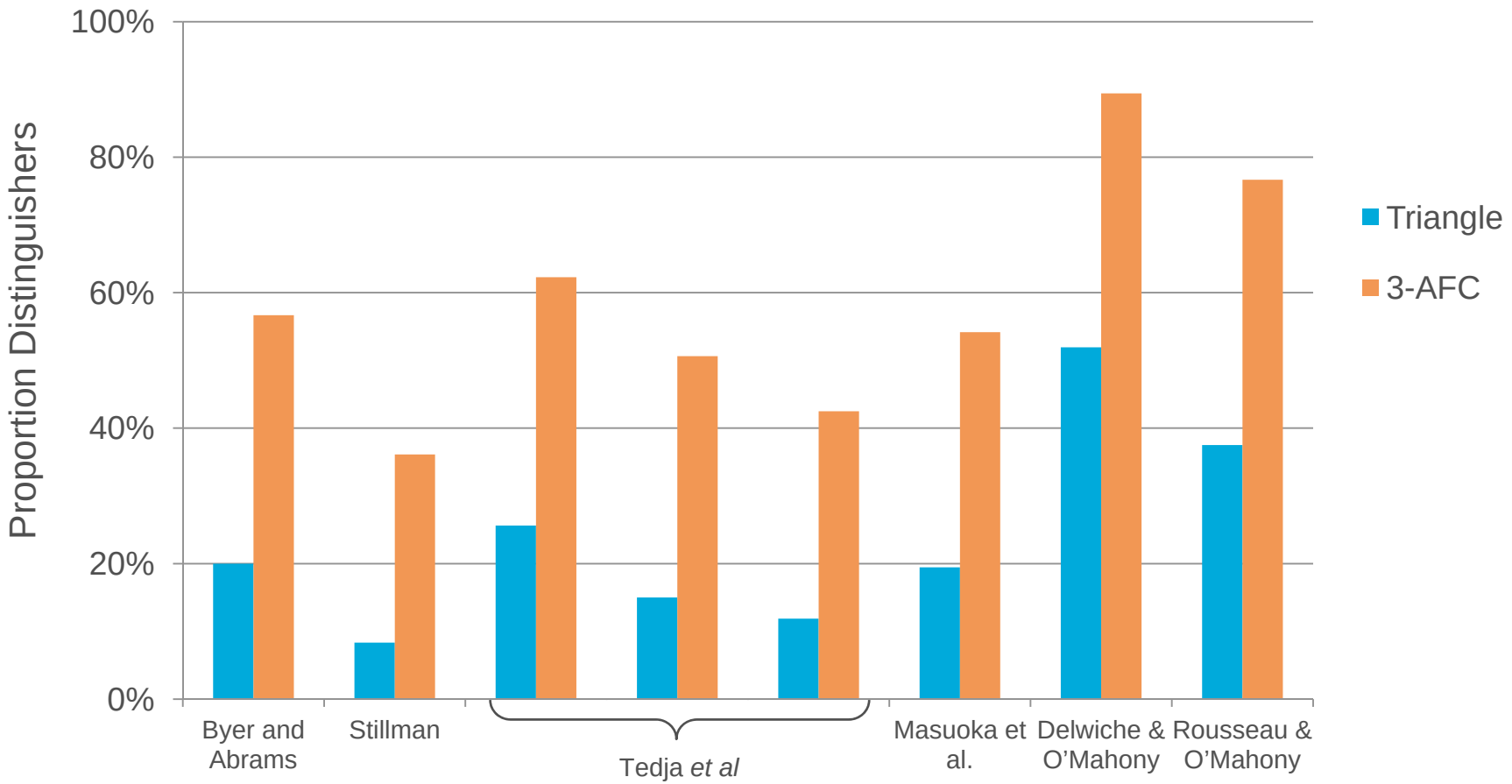
Guessing Probability = 1/3

Gridgeman's Paradox

Gridgeman, N. T. (1970). A re-examination of the two-stage triangle test for the perception of sensory differences. *Journal of Food Science*, *35*, 87-91.

Study	Product	# Tests	P_C Triangle	P_C 3-AFC
Byer and Abrams, 1953	Bitter solutions	45	47%	71%
Stillman, 1993	Party onion dip	108	39%	57%
Tedja *et al.*, 1994	Salt Solutions	720	50%	75%
		240	43%	67%
		240	41%	62%
Masuoka *et al.*, 1995	Beer	108	42%	69%
Delwiche & O'Mahony, 1996	Chocolate pudding	156	68%	93%
Rousseau & O'Mahony, 1997	Yogurt	180	58%	84%

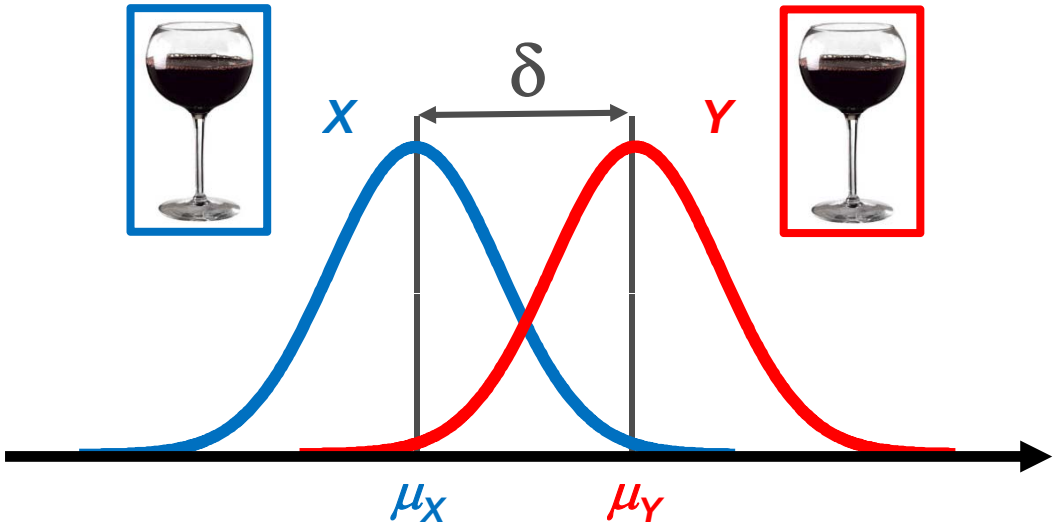
Gridgeman's Paradox Revisited



Thurstonian approach

A model which resolves Gridgeman’s paradox

Thurstonian model principle



δ = Distance between the means (μ_X and μ_Y) in terms of standard deviations

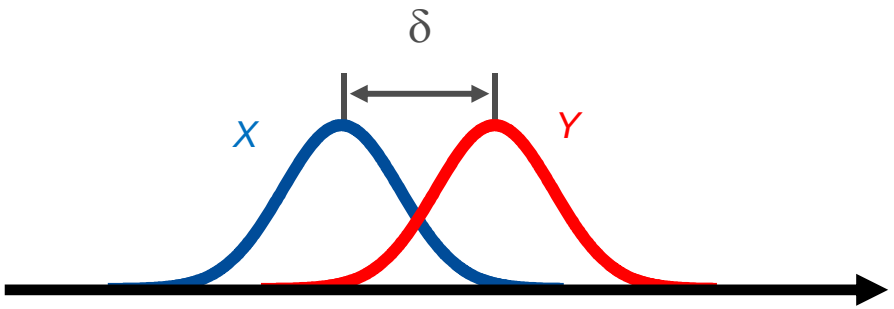
d' = Experimental estimate of δ

Two main assumptions :

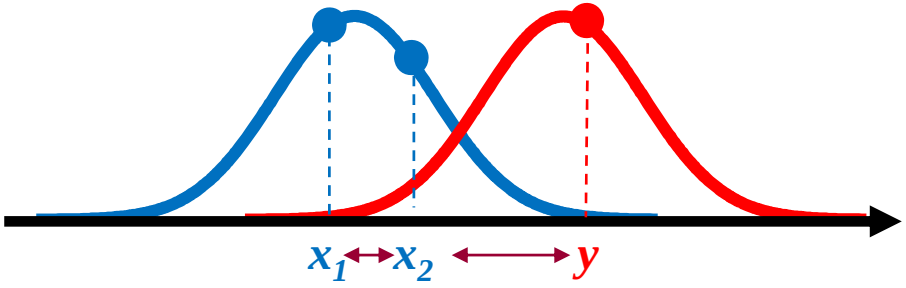
Variability

Decision Rule

Thurstonian view of Triangle Test

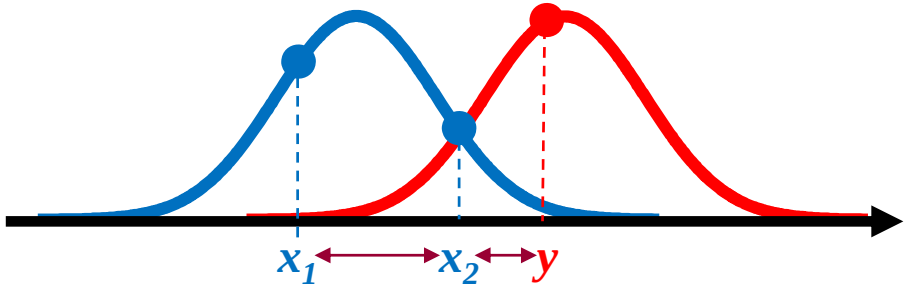


Triangle test



$|x_1 - x_2| < |x_1 - y|$

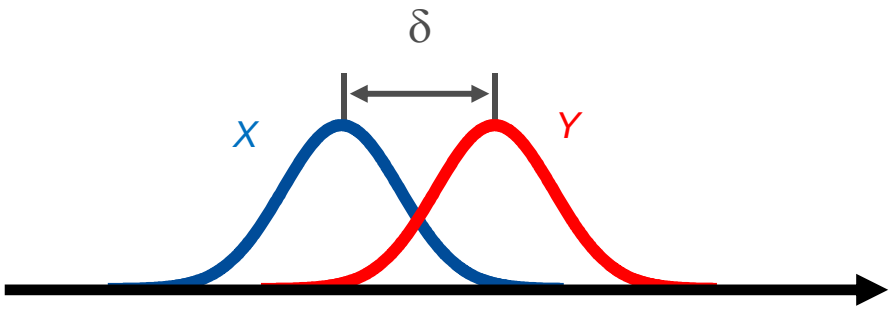
Correct



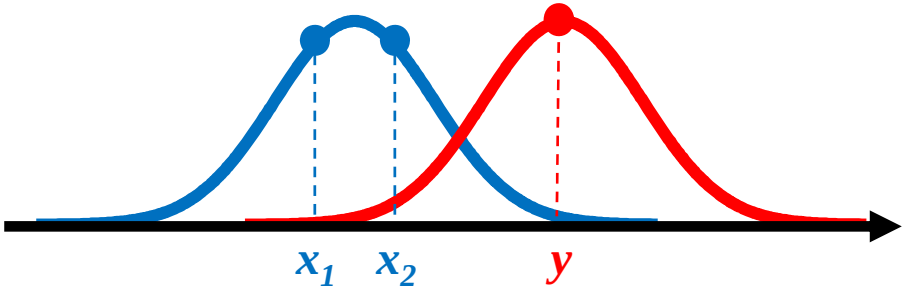
$|x_2 - x_1| > |x_2 - y|$

Incorrect

Thurstonian view of 3-AFC

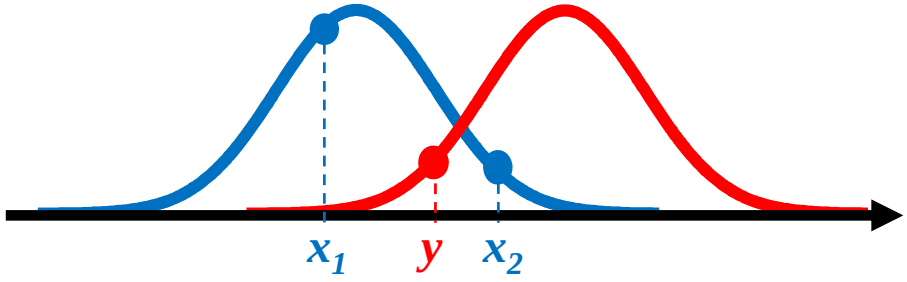


3-AFC method



$y > x_1$ *and* x_2

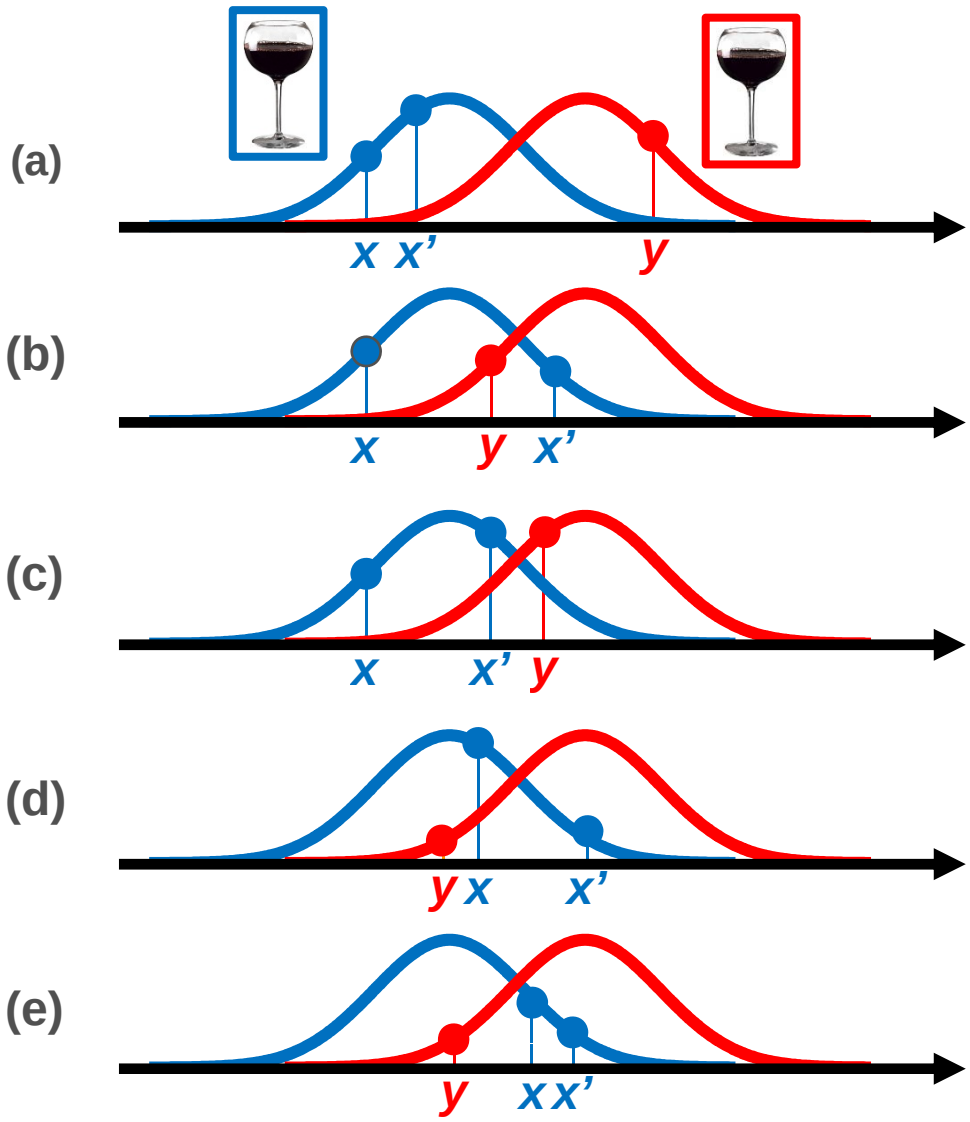
Correct



$y < x_1$ *or* x_2

Incorrect

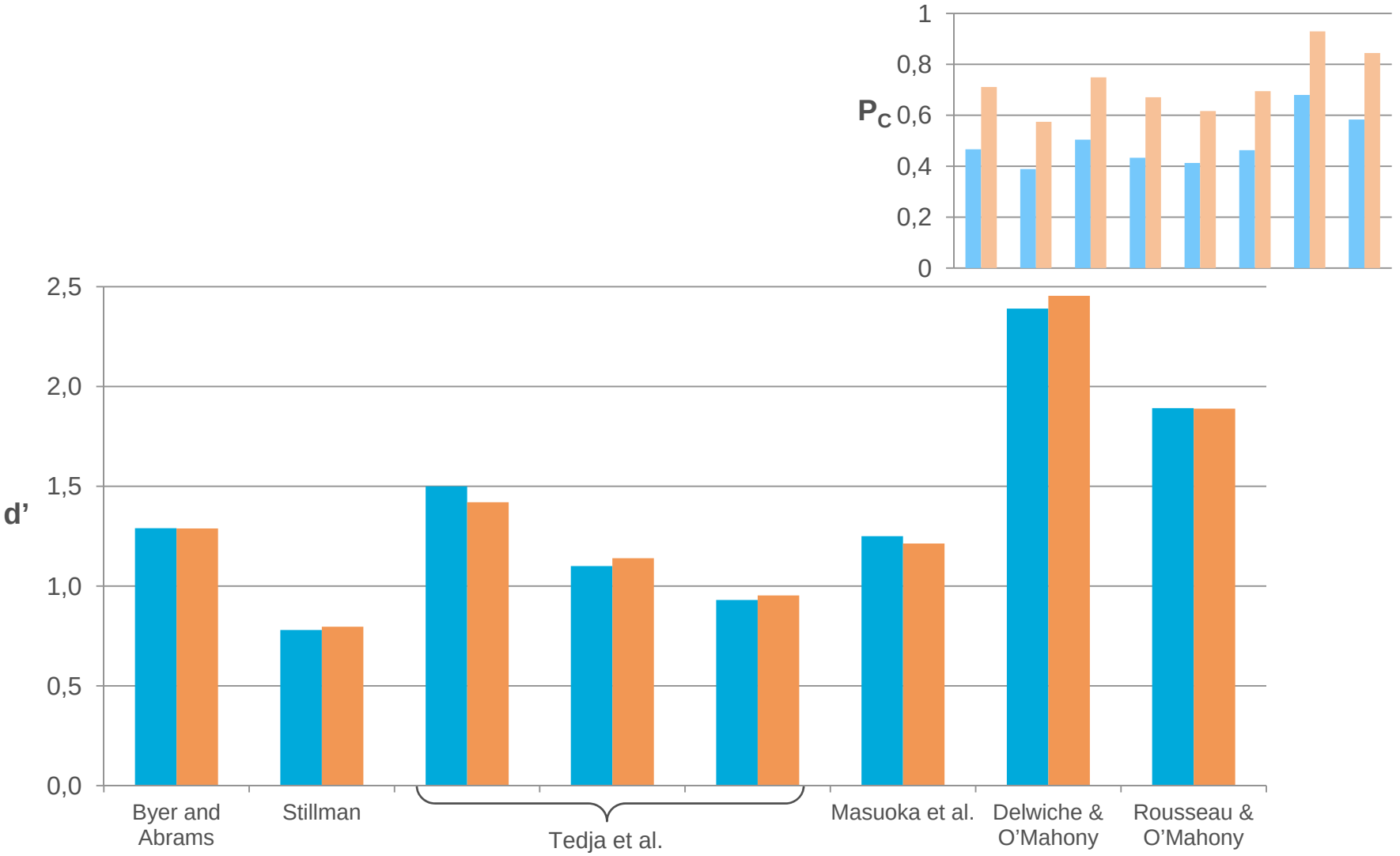
Resolution of Gridgeman's Paradox



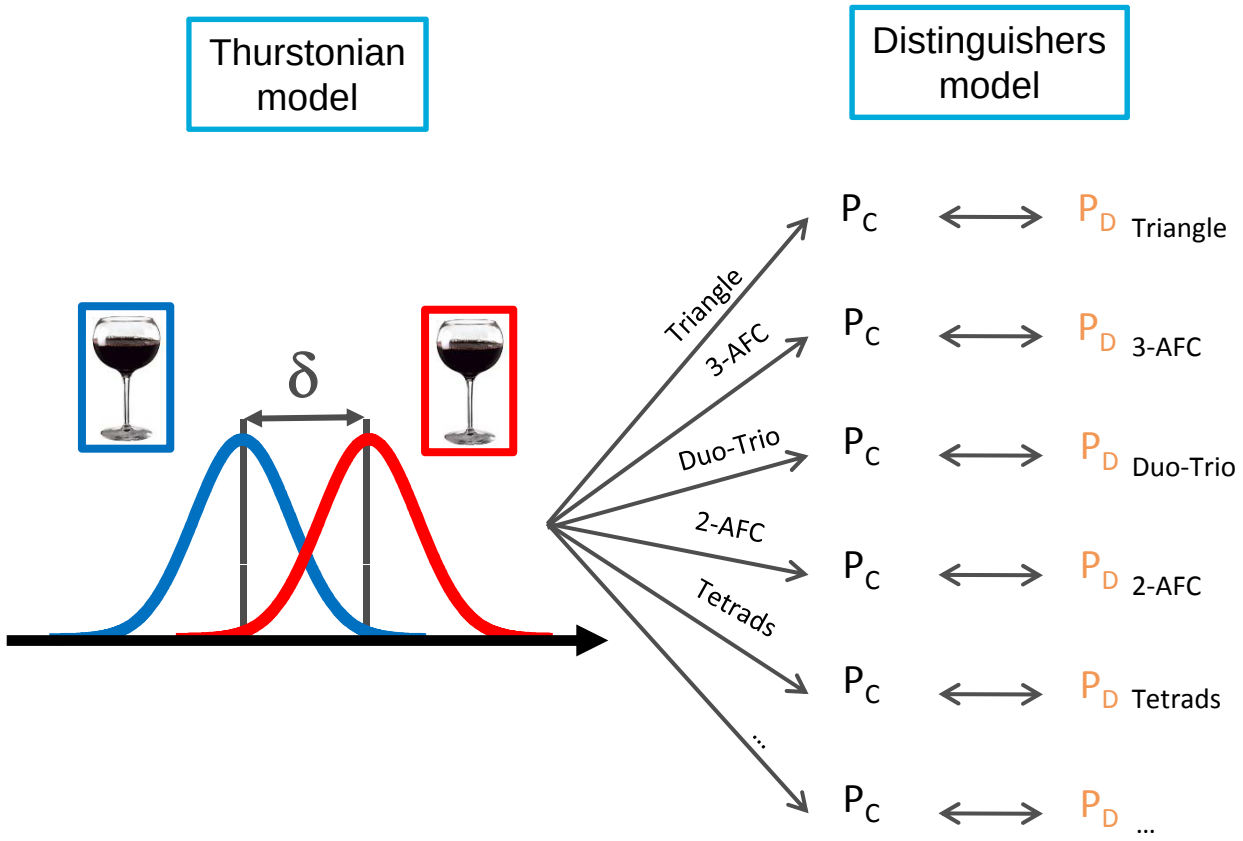
Monte-Carlo simulations
(δ=1.5, N=100,000 tests)

Triangle : Correct 3-AFC : Correct	48.0%
Triangle : Wrong 3-AFC : Wrong	17.9%
Triangle : Wrong **3-AFC : Correct**	28.5%
Triangle : Wrong 3-AFC : Wrong	3.2%
Triangle : Correct 3-AFC : Wrong	2.3%

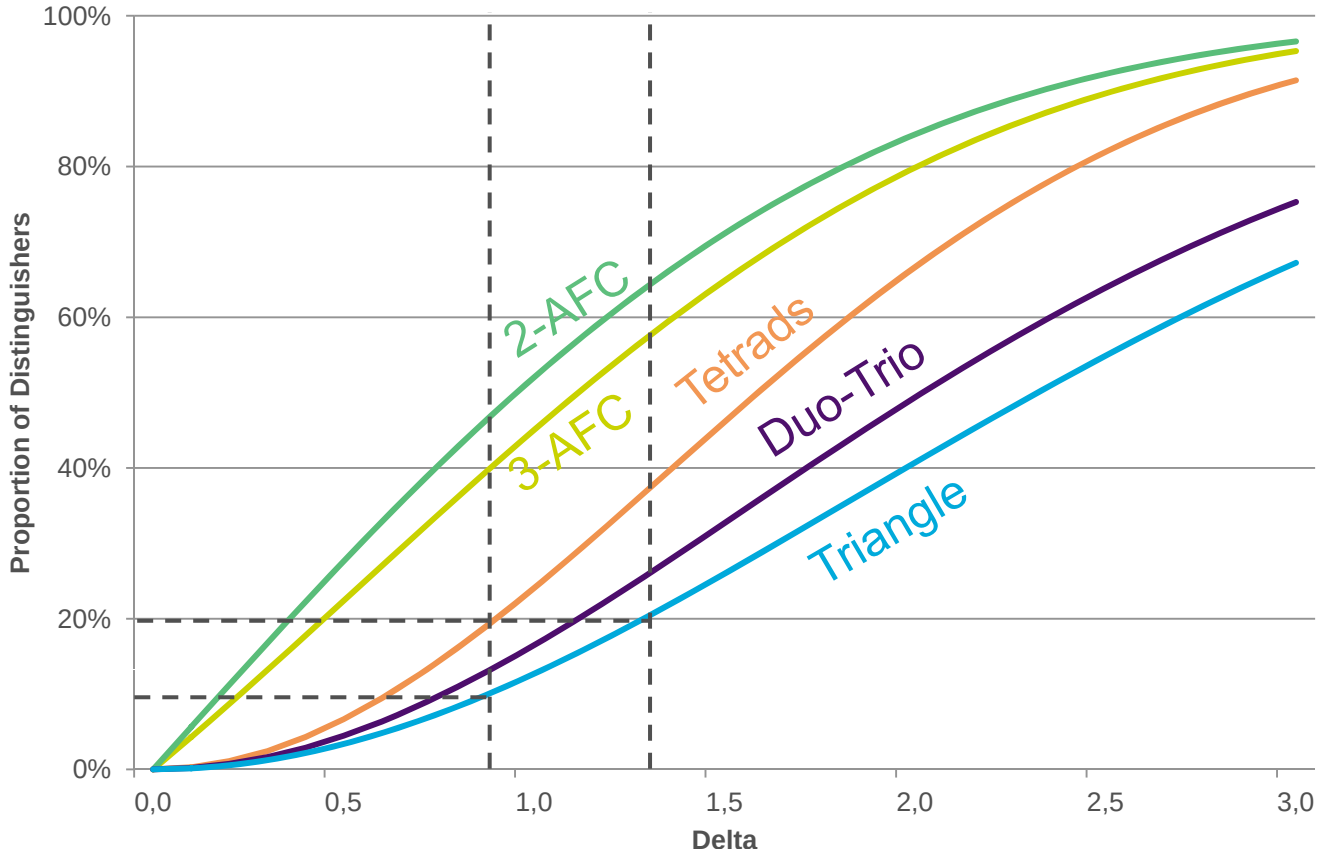
Resolution of Gridgeman's Paradox



A Method-Invariant Measure: δ



Connecting δ and Proportion Distinguishers



Tables and Tools to transition easily

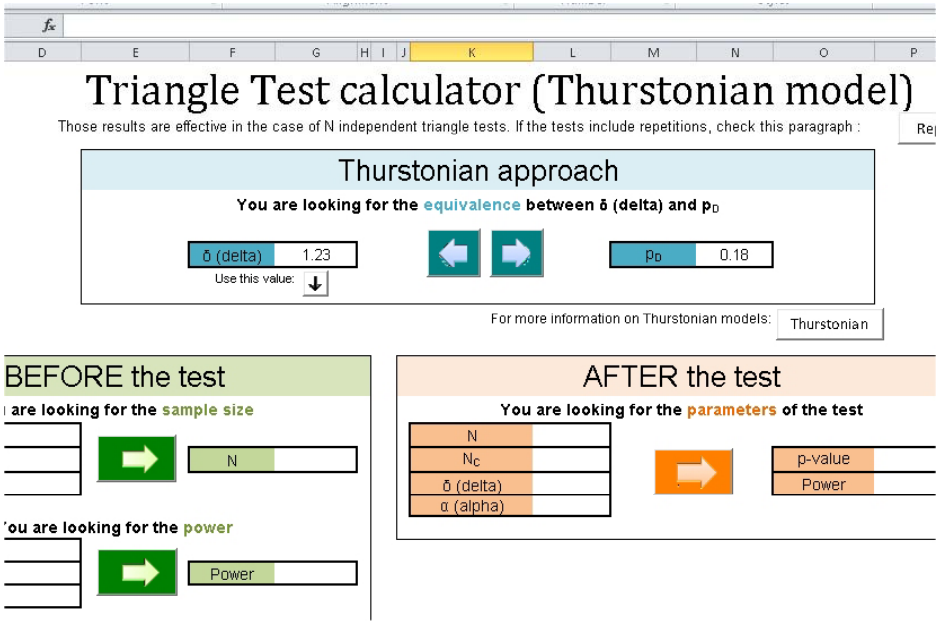
Jesionka, V. , Ennis, J., Rousseau B. (in preparation). Transitioning from Proportion of Distinguishers to a more meaningful measure of sensory difference, *Food Quality and Preference*

3-AFC

Tetrads

Triangle

p_D	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.000	0.270	0.383	0.470	0.545	0.611	0.672	0.728	0.781	0.831
0.1	0.879	0.925	0.969	1.012	1.054	1.095	1.134	1.174	1.212	1.250
0.2	1.287	1.323	1.359	1.395	1.431	1.466	1.501	1.535	1.570	1.604
0.3	1.638	1.672	1.706	1.739	1.773	1.807	1.840	1.874	1.908	1.941
0.4	1.975	2.009	2.043	2.077	2.111	2.146	2.180	2.215	2.250	2.285
0.5	2.321	2.357	2.393	2.429	2.466	2.503	2.541	2.579	2.617	2.656
0.6	2.696	2.736	2.776	2.818	2.860	2.902	2.946	2.990	3.035	3.081
0.7	3.128	3.176	3.225	3.276	3.328	3.381	3.436	3.492	3.550	3.611
0.8	3.673	3.738	3.806	3.876	3.950	4.027	4.109	4.195	4.287	4.385
0.9	4.491	4.606	4.732	4.872	5.030	5.212	5.428	5.698	6.061	6.645



Thank you

Virginie Jesionka: v.jesionka@skimgroup.com, www.skimgroup.com

John M. Ennis: john.m.ennis@ifpress.com, www.ifpress.com

Benoit Rousseau: benoit.rousseau@ifpress.com, www.ifpress.com