

Tuesday June 27, 2017
Las Vegas, NV



*It only takes 2 to tango –
but “N” to understand products and people*

How **Big**, or Small, Should I Go?

Establishing an Optimal Sample Size

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1/21

Two Potential Myths on Sample Sizes



I need a very large sample size if I
want to be confident about the
conclusions I reach in my research

I can be confident about the conclusions
from my research even if I do not use a
very large sample size

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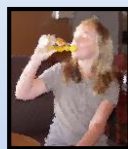
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Sample Sizes in Discrimination Testing



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Common Sensory Discrimination Methods



<i>Information regarding the sample to be selected not required</i>		
❖ Triangle		Which one is different?
❖ Duo-trio		Which one is the same as the reference ?
❖ Tetrad		Group the samples into 2 groups of 2
❖ ...		
<i>Information regarding the sample to be selected required</i>		
❖ 2-AFC		Which one is more ... ?
❖ 3-AFC		Which one of the three is the most ... ?
❖ ...		

Are all these
methods
equivalent?

Can I use the
same sample
size for all?

How can
I choose?



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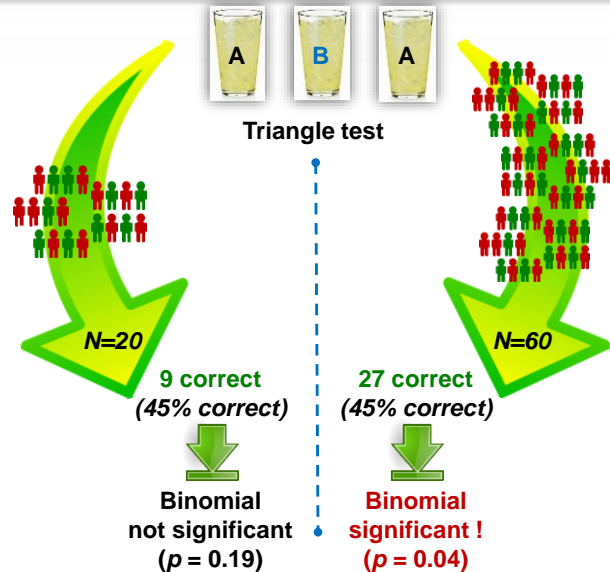
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Rethinking our Thinking About Sensory Differences

Statistical hypothesis testing is futile because with enough replications, the null hypothesis will always be rejected



Victor Chew (1977)



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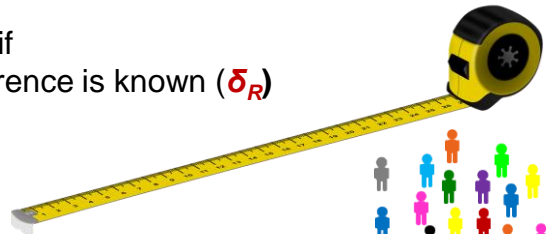
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The Need for Information on Consumer Relevance

- Essential fact:
 - When comparing two products for similarity
 - Assuming that the sample size is large enough
 - A statistically significant result will always be found*



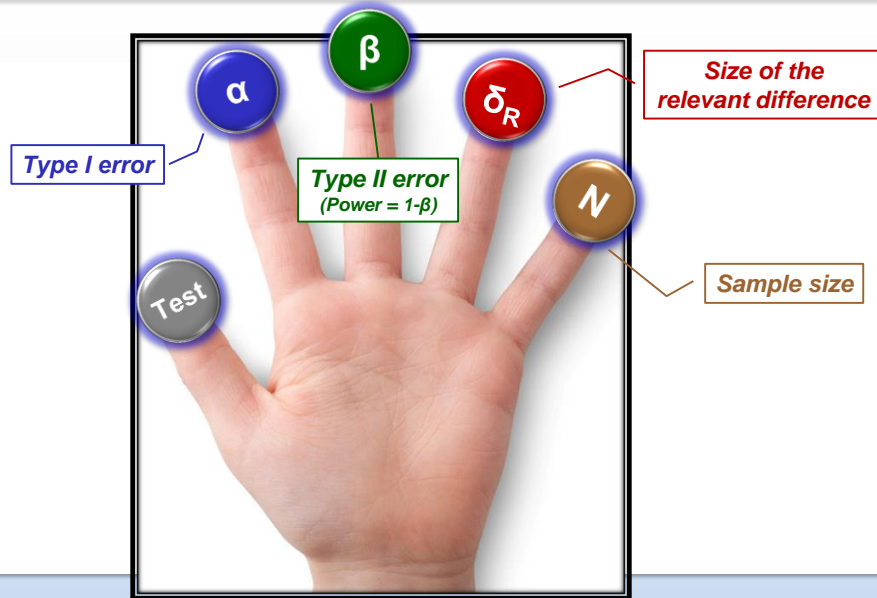
- What is the optimal sample size? 12? 20? 100? 1,000?
- An optimal sample size can only be set if the size of the relevant difference is known (δ_R)



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5 Factors in Sensory Discrimination Testing



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How Can We Set δ_R ?



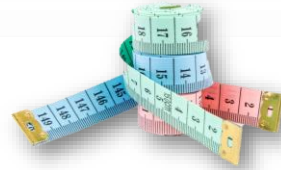
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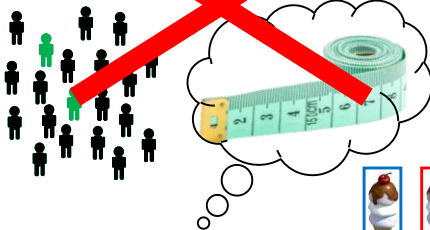
How to Set δ_R ?



- We need a way to measure the size of sensory differences



- First idea: ~~Proportion of discriminators in the population~~



- Second idea: Use a standardized measure of sensory difference

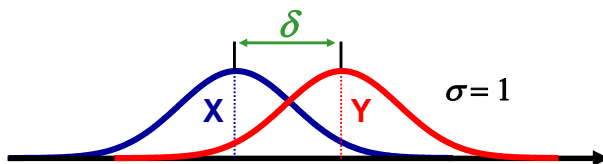
Thurstonian models



Thurstonian Models

δ = Standardized measure of sensory difference

d' = Experimental estimate of δ



- In sensory testing, δ typically varies between 0 and 2



Discrimination Methods and Decision Rule



Information regarding the sample to be selected not required

❖ Triangle		Which one is different?
❖ Duo-trio		Which one is the same as the reference ?
❖ Tetrad		Group the samples into 2 groups of 2
❖ ...		

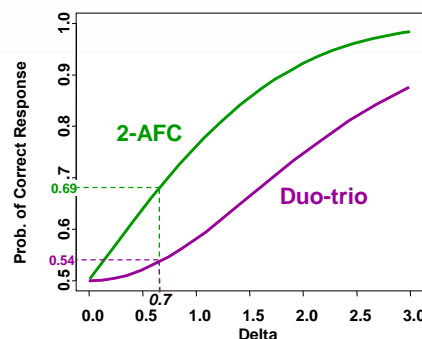
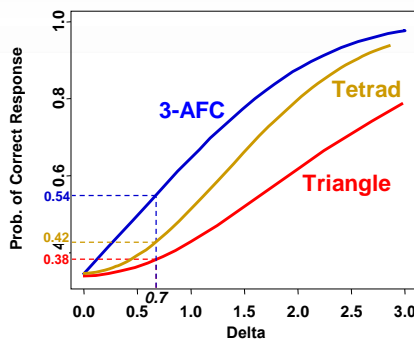
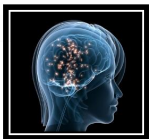


Each methodology involves a different decision rule



Some decision rules are more efficient than others

δ vs. Proportion Correct



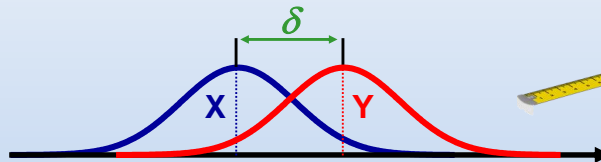
- For a given δ , methodologies with higher curves will have a greater probability of correct responses
 → They will reach significance sooner
- They are statistically more powerful and thus require smaller sample sizes



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How Can We Set δ_R Using Thurstonian Ideas?



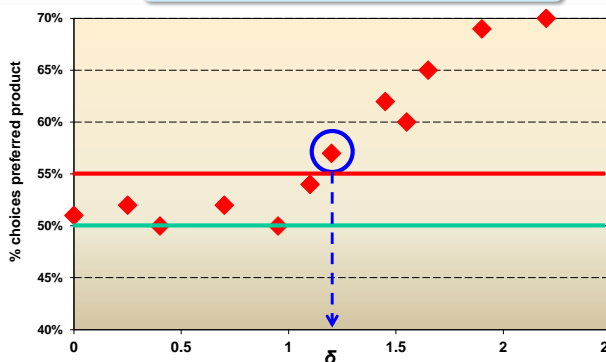
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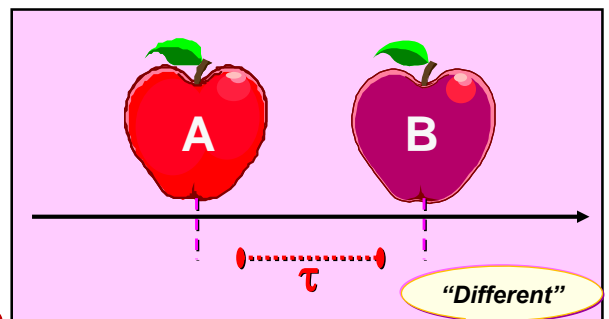
Setting δ_R using Thurstonian Ideas



Relate δ and consumer preference



Relate Same-Different tau and δ



Rousseau, O'Mahony and Ishii, 2016

Consumer preference $\delta_R=0.96$
Same-different $\delta_R=0.93$



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Back to Sample Sizes

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Estimating Sample Sizes



- 5 linked components:

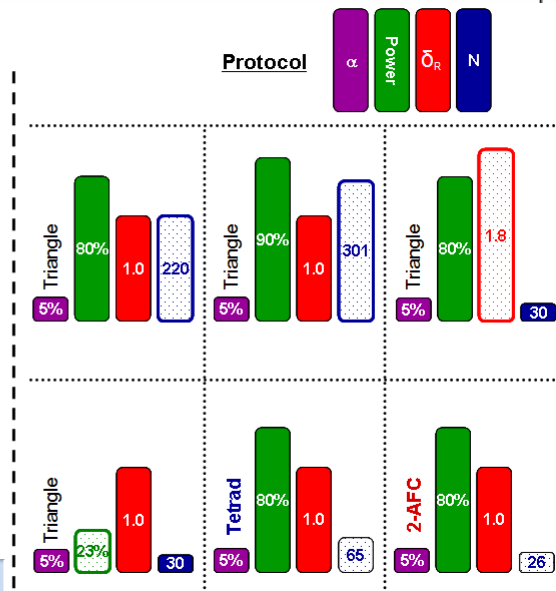
α : Probability of a **Type I error**
(wrongly concluding that a
difference exists between the
products)

β : Probability of a **Type II error**
(wrongly concluding that no
difference exists between the
products = **1-power**)

δ_R : Size of the difference
of interest

N : Sample size

Protocol



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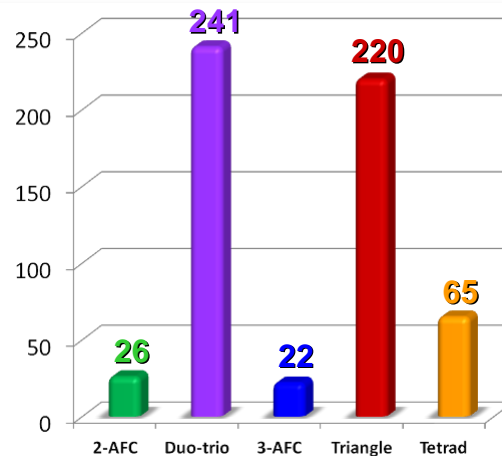
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Business Impact: The Cost of Decision Rules (1)



Scenario 1

- **Size of the difference:**
76% correct in a 2-AFC
(δ_R of 1)
- **Power:** 80% chance of
detecting the difference
- **α level:** 5%
- **Sample size needed** ➡

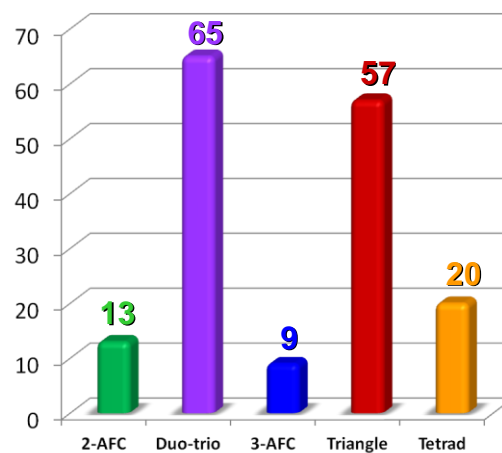


Business Impact: The Cost of Decision Rules (2)



Scenario 2

- **Size of the difference:**
86% correct in a 2-AFC
(δ_R of 1.5)
- **Power:** 80% chance of
detecting the difference
- **α level:** 5%
- **Sample size needed** ➡





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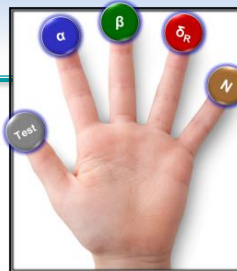
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Revisiting the Myths

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Revisiting the Myths



I need a very large sample size if I want to be confident about the conclusions I reach in my experiment

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It depends on ...

the method

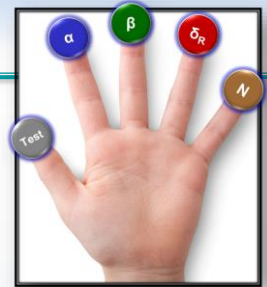
α and β

δ_R

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Thank you !