



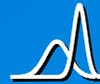
Ewha Womans University

Tuesday June 12, 2012 • Seoul, South Korea

Five Key Experimental Factors for a Successful Sensory Discrimination Program

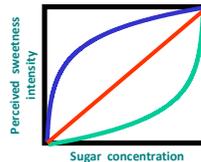
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Main Research Themes

Sensitivity (Thresholds)



Discrimination

Triangle



Which sample is different from the other two?

Descriptive

1 2 3 4 5 6 7 8 9



• How sweet?



• How bitter?



• How fruity?



• How astringent?

Hedonic



Which sample do you prefer?



Why Discrimination Testing?



- Measure the size of the difference between products
- Two main objectives
 - ❖ Prove products are different
 - “New and improved”, “Fresher, crisper taste”
 - ❖ Prove products are similar
 - Ingredient change, new supplier, government regulation (e.g., salt or sugar reduction)
- Use discrimination testing to measure small sensory differences



How Discrimination Testing?



- Get samples to be compared



“Which one is more bitter?”

- Get panelists



- Get results (e.g., $15/20$ correct)



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 identical samples
❖ Method of triads		Which one is more similar to the reference ?
❖ Same-different		Are they the same or different ?
❖ ...		
<i>Information regarding the sample to be selected required</i>		
❖ 2-AFC		Which one is <i>more</i> ... ?
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❖ Specified tetrad		Which <u>two</u> are the <i>most</i> ... ?
❖ Identification		Is it A or B ?
❖ ...		

Sensory Discrimination Program

❖ 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 : Size of the difference of interest



N : Sample size



Testing Protocol

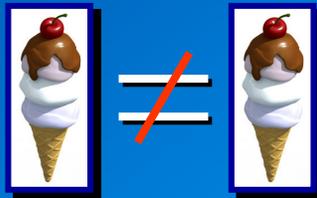




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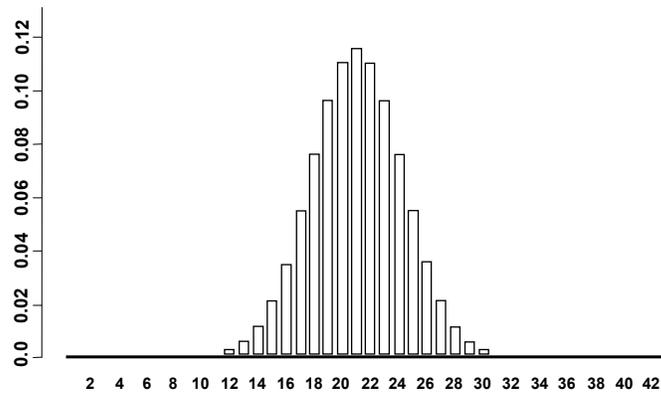
α : Type I Error

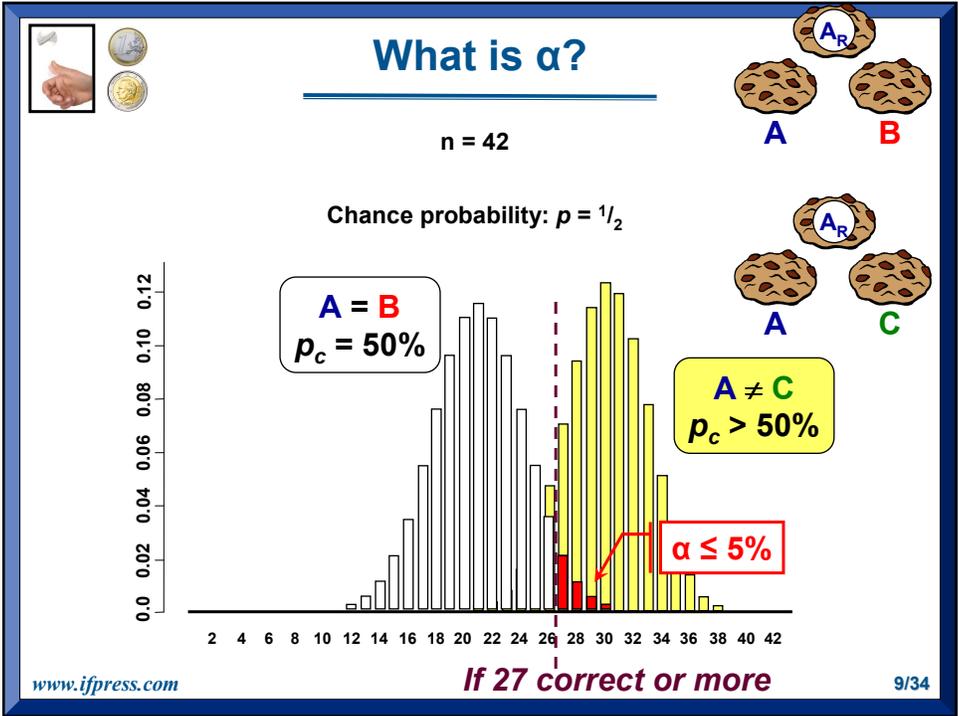


Binomial Theory

$n = 42$

Chance probability: $p = 1/2$





Binomial table for the Duo-Trio and 2-AFC Tests

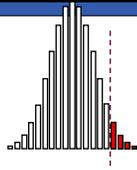
If sample size = 42

27

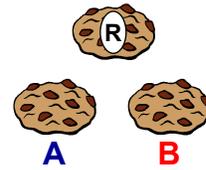
Number correct needed to be significant at $\alpha=5\%$

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<i>n</i>	0	1	2	3	4	5	6	7	8	9
10	9	9	10	11	12	12	13	13	14	
20	15	15	16	17	18	18	19	19	20	
30	20	21	22	23	23	24	24	25	26	
40	24	25	26	27	27	28	28	29	30	31
50	27	28	29	30	30	31	31	32	33	34
60	30	31	32	33	33	34	34	35	36	37
70	33	34	35	35	36	36	37	37	38	39
80	35	36	37	37	38	38	39	39	40	41
90	37	38	38	39	40	40	41	41	42	42
100	39	40	40	41	42	42	43	43	44	44
110	41	42	42	43	44	44	45	45	46	46
120	42	43	43	44	45	45	46	46	47	47
130	44	44	45	46	46	47	47	48	48	49
140	45	46	46	47	47	48	48	49	49	50
150	46	47	47	48	48	49	49	50	50	51
160	47	48	48	49	49	50	50	51	51	52
170	48	49	49	50	50	51	51	52	52	53
180	49	50	50	51	51	52	52	53	53	54
190	50	51	51	52	52	53	53	54	54	55
200	51	52	52	53	53	54	54	55	55	56
210	52	53	53	54	54	55	55	56	56	57
220	53	54	54	55	55	56	56	57	57	58
230	54	55	55	56	56	57	57	58	58	59
240	55	56	56	57	57	58	58	59	59	60
250	56	57	57	58	58	59	59	60	60	61
260	57	58	58	59	59	60	60	61	61	62
270	58	59	59	60	60	61	61	62	62	63
280	59	60	60	61	61	62	62	63	63	64
290	60	61	61	62	62	63	63	64	64	65
300	61	62	62	63	63	64	64	65	65	66



Type I Error



➤ Falsely concluding that the products are different when they are not

➤ Consequence:

❖ Two main objectives

• Prove products are different

– “New and improved”, “Fresher, crisper taste”

– **Conclude a difference, but product was not improved**



• **Prove products are similar**

– Ingredient change, new supplier, government regulation (e.g., salt or sugar reduction)

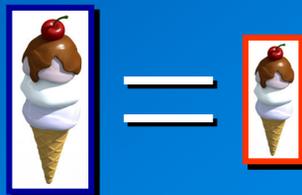
– **Conclude a difference**

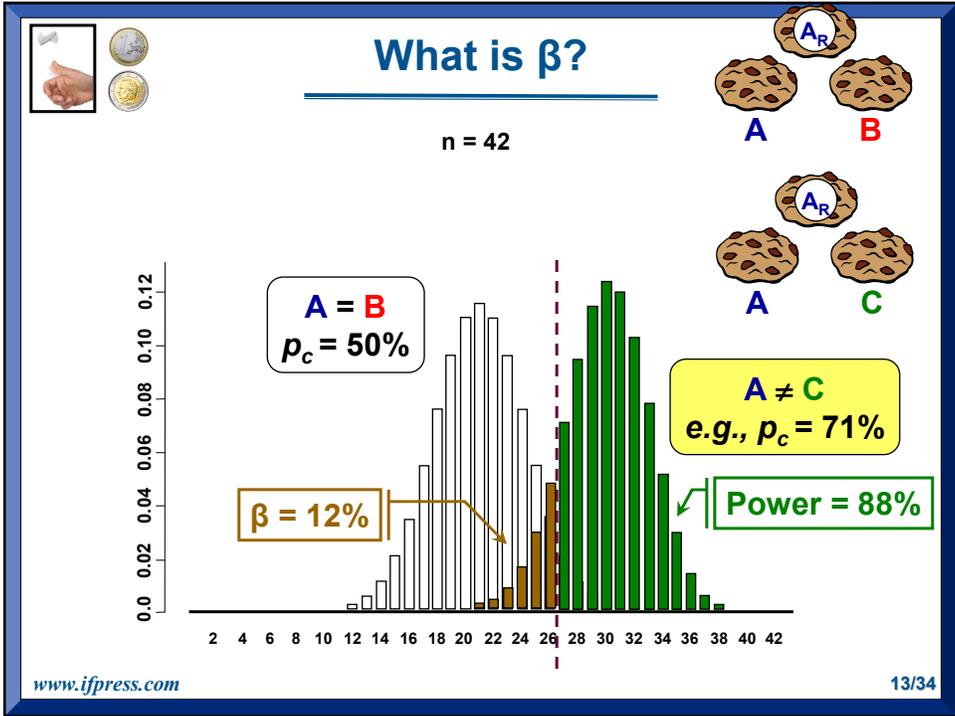
→ **Missed an opportunity for change**



Five Key Experimental Factors
for a Successful
Sensory Discrimination Program

β : Type II Error
(1 – power)





Type II Error

- Falsely concluding that the products are not different when they are; failing to find a difference
- Consequence:
 - ❖ Two main objectives
 - Prove products are different
 - “New and improved”, “Fresher, crisper taste”
 - **Conclude similarity, missed an opportunity for change**
 - Prove products are similar
 - Ingredient change, new supplier, government regulation (e.g., salt or sugar reduction)
 - **Conclude similarity → Release on the market of a sensorially different product**




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Size of the Relevant Difference



Comments on Sensory Differences



**Two different products
will never be identical**

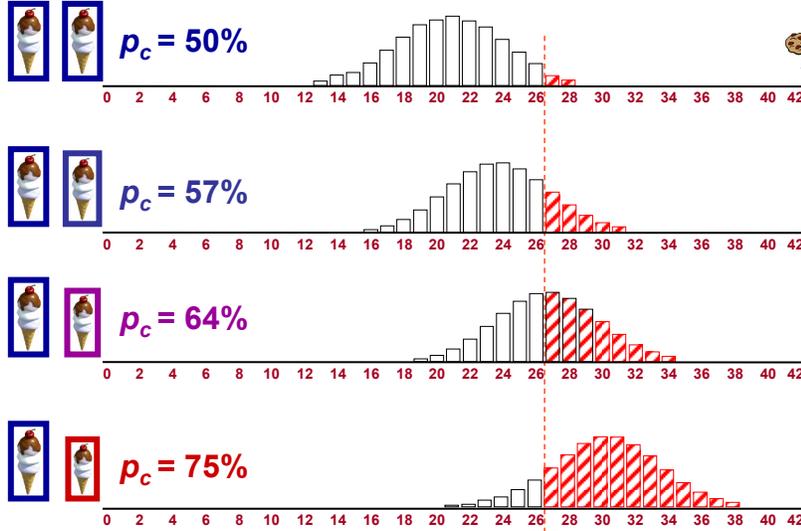
**A lack of significance difference does not
mean that two products are identical/similar**

**A significant difference can always be found,
provided that the sample size is large enough**



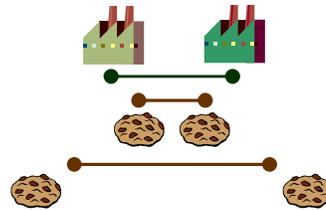
Increasing the Size of the Difference

N=42



Estimating the Size of a Relevant Difference

- No universal answer
- Research is necessary
- Various options
 - ❖ *Measuring inter factory differences*

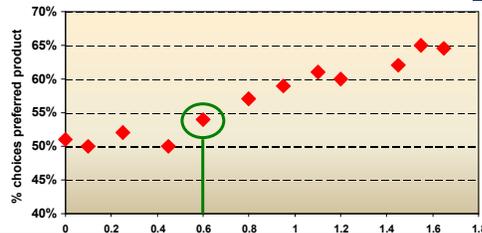


- ❖ *Use the same-different test*
 - Estimate the size of the sensory difference above which consumers call the products 'Different'



"Are they the same or different?"

- ❖ *Build a relationship between perceived differences and consumer preferences*



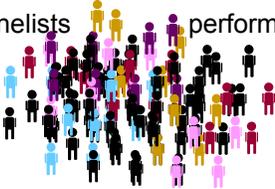


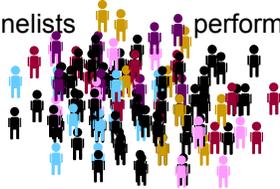
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Sample Size



Effect of Sample size on Discrimination

- Greater sample sizes provide greater statistical power
- Example: One study, no significance difference found
 - ❖ 5 panelists  performing one triangle 
 - vs.
 - ❖ 500 panelists  performing one triangle 

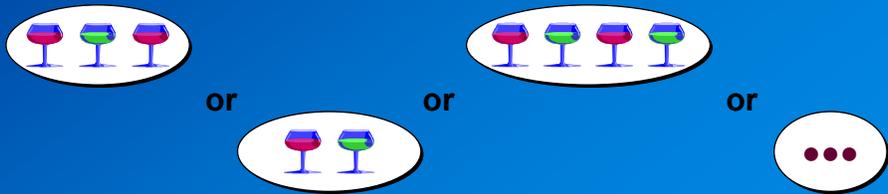


- Larger sample sizes are less likely to miss sensory differences
- The sample size is a function of α , β , the **size of the difference** of interest and the **test methodology**



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Test Protocol

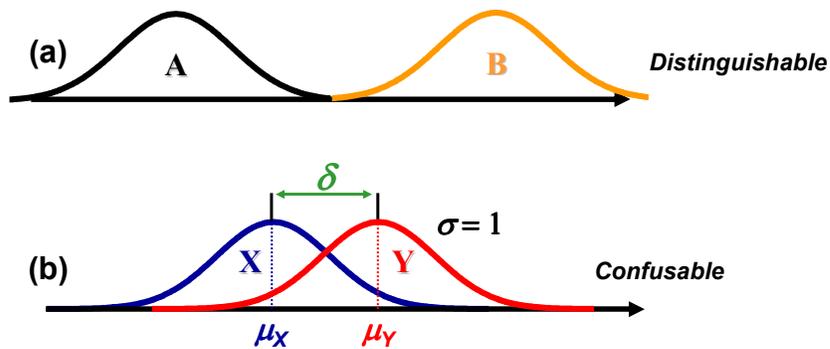


Common Sensory Discrimination Methods

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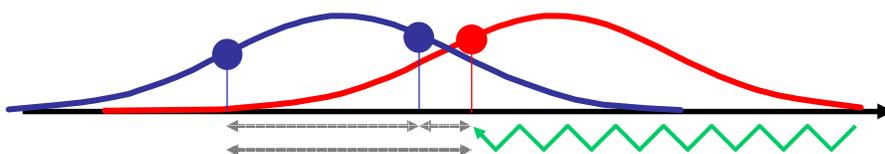
Sensory Differences



δ = distance between the means (μ_X and μ_Y) of the distributions measured in terms of their standard deviation (σ)

d' = Experimental estimate of δ

Decision Rules



❖ Triangle: **Wrong**

Comparison of distances

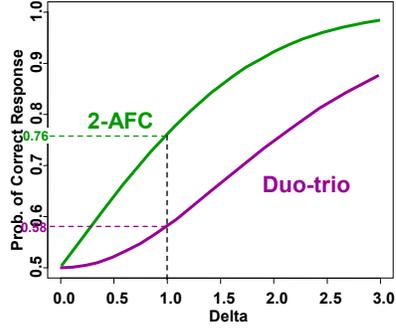
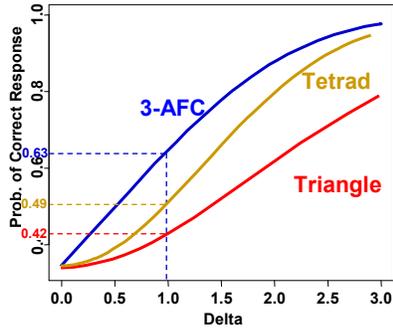
❖ 3-AFC: **Correct**

Magnitudes

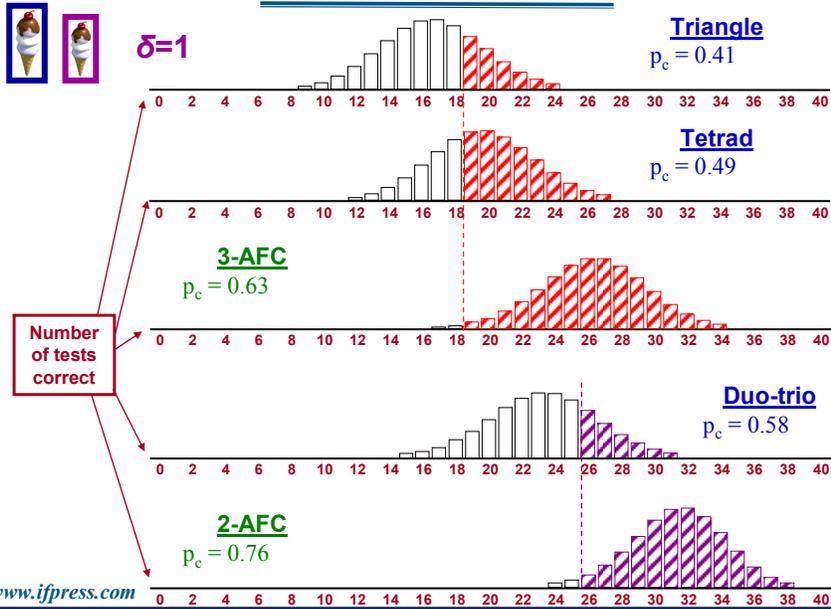


Comparison of distances	Magnitudes
Triangle, Duo-trio, Tetrad	2-AFC, 3-AFC, m -AFC,

Proportion Correct vs. δ



Relative Discrimination Power, N=40





Five Key Experimental Factors
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Establishing a Successful Sensory Discrimination Program



Sensory Discrimination Program

❖ 5 linked components:

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

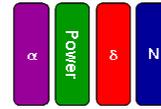
β : Probability of a Type II error (wrongly concluding that no difference exists between the products = 1-power)

δ : Size of the difference of interest

N : Sample size

Testing Protocol

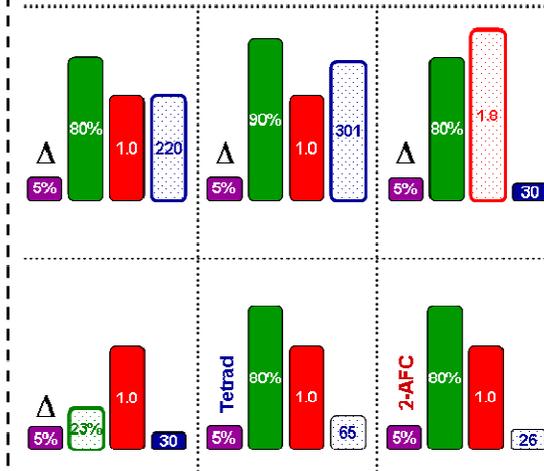
Power



❖ 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 : Size of the difference of interest
- N : Sample size

Protocol



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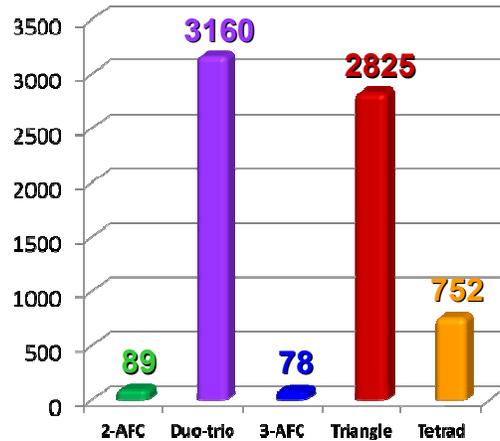
Conclusions

The Cost of Decision Rules (1)



Scenario 1

- **Size of the difference:** 64:36 in a 2-AFC (δ of 0.5)
- **Power:** 80% chance of detecting the difference
- **α level:** 5%
- **Sample size needed** →

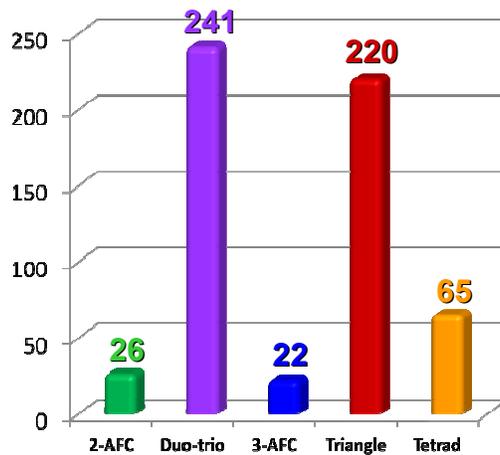


The Cost of Decision Rules (2)



Scenario 2

- **Size of the difference:** 76:24 in a 2-AFC (δ of 1)
- **Power:** 80% chance of detecting the difference
- **α level:** 5%
- **Sample size needed** →





Discrimination Testing



➤ Two main objectives

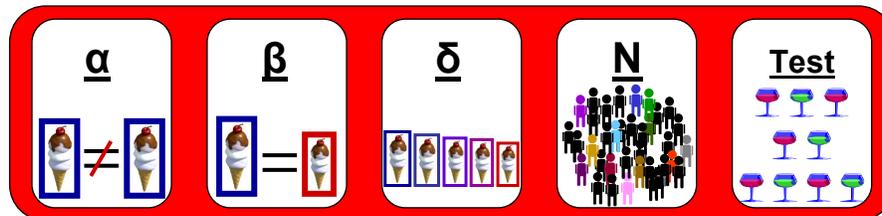
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Thank You Very Much
Any Questions?

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