

"Myth" Busting Seminar ASTM Meeting - Anaheim, CA April 14, 2011



Busting the Myth that the Power of the 3-AFC over the Triangle comes from Attribute Awareness

John M. Ennis, Daniel M. Ennis, & Benoit Rousseau *The Institute for Perception* <u>E-mail</u>: john.m.ennis@ifpress.com <u>Phone</u>: (804) 675 2980





Does the choice of testing methodology matter?





Gridgeman's Paradox

Discrepancy between Triangle Test and 3-AFC?



Gridgeman's Paradox

Discrepancy between Triangle Test and 3-AFC?



Gridgeman's Paradox

Discrepancy between Triangle Test and 3-AFC?

	# correct		Prop. correct			
Study	Product	# tests	Triangle	3-AFC	Triangle	3-AFC
Byer and Abrams, 1953	Bitter solutions	45	21	32	47 %	71 %
Stillman, 1993	Party onion dip	108	42	62	39 %	57 %
Tedja <i>et al.</i> , 1994	Salt solutions	720 240 240	363 104 99	539 161 148	50 % 43 % 41 %	75 % 67 % 62 %
Masuoka <i>et al.</i> , 1995	Beer	108	50	75	42 %	69 %
Delwiche & O'Mahony, 1996	Pudding	156	106	145	68 %	93 %
Rousseau & O'Mahony, 1997	Yogurt	180	105	152	58 %	84 %



Triangle test returns a lower proportion correct than 3-AFC



Issue: Same criterion for Triangle and 3-AFC Example:

If sample size = 40

Number correct needed = 19

Which cookie is most (least) bitter?



New Cookie found to be more bitter



Which cookie is different?

Correct	Incorrect	Total
17	23	40

New Cookie not found to be different

The Triangle and 3-AFC Methods Minimum Number of Correct Judgments for Significance at α=0.05										
n	0	1	2	3	<u>,</u> ' 4	5	6	7	8	9
10	7	7	8		9	9	9	10	10	11
20		12	12	12	13	13	14	14	15	15
	4.0	16	16	17	17	17	18	18	19	19
Λ	1 Q	20	20	20	21	21	22	22	22	23
		24	24	24	25	25	26	26	26	27
		27	28	28	29	29	29	30	30	31
70	31	31	32	32	32	33	33	34	34	34
80	35	35	35	36	36	37	37	37	38	38
100	38	39	39	40			41	41	41	42
110	46	46	47	43	47	48	48	48	40	40
120	50	50	50	51	51	51	52	52	53	53
130	53	54	54	54	55	55	55	56	56	57
140	57	57	58	58	58	59	59	59	60	60
150	61	61	61	62	62	62	63	63	63	64
160	64	65	65	65	66	66	66	67	67	67
170	68	68	69	69	69	70	70	70	71	71
180	71	72	72	73	73	73	74	74	74	75
190	75	75	76	76	77	77	77	78	78	78
200	79	79	79	80	80	81	81	81	82	82
210	82	83	83	83	84	84	84	85	85	86
230	86	86	87	87	87	88	88	88	89	89
240	90	90	90	91	95	05	92	92	92	93
250	97	97	97	0.8	98	98		90	100	100
260	100	101	101	101	102	102	102	103	103	103
270	104	104	105	105	105	106	106	106	107	107
280	107	108	108	108	109	109	110	110	110	111
290	111	111	112	112	112	113	113	113	114	114
300	115	115	115	116	116	116	117	117	117	118
310	118	118	119	119	119	120	120	121	121	121
320	122	122	122	123	123	123	124	124	124	125
330	125	126	126	126	127	127	127	128	128	128
340	129	129	129	130	130	130	131	131	132	132
350	132	133	133	133	134	134	134	135	135	135
300	130	130	137	137	137	141	138	138	139	139
380	143	143	144	144	144	145	145	145	142	143
390	146	147	147	147	148	148	149	149	140	150
400	150	150	151	151	151	152	152	152	153	153
410	153	154	154	155	155	155	156	156	156	157
420	157	157	158	158	158	159	159	159	160	160
430	161	161	161	162	162	162	163	163	163	164
440	164	164	165	165	165	166	166	166	167	167
450	168	168	168	169	169	169	170	170	170	171
460	171	171	172	172	172	173	173	174	174	174
470	175	175	175	176	176	176	177	177	177	178
480	178	178	179	179	179	180	180	181	181	181
490	182	182	182	183	183	183	184	184	184	185
510	185	185	186	186	186	100	187	188	188	188
520	102	102	102	190	190	194	191	105	191	192
530	196	196	196	197	197	197	198	198	198	195

Relative Power of the Triangle and 3-AFC



Cost Consideration: Sample Size



<u>Scenario</u>

- Size of the difference:
 - 76:24 in a 2-AFC
- Power: 80% chance of detecting difference
- > α level: 5%





Low power leads to increased cost

But why is 3-AFC more powerful than Triangle?

Reasonable-ish explanation:

3-AFC is more powerful than Triangle because knowledge of attribute assists respondents

This is the "myth" we will bust

Myth Busting 1

- Gridgeman's paradox occurs even when respondents know attribute of difference
- > Example: Tedja et al. (1994) Salt solution evaluations



Myth Busting 2

Triangle has less power than other unspecified methods
Example: Delwiche and O'Mahony (1996) – Tetrads



Sample sizes required for 80% power in previous scenario with $\alpha = 0.05$



Myth Busting 3

Gridgeman's paradox is resolved by finding an underlying measure of effect size (Frijters 1979)





If attribute awareness doesn't explain difference in power between Triangle and 3-AFC, what does?

Answer: Noise makes Triangle task more difficult

Gridgeman's Paradox Revisited

Discrepancy between Triangle Test and 3-AFC?





Triangle test lacks power when differences are small relative to noise

Other methods, such as Tetrads, are more robust in presence of noise

These methods have other drawbacks such as memory and sensory fatigue



We would like to pick methodology based on circumstances and then compare results from different methodologies



"Myth" Busting Seminar ASTM Meeting - Anaheim, CA April 14, 2011



For more info: www.ifpress.com john.m.ennis@ifpress.com

Presented By: John M. Ennis The Institute for Perception E-mail: john.m.ennis@ifpress.com Phone: (804) 675 2980

