

Challenges in Data Collection and Analysis in Multi-National Experimentation

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Outline

- Purpose
- Introduction – MNE 4 and UR2015
- Aspects of Multinational Experimentation
- Differences between MNE 4 and UR2015
- Data Collection and Analysis Challenges
- Conclusion

Purpose

- Expand the COBP Experimentation
- Promote Multi National Experimentation
- Provoke discussion
- Learn from the Community

Introduction – MNE4

- 3-week experiment
- Afghanistan scenario
- Baseline LOE's performed
- Distributed environment
 - Most nations operated from within their own country

Introduction – UR2015

- 3 – 2 week experiments
 - Week 1 – Baseline (2005)
 - Week 2 – Addition of technologies (2015)
 - Week 3 – Addition of C2 methods (2015)
- Urban environment
- Predominantly single location

Multi National Experimentation Aspects

- Culture
- Competing Priorities
- Data Collection
- Data Analysis
 - Sample sizes are normally small
 - Random sampling difficult

Data Collection and Analysis Challenges

- Sample Size
 - Wilcoxon Rank-Sum Test
 - Vector Method
- Surveys

Sample Sizes

- Normally small, < 10
- How to analyze?
 - Parametric Methods
 - t-test (if \approx normal in distribution)
 - Non parametric methods
 - Wilcoxon Rank Sum
 - Vector Method

Wilcoxon Rank-Sum

- Small Sample Size
- Non-normal type distribution, or unknown distribution

Wilcoxon Rank-Sum - Example

- Compiled results of a survey question from 3 different trials:

Understanding		
(baseline) Trial 1	Trial 2	Trial 3
6	7	7
6	6	6
3	3	3
7	5	2
6	6	6
5	6	7
6	2	2

Table 1

Wilcoxon Rank-Sum - Example

- Ranking:

Trial #	Score	Rank
Trial 2	2	1
Trial 1	3	2.5
Trial 2	3	2.5
Trial 1	5	4.5
Trial 2	5	4.5
Trial 1	6	9
Trial 2	6	9
Trial 2	6	9
Trial 2	6	9
Trial 1	7	13.5
Trial 2	7	13.5

Trial #	Score	Rank
Trial 3	2	1.5
Trial 3	2	1.5
Trial 1	3	3.5
Trial 3	3	3.5
Trial 1	5	5
Trial 1	6	8.5
Trial 3	6	8.5
Trial 3	6	8.5
Trial 1	7	13
Trial 3	7	13
Trial 3	7	13

Wilcoxon Rank-Sum - Example

- Add and Compare:

Trial #	Score	Rank
Trial 1	3	2.5
Trial 1	5	4.5
Trial 1	6	9
Trial 1	7	13.5
TOTAL		56.5
Trial #	Score	Rank
Trial 2	2	1
Trial 2	3	2.5
Trial 2	5	4.5
Trial 2	6	9
Trial 2	6	9
Trial 2	6	9
Trial 2	7	13.5
TOTAL		48.5

Trial #	Score	Rank
Trial 1	3	3.5
Trial 1	5	5
Trial 1	6	8.5
Trial 1	7	13
TOTAL		55.5
Trial #	Score	Rank
Trial 3	2	1.5
Trial 3	2	1.5
Trial 3	3	3.5
Trial 3	6	8.5
Trial 3	6	8.5
Trial 3	7	13
Trial 3	7	13
TOTAL		49.5

Wilcoxon Rank-Sum - Example

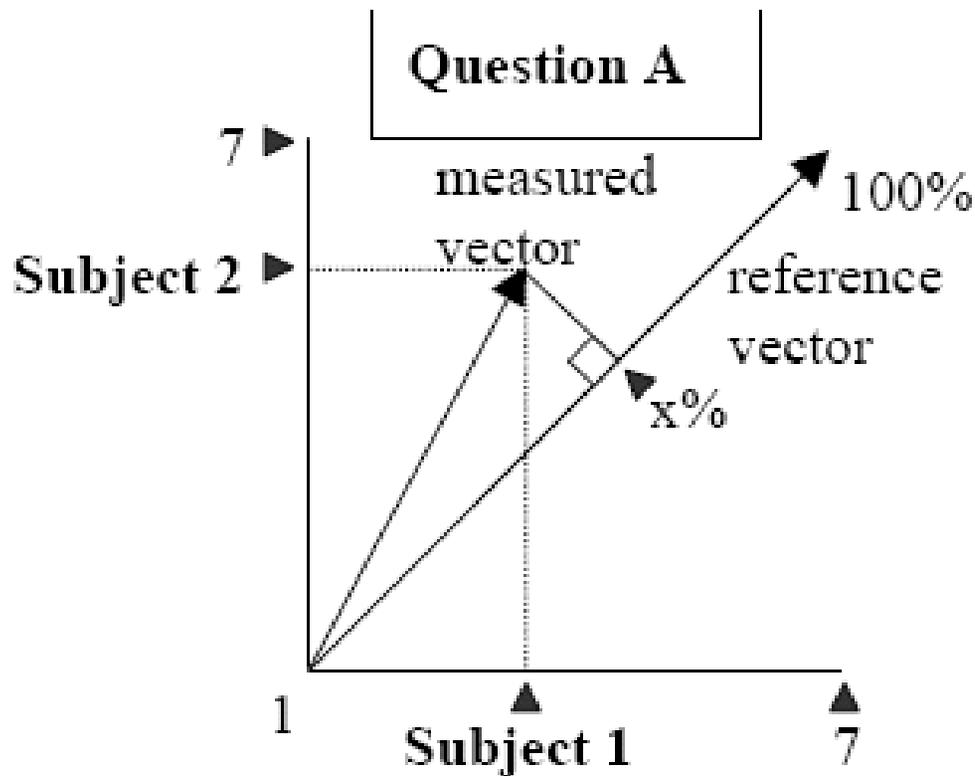
- Compare on Table:

a. $\alpha = .025$ one-tailed; $\alpha = .05$ two-tailed

$n_1 \backslash n_2$	3		4		5		6		7		8		9		10	
	T_L	T_U														
3	5	16	6	18	6	21	7	23	7	26	8	28	8	31	9	33
4	6	18	11	25	12	28	12	32	13	35	14	38	15	41	16	44
5	6	21	12	28	18	37	19	41	20	45	21	49	22	53	24	56
6	7	23	12	32	19	41	26	52	28	56	29	61	31	65	32	70
7	7	26	13	35	20	45	28	56	37	68	39	73	41	78	43	83
8	8	28	14	38	21	49	29	61	39	73	49	87	51	93	54	98
9	8	31	15	41	22	53	31	65	41	78	51	93	63	108	66	114
10	9	33	16	44	24	56	32	70	43	83	54	98	66	114	79	131

Challenges and Solutions

- Vector Method



Challenges and Solutions

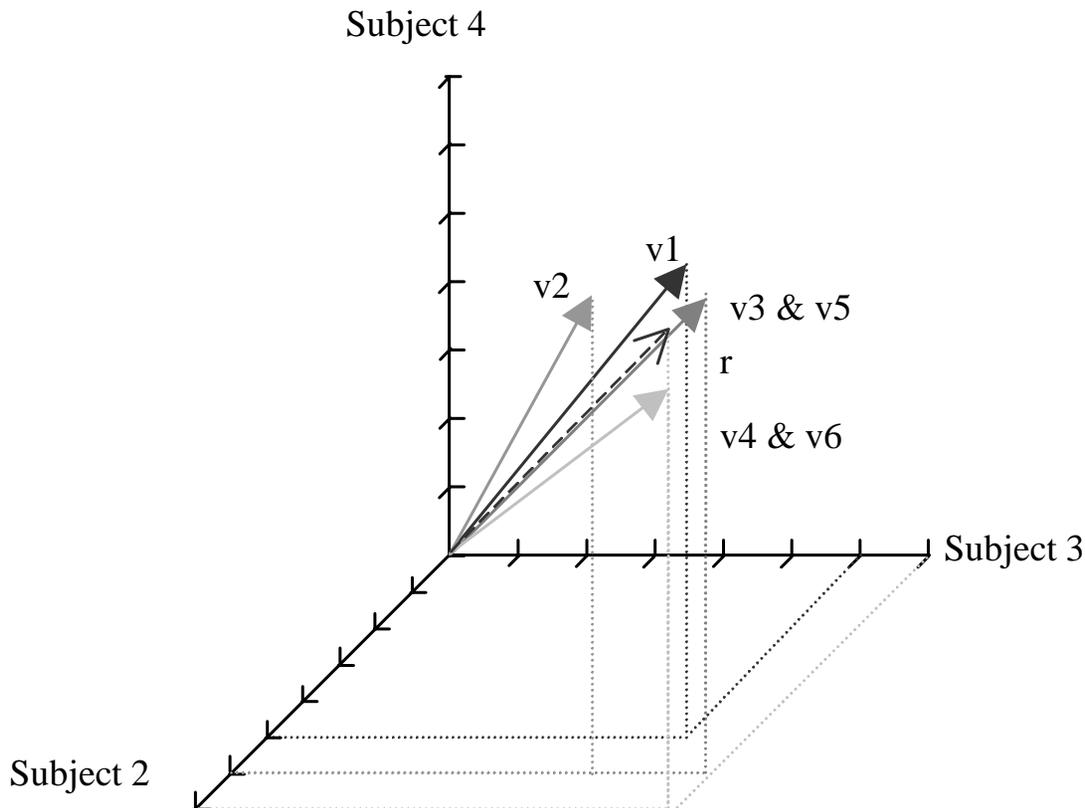
- **Vector Method**

Measured vector projected onto reference vector for **different** sample sizes

		CG	EBP	EBE	EBA	KBD	KM	MNIG
28 Feb	Sample	4	12	19	32	22	18	9
	Projection (%)	88	67	58	64	67	57	56
2 Mar	Sample	4	12	22	34	21	18	10
	Projection (%)	88	69	61	60	65	53	53
7 Mar	Sample	4	11	21	34	21	18	11
	Projection (%)	96	67	70	70	66	59	65
9 Mar	Sample	4	12	21	33	22	18	11
	Projection (%)	96	69	74	69	58	66	64
14 Mar	Sample	4	10	20	34	21	18	8
	Projection (%)	96	78	77	75	66	64	60
16 Mar	Sample	4	10	20	34	20	18	7
	Projection (%)	96	80	78	72	68	69	69

Challenges and Solutions

- Vector Method
 - 3D visualization of CG results over time.



Surveys

- Surveys versus Interviews
 - Surveys, for this paper, are either electronic or paper issued
 - Interviews are considered face-to-face with participant

Surveys – MNE4

- MNE4
 - 141 total surveys distributed
 - 14,400 total surveys answered
 - Participants received too many questions
 - Participants completed surveys the following experiment day – “Pub” effect?
 - Are results accurate or reliable?

Surveys – UR 2015

- UR 2015
 - 72 total surveys distributed
 - 2,394 total surveys answered
 - Participants still complained
 - Unfinished surveys were deleted from record prior to next experiment day

Conclusions

- Small sample sizes do have statistical tools that are more appropriate to their uniqueness
- Use the most appropriate statistical tool available
- Surveys
 - Use sparingly
 - Do NOT overwhelm the participant
 - Consider how to motivate participants to complete surveys that given day