

## INTRODUCTION

The unspecified tetrad method has been shown to be a more powerful discrimination method as long as the correct instructions, "Group the samples into two groups of two, based on similarity", are used. If alternative instructions such as, "Select the two samples that are most similar", are used the power advantage diminishes, through a modification in the participants' decision rule. Recent studies have shown a disconnect in the true power and post-hoc power that suggest there is a misalignment between what panelists are doing and what they are asked to do. While a strong case has been made that both test instructions and decision strategy matter in the tetrad testing, no objective link has been drawn between the two important factors. More plainly, we do not know how tetrad test directions influence the decision strategy of a test participant.

## OBJECTIVES

- Explore the effect of test directions on the decision strategy used by test participants.
- Determine impact of test instructions and decision strategy on discriminatory ability.

## MATERIALS AND METHODS

### Panelists:

- 229 volunteers, recruited from UTK Sensory Lab database
- 78% between 18-44
- 30% male, 70% female



### Samples:

- Fage® Total and Total 2% plain Greek yogurt (Fage International S.A., Strassen, Luxembourg)

## PROCEDURE AND ANALYSIS

### Tetrad Test

On testing day, panelists were randomly assigned to one of three tetrad instruction groups:

- "Group the samples into two groups of two, based on similarity"
- "Select the two samples that are most similar"
- "Group into two groups of two based on similarity. Select the codes from one of your groups below".

After completing the test, panelists were asked to describe how they completed the tetrad test by answering a randomized multiple-choice question.

The samples were served to participants at refrigeration temperature (40°F) in off-white, noise-controlled sensory booths. Samples were labeled with a three-digit code and the serving order was randomized.

### Statistical Analysis

The sensR (2018) package was used to:

- Determine p-values for each of the instruction groups and decision rules
- Estimate effect size ( $d'$ ) and variance
- Compute test power for each instruction group and decision rule

JMP was used to:

- Compare instruction effects on decision rule using chi-square categorical analysis

## RESULTS

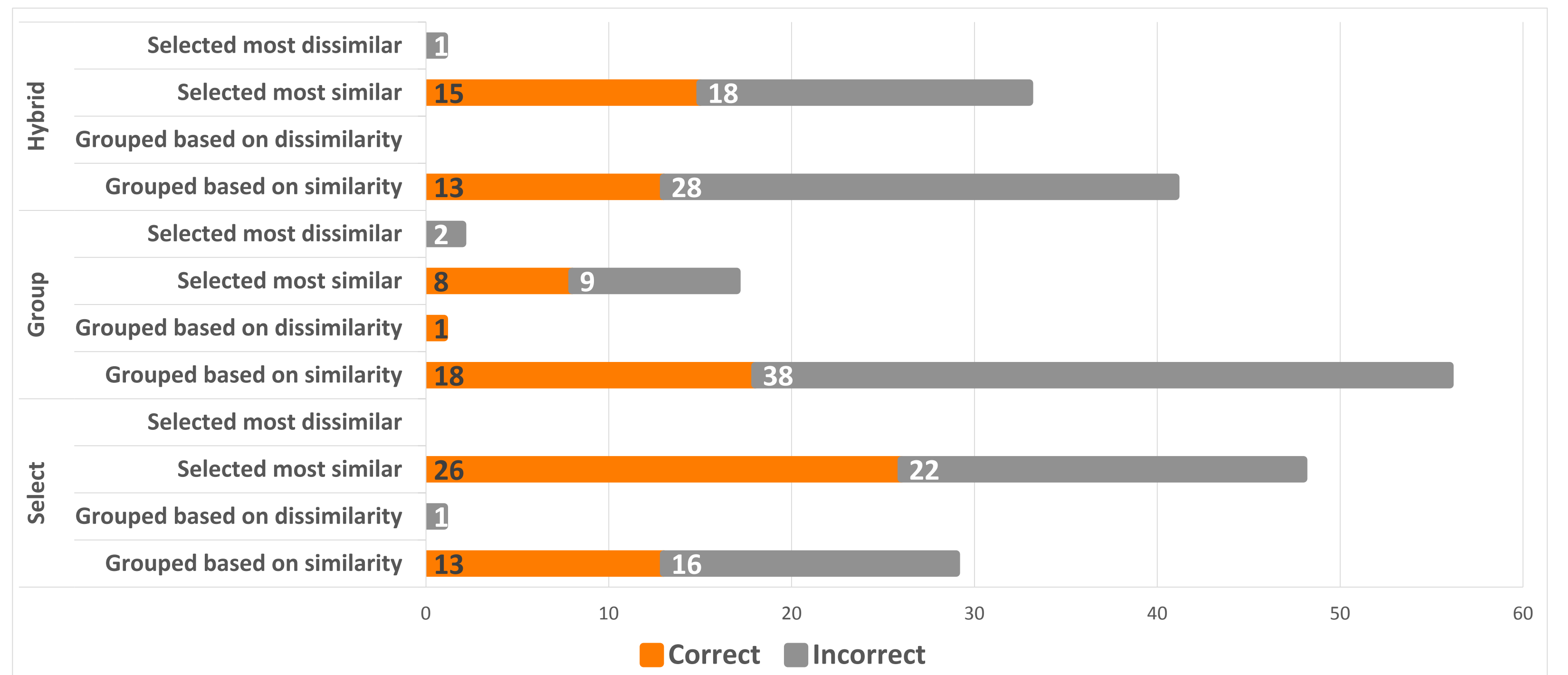
**Table 1.** Results comparisons for instruction groups

Instruction	N	Correct	p-value	$d'$	Std. Error	$d'$ Confidence Interval	Test Power
Select	78	39	0.0017	1.022	0.201	0.539 - 1.414	0.703
Group	76	27	0.3836	0.348	0.444	0.000 - 0.925	0.075
Hybrid	75	28	0.2675	0.474	0.341	0.000 - 0.996	0.091

- Significant difference only found with Select instructions
- Larger effect size found with Select instructions, although not significantly so ( $p = 0.0834$ )
- Operational power for Group and Hybrid much lower than Select instructions

## RESULTS CONT.

**Figure 1.** Frequency of self-reported test decision rule used by panelists after testing for each instruction group



- Very few either grouped or selected by dissimilarity
- Majority used same decision rule as instructions given with some exceptions
- Almost even split between Group and select for Hybrid instruction group

**Table 2.** Results comparisons for self-reported decision rule used

Rule	N	Correct	p-value	$d'$	Std. Error	$d'$ Confidence Interval	Test Power
Group	128	45	0.3316	0.317	0.372	0.000 - 0.782	0.085
Select	101	49	0.0008	0.969	0.181	0.562 - 1.303	0.698

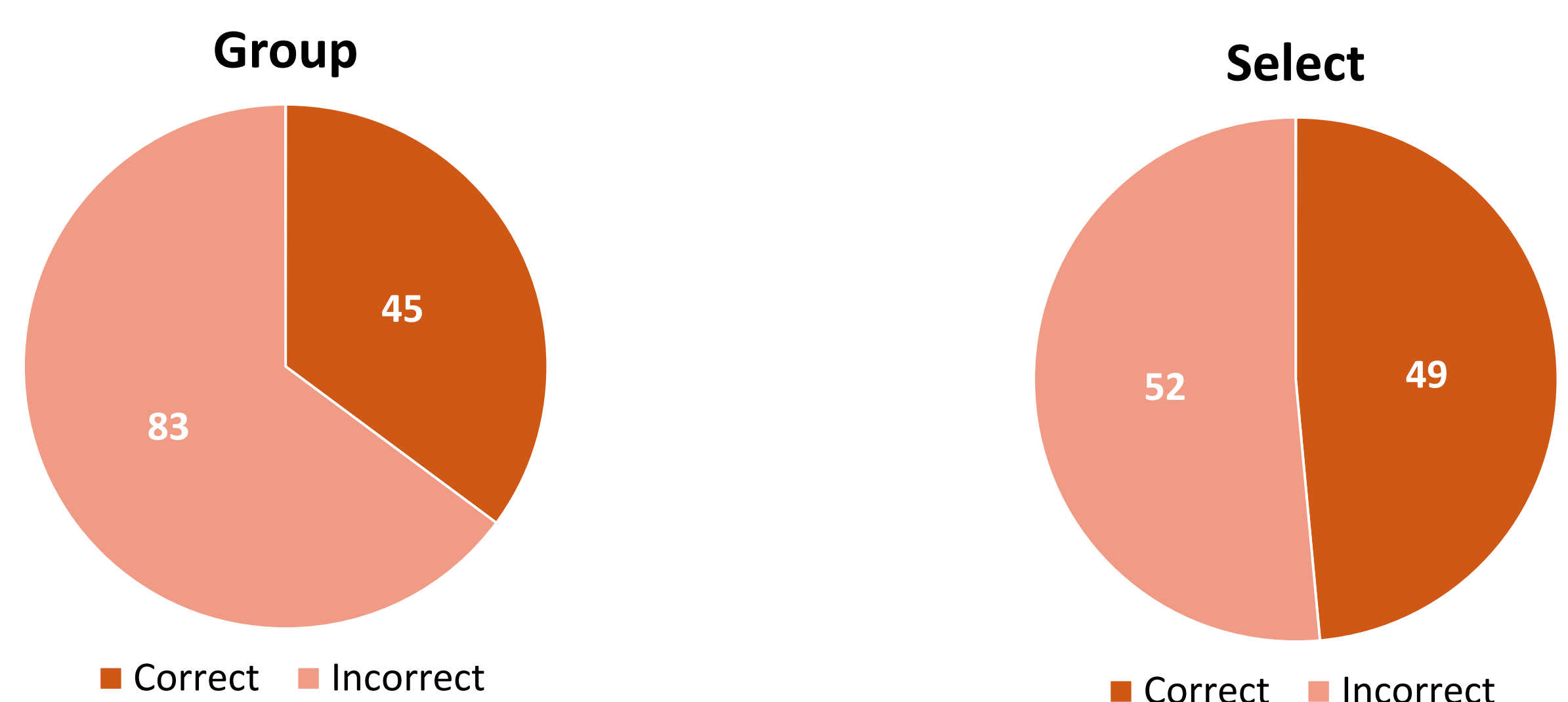
- Panelists were able to significantly differentiate samples using the Select decision rule
- Effect size ( $d'$ ) significantly larger ( $p = 0.0163$ ) with Select decision rule than Group
- Operational power much lower for Group decision rule than Select

**Table 3.** Effect of decision rule used by instructions given comparison

Decision Rule	Hybrid - Group	Hybrid - Select	Group - Select
Grouped by similarity	0.0144	0.0296	<0.0001
Selected by similarity	0.0045	0.0294	<0.0001

- Test directions influenced decision rule used ( $\chi^2 = 28.505$ ,  $p < 0.0001$ )
- Panelists more likely to group when asked to group compared to Hybrid and Select instructions ( $p = 0.0144$  and  $p < 0.0001$ , respectively)
- Hybrid instructions found to lead to more use of the Selection decision rule ( $p = 0.045$ )
- Select instructions more likely to lead to selection approach than Hybrid ( $p = 0.0294$ )

**Figure 2.** Likelihood of decision rule used to yield correct response comparison



- Decision paradigm used significantly influenced the amount of correct answers in the tetrad ( $\chi^2 = 8.419$ ,  $p = 0.0381$ )
- Correct answers significantly more common when the select decision rule was used ( $p = 0.0231$ )

## CONCLUSION

- Operational power is not only affected by the instructions given but the decision rule employed by panelists
- Panelists who selected samples based on similarity performed better than those who grouped the samples regardless of the instructions given
- Ensuring all participants use the correct decision rule is vital to the outcome of the test
- Combination of verbal and written instructions may be required to ensure all panelists use the same decision rule and maximize test power