Do Riding's style dimensions have neural correlates?

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Arguments

- In this paper I argue for further research around Riding's style model despite recent criticism of the CSA
- I argue that perhaps the model is valid but the instrument needs attention
- The model has sound theoretical underpinnings

Background

- A lot of research done around Riding's style dimensions
  - Wholist-analytic dimension
    - Describes whether an individual tends to organise information in wholes or parts
  - Verbal-imagery dimension
    - Indicates whether an individual is inclined to represent information during thought, verbally or in mental pictures
- Cognitive Style Analysis (CSA) used as the instrument to assess style

Background

- A number of studies have brought the psychometric properties of the CSA into question (e.g. Coffield, Moseley, Hall & Ecclestone, 2004; Peterson, Deary & Austin 2003a & b; Parkinson, Mullally & Redmond, 2004; Rezaei & Katz, 2004)
  - Especially the reliability of the Verbal-Imagery dimension

Background

- R. J. Riding (personal communication, October 1, 2005) says that:
  - "with the CSA there is actually considerable evidence that, at least on its first presentation, it assesses style since many results are in directions that fit an expectation or explanation, as shown in the various reviews e.g. Riding & Rayner, 1998" (p. 2).

Background

- Riding and Rayner (1998) stated that cognitive style may be categorised as a fixed attribute of an individual with an underlying physiological basis.

Background

- Riding, Glass, Butler and Pleydell- Pearce (1997) measured the Alpha EEG patterns of individuals of different cognitive styles
  - They found that there was a significant correlation between the verbal imager scale and hemisphere activation with imagers using the right side and verbalisers the left
  - differences were found for the wholist analytic dimension along the mid-line

Background

- Glass & Riding (1999): reported findings for delta, theta, alpha, gamma and beta bands.
  - Results indicated increased alpha and theta powers for wholists along the midline and left-right differentials between verbalisers and imagers

Aims

- The purpose of the present study was to explore further whether neural correlates of the Verbal-Imager and Wholist-Analytic dimensions of cognitive style exist
  - In particular the Verbal-Imagery dimension

Method

- EEG study
- 16 paid volunteers aged 16-27 (8 males, 8 females)
- All participants were assessed individually for their cognitive style
- Participants were attached to Bio-logic EEG recording equipment via 19 electrodes at scalp positions Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4,T5, P3, Pz, P4, T6, O1 and O2 (see Figure 1).

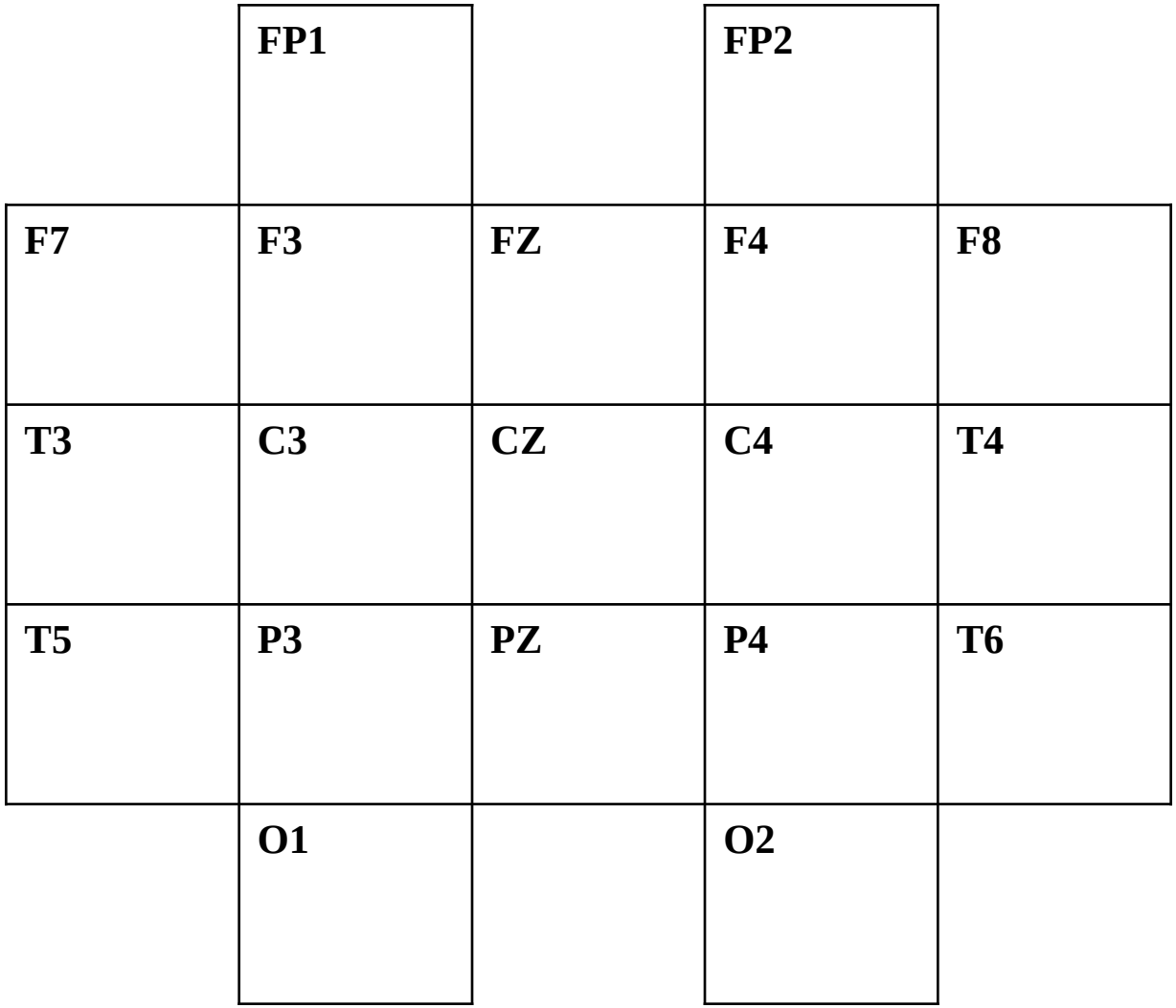


Figure 1 Schematic diagram of electrodes positioned on the scalp.

Method

- *Baseline*
  - EEG recorded whilst participants were at rest with eyes closed for 2 minutes.
- *Passage 1 (complex imagery)*
  - EEG recorded for the duration of the passage played to the participant via headphones (with eyes closed).
- *Passage 2* (complex acoustical and semantic)
  - EEG was recorded for the duration of the passage played under the same conditions as for passage 1 (eyes closed).
    - Both passages taken from Riding and Calvey (1981).

Method

- Passage order counterbalanced
- participants listened to each passage actively as they expected to answer some questions about it afterwards

Analysis

- particularly complex data set
  - 19 electrodes
  - 3 conditions
  - 3 frequency bands
  - 2 min recordings (split into epochs)
- Initially analysed using MANOVA with topographically clustered lines of electrodes – but too complex and difficult to interpret

Analysis

- At this stage I wanted general trends and evidence for neural correlates
- epochs averaged out
- Six stepwise discriminant analyses (one for each frequency band for both style dimensions V-I, W-A)
- 38 regressors entered into each analysis (19 electrode positions for each passage).

Analysis

- The results of this analysis should tell me if there were any particular electrode positions that predicted whether an individual was an imager, verbaliser, wholist or analytic

Results and Discussion

- Results shown diagrammatically
- Shaded squares show increased cognitive activity (Red=Passage 2, Yellow = Passage 1)
- Effect sizes shown also

Alpha for Verbalisers

	FP1		**FP2**	
F7	**F3**	**FZ**	**F4**	**F8**
T3	**C3**	**CZ**	**C4**	**T4**
T5 **1.3**	**P3**	**PZ**	**P4**	**T6**
	O1		**O2**	

Alpha for Imagers

	FP1		**FP2**	
F7	**F3**	**FZ**	**F4**	**F8** **0.45**
T3	**C3**	**CZ**	**C4**	**T4**
T5	**P3**	**PZ**	**P4**	**T6**
	O1		**O2**	

Theta for Verbalisers

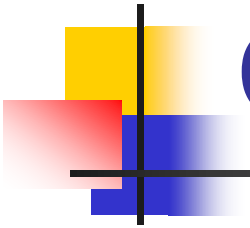
	FP1 0.19		FP2	
F7 1.29	F3 0.29	FZ	F4	F8 0.65
T3	C3	CZ	C4	T4 0.43
T5	P3	PZ	P4	T6
	O1		O2	

Beta for Wholists

	FP1		**FP2**	
F7	**F3**	**FZ**	**F4**	**F8**
T3	**C3**	**CZ**	**C4**	**T4**
T5	**P3**	**PZ** **1.47**	**P4**	**T6**
	O1		**O2**	

Theta for Analytics

	FP1		FP2	
F7	F3	FZ	F4	F8
T3	C3 0.47	CZ	C4	T4
T5	P3	PZ	P4 0.83	T6
	O1		O2	



Conclusions

- appears to show that neural power values can differentiate between verbalisers and imagers and wholists and analytics
- they seem to accord with previous results reported by Riding et al. (1997) and Glass and Riding (1998).

Conclusions

- However, caution needed:
  - needs to be replicated using a larger and more representative sample
  - It doesn't really address the CSA reliability issues
  - The task was one designed to differentiate verbalisers and imagers
  - It may be pertinent to include other style measures in future studies
- However, we should continue to explore Riding's model