



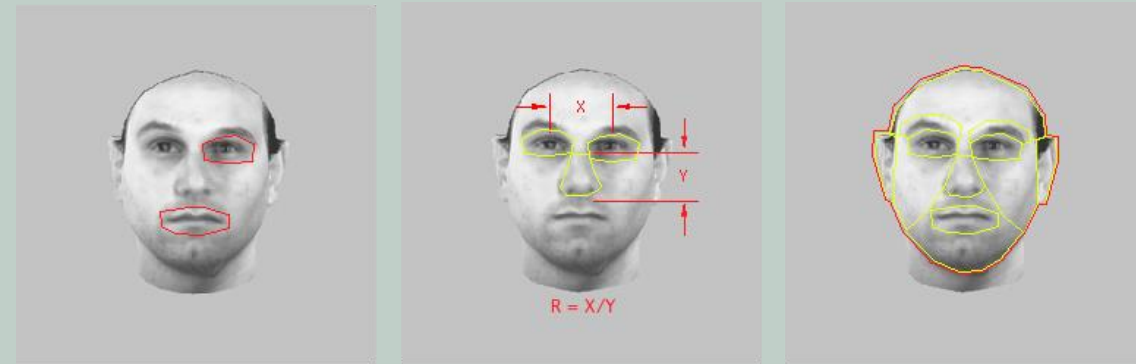
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Investigating the Relationship Between Facial Recognition Tasks

Abhisheka Vengadeswaran | Supervised by Elizabeth A. Nelson & Dr. Charles A. Collin (University of Ottawa)

Introduction



It is theorized that two or three facial recognition processing mechanisms exist: featural, configural, and holistic (which combines featural and configural components). To date, researchers have used facial recognition tasks interchangeably as measures of holistic processing. Results across studies have been inconsistent, and we postulate that these commonly used facial recognition tasks are not measuring the same construct, or same component thereof. The purpose of this study is to empirically determine patterns of performance (as measured by accuracy) across these tasks and to investigate if and how performance correlates with general face memory ability as measured by the Cambridge Face Memory Test.

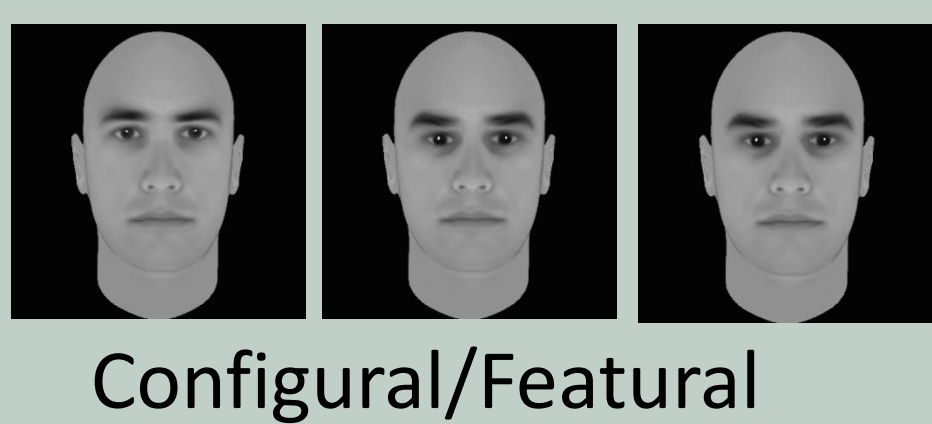
Methodology

We measured accuracy across the following tasks:

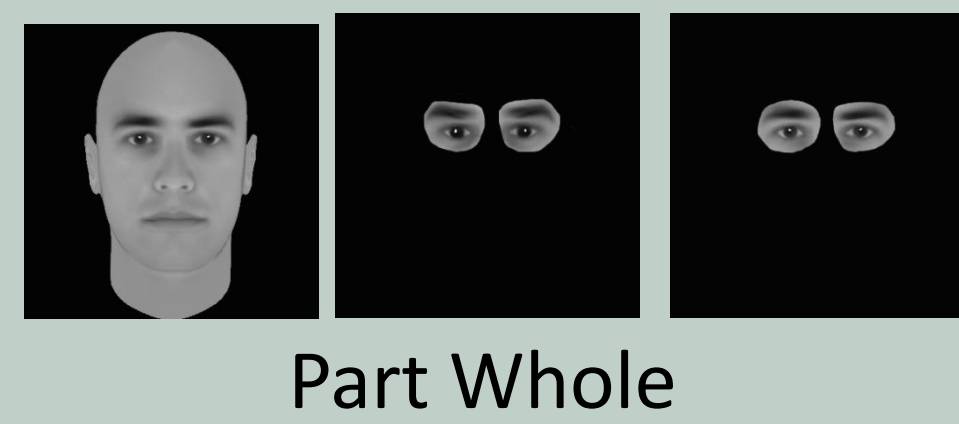
- Partial Composite Effect Task
- Complete Composite Effect Task
- Configural/Featural Difference Detection Task
- Part Whole Effect task
- Cambridge Face Memory Test (CFMT)

Stimuli

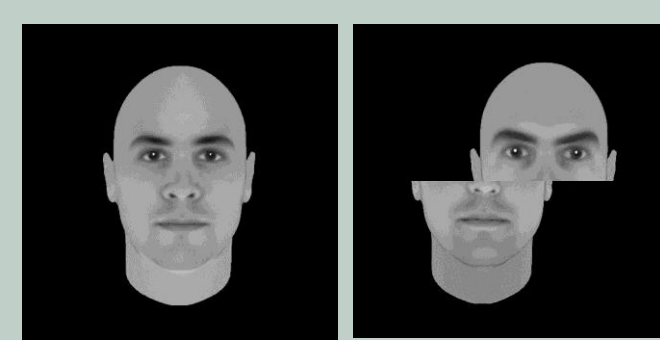
The face stimuli were taken from the Matheson-McMullen Face Database. Using Photoshop and Matlab 2010a, all stimuli were equated for luminance and RMS contrast. All face stimuli were male. Stimuli were scaled to 9 x 9 cm.



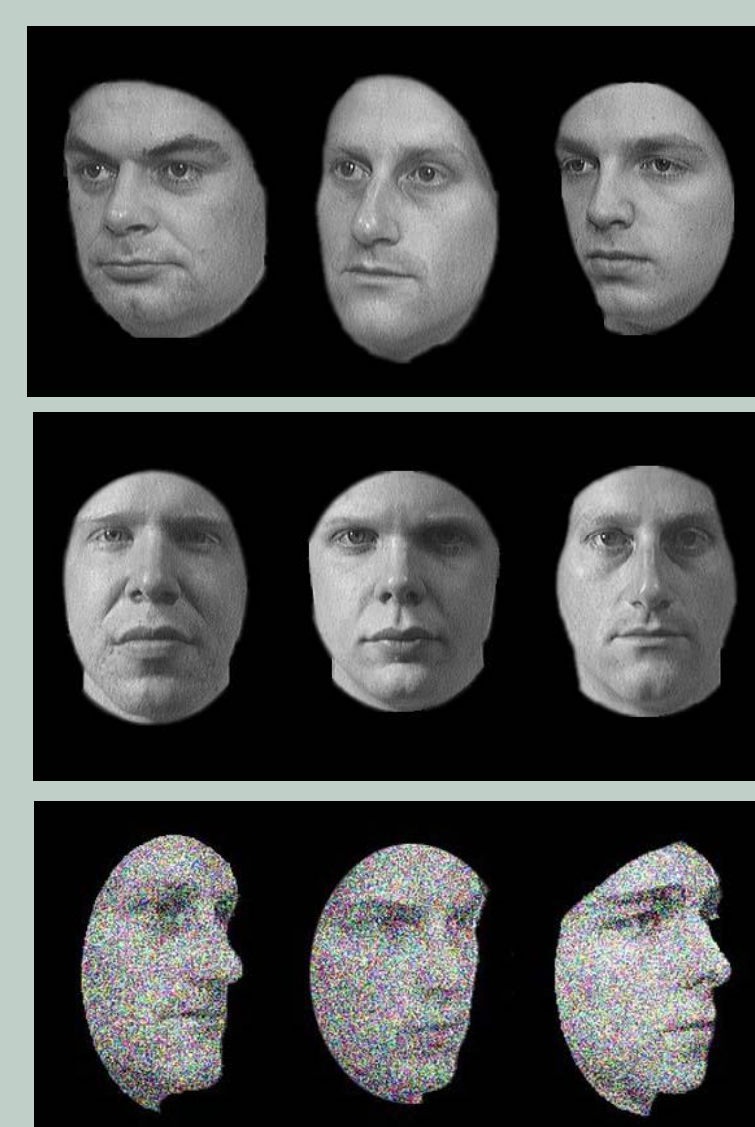
Configural/Featural



Part Whole



Partial Composite
Complete Composite



Cambridge Face Memory Test

Participants

Participants were recruited through the undergraduate subject pool at the University of Ottawa (N=115). Each completed all five tasks and order was randomized across participants.

Results

By analyzing the correlations of the accuracy scores across the five tasks, we were able to test whether the tasks measure similar constructs: If they correlate, they do. We expected to see strong correlation within tasks and weak/no correlation across tasks if they are indeed measuring different constructs (processing mechanisms, or components thereof).

ANOVA Graphs:

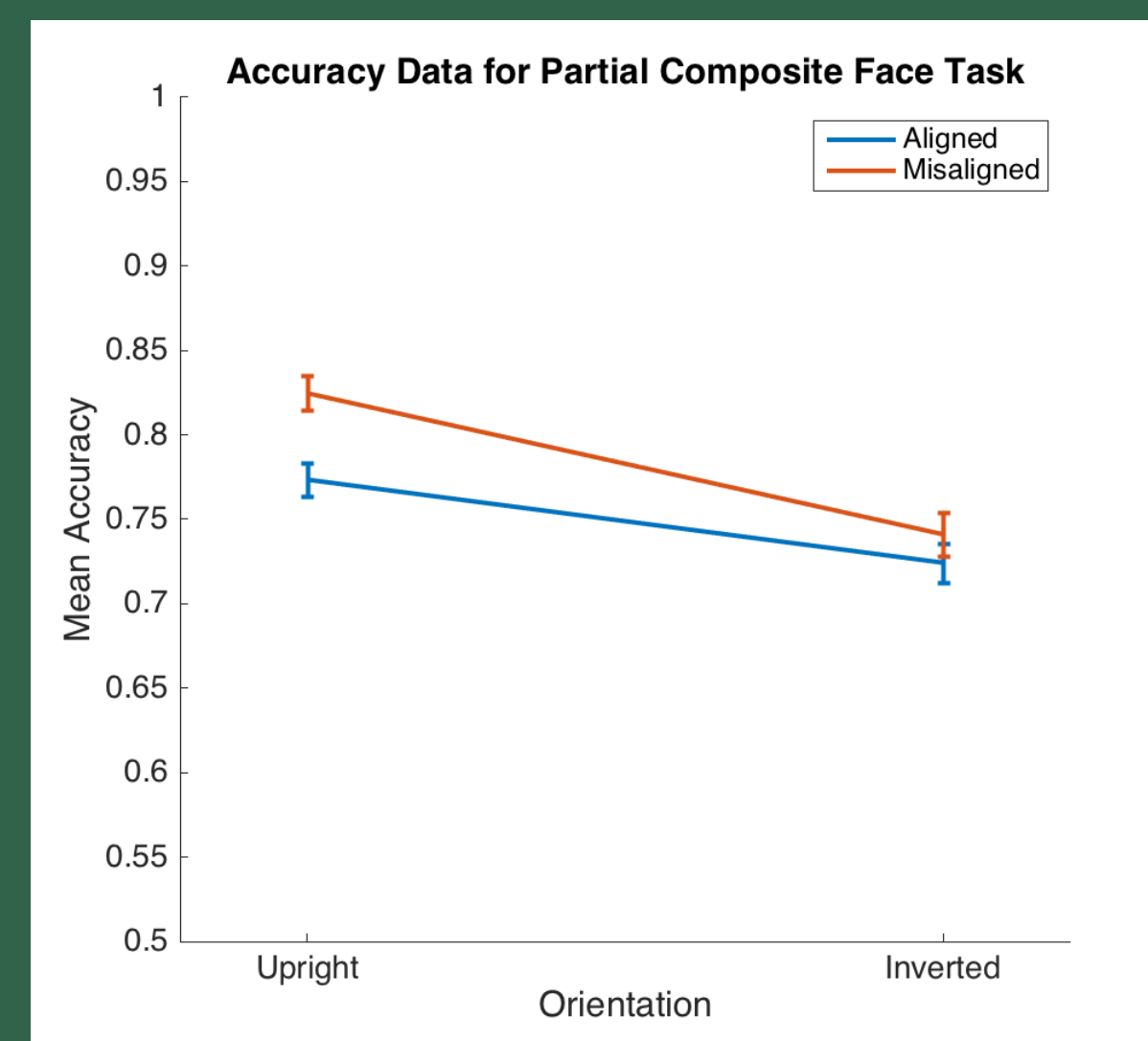


Figure 1. Accuracy results in Partial Composite Effect Task. Main effect of alignment, orientation, and the interaction are significant.

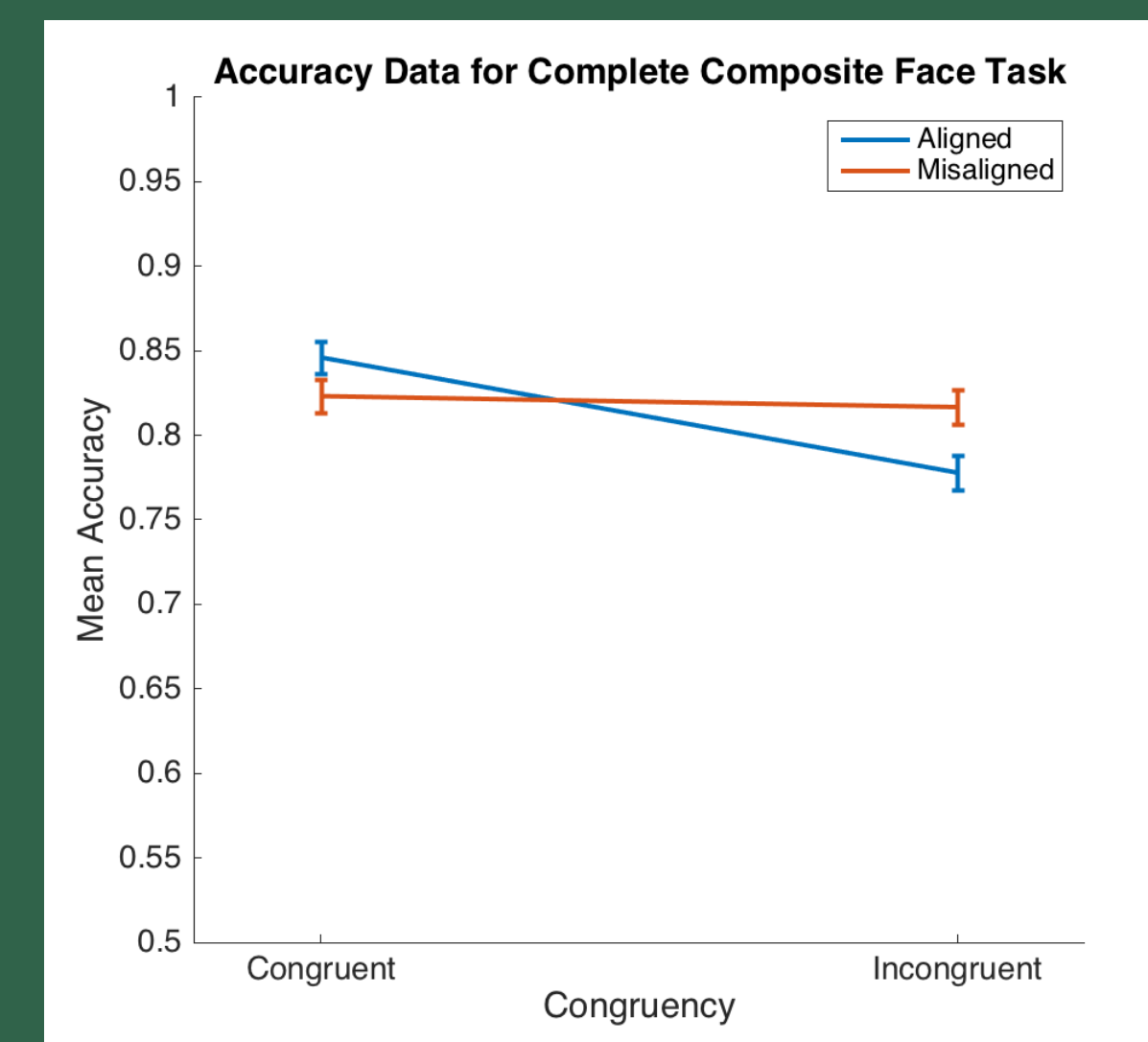


Figure 2. Accuracy results in Complete Composite Effect Task. Main effect of alignment, congruency, and the interaction are significant.

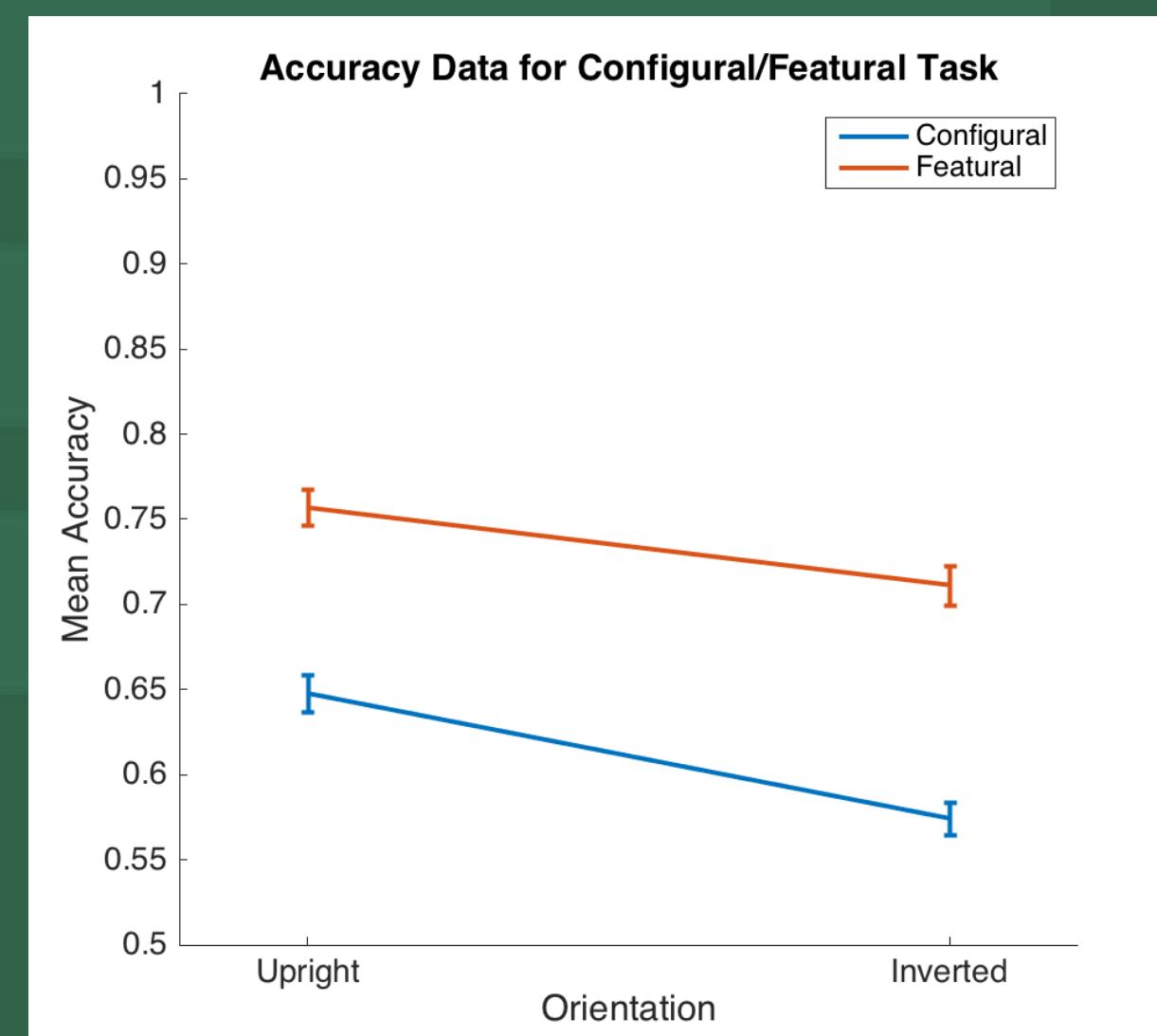


Figure 3. Accuracy results in Configural/Featural task. Main effect of task manipulation, orientation, and the interaction are significant.

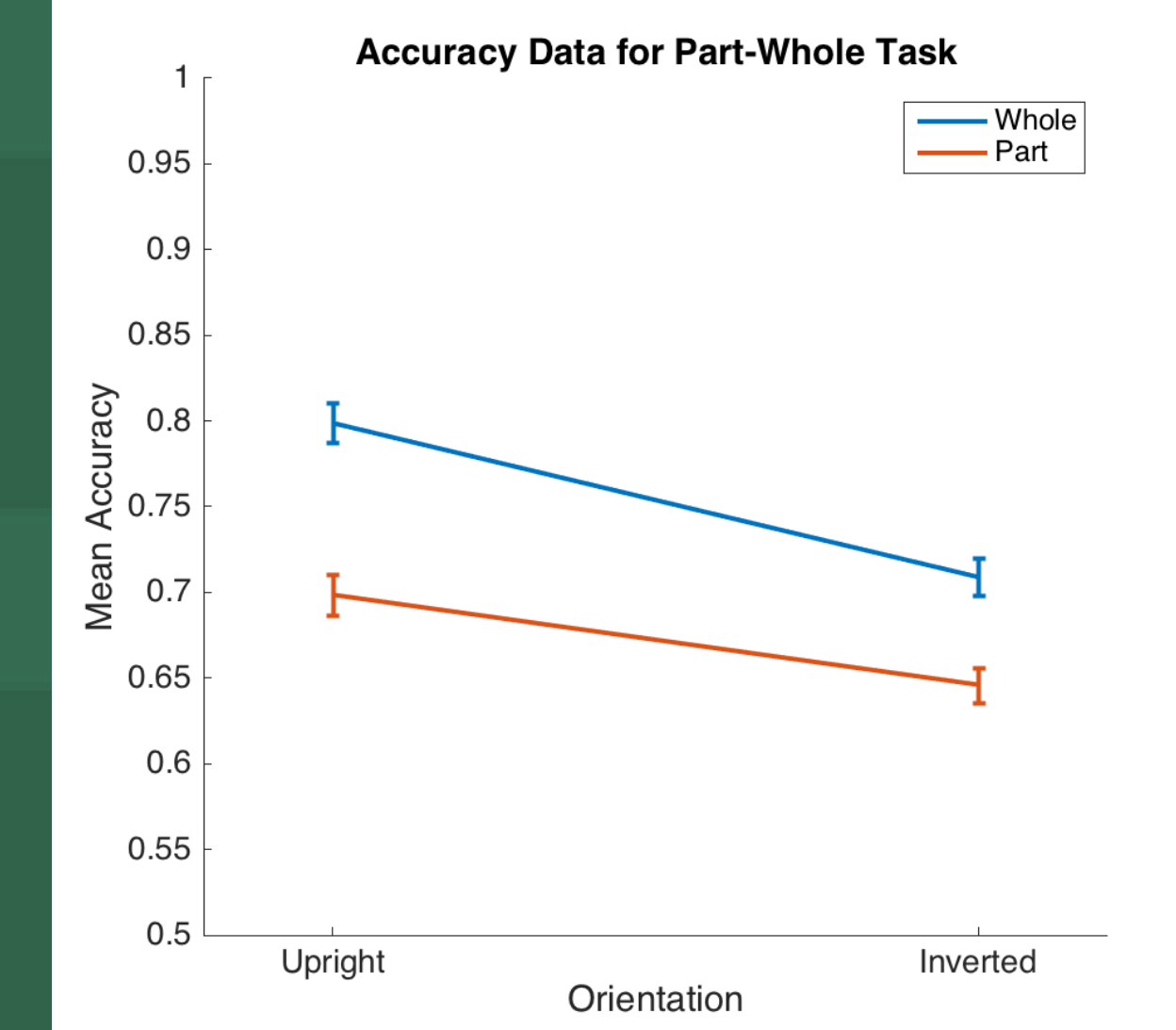


Figure 4. Accuracy results in Part Whole Effect Task. Main effect of task manipulation, orientation, and the interaction are significant.

Analysis of variance (ANOVA): We performed ANOVAs for each task to ensure that we replicated the expected interaction effects. For the all four tasks (see Fig. 1-4) recognition was significantly better across task conditions in the upright orientation compared to the inverted orientation. This replicates the finding that inverting a face disrupts recognition ability. In the partial composite task, recognition accuracy in the upright condition was better on misaligned trials compared to aligned trials. In the complete composite task, people recognized faces more accurately in the congruent condition compared to the incongruent condition in which the different bottom half of the face influences the judgment about the top half of the face. This indicates the use of holistic processing. In the part whole task, recognition accuracy was significantly higher when recognizing face parts within a whole face compared to a part of a face on its own. The results replicated the expected patterns for all the tasks.

Correlational analysis: Our results (Fig. 5) show that performance is strongly correlated between the conditions within each tasks and much more weakly correlated between different tasks. We see strong correlations within the partial composite and the complete composite tasks; however, we see no correlation between them which indicates that these tasks are not measuring the same thing. For configural/featural, and in the part whole task, we see a weaker correlation between the conditions within each task as a result of lower task reliability (Guttman's λ_2). Performance on the CFMT was not correlated with performance on the other five tasks suggesting that Face Memory ability is not related to Face Recognition ability.

Conclusion

Our analysis reveals weak to no correlation between the different tasks which suggests that each measures a distinct facial processing mechanism, or component thereof. In particular, the partial and complete version of the composite task had absolutely no correlation, suggesting these similar tasks measure different constructs and thus should not be used interchangeably as measures of holistic processing. This recommendation applies to the other tasks as well.

Correlations of Accuracy :

	AllUp	AllInv	MisUp	MisInv	AllCong	AllIncong	MisCong	MisIncong	ConfigUp	ConfigInv	FeatUp	FeatInv	WholeUp	WholeInv	PartUp	PartInv	CFMT
AllUp	1																
AllInv	**0.354	1								Very Weak	0.0-.19						
MisUp	**0.722	**0.411	1							Weak	2-3.9						
MisInv	**0.434	**0.837	**0.552	1						Moderate	4-5.9						
AllCong	0.064	0.025	0.069	0.048	1					Strong	6-1.0						
AllIncong	-0.032	0.008	0.019	0.044	**0.832	1											
MisCong	0.049	-0.02	0.034	-0.004	**0.904	**0.792	1										
MisIncong	0.083	-0.007	0.087	0.013	**0.885	**0.872	**0.874	1									
ConfigUp	-0.001	0.018	-0.048	-0.029	0.083	0.03	0.093	0.059	1								
ConfigInv	*-0.184	*-0.187	-0.158	-0.136	0.087	**0.265	0.127	0.14	**0.363	1							
FeatUp	-0.069	-0.055	-0.102	-0.125	**0.388	**0.37	**0.398	**0.375	**0.446	**0.295	1						
FeatInv	-0.04	0.047	-0.091	0.013	**0.329	**0.365	**0.314	**0.298	**0.384	**0.441	**0.545	1					
WholeUp	*-0.194	-0.18	**0.262	*-0.208	**0.405	**0.382	**0.404	**0.352	**0.294	**0.286	**0.42	**0.334	1				
WholeInv	0.011	-0.167	0.012	-0.174	**0.328	**0.315	**0.306	**0.315	*0.2	*0.225	**0.376	**0.304	**0.508	1			
PartUp	-0.135	-0.11	-0.141	-0.045	**0.307	**0.325	**0.34	**0.313	**0.219	0.167	**0.398	**0.331	**0.459	**0.398	1		
PartInv	0.023	0.025	0.07	-0.04	**0.41	**0.405	**0.438	**0.405	*0.198	**0.256	**0.356	**0.301	**0.435	**0.483	**0.399	1	
CFMT	-0.075	-0.052	-0.043	-0.027	0.166	0.14	0.156	0.158	0.112	0.074	0.167	0.101	0.101	0.05	0.183	0.075	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Figure 5. Correlational Analysis for Accuracy Broken Down by Task Condition

Acknowledgements:

Special thanks to my supervisor Elizabeth A. Nelson for all her help and guidance throughout the course of this project. I would also like to thank Dr. Charles A. Collin for his invaluable support and the University of Ottawa UROP program.

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