

The real-time prediction and inhibition of linguistic outcomes: Effects of language and literacy skill

(Kukona et.al, 2016)



Introduction

Prediction in low literates

Global matching: partially matching representations are simultaneously activated, creating interference for identifying a correct target

Capacity based view/Experience based view

Examined comprehenders' ability to both activate predictable outcomes and inhibit implausible outcomes



Experiment

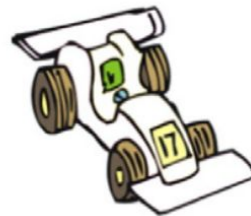
Eye tracking study - VWP

Extensive battery of skill measures.

70 English native speakers participated

16 unique sentences

Verb predicted target (cake); non-verb competitor (car); 2 color adjectives (white/brown);



+



Fig. 1. Example visual display from the visual world experiment. Participants heard the example sentence “The boy will eat the white cake.”



Experiment

Half of participants heard one of the adjectives (e.g., “white”), while the other half heard the other adjective (e.g., “brown”)

Individual measures: : reading and listening comprehension, vocabulary, decoding, reading fluency, rapid automatized naming (RAN), phonological skills, and print experience, working memory, visio-spatial memory, matrix reasoning, anti saccade task



Results

For all measures except the RAN measures, higher scores reflect better performance and lower scores worse performance.

Exploratory factor analysis: single predictor and multiple predictor model

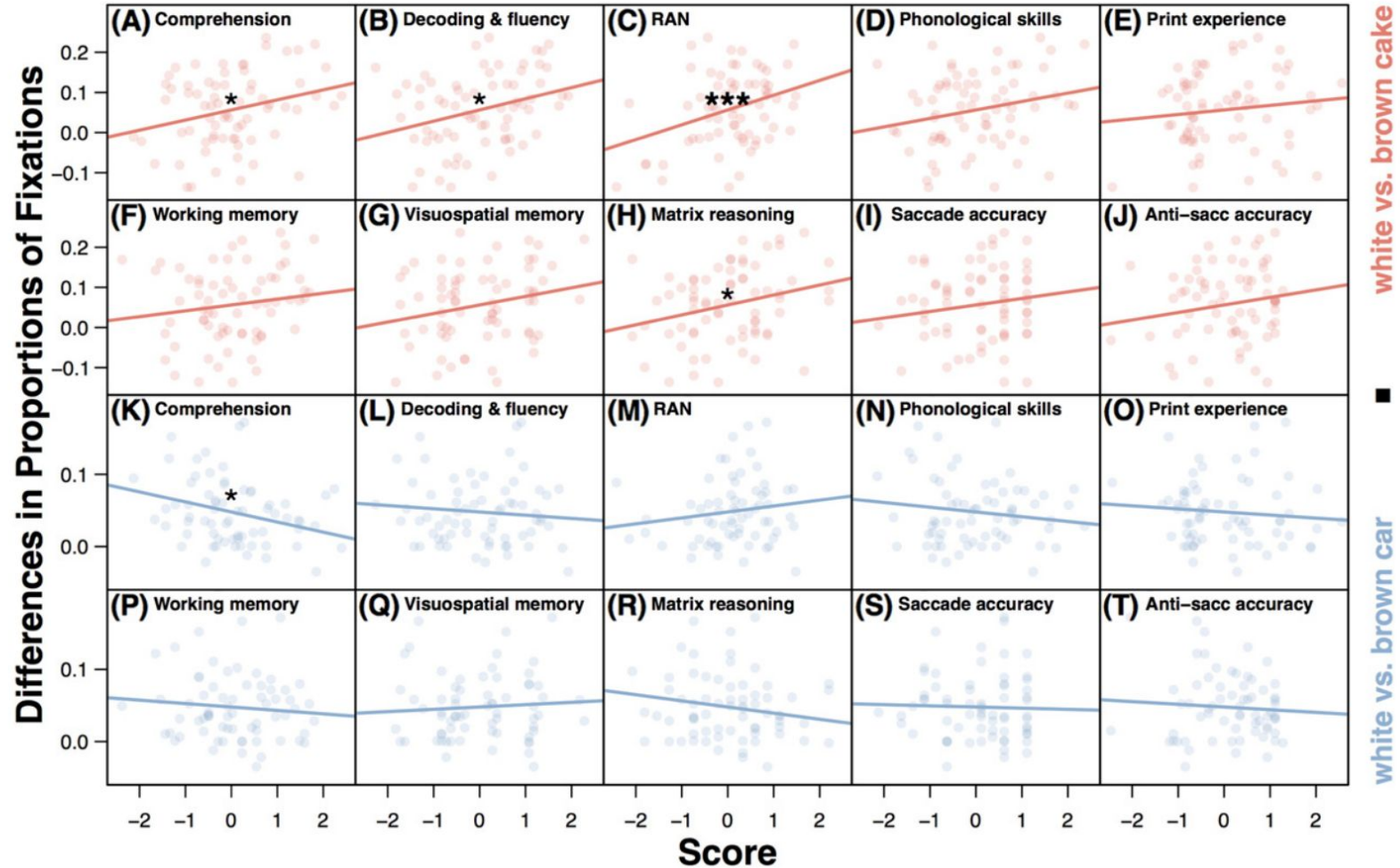
- more eye movements to the WHITE CAKE than BROWN CAKE for individuals with average scores on each skill measure
- comprehenders showed a smaller WHITE CAR vs. BROWN CAR advantage than poor comprehenders, while conversely individuals with better RAN performance showed a larger WHITE CAR vs. BROWN CAR advantage than those with lower RAN scores.

Table 4

Regression results for the single predictor simple linear regression analyses with the composite measures. Each β reflects a separate regression model.

	<i>White vs. brown cake</i>				<i>White vs. brown car</i>			
	β^a	SE^a	t	p	β^a	SE^a	t	p
1. Comprehension	2.51	1.07	2.35	<.05	-1.39	0.59	-2.37	<.05
2. Decoding & fluency	2.79	1.06	2.64	<.05	-0.44	0.61	-0.73	.47
3. RAN	3.69	1.02	3.62	<.001	0.82	0.60	1.36	.18
4. Phonological skills	2.10	1.08	1.94	.06	-0.65	0.61	-1.08	.28
5. Print experience	1.13	1.10	1.02	.31	-0.42	0.61	-0.70	.49
6. Working memory	1.46	1.10	1.33	.19	-0.47	0.61	-0.78	.44
7. Visuospatial memory	2.14	1.08	1.97	.05	0.32	0.61	0.53	.60
8. Matrix reasoning	2.48	1.07	2.31	<.05	-0.85	0.60	-1.41	.16
9. Saccade accuracy	1.62	1.09	1.48	.14	-0.16	0.61	-0.27	.79
10. Anti-sacc accuracy	1.87	1.09	1.72	.09	-0.37	0.61	-0.61	.54

^a β and SE values $\times 10^{-2}$.





Discussion

Activation of predictable outcomes

Clear predictive effects observed, with skilled individuals showing stronger effects than less skilled comprehenders.

Rapid Automatized Naming (RAN) was identified as a key determinant of prediction ability

Positive relationships observed between prediction ability and comprehension, decoding & fluency, RAN, and matrix reasoning skills.

Multiple predictor models indicated that only RAN uniquely accounted for individual variation in prediction ability.

RAN may tap into generalized speed of processing, influencing prediction ability.

Alternatively, RAN may reflect the automation of linguistic processes, impacting prediction ability.



Inhibition of implausible competitors

Examined comprehenders' ability to inhibit implausible outcomes that share features with predictable referents.

Clear interference effects observed from competitor objects in the visual display.

Skilled comprehenders showed less interference, indicating better ability to inhibit implausible competitors.

Both comprehension and Rapid Automatized Naming (RAN) composites accounted for unique variance in inhibition ability.

Skilled individuals on RAN showed more interference, suggesting less ability to inhibit implausible competitors.

Indicates a tradeoff: rapid activation of information facilitates prediction but also drives activation of competitors



Self-organization

Self-organization assumes competitive dynamics among lower-level representations drive activation of higher-level representations.

Language skill dependence on experience is assumed, with certain aspects like speed, automation, and comprehension being more connected to prediction.

Self-organization predicts diffuse activation of representations, with inhibitory connections crucial for language comprehension.

Predicts that inhibition is crucial for maintaining equilibrium in the face of interference.

Capacity-based and experience-based approaches do not fully account for the observed findings.

No support for the capacity-based prediction that larger capacities lead to greater interference.