

# The Relationship between Strategy Complexity and Accuracy: Adult Performance on a Number Line Task

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## Introduction

- Individual differences on number line task performance are correlated with mathematics achievement.
- Strategies used by adults to complete this task have yet to be investigated.
- The current study aimed to identify predictors of accuracy on a number line task in an adult population. Mathematical ability, spatial skill, and strategy type were examined.
- **Hypothesis:** Participants who employ more complex strategies (i.e. using multiple reference points) will have a higher degree of accuracy on this task.

## Method

Participants:  $N=134$  adults

### Procedure:

#### Math Measures

Ordering task:



Brief Math Assessment:

$$\begin{array}{r} 56 \\ + 17 \\ \hline \end{array} \quad \begin{array}{r} 8\frac{1}{4} \\ - 5\frac{2}{3} \\ \hline \end{array}$$

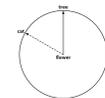
#### Spatial Measures

Spatial Orientation Task:

Imagine you are standing at the flower and facing the tree.



Point to the cat.



#### Strategy Type: Simple vs. Complex

Upon completion of all number line trials, participants were asked to report any strategies used to identify the location of the target number.

Simple strategy users reported using a single reference point (e.g., midpoint).



Complex strategy users reported using multiple reference points (e.g., midpoint and quarters).



## Results

Figure 1. The relationship between strategy and accuracy for a number line task.

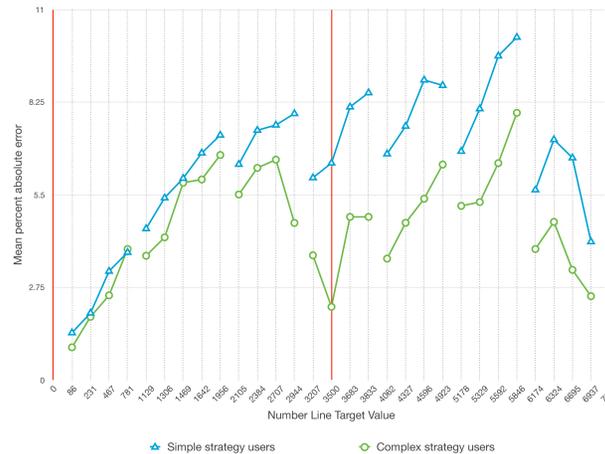


Table 1. Simple correlations between measures and dependent variable.

	Predictors			
	Brief Math Assessment	Ordering Task	Spatial Orientation	Strategy Type
Mean PAE for all NL trials	-.410**	-.381**	.336**	-.288**

Note: \*\* $p < .001$ .

A hierarchical multiple regression was run to identify skills that predict performance on the number line task. The full model of math ability, spatial skill, and strategy type was statistically significant,  $R^2 = .261$ ,  $F(4, 129) = 4.023$ ,  $p = .047$ ; adjusted  $R^2 = .238$ .

Table 2. Hierarchical Multiple Regression Predicting mean PAE for 29 number line targets from Math Ability, Spatial Skill, and Strategy type.

Variable	Mean PAE for all 29 number line targets					
	Model 1		Model 2		Model 3	
	B	$\beta$	B	$\beta$	B	$\beta$
Constant	11.69**		10.05**		11.01**	
BMA	-.49*	-.30	-.39*	-.23	-.33*	-.20
Ordering	-3.61*	-.24	-3.30*	-.22	-3.11*	-.21
Sp. Or.			.02*	.17	.02†	.16
Strategy					-1.01*	-.16
$R^2$	.214		.238		.261	
F	17.83**		13.53**		11.39**	
$\Delta R^2$	.214		.024		.023	
$\Delta F$	17.83**		4.08*		4.02*	

Note:  $N=134$ . \* $p < .05$ , \*\* $p < .001$ , † $p = .059$ .

## Discussion

- The striking pattern of increasing error within each thousand range (e.g., 4000 – 5000; Fig. 1), along with better performance at the midpoint and endpoints, suggests that adults are using proportional reasoning strategies based on reference points.
- Complex strategy users ( $N=60$ ) had lower error scores on targets greater than 3500 (the midpoint), compared to simple strategy users ( $N=74$ ).
- Complex strategy users had lower error scores and less variability when selecting the midpoint ( $M$  PAE=2.18%,  $M$  selected=3417,  $SD=252$ ), compared to simple strategy users ( $M$  PAE=6.44%,  $M$  selected=3335,  $SD=687$ ).
- Overall, performance on the number line task was related to strategy complexity and to mathematical achievement.

**Participants who incorporate multiple reference points into their strategy perform more accurately on the number line task than those who use a single reference point. The relationship between strategy and accuracy is especially evident for targets in the upper range.**