Helpful Hands: Gestures Boost Young Children's Performance in a Memory Task

Daniela Galvez-Cepeda, Dan O'Connor, Isabel Rodden, Hannah Dineen, Eliza Congdon

Williams College

1. Introduction & Motivation

- The neural systems involved in item and location recall are independent from each other.[1]
- Additionally, cognitive load theory posits that recall abilities have a limited capacity that gets overwhelmed by too much information.[2]
- Gestures can represent what an item is (iconic gestures) and where an item is (deictic gestures).[3]
- Gestures have also been shown to reduce children's cognitive load.[4]
- Given these properties, we expect the two different types of gestures (deictic and iconic) to influence the two independent neural systems involved in recall.
- We hope that our findings will teach us more about the mechanisms of different gesture types and inform our understanding of how to improve specific recall strategies.

Research Questions and Hypotheses

1. **Do gestures decrease children's cognitive load and boost their short-term visuospatial recall?**

   H_1: Children who are asked to gesture while receiving visuospatial input will do better on our memory grid task.

2. **Might this relation between gestures and performance be moderated by age?**

   H_2: Gesture will be especially helpful for younger (vs. older) children.

3. **To what extent do gestures affect the type of errors that older and younger children make (i.e., wrong item, wrong location) in a visuospatial task?**

   H_3: Children who make iconic gestures while receiving visuospatial input will have fewer "wrong item" errors, while those who make deictic gestures will have fewer "wrong location" errors.

Score types (all out of 90):

- Crude Score: 1 point for right item in right location
- Item Score: 1 point for right item anywhere on board
- Location Score: 1 point for right location ignoring item

+ $p < .10$ * $p < .05$ ** $p < .01$

2. Method

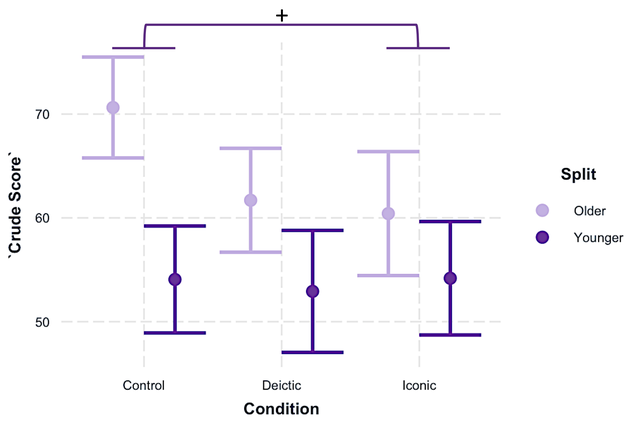
- **Participants.** Eighty-two 6- to 12-year-olds (M_{age}= 8.48, SD_{age}= 2.11) from western MA. 43 girls, 37 boys, and 2 non-binary children.
- **Procedure.**

	Iconic	Deictic	Control
1	Item Familiarization		
2	Practice Trials (3)		
3	Memory Game (10)		
Grid appears with some items:	"Act" out each item	Point to each item	[uninstructed]
Grid and items disappear:	Recall what items they saw and where they saw them to remake the grid		

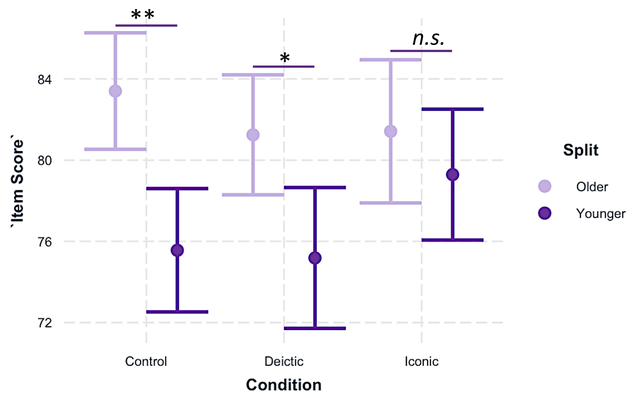
Following the memory game (pictured above), we also measured children's (i) spatial working memory (Corsi block tapping task) and (ii) verbal working memory (letter span task) to control for these individual differences.

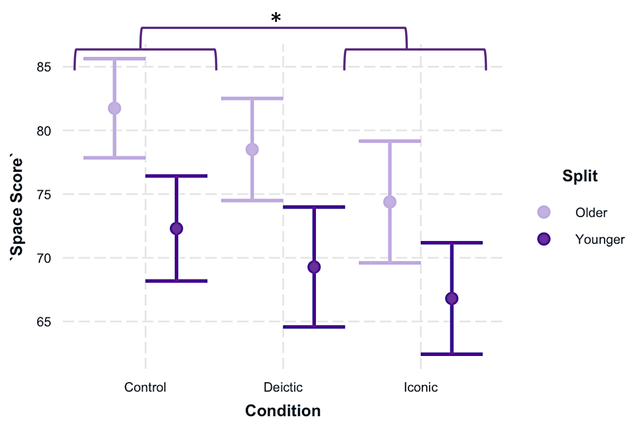
3. Results & Discussion

Q1 After controlling for both spatial and verbal working memory, we found that **children in the control (uninstructed) condition outperform those in the iconic gesture condition (β = -6.02, SE = 2.96, *t* = -2.03, *p* = .046).** Children in the deictic condition do not perform differently from either of the other two groups.



Q2 **This effect varies by age group:** the age gap between older and younger kids is larger for the uninstructed group than for the iconic group (β = 10.33, SE = 5.33, *t* = 1.94, *p* = .056). This may be driven by iconic gesture production hindering performance of the older children.





Q3 An analysis looking at children's ability to correctly identify the items showed that **younger children perform worse than older children in the uninstructed and deictic conditions, but not in the iconic condition ($\beta_{interaction}$ = 5.71, SE = 3.14, *t* = 1.82, *p* = .073).**

↳ This marginal interaction appears to be driven by iconic gesture boosting the performance of younger kids in remembering item identities.

An analysis looking at children's ability to correctly identify the location of the items showed that children in **the iconic condition had significantly more location errors overall (β = -7.36, SE = 3.02, *t* = -2.44, *p* = .017) than those in the uninstructed condition.** Children in the deictic condition do not perform differently from either of the other two groups.

↳ This pattern was true for both age bins.

References: ***1.*** Courtney, Ungerleider, Keil, & Haxby (1996) ***2.*** Sweller, Mestre, & Ross (2011) ***3.*** Roth (2001) ***4.*** Goldin-Meadow, Nusbaum, Kelly, & Wagner (2001)

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: dgalvezcepeda.com || : dg18@williams.edu || : @dgalvezcepeda