

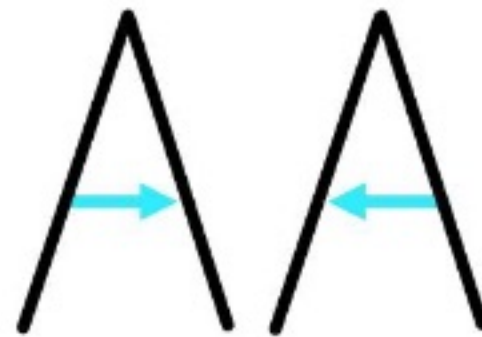
## Background

We write every day, whether it be a post-it note or a romantic handwritten letter. Despite how easy it seems, the act of writing is a product of many complicated cognitive processes. Our lab has been investigating the principles guiding how we write letters, such as what governs the order and the direction of letter strokes we make when we write.

For example, why do right-handers almost always make a rightward horizontal stroke for A?

Possible clues from our previous studies:

- Both right- and left-handers make leftward horizontal stroke when they are writing with their left hand.
- Depending on the hand they are asked to write with, people typically change stroke direction, sometimes immediately
- Phenomenon present without practice or experience



## Question / Hypotheses

How and why does stroke direction change in the absence of knowledge or practice to inform their Non-Dominant handwriting?

- **Motor Control Hypothesis:** Better motor control for movements and increased stableness in motion when we move our hand from medial to lateral direction.
- **Visual Obstruction Hypothesis:** To combat visual obstruction and see their letter stroke better



This hand is twisted so the pen comes from above the line of writing.

*Visual Obstruction Hypothesis* is inspired by the common difficulty English-using L handers face due to their hand covering their letters when they write Rightward. Many compensate the inconvenience (e.g. smudging, unable to see previous letters) by changing their writing posture (fig. 1) or paper orientation

## Present Experiment

**Purpose:** Test the Visual Obstruction Hypothesis

**How we did it:** Remove all visual components of writing.

- If the writers are writing under the Visual Obstruction Hypothesis, then the stroke direction shouldn't change from rightward to leftward when they right in their ND (L) hand

## Methods

- 20 Right-Handed, native English speakers
- 3 trial blocks (1 x RH + 2 x LH); 44 stimulus words, all tested in each block
- Using tablet and stylus, participants wrote words dictated to them by the experimenter.
- Experimenter conducted trials using a laptop connected to the tablet using MATLAB to collect real time writing including stroke directions, speed of writing, tablet angle, and pen angle



*Setup: Participants sat behind a black curtain with their tablet on the other side, which blocked them from seeing both what they are writing and their hand*

## Results

Analyzed strokes of interest:

- Horizontal strokes ( e.g. A, T, H )

Results:

- **Frequency of changing stroke direction was just as great as results seen in prior studies that did not take away visual components**

An example of analysis 'A'

- D condition showed close to 100% Rightward stroke
- **ND Frequency of Stroke Direction:**

	Rightward	Leftward	Proportion of Leftward
With Visual	614	694	53.1 %
Without Visual	329	549	62.5 %

No significant proportion difference of Leftward strokes in ND  
( $t(48) = -.702, p > .05$ )

## Conclusions

- Manipulation of taking away visual component made no differences (from studies with visual feedback)
- Results argues strongly against Visual Obstruction Hypothesis as a possible explanation for the observed shift in stroke pattern
- Provides stronger argument and evidence for the Motor Control Hypothesis

## Notes/Correspondence

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