Learning to Write letters: Examination of Learning Processes for Novel Character Acquisition

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Background

Current research suggests that given a character 'A' one can recall a general stroke pattern that is consistent across all characters and with no deviation. Another hypothesis is that for each character such as 'A' there are specific rules of how lines are written in accordance to the directionality of the lines and can be further demonstrated as certain directions (in to out) are mirrored if using a non-dominant hand to write characters.

Ex. For right-handed individuals, the cross of a 'T' would be written from left to right (abduction: movement away from body), and for left-handed individual it would be reversed—right to left. This pattern should be largely consistent when switching to a non-dominant assuming rules regarding ease of writing certain lines. A last hypothesis that is being analyzed is if there are no consistencies of character stoke pattern.

This research is a fundamental question to how humans learn and how writing abilities have progressed. Due to the complex nature of writing it is valuable to study learning with novel characters. While verbal language has evolutionary and innate supporting evidence (i.e., babbling stages even seen with deaf babies), writing is learned at later stages of life and has more ambiguous origins. Understanding the process can better guide us to the human abilities that allow us to use writing so efficiently

Methods

Johns Hopkins students completed copying task of 18 novel characters via a computer monitor onto a recording tablet. Due to COVID-19 a remote option was necessary, and a second experiment was redone to use Zoom to present characters remotely. Participants used their iPad and Apple pen to copy the given character as it appeared on screen. After a practice set, participants had a pre and post test of all 18 characters and practiced writing a subset of 9 characters each 12 times.

Experiment 1:

- 6 undergraduate students
- In person testing
- Lab tablet with pen to write response & monitor for characters
- Data collected over 2-month period

Experiment 2:

- 6 undergraduate students
- Remote via Zoom testing
- Personal iPad with Apple pen & computer for characters
- Data collected over 1 month period

Characters

Figure 1. Novel character pair

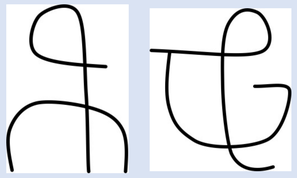

Figure 2. Novel character pair

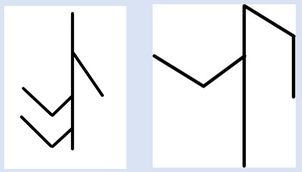

Figure 3. presented character (left) and copied character (right)

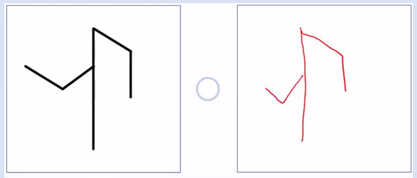

Figure 1 and 2 shows pairings of the novel characters used. A total of 18 novel characters were made and depending on the trial (A or B) the participant practiced a subset of 9 characters. The 18 characters had a corresponding pair matched based off similarity and difficulty level of writing to ensure the sets were balanced. Figure 3 shows how the character was presented, and in an empty box they had to copy the character (seen in red).

Data

Hypothesized results are quicker times and more consistent stoke patterns for practiced vs. unpracticed set. Results indicated quicker times throughout study but not significant over subsets of characters

Based off the data collected, the results do not show a significant value of learning or consistent stroke pattern. This is likely due to the number of trials needed to show significant range of learning effects. Due to the type of testing during COVID social distancing some errors of timing are to be expected and most likely contribute as well to the data found.

Conclusions

The current data shows some trends of consistency when comparing the practiced vs. unpracticed set of characters. This along with recorded data, shows trends of overall learning effects. However, the times gathered for participants does not reflect a significant difference to support learning effects. This current data is most similar to the hypothesis of partial stoke patterns or no stoke patterns at all.

In future studies better timing control using recording tablets and longer sessions for a longitudinal study may prove to showcase these predicted results. Additionally, this study focused on right-handed participants that only wrote with their dominant hand. Follow up studies using the same set of 18 novel characters can further examine possible differences in stroke patterns across usage of dominant and non-dominant writing.

Citations

- Dennett, D. C., & Hofstadter, D. R. (1982). Preface 10: The Intoxicating World of Alphabets and Their Styles. In *The mind's i*. essay, Penguin books.
- Seyll, L., Wyckmans, F., & Content, A. (2020). The impact of graphic motor programs and detailed visual analysis on letter-like shape recognition. *Cognition*, *205*, 104443. https://doi.org/10.1016/j.cognition.2020.104443
- Wright, C. E. (2018). Generalized Motor Programs: Reexamining claims of effector independence in writing. *Attention and Performance XIII*, 294–320. https://doi.org/10.4324/9780203772010-9
- Zhai, M., & Fischer-Baum, S. (2019). Exploring task demand effect on stroke-motor representations of Chinese characters in reading. *Frontiers in Human Neuroscience*, *13*. https://doi.org/10.3389/conf.fnhum.2019.01.00017

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