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To cite this version:
Mélanie Jucla, Samuel Planton, Jean-François Démonet, Christiane Soum. ERP and behavioral evidence for interaction/cascade between central (linguistic) and peripheral (motor) processes during word handwriting. International workshop on writing, Jul 2015, Poitiers, France. 2015.

HAL Id: hal-01224891
https://hal-univ-tlse2.archives-ouvertes.fr/hal-01224891
Submitted on 26 Feb 2016

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ERP and behavioral evidence for interaction/cascade between central (linguistic) and peripheral (motor) processes during word handwriting.

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Background
Models of handwritten language production make a distinction between central [access to semantic, orthographic and phonological information] and peripheral [allographic and gesture planning] processes (see van Galen, 1991; Raap, 2002). Though, this is still a matter of debate whether these central and peripheral modules are processed in a cascaded or in a serial way (Delattre, Barry & Bonin, 2006; Damian & Stadthagen-Gonzalez, 2009). In the same view, another question still debated is “do central and peripheral processes ‘interact’ in handwritten word production compared to oral naming?”

ERPs and behavioral effects

Task: Written spelling under dictation of isolated words

Population: 26 (exp. 1) and 27 (exp. 2) French adults

Data Acquisition & Analysis
Written response registered on a Wacom digitizing tablet (via Matlab)
Variables measured: Errors, writing latencies and duration, relative writing speed

Statistics: Linear mixed models (subjects and items as random effects). Length x regularity x position effects

Experiment 1
Stimuli: 44 monomorphic nouns, varying on length (short-1 syll.- vs. long -3 syll.-) and regularity paired on frequency (Lexique.org), Inconsistencies at the beginning or at the end

Results:
- Latency effect
- Length effect (controlled for stimulus length)
- Regularity effect

Experiment 2
Stimuli: 180, monomorphic nouns of 1, 2 et 3 syllables. Consistency manipulated on the first and last segment (→ 4 conditions, in/consistent at the beginning and/or at the end

Results:
- Consistency effect
- Regularity effect
- Length effect (controlled for stimulus length)

Discussion
Effects on latencies (no effect of final inconsistencies, of the increased number of letters) contradicts a purely serial conception. Inconsistencies at the end of long words seem to reduce writing execution speed during the production of the first syllable.

In favor of a parallel/cascaded view of central and peripheral processes during writing

References