Abstract Book

Writing Word(s) Workshop

Marseille – June 27~29, 2019

We are pleased to acknowledge the support of the following institutions:

Program

JUNE 27

09:30 – 10:00 am   **Welcome and Coffee**

10:00 am – 12:00 pm   **Session A**

 Chair: Olivia Afonso

- A. Molyneaux, A. Barnett, & V. Connelly – "Spelling strategies in copied and self-generated writing."

- S. Palmis, J.L. Velay, M. Habib, J.L. Anton, B. Nazarian J. Sein, M. Longcamp – "Development of the handwriting network: A coupled fMRI and kinematics study in middle-age children"

- F. Bara – "From manuscript to cursive: Does the font matter in the first years of reading and handwriting acquisition?"

- S. Hurschler, W. Wicki & P. Falmann – "Gender differences among third graders' writing bursts."

12:00 – 02:00 pm   **Lunch and Poster session 1**

02:00 – 03:30 pm   **Session B**

Chair: Mark Torrance

- O. Afonso, & C.J. álvarez – "Constituent frequency effects in the written production of Spanish compound words."

- C.J. álvarez, Y. Hernández-Gálvez, & O. Afonso – "Influence of the syllabic structure of L1 when writing words in L2."

- J. Ernst, E. Belke, & S. Kandel – "Handwriting in German: Processing units, statistical influences and orthographic phenomena"

03:30 – 04:00 pm   **Coffee**

04:00 – 05:30 pm   **Session C**

Chair: Marieke Longcamp

- M. Mccloskey, K. Wong, & G. Ellenblum – "In what sense are graphic motor plans effector-independent?"

- C. Younes Harb, C. Matta-Abizeid, J.M. Albaret, J.L. Velay – "Handwriting analysis in bigraphic subjects writing French and Arabic".

- Y. Yang & H.Y. Bi – "Functional connectivity underlies gender differences in writing."

07:00 pm   **Bistrot dinner at "Comptoir Dugommier"**

Speaker

1st Day

Annabel Molyneaux

Spelling strategies in copied and self-generated Writing

Annabel Molyneaux[1], Anna Barnett[1], and Vince Connelly[1]

1 Oxford Brookes University – United Kingdom

Introduction. Classroom writing activities range from self-generated writing to verbatim copying. Self-generation utilises familiar vocabulary and temporary storage of words in the 'inner voice' (phonological code) supports meaningful text-generation and facilitates spelling (Adams, Simmons, Willis, & Porter, 2013; Torrance & Galbraith, 2006). Copying includes curriculum-words with unfamiliar meanings and pronunciation. Laishley, Liversedge and Kirkby (2015) showed that children aged 7-10 processed longer words in sublexical units separated by gaze-shifts, and imprecise letter-position coding may result in inaccurate gaze- shifting (Castles, Davis, Cavalot, & Forster, 2007). Little is known about how these factors affect spelling in classroom writing.
Aim. This study compared children's spelling errors in the classroom during self-generated writing and copying.

Method: Ninety-four children in eight Year 5 classes (9-10 years) participated (children using English as an additional language or with special educational needs were excluded for these analyses). All handwritten work carried out during one typical school week was photographed and transcribed. Word counts for copied and self-generated writing were calculated. Spelling error rates were calculated and the errors categorized as phonologically plausible or implausible. Mean word lengths and frequencies were calculated for each writing activity and spelling error category.

Results: More words were self-generated than copied (mean values: self-generated 263.4, copied 45.3). Spelling error percentage was not associated with word length or frequency in either copied or self-generated writing. Phonologically plausible errors were significantly more frequent in self-generated writing than in copying, whereas implausible errors were more common in copied writing.

Discussion: The preponderance of phonologically plausible errors in self-generated writing might signify use of the phonological 'inner voice'. The greater proportion of phonologically implausible errors in copied writing may result from inaccurate relocation on the source material or lack of familiarity with word pronunciation. Potential educational implications will be discussed.

Oral Session A

Sarah PALMIS

Development of the handwriting network: A coupled fMRI and kinematics study in middle-age children

Sarah Palmis[1], Jean-Luc Velay[1], Michel Habib[1], Jean-Luc Anton[2], Bruno Nazarian[2], Sein Julien[2], Marieke Longcamp[1]

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The handwriting brain network has previously been defined in adults but never in children. Behaviorally, the progressive acquisition of the motor patterns is characterized by a switch in the control mode. Children proceed through an online adjustment of the trajectory. Adults switch to a fully proactive, automatized control. We measured the changes in the handwriting network between age 8/11 and adulthood. In adults, the network is formed of 5 key regions (left dorsal premotor cortex, superior parietal lobule, fusiform and inferior frontal gyri, and right cerebellum). We hypothesized that the automated writing of adults would rely on more focal and stronger activations in this network. We also expected that the more controlled writing of children would recruit extra visual, somatosensory and prefrontal regions.

23 adults 42 children right-handed native French speakers were instructed to write the alphabet, the days of the week and to draw loops in consecutive 16s blocks, while being scanned. The writing kinematics were recorded on an MRI-compatible digitizing tablet. fMRI second-level analyses were carried out using factors condition (letters vs loops/words vs loops) and group (adult vs children). Kinematic recordings confirmed the presence of behavioral effects within the scanner, with lower stops duration in adults.
The network described in adults was also strongly activated in children. A quantification of the local maxima coordinates in key regions indicated that left fusiform activations was more anterior in children. Right Cerebellum presented more local maxima in adults. The primary motor cortices and the right anterior lateral cerebellum were more strongly activated in adults. Finally, children recruited more prefrontal regions.

This constitutes the first investigation of the handwriting network in typical children. Results suggest that the network supporting orthographic and motor processing is already established in middle-childhood. Our results also highlight the major role of prefrontal regions in learning this complex skill. Finally, they confirm the importance of the motor cortices and anterior cerebellum in the performance of automated handwriting.

Keywords
Handwriting, development, motor learning, children, fMRI

Oral Session A

Florence Bara

From manuscript to cursive: Does the font matter in the first years of reading and handwriting acquisition?

Florence Bara[1,2]

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Letter production can be achieved through a variety of handwriting styles. When children learn to write in manuscript, the handwritten and visual forms match. However, when they learn to write in cursive, the shape produced is different from the shape visually learned. This difference might have a cognitive cost. On the other hand, cursive might help recognition of isolated words by reducing letter confusion.

The aim of this study is to assess the relative benefits of cursive and manuscript in word recognition and handwriting. 41 first grade children participated in the study.

Two conditions (cursive or manuscript, as a within participant factor) were compared. Two tasks, copy and segmentation, were administered to the children three time during the school year (november, january, june). The children had to copy in cursive a list of 16 words (85 letters) as fast as they can. The words were presented either in cursive or manuscript.
In the second task, the words were presented on two lines with no space between them, either in cursive or manuscript and the children had to recognize as most words as they can.

The results showed that children were able to copy more letters when the model was in cursive in first and second time of testing. However, at the end of first grade no difference remained between a model presented in cursive or manuscript. The number of mistakes was higher with a manuscript model than with a cursive model at the three times of testing. No significant difference between manuscript and cursive was obtained in the segmentation task.
Even if the transfer from manuscript in reading to cursive in handwriting seems to have a cost at the beginning of learning, children were rapidly able to move from one font to another.

Keywords:
handwriting, cursive, manuscript, children

Oral Session A

Sibylle Hurschler

Gender Differences among Third Graders' Writing Bursts

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2 University Koblenz-Landau – Germany

When examining composing processes of adult writers, Chenoweth & Hayes (2001) revealed that skilled writers translate their ideas into "language bursts" of about 9 words. Writing bursts are determined as at least one word written between two pauses of more than 2 seconds due to planning or revising processes. In children's writing processes, there are just a few studies showing that their burst pattern consist of a lower number of words per burst than those of adults (Connelly et al., 2012, Alves & Limpo, 2015).

In our longitudinal study, we explored burst pattern and gender differences among German-speaking third graders in Switzerland. We selected the sample (N= 87) randomly from a previous intervention study (Hurschler Lichtsteiner, Wicki, & Falmann, 2018). Data were collected by means of individually administered tasks (17 handwriting tasks on a digitizing tablet, including an informative text of 3 min duration) and group-administered tests (e.g. copy task) to gain digital and as well paper-based measurements of handwriting fluency. The digital handwriting data were analyzed by the software CSWin (Marquardt, 2012) for velocity and automaticity parameters and then imported into a database suitable to the softwareMarkWritev0.3.2 (Nottbusch, Simpson & Torrance, 2017) in order to analyze 2 sec. pauses and bursts.

Results indicated a significant increase in burst lengths over time and significant gender differences with girls writing much longer bursts than boys do, as already shown by other studies (Alves, Branco, Castro, & Olive, 2012). The gender differences are not due to differences of handwriting fluency measures. Therefore, further reasons for these findings will have to be examined and discussed in the presentation.

Keywords:
handwriting, writing bursts, fluency, gender

Oral Session B

Olivia Afonso

Constituent frequency effects in the written production of Spanish compound words

Olivia Afonso[1] and Carlos J. Alvarez[2]

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2 University of La Laguna – Spain

The debate about whether compound words are accessed as whole-words or via their constituents remains unresolved, especially in the field of language production.

In the present study, three experiments using a copying task examined whether Spanish compound words are accessed via their constituents or as in handwriting production. Written onset times and inter-letter intervals located before the end of the first constituent and at the between-constituent boundary were measured to investigate whether morphological decomposition occurred before production started or online during handwriting.

In Experiment 1, participants copied compound words and noncompounds. The last inter-letter interval within the first constituent of compounds was observed to be significantly shorter than the same interval in noncompounds, revealing that writing durations are sensitive to morphological processing.

In Experiments 2 and 3, the first and second constituent frequency was manipulated respectively. The frequency of both constituents affected writing onset times. Interestingly, the interval between the last two letters of the first constituent was shorter when the second constituent was of high-frequency, suggesting that the effect obtained in this position in Experiment 1 was related to the anticipation of the second constituent.
Our findings indicate that in Spanish both constituents are activated before the initiation of the written response and that the second constituent is reactivated before the production of the first constituent has finished.

Keywords:
compound words, writing onset time, writing durations, morphology, lexical access

Carlos J. Alvarez

Influence of the syllabic structure of L1 when writing words in L2

Carlos J. Alvarez, Yurena Hernandez-Galvez, and Olivia Afonso[1]

1 Oxford Brookes University – United Kingdom

The goal of the present study was to investigate whether phonological processes of L1 are applied when writing words on a second language. More specifically, we focus on syllabic processing. Previous studies have found that the process of handwriting is influenced by the syllabic structure of the words to be written, mainly in Spanish and other languages with clear syllabic structures.
We selected three groups of participants, with different levels of English: native speakers of Spanish with a basic level of proficiency in English, native speakers of Spanish with a high level of proficiency in English and a group of English native speakers as control.

The participants were faced with a task of writing English words that would have two syllables if read in Spanish (BASE), as opposed to words that would have one syllable in both languages (BASH). Both types of words were monosyllabic in English and were matched on several psycholinguistic variables. The words were presented visually and the participants had to write them on capital letters on a graphical tablet. Several on-line chronometric measures were taken, including written latencies, letter durations and inter-letter intervals.

The results showed that writing times were greater for the first type of words (bisyllabic in Spanish) than for the second type (monosyllabic in English and Spanish) in the basic level group. In the advanced level we also find the same effect but to a lesser extent.
Our results suggest that phonological processes developed in L1 are employed when writing in L2 and that this influence from L1 lasts for some time.

Oral Session B

Jessica Ernst

Handwriting in German: Processing units, statistical influences and orthographic phenomena

Jessica Ernst[1], Eva Belke[1], and Sonia Kandel[2]

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In three cross-sectional experiments, we investigated to what extent the German hand-writing process is influenced by syllabic structure and/or bigram frequencies (Experiment 1), double consonant spellings (Experiment 2), and the devoicing of a word final obstruent (Experiment 3).

We collected handwritten responses of four groups of participants: primary school children (3rd and 4th graders), 6th graders, young adults (18-23 years), and adults (40-65 years). Participants copied words shown on a computer screen onto a graphic tablet, and we recorded their movements using the Ecriture module of Ductus.

We recorded (and coded) writing onsets, stroke durations, and pauses between letters as dependent variables (DV). For each DV and each experiment, we fitted linear-mixed effect models entering position and word type as predictors. Our results provide further evidence for a role of the syllable as a processing unit during German handwriting (Experiments 1 and 2).
They also reveal sensitivity for statistical word properties during the writing process (Experiment 1) and, in accordance with results of studies in other languages, a special status of orthographic phenomena such as double consonant spellings (Experiment 2) and spelling of final devoicing (Experiment 3).

Keywords:
handwriting, spelling, double letters, bigram frequency, syllable, final devoicing, German

Michael Mccloskey

In what sense are graphic motor plans effector-independent?

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1 Johns Hopkins University – United States

Most theorists assume that writing of characters (e.g., 'A') is mediated by learned graphic motor plans that represent sequences of writing strokes in a form sufficiently abstract to support writing with any chosen effector (e.g., right or left hand). However, effector-independence does not necessarily imply that motor plans are optimal for all effectors. For example, right-handed writers have better control over left-to-right than right-to-left horizontal strokes, but the opposite is true for left-handers (because abduction is better controlled than adduction). Consequently, motor plans specifying left-to-right horizontal strokes (e.g., for 'T') may be optimal for right- but not left-handers. We explored two contrasting hypotheses concerning effector-independence. The fixed-motor-plan hypothesis assumes that graphic motor plans specify fixed directions for strokes (e.g., left-to-right), and a fixed stroke ordering. Although executable with any effector, fixed plans may not be optimal for all effectors. The adaptive-motor-plan hypothesis proposes that motor plans represent stroke information in some form that automatically yields optimal stroke patterns for any effector (e.g., describing horizontal strokes in abduction-adduction rather than left-right terms).

Right- and left-handers wrote words in upper-case print with their dominant and non-dominant hands. Dominant-hand stroke patterns differed between right- and left-handers (e.g., horizontal strokes written left-to-right by right-handers, but usually right-to-left by left-handers). Comparing writing with dominant and non-dominant hands, we asked whether participants' stroke patterns remained constant across hands, or shifted seamlessly in adaptation to the specific effector. Stroke-pattern shifts were observed but, contrary to the adaptive-motor-plan hypothesis were usually neither immediate nor consistent.
We argue for fixed motor plans, and suggest that stroke-pattern differences between dominant and non-dominant hands reflect development of new fixed plans optimized for the non-dominant hand. For example, a right-hander attempting left-hand writing may initially rely upon previously learned motor plans optimal for right-handed writing, gradually acquiring plans better suited to the left hand.

Keywords:
handedness, stroke patterns, graphic motor plans, effector, independence

Celeste Younes Harb

Handwriting analysis in bigraphic subjects writing French and Arabic

Celeste Younes Harb, C. Matta-Abizeid, Jean-Michel. Albaret, Jean-Luc Velay

Background and aim: The concept of bigraphism is defined as the ability to write in two different writing systems. Lebanese people, for instance, use two writing systems based on two different alphabets: Arabic, (right to left) and Latin (left to right) in both their school and professional life. This research aims to study the possible interferences between these two writing systems. In other words, to what extent does Lebanese writers (Arabic and French bigraphs) diverge from Arabic and French monographs? Is the Lebanese handwriting more affected by the features of Latin or Arabic writing system?

Methods: 49 typically writing adults were divided into three groups: 15 Lebanese bigraphs (French-Arabic), 15 French monographs and 19 Syrian Arabic monographs. All participants were asked to write words on a paper sheet fixed on a Wacom Intuos Pro large graphic tablet. Several handwriting variables (spatial, temporal and kinematic variables) as well as pen tilt angles (Azimuth and Altitude) were analyzed.

Results: For the Arabic words, no significant difference was found between Lebanese and Syrian monographs regarding all variables.

For the French words, significant differences were found between Lebanese and French monographs in kinematic and spatial variables: Lebanese wrote the words faster and larger than French monographs. The pen tilt angles were different in Lebanese and French writers, whereas in Lebanese writers the angles were the same whatever the language (French or Arabic) they wrote. This implies that Lebanese adults adopt the same hand and pen postures in both writing systems.

Conclusion: Despite their exposition to both French and Arabic writing systems since early childhood, Lebanese handwriting characteristics tend to resemble more to Arabic than to French. When they write in Arabic, they remain unaffected by the French writing patterns, whereas their French handwriting's characteristics are influenced by the Arabic writing patterns. Interestingly, they hold their pen similarly as Arabic monographs do, both when they are writing from right to left (Arabic) and from left to right (French). These results suggest that the motor constraints needed by the Arabic writing system are stronger than those required by the French writing system and they impose the way bigraphs held the pen and write.

Oral Session C

Yang Yang

Functional connectivity underlies gender differences in writing

Yang Yang[1] and Hong Yan Bi[1]

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Gender difference is a critical aspect of individual variations in language skills. Writing is an essential language skill that involves multiple linguistic, cognitive and motor processes. Gender difference has also been observed in writing, but its neuroanatomical basis is unclear.

Using functional magnetic resonance imaging (fMRI) in a writing to dictation task, this study investigated the neural basis of gender differences in writing in a group of 34 adults (18 male; mean age=22.4 years). The results indicated that no gender difference was identified in brain activation during writing. But males and females differed in functional connectivity associated with writing: females showed greater functional connectivity between the left supplementary motor area (SMA) and left middle occipital gyrus, while males exhibited greater functional connectivity between the left SMA and left middle frontal gyrus and the connectivity between the left superior parietal lobule and right cuneus. Furthermore, significant correlations between functional connectivity and behavioral performance of writing with pen and paper confirm the role of theses neural circuits in gender differences in writing.

Together, this study for the first time illustrates the neural mechanisms underlying the gender differences in writing, advancing our understanding of individual variations of language skill.

Keywords:
gender differences, writing, brain activation, functional connectivity

Poster

1st session

Carmen Mayer

Does the writing instrument (pencil, tablet stylus or keyboard) affect letter recognition in kindergarten children?

Carmen Mayer[1], Stefanie Wallner[1], Nora Budde-Spengler[1], Markus Kiefer[2], Petra Arndt[1]

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2 Klinik für Psychiatrie und Psychotherapie III, Universität Ulm

In the digital age, handwriting with paper and pencil is increasingly replaced by typing or writing on digital devices. Current evidence regarding the influence of the writing instrument during literacy education on reading and writing performance in children is mixed. There are findings that show a positive correlation between frequency of computer use and letter knowledge. Other studies indicate benefits of handwriting. An explanatory approach for findings in favour of handwriting is the meaningful coupling between action and perception during handwriting. This establishes sensory-motor memory traces, which could facilitate written language acquisition.

The present study aimed at clarifying the role of the writing instrument for reading and writing acquisition. We developed an intensive training program for preschool children attending German kindergarten. The program consisted of 28 training sessions distributed across seven weeks. Sixteen letters of the German alphabet and 12 words were trained in a sample of 145 children either by handwriting with paper and pencil, by writing with a stylus on a tablet PC or by typing on a virtual keyboard of a tablet. Closely matched letter learning games were used. Letter recognition, naming and writing performance were assessed at two to four time points depending on the test used. Word as well as pseudoword reading and writing performance were measured directly after training and two weeks later. The focus of the first analysis was on letter recognition. For letter recognition increase in knowledge during training, knowledge stability and knowledge gain (= increase of knowledge + knowledge stability) were considered.

The results show a significant advantage of writing by hand compared to the digital keyboard for the learning gain. So, letter recognition benefits more from handwriting training with pen and paper than from typing. In the next steps, the other tests will be analyzed to obtain a holistic view.

Poster Session 1

Nathalie Bonneton-Botte

Can tablet apps support the handwriting learning?
An investigation of learning outcomes in kindergarten classroom

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The aim of this research was to assess the impact of implemented in a classroom context a digital notebook designed for stylus oriented tablet dedicated to handwriting skills acquisition of beginner writer. With the help of an artificial intelligence which finely analyzes the spatio-temporal characteristics of the writing (i.e, shape, order and direction of the segments), the exercises are personalized and extrinsic feedback is delivered at the end of each trial to provide knowledge of results to the learner.

Twenty-two kindergarten classes participated in 12-week teacher-implemented program, 13 of them working exclusively with paper and pencil while the others realized partially their handwriting training on the digital notebook. All students progress were assessed thanks to a paper-pen writing task as pretest and posttest realized on a Wacom tablet.

Data analysis highlights that the digital notebook can viably support the learning and teaching of handwriting and that learning outcomes are dependent on the level of the writers at the beginning of the study.
The results are discussed in the light of the existing literature on the impact of extrinsic feedback and of learner characteristics.

Keywords:
tablet apps, handwriting, learning, kindergarten, classroom context

Tania Cerni

Two thumbs and one index: A comparison of manual coordination in touch-typing and mobile-typing.

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It has been extensively demonstrated that in touch-typing, manual alternation is performed faster than manual repetition, due to parallel activation of successive keystrokes.

In this experiment, we tested whether the manual coordination patterns typical of touch-typing can be observed in mobile-typing.
We recruited skilled touch-typists and divided them into two groups depending on their typing habits on the mobile device. The "one-hand" group typed with one index finger on the mobile, and therefore produced words exclusively through manual repetition. The "two-hands" group used two thumbs, and therefore produced words through a combination of mobile-typing repetitions and alternations. The two groups were tested in a typing to dictation task with both a standard keyboard and a mobile keyboard.

Results showed that manual alternation and manual repetition patterns are similar in touch-typing and in mobile-typing. For the "two-hands" group, the mean interkeystroke intervals (IKIs) for touch-typing decreased as manual alterations in words increased in both touch- and mobile-typing. The "one-hand" group showed an opposite pattern in mobile-typing. Bigram frequency was correlated with IKIs per bigrams in both tasks and groups, but the correlation for the "one-hand" group in mobile-typing was different. Our results suggest that manual coordination processes are the same in touch-typing and in mobile-typing despite different effectors, provided that both hands are used to type.

Keywords:
Touch typing, Mobile typing, Bimanual coordination, Peripheral processes

Camilla Fitjar

Children's letter writing automaticity at school entry

Camilla Fitjar[1], Mark Torrance[2], Guido Nottbusch[3], and Vibeke Rønneberg[1]

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2 Nottingham Trent University – United Kingdom
3 University of Potsdam – Germany

Both fine motor skill and letter knowledge contribute to handwritten production of letters; however, their relative contribution to children's handwriting at school entry is unclear.
The aim of this study is to investigate the relative contribution of pen control and letter knowledge, to letter handwriting automaticity at school entry in a Norwegian context.
Norwegian first graders (N=186) completed a letter-knowledge test battery and a graphomotor test battery. Letter knowledge tests included letter identification, first sound identification in a word, spelling, reading, phoneme segmentation, and letter naming. The graphomotor test battery included non-letter graphomotor tasks, letter copying, and letter writing.
The first involved drawing basic strokes, up and down, left and right, circles in both directions, continuous loops, and the number eight - all movements common in letter writing.
The copy task was near point copying of letters and symbols. The letter-writing task was letter-sound dictation.

To investigate how non-letter graphomotor skills and letter knowledge contribute to hand-writing automaticity, three hypotheses were tested. First, fluency of letter production will be predicted by letter-sound knowledge and letter recognition. Second, children with good letter knowledge will copy more letters fluently because they benefit from letter knowledge in the production in addition to graphomotor skills. Third, non-letter graphomotor skills will correlate with letter knowledge.
Digitizing tablets and OpenHandWrite (Simpson, Torrance, and Nottbusch; https://github.com/isolver/OpenHandWrite) were used to gather process data from graphomotor tests and handwriting tasks. Signal-to-Noise Velocity peaks (Danna, Paz-Villagr ́an, & Velay, 2013) will be included in the analysis as a measure of automaticity. The data collection is complete, and the analysis is underway.
The results will be analyzed using linear mixed effect models.

Keywords:
handwriting, automaticity, graphomotor, letter knowledge, children

Yurena Hernandez-Galvez

Writing cognate word: Is there automatic activation of translation equivalents?

Yurena Hernandez-Galvez[1], Olivia Afonso Hernandez[2], and Carlos Javier Alvarez Gonzalez[1]

1 Universidad de La Laguna [Tenerife - SP] – Spain.
2 Oxford Brookes University – United Kingdom

In the bilingual and second language acquisition research, in order to study the role or the activation of one language when processing other, a typical strategy is to use words with some overlap. This overlap can be orthographic, phonological, morphological or semantic. Cognate words are an example of this fact: words that share form and meaning in different languages.Although there has been much research done using these (or other) words in word recognition, the same is not applicable to handwriting.

In this experiment, we used two groups of both native speakers of Spanish with different level of proficiency in English. They were presented English words that were cognate words (e.g., CONFIRM, CONFIRMAR in Spanish) and non cognates (CONVEY, TRANSMITIR in Spanish).The word frequency was also manipulated while different psycholinguistic variables, such as the first letters, were controlled.

The participants had to write the words on a graphic tablet. Written latencies and writing durations were measured.
The results give us some relevant clues about the question of whether Spanish translations are automatically activated when writing English words and how and when the orthographic overlap existing in the case of cognates affects the dynamics of writing by hand L2 words. In addition, the role of English proficiency will be addressed.

Keywords:
Second language acquisition, writing cognate non cognate words

Eric Lambert

Is spelling memory improved by reading aloud ? A study with fourth and seventh grade students, and adults

Eric Lambert[1,2] and Manuel Gimenes[3]

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2 Université de Poitiers, Poitiers - France
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Reading a word aloud allows for better memory performance than simply reading it silently (MacLeod et al., 2010). This "production effect" has been demonstrated with recognition tasks where the memorization of phonological information was sufficient. But does this effect also enhance spelling representations?

We explored this question by selecting fourth (N=30) and seventh (N=46) grade students, and adults (N=30). The MacLeod et al. (2010) procedure was used: In a first phase (learning phase), pseudowords were read silently or aloud according to their color. In a second phase (test phase), participants were asked to write the pseudowords presented in the learning phase.
The material was composed of 40 pseudo-bisyllabic words, all containing an irregular spelling (eg. mossut, /mosy /, the grapheme "UT" is not the most frequent conversion of the phoneme /y/). In order to succeed in this dictation task, participants had to remember the spelling of words.

The results showed a production effect on the memorization of pseudoword spelling (overall a benefit of 7%). Moreover, this effect was found in all three age groups. Finally, there was no interaction between age group and the size of the production effect, suggesting this spelling benefit when reading aloud is the same for all three groups.

Keywords:
spelling, production effect, orthographic representation, memory

Betty Laroche

The Role of Visual Feedback in Written Word Production: A Topographic ERP Analysis

Betty Laroche[1], Cyril Perret[1], and Thierry Olive[1]

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Perret and Laganaro (2013) have shown that latencies in a written picture naming task are shorter without visual feedback (hand masked condition) than in normal visible condition. Moreover, analyses of the predictors of the latencies have shown that the number of letters is a predictor of hand masked condition only. This result could suggest that visual feedback impact central processes.

The present study aimed at determining whether and how suppression of visual feedback in a written picture naming task affect the processing levels engaged in this task. For this purpose, we recorded the writers' electroencephalography, and conducted a spatiotemporal analysis of the data. High density EEG (128 electrodes) was recorded on 30 participants during a picture-naming task in two conditions: with and without visual feedback (hand masked condition).
All participants carried out the handwritten picture naming task in both conditions on the same set of 120 stimuli. For both conditions of vision, latencies were analysed and topographical pattern analyses were run on stimulus- and response-aligned ERPs in order to cover the whole handwritten word encoding processing. This procedure follows the work from Perret and Laganaro (2012) who specified the time-windows for each process involved in a handwriting picture-naming task with this method.

In the present study, we observed an increase of the latencies without visual feedback. Furthermore, the use of topographic ERPs analyses permitted us to observe that only late time windows (450 – 850ms) were affected by the suppression of visual feedback. Results suggest that peripheral processes only are affected by the suppression of visual feedback.

Keywords:
handwriting, visual feedback, electroencephalography

JUNE 28

09:30 – 10:00 am   **Coffee**

10:00 am – 12:00 pm   **Keynote Lecturer: Gordon D. Logan**

12:00 – 02:00 pm   **Lunch and Poster session 2**

02:00 – 03:30 pm   **Session D**

Chair: Eva Belke

- R. Laarmann-Quante, S. Dippe, & E. Belke – "What makes a word difficult to spell and for whom? A corpus-based study."

- C. Solier – "Spoken-written language interface in L2 language acquisition. The influence of orthographic input on phonological representations: the case of Morroccan learners."

- M. Torrance, J. Roeser, T. Baguley, M. Andrews – "Semantic and lexical effects on within-word production timecourse in typed object naming."

03:30 – 04:00 pm   **Coffee**

04:00 – 05:30 pm   **Session E**

Chair: F-Xavier Alario

- K. Neophytou, R Wiley, K Tsapkini, B Rapp– "Spelling as a single classification task in primary progressive aphasia: Theoretical and practical implications."

- S. Pinet & N. Nozari – "The role of visual feedback in detecting and correcting typing errors: a behavioral and electrophysiological investigation."

- J. Roeser, M. Andrews, M. Torrance, T. Baguley – "No scope for planning – latent mixture modelling of keystroke latencies."

Speaker

2nd Day

Ronja Laarmann-Quante

What makes a word difficult to spell and for whom? A corpus-based study

Ronja Laarmann-Quante[1], Stefanie Dipper[1], and Eva Belke[1]

[1] Ruhr University Bochum – Germany

Based on the Litkey Corpus, a richly annotated corpus of 1,922 freely written texts produced by German primary school children between grade 2 and grade 4, we investigated which properties of words make spelling errors likely to happen and how this differs for different learners.

Our pilot studies on subsets of the data have suggested that both statistical word properties such as frequency and particular phenomena of the German orthographic system such as consonant doubling can have an effect on the misspelling likelihood of a word. We also found interactions between these effects and the overall spelling abilities of a child in that the effects tended to be stronger for children who committed many errors overall compared to children with fewer errors.

By the time of the workshop we will have results from a more detailed analysis of the whole dataset. We will perform Generalized Linear Mixed Effects Modeling with a large number of potential predictors, which include properties of the word to spell (e.g. length, orthographic consistency, existence of a particular spelling phenomenon) and of the child who is spelling the word (e.g. language background, grade). The results will also shed light on the question to what extent spelling errors can be predicted, which could be useful for instance in the context of the assessment of spelling competence.

Keywords:
spelling errors, corpus study, German, Generalized Linear Mixed Effects Modeling

Oral Session D

Clara Solier

Spoken-written language interface in L2 language acquisition. The influence of orthographic input on phonological representations: the case of Morroccan learners

Clara Solier[1]

1 Octogone Unité de Recherche Interdisciplinaire (Octogone) – Université Toulouse le Mirail - France

Numerous studies have shown that orthography impacts speech perception and production processes. However, the influence of orthography is not taken into consideration in speech perception models, nor in speech production models. The aim of this study is to investigate the influence of orthography on L2 spoken production. We compare written production tasks to spoken production tasks. We assumed that the orthographic representations activated during written production allow phonological representations to be modified, thereby leading to a more accurate pronunciation. We tested this hypothesis on 100 Moroccan beginning learners of French, using a pretest-posttest design. Stimuli were split in four categories, containing four target vowels (//, //, /i/, /e/) in final word position.

Participants were divided in 5 groups, each performing an experimental condition training: (1) repetition of minimal pairs, (2) word repetition with verbotonal method of phonetic correction, (3) vocalized copy, (4) dictation, and (5) copy. Participants completed a word repetition task in pretest and posttest. We analyzed the effect of the experimental condition on the pronunciation accuracy in the posttest and training tasks. Results confirmed our hypothesis: pronunciation accuracy is significantly better in posttest after written production training. Moreover, results indicate that the copy task improved the posttest pronunciation accuracy the most. Our study supports the fundamental role of orthography on second language phonology.

We will present and discuss posttest findings focusing on the difference between copy and dictation task efficiency at improving speech production.

Keywords:
spoken, written language interface, phonological and orthographic representations, copy task, dictation task

Mark Torrance

Semantic and lexical effects on within-word production timecourse in typed object naming

Mark Torrance[1], Jens Roeser[1], Thom Baguley[1], and Mark Andrews[1]

1 Nottingham Trent University – United Kingdom

One possible account of written word production is that linguistic processing – the cascade of semantic and linguistic processes that lead to an orthographic word form – is typically complete before production onset (i.e. before the writer starts producing the first letter of the word). Output of the word then involves informationally-encapsulated motor planning and execution. If this is the case then factors assumed to affect pre-motor processing (lexical retrieval, spelling retrieval, possibly even object recognition) will affect output-onset latency (RT) but will not affect production timecourse once output has started. There is, however, evidence to the contrary. For example, word frequency, as a proxy for lexical retrievability,
explains unique variance in mean within-word IKIs when participants type names for all of the pictures in the colourised Snodgrass and Vanderwart picture set (Rossion & Pourtois, 2004. Scaltritti, Arf́e, Torrance, & Peressotti, 2016; Torrance et al., 2018).

The present study adopts a similar approach, but with more direct measures of ease of recognition and of lexical retrieval. Separate samples from the same student population made speeded semantic categorization decisions (N = 84), and gave spoken or typewritten names (Ns 80 and 103) for each of the 260 Rossion and Pourtois images. Our analysis of these data, which is currently in progress, uses Bayesian linear mixed effects methods to model individual (unaggregated) within-word IKIs.

Our aim is to determine how, if at all, mean spoken-naming and categorysation RT for an image predicts the timecourse of typing its name, and what factors (e.g., spelling difficulty, word-length) moderate this relationship.

Oral Session E

Kyriaki Neophytou

Spelling as a single classification task in Primary Progressive Aphasia: Theoretical and practical Implications

Kyriaki Neophytou[1], Robert Wiley[1,2], Kyrana Tsapkini[3], and Brenda Rapp[1]

1 Johns Hopkins University – United States
2 The University of North Carolina Greensboro – United States
3 Johns Hopkins University School of Medicine [Baltimore] – United States

Currently, variant subtyping in primary progressive aphasia (PPA) requires an expert neurologist and extensive language and cognitive testing [1]. Spelling impairments appear early in the development of the disorder, and the three PPA variants (non-fluent, semantic and logopenic) reportedly show fairly distinct spelling profiles [2]. Theoretical and empirical evidence indicates that spelling recruits most key language and cognitive functions [3-5] and, therefore, may serve as a proxy for extensive language and cognitive testing. The current study aimed to determine whether spelling performance, evaluated with advanced statistical analyses and machine learning algorithms allows for accurate PPA variant classification.

A spelling to dictation task (with real words and pseudowords) was administered to 33 individuals with PPA: 17 logopenic, 10 non-fluent, 6 semantic. First, using Linear Mixed Effects Models we extracted individual participant beta values for each of nine variables (lexicality, length, letter position, letter position quadratic, imageability, frequency, phoneme-grapheme probability matching, orthographic neighborhood density, phonological neighborhood density) and also calculated the accuracy difference between words and pseudowords. Second, using Random Forest analyses we extracted the most significant of these variables in predicting PPA variants from pairwise variant comparison. Third, using the most significant variables and the percentages of error types, we classified every individual in each pairwise comparison, using Binomial Model analyses. Finally, we verified the effectiveness of this method by classifying unlabeled cases.

The pairwise variant classification accuracies ranged between 67-100%, while the classification of unlabeled cases yielded individual variant prediction accuracies between 65-70%. To our knowledge, this is the first time that every PPA variant, including the most challenging logopenic variant, is classified with such high accuracy when using information from a single language task. These results support the possibility of introducing a single spelling task for PAA variant classification and emphasize the rich structure of spelling.

Keywords:
primary progressive aphasia, spelling, variant classification

Svetlana Pinet

The role of visual feedback in detecting and correcting typing errors: a behavioral and electrophysiological investigation

Svetlana Pinet[1] and Nazbanou Nozari[1]

1 Johns Hopkins University – United States

We frequently detect and correct our errors in oral and written communications. It has been proposed that both internal monitoring mechanisms and external feedback are involved in these processes; however, the contribution of each channel to error detection and correction remains unclear. We addressed this question by manipulating visual feedback during word typing in two experiments. Participants typed words under dictation and had to report whether they had made an error during typing.

In Experiment 1 we recorded 13,369 errors from 60 participants. Without visual feedback results showed a 17% decrease to the detection of errors, and a much larger (70%) decrease to the correction of errors. When providing positional information (i.e., asterisks as in typing a password) corrections improved, but not to the level of full visual feedback where both letter identity and position were visible.

Experiment 2 investigated the electrophysiological signatures of monitoring with and without visual feedback. Without visual feedback, we observed a keystroke-locked ERN, suggesting uncertainty about the response during execution. When participants were later presented with the erroneous response they had typed, only errors that were not detected during typing presented further post-error adaptation in the form of a later positive component. In contrast, when visual feedback was available during typing, we observed a late keystroke-locked positive component (Pe) usually associated with conscious error detection but no ERN. Some early differences between correct and error trials were also observed before execution begins, which might suggest that error processing takes place already before execution.

In summary, our results suggest that the external visual feedback is more important for correction than for detection of typing errors and that information about position contributes to the correction process. Moreover, online error detection mechanisms are dependent on whether visual feedback is available or not.

Keywords:
typing, EEG, feedback, monitoring, cognitive control

Jens Roeser

No scope for planning – latent mixture modelling of keystroke latencies

Jens Roeser[1], Mark Andrews, Mark Torrance, and Thom Baguley

1 Nottingham Trent University – United Kingdom

Writers must pre-plan some minimal linguistic unit before they can start writing a sentence. Whether or not this unit is syntactically organised is highly controversial (Bock & Ferreira, 2014). The argument that pre-planning involves syntax hinges, partially, on the observation that, when the sentence starts with a conjoined NP (The A and the B), the onset is delayed compared to matched sentences starting in simple NPs (The A) (e.g. Roeser et al., 2018). An alternative view is that syntax is not obligated by the linguistic encoder but longer keystroke latencies may occur sporadically for conjoined NP, for reasons beyond the obligatory planning scope.

We contrasted these views directly using keystroke latencies for simple descriptions of arrays of moving images starting with either a conjoined or a simple NP. We fitted a series of Bayesian models to directly test the predictions from the two contrasting theories. Linear mixed models were used to evaluate the effects of NP complexity as a test of the phrasal scope hypothesis. The alternative hypothesis that planning syntax is more likely for conjoined NPs but not obligated by the production system was implemented as mixture models, assuming that the data comes from a mixture of distributions with the same mean and variance but varying mixing proportions for each NP type.

Model comparisons revealed higher predictive performance for mixture models than for linear mixed models. The mixture models show a larger proportion of long latencies for conjoined NPs. However, the majority of observations were associated with the same distribution as simple NPs. This is not consistent with obligatory phrasal scope, but rather that advance planning is scoping, at most, over the sentence-initial noun. We suggest that the frequently replicated slowdown for conjoined NPs might be better explained by non-syntactic processing demands that act only on some trials.

Poster

2nd session

Poster Session 2

Thierry Olive

The cognitive demands of handwriting and of typing in university students

Thierry Olive[1] and Sirine Bouriga[2]

1 Centre de Recherches sur la Cognition et l'Apprentissage – CNRS and Université de Poitiers – France
2 Centre de Recherches sur la Cognition et l'Apprentissage (CeRCA) – Université François Rabelais – Tours, Université de Poitiers, CNRS : UMR7295, Poitiers, France

The present study tested whether the use of a keyboard by students requires more cognitive resources than handwriting. In Experiment 1, participants copied texts by handwriting and by typing (in counterbalanced order). They simultaneously performed a secondary reaction task which aimed at assessing the cognitive effort of copying. The findings indicated that typing was more effortful than handwriting.

In Experiment 2, we investigated the consequences of such higher cognitive demands on memory. Free recall of texts or words is indeed lower when typing (e.g., Mangen, Anda, Oxborough, & Brønnick, 2015). We used a serial recall task with increasing sets of words. Because participants needed to share their attention between storage and writing the words, if typing was more resource-demanding than handwriting, recalling words with a keyboard would result in lower recall than when handwriting.

In Experiment 2a, undergraduates recalled words by typing and by handwriting (counterbalanced).Two different lists were constructed, with blocks of 4 to 7 words. No difference was observed in the number of words recalled. However, recall by typing was significantly faster than by handwriting, and a ceiling effect was observed with a recall score of 80%.

In Experiment 2b, we fixed the rate of recall and added two blocks of 8 and 9 words. When controlling recall rate, the number of words recalled by handwriting was higher when typing, but the output modality x memory load interaction indicated that typing is detrimental only under high cognitive load.

The findings of these experiments clearly indicate that typing is more effortful that handwriting, even in undergraduate students. To avoid that these demands negatively interact with central writing processes, it seems important that writers intensively practice typing to fully automatize it.

Keywords:
handwriting, typing, cognitive effort, resources sharing

Poster Session 2

Svetlana Pinet

How well do university students type? Linking typing habits to proficiency in an academic population

Svetlana Pinet[1,2], Christelle Zielinski[3], Marieke Longcamp[4], and F.-Xavier Alario[1]

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Aix-Marseille Université – France
2 Johns Hopkins University – United States
3 Institute of Language, Communication and the Brain – Aix Marseille Université – France
4 Laboratoire de neurosciences cognitives – Aix-Marseille Université – AMU, CNRS : UMR7291 – France

Despite the increasing availability of voice recognition software, keyboards remain the most popular user-interface for digital tools. In western cultures, virtually everyone above the age of 12 has already used a keyboard, and uses it occasionally, often, or daily. This 100% prevalence is likely made up of highly heterogeneous typing proficiency, whose origin has not been thoroughly explored. Typing "experts" were traditionally defined as people formally trained (i.e. professional typists), or, more recently, as people achieving a high level of speed and accuracy through mere keyboard use. Here, we quantify the distribution of the latter typing "expertise" within a population of university students, those typically tested in cognitive psychology experiments, and examine the links between typing proficiency and typing habits.

Through an online platform, 1056 French-speaking participants performed a sentence copying task and filled out a questionnaire about their typing habits. We extracted two proficiency groups, corresponding to lower vs. higher performance in speed and accuracy, which we took to index expertise. Gender distribution was even in these two groups. High performers were significantly older than low performers. They reported a higher daily practice, more years of practice, and used a larger number of fingers for typing than less proficient typists. High performers also reported looking less frequently at their hands when typing than less proficient typists. In contrast with previous definitions of typing expertise, the proportion of
participants that deliberately tried to improve their typing skills (i.e., through self-training or typing classes) did not differ between proficiency groups.

In sum, a high level of speed and accuracy in typing is associated with higher levels of practice that are not necessarily deliberate. Proficient typists presented characteristics usually taught in formal training (i.e., 10-finger touch typing) that were here achieved mostly by self-training. Mere typing appears very good training for typing.

Keywords:
typing, online experiment, performance, deliberate practice

Qingqing Qu

Facilitation and Interference in Written Word Production: Evidence from a Chinese Blocked Cyclic Task

Qingqing Qu[1] and Markus Damian[2]

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2 School of Psychological Science, University of Bristol– United Kingdom

It is relatively well established that in written production tasks such as "blocked cyclic naming", orthographic similarity between response words facilitates naming times. Three experiments reported here further examined the effects of orthographic overlap in such tasks.
Chinese participants repeatedly wrote the names of a small set of objects within experimental blocks, and orthographic overlap between response words within a block was manipulated.

 In Experiment 1, response words in a block shared the initial radical of the first character (e.g., , /sha1fa1/, sofa -, /hai3luo2/, conch -, /han4bao3/, burger -, /qi4che1/, car). In line with previous findings, orthographic overlap exhibited a facilitatory effect.

 In Experiment 2, orthographic overlap across response words was distributed unpredictably across word positions; in half of the items, the shared radical occurred in the initial character (e.g., , /sha1fa1/, sofa - , /qi4che1/, car) and in the other half in the second character (e.g., , /pi2jiu3/, beer -, /qi4pao4/, bubble). Here, orthographic overlap entailed an inhibitory effect on writing latencies. Two accounts could explain the orthographic interference effect: competition between form-related co-activated words, or incremental learning. Critically, the first account should be time-sensitive but the second should be persistent.

In Experiment 3, critical trials were interleaved with filler trials but orthographic inhibition still emerged, suggesting a persistent origin. The implications for theoretical models of orthographic production are discussed.

Keywords:
Facilitation effects, Interference effects, Chinese, Blocked Cyclic Task

Poster Session 2

Michele Scaltritti

Beta-band desynchronization in reading and typing

Michele Scaltritti[1,2], Caterina Suitner[2], and Francesca Peressotti[2]

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We exploited beta-band power modulations, an electroencephalographic (EEG) index associated with motor programming and motor-response execution, to compare reading and writing (typing) and to elucidate the interplay between semantic processing and motor control in language production.

Participants performed a silent-reading and a copy-typing task on words displayed on the computer screen. Stimuli consisted of emotionally negative and neutral words. We recorded the electroencephalographic signal and focused power modulations of frequencies in the low (13-20 Hz) and in the high (21-30 Hz) beta bands.

In the reading task, a single beta-band desynchronization was found, occurring around 500 ms after target presentation. This desynchronization was sensitive to the emotional valence of the stimuli, with lower beta frequencies (13-20 Hz) showing a stronger desynchronization for neutral compared to emotional words.
In the copy-typing task we found two desynchronizations. The first desynchronization, similarly to the reading task, occurred around 500 ms after stimulus onset, but was insensitive to the emotional valence of the stimuli. The second desynchronization appeared in a time-window corresponding to the execution of the typed response. Here, the emotional valence of the stimuli affected frequencies in the higher betaband.

Taken together, these results suggest that the same semantic variable might affect reading and writing in different ways and that linguistic aspects might influence processes related to motor-response execution.

Keywords:
typing, motor programming, EEG, neural oscillations

Christiane Soum-Favaro

Writing in dyslexia: Produce sentences in a dictation task.

Christiane Soum-Favaro, Clara Solier, Sindy Hoquet-Pacaud

We used the Chronodictées clinical protocol (Baneath, B., Boutard, C., Alberti, C., 2015) to study writing performance in dyslexic teenagers. This exploratory study examine if there are or not typical errors depending on subtypes of dyslexia.

Thirty-four dyslexic children participated in this experiment. They were 11;3 to 15;5 years old and presented different types of comorbidities (gifted children, attention deficit/hyperactivity, dyspraxia, dyscalculia, dysorthographia). All pupils were recruited by a specialist of speech-language therapy. Dyslexic children performances were compared to control children. Children had to write eight sentences by dictation without speed.

We are currently studying data.

Keywords:
Dyslexia, Comorbidities, Sentences dictation task, Lexical errors, Grammatical errors

Lauriane Véron-Delor

Does handwriting sonification help Parkinson's patients to write words?

Lauriane Véron-Delor[1,2], Serge Pinto[2], Alexandre Eusebio[3 ?4], Jean-Luc Velay[1], Jeremy Danna[1]

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2 Aix Marseille Univ, CNRS, LPL, Aix-en-Provence, France
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Parkinsonian dysgraphia is characterized by the alteration of handwriting that oversteps the pure reduction of writing size, namely micrographia.

In this study, we tested an original strategy of musical sonification in PD dysgraphia. This method changes music as functions of handwriting kinematics in such a way that velocity distortions generate music distortions. Indeed, music has been shown to activate a pathway that may compensate for the defective cortico-striatal networks in patients with Parkinson disease (PD), leading to motor improvements.

Twelve PD patients, with medication, and 12 healthy controls were recruited for a "pre-test/training/post-test" experiment design. Three training sessions were compared, during which participants were asked to produce graphomotor exercises. Each session was conducted under one of the following experimental conditions: background music (unrelated to handwriting), musical sonification (related to handwriting), and silence. The trainings were counterbalanced between participants. During the tests (all in silence), participants were required to draw loops, to write the French word "cellule" (cell), and to make their own signature.

Analyses focused on four kinematics variables: movement frequency, velocity and fluency, and item height. At baseline, both groups performed similarly, except for the signature that was slower for the PD patients. Performance during trainings was better under musical sonification than under silence or background music, for both groups. After training, the benefits of musical sonification were still present for both groups, with a higher effect for PD patients than for control participants.

Our results provide a proof of concept to consider musical sonification as a relevant auditory-cued strategy for movement rehabilitation in patients with PD.

Keywords:
Parkinson's disease; Handwriting; Musical sonification

Tutorial Session

Tutorial session

Guido Nottbusch, Stefan Heß, and Mark Torrance

OpenHandWrite

Guido Nottbusch[1], Stefan Heß, and Mark Torrance[2]

1 University of Potsdam – Germany
2 Nottingham Trent University – United Kingdom

We would like to share our open source program OpenHandWrite for capturing and analysing pen movements. The full workflow, from setting up the experiment to reporting summary statistics, will be presented.

a) GetWrite (part of OpenHandWrite) provides accurately timed capture of pen movement data from digitising tablets and similar devices (Windows): We'll demonstrate how to set up an experiment.

b) MarkWrite (part of OpenHandWrite) is a markup and analysis tool that allows users to manually segment the pen trace into meaningful units (sentences, words, lines, strokes) and then computes by-segment summary statistics. We'll show the annotation process and the resulting file formats using typical data (single word and text).

c) R (Project for Statistical Computing): We'll demonstrate how to run a number of R- scripts on MarkWrite data that we provide with OpenHandWrite. The scripts define segments/strokes and then analyse the fluency/automaticity by calculating the Signal-to-Noise velocity peak differences (Danna et al. 2013) and finally report summary statistics. MarkWrite can also open files of various types, including data collected using Eye and Pen and Handspy. We'll demonstrate briefly how this can be done.

Keywords:
handwriting, experiment, markup, annotation, analysis

SCHEDULE

	Thursday, June 27 Pharo Campus, Amphithéâtre A	Friday, June 28 Pharo Campus, Amphithéâtre A	Saturday, June 29 St Charles Campus, Room Phy51
09:00			Tutorial session: **OpenHandWrite**
09:30	Welcome and Coffee	Coffee	
10:00		Keynote: **Gordon D. Logan**	Data acquisition
10:30	Session A	Automatic control: How to	Data annotation
11:00		type without thinking	Data analysis
11:30			Coffee break
12:00			Wrap-up, discussion and
12:30	Lunch + poster session 1	Lunch + poster session 2	perspectives
13:00			
13:30			
14:00			
14:30	Session B	Session D	
15:00			
15:30	Coffee	Coffee	Visit of Marseille's Calanques
16:00			(optional)
16:30	Session C	Session E	
17:00			
17:30			
18:00			
18:30			
19:00	Bistrot dinner at "Comptoir		
19:30	Dugommier"		