SN180

Rhythmic structure in the children's first handwriting (2014-2016)

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Methodological Notes[1]

During the experiment, 298 Italian monolingual children were tested. Children were divided into five groups, according to their school grade, from three different schools in the provinces of Milan and Pavia (Italy).

Participants were asked to manipulate their handwriting movement velocity and size. The Italian word *burle* (English translation: "jokes") was chosen as the target word because it is usually written in a smooth, continuous line when writing in cursive script.

Two pairs of contrasting conditions (Big versus Small; Fast versus Slow) were included in the experimental design in order to foster a natural change in size and velocity of the handwriting according to the size and the speed of the experimental conditions. The same task was conducted both in all-capital block letters script and in cursive script, and the order of execution of the script was fixed for all participants: first all-capitals block script and then cursive script. For each script, children were first asked to write the target word in the Spontaneous condition, i.e., as they habitually do in class, with no further instruction. The Spontaneous condition served as a baseline. Shortly after, children were asked to write the same word in another four different conditions: smaller (Small condition), bigger (Big condition), slower (Slow condition), and faster (Fast condition) with respect to the Spontaneous condition. Thus, the word *burle* was written ten times in total varying in script, size, and speed.

Each participant was tested individually in a quiet room at her/his school. The whole testing session lasted approximately 15 minutes. Before testing, the experimenter demonstrated to each child the use of the digitizing tablet: she showed that the pen functioned as a normal pen and that the tablet recorded the handwriting movement on-line. In order to foster modulation, participants were not given any template.

Children were asked to write on an unruled A4 size paper rested in landscape orientation on the recording surface of an Intuos 3 Wacom tablet[2]. Children were required to grasp the wireless pen of the digitizing tablet with their dominant hand as if they were writing normally with a common pen. The digitizing pen left a visible ink trace on the paper and therefore the handwriting activity took place in a very realistic way. The digitizing tablet was connected to a computer via a USB cable. The data were acquired using VBDigitalDraw 2.0 software, which permits the collection of an ample set of geometric, kinematic, and dynamic descriptors of handwriting.

The trajectory of the handwriting was recorded as Cartesian coordinates (x, y), both when the pen tip was in contact with the surface of the digitizing table and when the pen tip position was in the air above the digitizer active area with pressure = 0 (i.e., when the writer was temporary pausing or planning the next movement sequence).

The continuous string of the handwriting performance was segmented into single words using the automatic segmentation procedure of the VBDigitalDraw 2.0 software. The outputs of the software segmentation procedure were double-checked by two independent experimenters. In case both independent experimenters identified a mismatch between the software output and the letter geometry, the letter segmentation was corrected manually by one of the experimenters as to match the standard letter geometry of the cursive script.

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[2] Sampling rate: 200 Hz; physical size (W×D×H): 440 × 340 × 14 mm; active area (W×D): 305 × 231 mm; pressure sensitivity: 1.024; levels resolution: 5.080 lpi; pen accuracy: ±0.25 mm; mouse accuracy: ±0.5 mm; tilt: ±60 degrees; maximum reading height with Pen: 6 mm