

Is Handwriting Relevant in the Digital Era?

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Handwriting is considered a fading practice in view of rapid technological advances that make their way into educational settings. Most schools in North America have opted out of teaching it (Dinehart, 2014) and in Finland, a leading force in education, it is no longer deemed necessary for everyday life (BBC, 2014). Still, France has reconsidered the importance of handwriting for children under recent neuroscientific data (Dunn, 2015), and several states in the U.S. have re-introduced the practice in elementary school (Chemin, 2014; Universal Publishing, 2012), while in Canada, explicit instruction of handwriting is still part of the PEI and Saskatchewan curricula (Holmes, 2010). Even so, teachers spend less time on handwriting instruction (McMaster & Robbins, 2015, p. 38; Van de Geyn, 2013) and others are left to choose the writing modality they will teach (Mangen & Balsvik, 2016, p. 8). We are facing an ambivalence towards preserving manuscript in primary school, created by the strong advocacy of experienced teachers (Handwriting in the 21st century? 2012; Hanover Research, 2012; National Literacy Trust, 2011), parents, voices in the social media (Mangen & Balsvik, 2016; McGinn, 2015) and finally, a growing body of cross-disciplinary research on the cognitive benefits of handwriting for early childhood.

This paper briefly discusses the reasons for maintaining handwriting (also known as manuscript or longhand) practice in technologically-driven educational systems today. Leaving aside the debate between printing and cursive (Medwell & Wray, 2008; Stokes, 2011; Schwellnus et al., 2012), it considers pen-and-paper in comparison to computer keyboards and iPads arguing for a

possible symbiosis in schools to consciously make use of advantages of old and new writing technologies.

In the thirty-six years of interdisciplinary research on writing modalities, the field has attracted a diverse group of experts ranging from educators, cognitive scientists and neuroscientists to forensics, biomedical engineers, and software developers among others, joining forces in the International Graphonomics Society (IGS). We now face a multifarious field that shows contradictory results – most, overwhelmingly in favour of handwriting, others in favour of keyboarding, and lately in favour of iPads.

The discrepancy has deeply-rooted theoretical and methodological causes. Wollscheid and her collaborators (2016) have pointed out for the period 2005-2015 that researchers who adopt the traditional definition of Literacy, as a set of socially organized practices which make use of a technology to teach how to read and write, and apply this knowledge to specific contents (p. 20), prefer quasi-experimental methods that conclude in favour of handwriting before keyboarding instruction to children (Stevenson & Just, 2014). Those researchers speak of cognitive benefits from the practice, such as self-regulation, attention sustenance, working memory activation, better transcription of thought-to-script, and overall quality of text production (Bara & Gentaz, 2011; Berninger et al., 2009a, 2009b; Connelly et al., 2007; Cunningham & Stanovich, 1990; Longcamp et al., 2005; Smoker et al., 2009; Velay & Longcamp, 2010). Others, who adopt the New Literacies definition, which includes technology in education and regards the learners as co-constructors of knowledge (Beschorner & Huchinson, 2013; Clark & Luckin, 2013, p. 4; Karsenti & Pollin, 2013; Wollscheid, 2016), prefer exploratory methods and find keyboarding and iPad interfaces more beneficial for motivational and social reasons, such as creativity, engagement and collaboration among learners. Mangen (2013) bemoans the polarization of

experts stemming from neuroscience on one hand and cognitive scientists on the other, which does not advance synergies. The fact that diverse researchers don't measure the same components and aspects of writing also speaks for the discrepancy in the field.

A closer look into the writing modalities shows that they are configured in entirely different ways (Mangen & Velay, 2010; Mangen, 2013, p. 101, 103): Handwriting is a unimanual and idiosyncratic visuomotor activity that involves recalling spelling from memory and translating thought into an autonomous graphic mark by gripping a writing tool and moving it on a surface, that provides friction (Bara & Gentaz, 2011; Bara et al., 2004; Jolly & Gentaz, 2013, p. 6; Mangen, 2013, p. 106) and natural sound as cognitive feedback, and where the writer must plan ahead spacial requirements, such as linearity, spacing and velocity of the text. Handwriting connects the visual with the writing surface and the pre-motor cortex in the brain with Broca's expressive speech area, Exner's graphomotor area and Wernicke's processing of spoken words area in adults (Berninger et al., 2009a, p. 135; Dinehart, 2014, p. 11; Gimenez et al., 2014; Longcamp et al., 2003, 2011; Mangen & Belsvik, 2016, p. 5). In children, and despite their incomplete laterization until the age of ten or eleven (Handwriting in the 21st Century?, 2012, p. 5; Yu et al., 2012, p. 50), handwriting activates an adult-like pathway when they see the letters (James, 2012) or words (Mangen et al., 2015) that they have produced by hand and allows them to memorise them better (Longcamp et al., 2005, 2008; Naka, 1998; Park & Shin, 2015; Smoker et al., 2009).

Keyboarding on the other hand is a bimanual, standardized and repetitive activity that invokes a mental schema of the letter coordinates on the keyboard to press the key (Longcamp et al., 2008, p. 802). The pointing and clicking activates the BA40 area in adults, equivalent to the activation in the brain of a drummer (Thaut et al., 2014, p. 435), and separates the unity of the visual and writing

surface, even for experienced typists. The word processor tackles spelling and editing issues, as words are produced faster and always legibly.

In what is regarded as the evolution of writing, a current practice, such as handwriting, is both disrupted and enhanced by digital technology, which helps retrieve older attributes of the medium and effaces others (M. & E. McLuhan, 1992, p.17). Keyboarding, with its undeniable legibility and easier editing is less time-consuming for the author. However, the speed between pressing keys is deceptively fast when it comes to overall text production (Berninger et al., 2009a, p. 135), raising issues about how translation of thought to the graphic mark works in adults and in children. To some adults, it keeps pace with fast thinking; for others who need to ponder and revise simultaneously, writing bursts and pen lifts in handwriting production informs their thinking (Steen in Mangen, 2013, p. 106). With children, although research results have been in favour of typing for severe and medium disabilities (Burns, 2009, p. 179-180; Calhoun, 1985; Healy, 1998, p.287; Kiefer et al., 2015, p. 144; MacArthur & Shneiderman, 1986), pupils who encounter problems with handwriting also do so with keyboarding (Berninger et al., 2009a, p. 70, p.137). This moves the issue to the thought processes of language and visuomotor functions that interact with the writing medium, and not the writing medium *per se* (Mangen & Belsvik, 2016, p. 7). Indeed, because earlier comparative research was conducted on the assumption that the ease of type-touching wouldn't demand instruction, as handwriting does, the former was found cognitively superior to keyboarding, possibly as a result of integrated prior experience with a writing mode in those experiments (Connelly et al., 2007; Kiefer et al., 2015, p. 144; Wollscheid et al., 2016, p.27). Recent research has shown no significant differences between the two when the young participants have received equal instruction time (Stainthorp, 1997;

Ouelette & Tims, 2014) but these findings need replicating. Keyboarding retrieves the legibility of a printed text and re-integrates symbols, but even with personalized fonts, the individuality of the human mark is lost, as the customized letters lack the personalized variability of handwriting.

Touchscreen interfaces seem to re-establish the value of mark-making and the behavioural and aesthetic benefits of pen-and-paper writing (Annett et al., 2014, p. 193). They unify the visuomotor surface and the eye-hand continuum, although the stylus (which children prefer to touchtyping or tracing, in McKnight & Cassidy, 2010, p. 14-15), requires a different grip than the pencil, and the haptic affordances of the screen provide subtle (Crescenzi et al., 2014, p. 92-93; Mangen & Balsvik, 2016, p. 6) yet importantly different feedback, especially resistive screens that require a stylus (McKnight & Cassidy, 2010, p. 2; Valderrama et al., 2013, p. 171). They alter the “kinetic and acoustic melody” (Chemin, 2014; Lurija and Oschner in Mangen & Velay, 2010, p. 391) of traditional writing while they ostensibly preserve its individuality. Although the research for early education is still scant, it is, however, a growing sub-field, though under the theoretical perspective of New Literacies (Kalantzis et al., 2010). Results show that children are engaged and motivated into producing a blended form of writing with drawing, called “inking” (Annett et al., 2014, p. 193) with increased repertoire of haptic behaviours compared to finger drawing (Crescenzi et al. 2014, p. 92), and creatively applying apps in their multimodal texts, which they can share with friends and families online (Couse & Chen, 2010). Introducing technological novelties with their playful potential is a welcome change to pupils (McKnight & Cassidy, 2010, p.10); it would be interesting, however, to research the educational value of iPads in classes where touchscreens have become the norm. Another parameter that diminishes reliability is the degree of teacher enthusiasm toward

technological innovations in the classroom (Karsenti & Collin, 2013, p. 114).

The history of writing is more symbiotic than transitory (Fischer, 2008). In contemporary educational systems there is scope to make use of an innate ability, which has shaped human cognition during thousands of years and encapsulates millions of years of tool-making and hand-brain connectivity (Wilson, 1998), let alone relates us visually, kinetically and aesthetically with our ancestors' writings (Burns, 2009, p. 154; Prince Edward Island, Guidelines for handwriting instruction, 2012, p.4). More so, because trends like embodied learning and mindfulness in schooling are already natural gifts of manuscript. By opting for abstract scripts that exclude handwriting, we choose to alter our brains in deep and unknown ways (Kress, 2003, p. 1; Mangen & Balsvik, 2016, p. 6; Vygotsky, 1962; Chandler, 1995, p. 159); in children it may affect the way they perceive written language (Velay & Longcamp, 2010, p. 463). Are we prepared to conduct a large-scale experiment with millennials (Kirgorian in Honan, 2013) or does a writing (r)evolution paradoxically include the old pen-and-paper instruction as a planned symbiosis with digital writing (Dinehart, 2014, p. 10; Fortunati & Vincent, 2013; Mangen & B, 2016, p. 7; Neumann & Neumann, 2014, p.13-14; Sassoon, 2007, p. 151; Zubrzycki, 2012)? In some democracies, educational policy is as much a matter of the learned few, as it is of agents from the informed public that manifest a growing awareness of what is lost and what is gained from the writing transition, as attested in social media. It will take courage for policy-makers to rethink one-sided writing practices for a balanced approach to early literacy skills.

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