Introduction to the special issue on Written Language Learning

Eva Commissaire, Elisabeth Demont, Anne-Sophie Besse

► To cite this version:

Eva Commissaire, Elisabeth Demont, Anne-Sophie Besse. Introduction to the special issue on Written Language Learning. *European Review of Applied Psychology / Revue Européenne de Psychologie Appliquée*, 2020, 70 (1), pp.100526. 10.1016/j.erap.2020.100526 . hal-02934987

HAL Id: hal-02934987

<https://hal.science/hal-02934987>

Submitted on 9 Sep 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Introduction to the special issue on Written Language Learning

Introduction au numéro spécial sur l'apprentissage du langage écrit

This special issue deals with the learning of written language and encompasses four scientific papers written by researchers working in the French language. This body of research hopefully reflects the scientific dynamics in the field of psycholinguistics in France; it also tackles current scientific issues addressed in the international literature while considering their educational applications.

Written language learning including reading and spelling or, in other words, perception/comprehension and production, is a long and effortful process that begins as early as 4–5 years old when Kindergarten children start to learn letters (i.e., their names, sounds, visual shapes and the motor act corresponding to their writing) and develop metalinguistic awareness (activities of reflection on language and its use and ability to control and plan one's own language processing; [Gombert, 1990](#)); yet, written language learning is in fact a lifelong phenomenon as some high-level components such as text reading and writing, and vocabulary and orthographic learning continue to evolve through adults' experiences (e.g., academic training) or ecological situations such as exposures to written materials (e.g., through reading).

More, written language learning is considered multidimensional as it involves a diversity of components which are known to be partly interdependent, leading to relevant implications for considering and planning teaching and learning. For example, reading and spelling influence each other during the early steps of literacy acquisition ([Abbott, Berninger, & Fayol, 2010](#); [Cataldo & Ellis, 1988](#)) and involve, at least partly, the same underlying skills such as phonological awareness ([Dębska et al., 2019](#); [Ritchey, 2008](#)) but also letter and orthographic knowledge ([Berninger et al., 1992](#); [Ecalte & Magnan, 2010](#); [Muter, Hulme, Snowling, & Taylor, 1998](#)). More specifically, theoretical frameworks such as the “simple view of reading” ([Gough & Tunmer, 1986](#); [Hoover & Gough, 1990](#)) actually assume interdependence among sub-components of reading skills; indeed, reading comprehension depends on both global and amodal linguistic comprehension skills but also on word-level identification skills such as accuracy, speed and automaticity. It is noteworthy that the sub-components involved in the production domain also interact with each other, despite much fewer research in the field ([Kiefer et al., 2015](#) on the benefit of handwriting over typewriting trainings on word spelling abilities and [Abbott et al., 2010](#) or [Arfé, Dockrell & de Bernardi, 2016](#) on the relationship between spelling skills and text production).

Another major general issue regarding written language learning relates to that it happens to rely on linguistic-specific skills

([Ziegler & Goswami, 2005](#) on phonological awareness) but also on more general cognitive skills ([Gathercole & Baddeley, 1993](#) and [Altemeier, Abbott, & Berninger, 2008](#) on the role of working memory and executive functions, respectively, during literacy acquisition), learning mechanisms (e.g., [Spencer, Kaschak, Jones, & Lonigan, 2015](#) on the relationship between statistical learning and early literacy), and metacognition ([Smith, Borkowski, & Whitman, 2008](#) on the impact of self-regulation on reading acquisition; [Cordewener, Hasselman, Verhoeven, & Bosman, 2018](#) on “spelling consciousness”). It therefore implies to determine the extent to which a whole set of cognitive-linguistic abilities predict written language learning. To this end, the correlational approach has been much favored and has triggered an extensive set of empirical studies in the last twenty years regarding the predictors of successful literacy acquisition ([Verhoeven & Perfetti, 2017](#)). Furthermore, the experimental approach, rather complementary, enables to more directly manipulate some of the factors that could influence this learning and thus catches the conditions that favor these learning dynamics. With this in mind, more direct testing of the effectiveness of intervention programs to promote literacy acquisition are needed and will help provide pedagogical support to teachers, from Kindergarten to higher education.

The first two scientific papers of this special issue more particularly address the acquisition of reading skills; both present an intervention program, either to help develop early literacy in Kindergarten ([Labat, Boisson, Brunel, Ecalte, Versace, & Magnan, in press](#)) or to improve decoding skills and reading fluency of readers with difficulties in elementary school ([Gallet, Viriot-Goeldel, & Leclercq, in press](#)). A wealth of research from the 1980's has uncovered two major skills that predict successful reading and spelling acquisition, namely phonological awareness and letter knowledge ([Caravolas, Hulme, & Snowling, 2001](#); [Ehri et al., 2001](#); [Foulin, 2005](#)). While most interventions studies targeting the learning or improvement of early literacy promoted the explicit instruction of letters and of grapheme-to-phoneme correspondences (GPCs; [Ecalte, Gomes, Auphan, Cros, & Magnan, 2019](#); see [Ehri et al., 2001](#) and [Piasta & Wagner, 2010](#) for meta-analyses), very few studies attempted to examine whether this knowledge can be acquired through implicit learning defined as “an adaptive mode in which children's behavior becomes sensitive to the structural features of an experienced situation, without the adaptation being due to an intentional exploitation of some pieces of explicit knowledge about these features” ([Vinter & Perruchet, 2000](#), p. 1223) despite

major evidence of the relevance and impact of such mechanism in the field of orthographic learning (Pacton, Perruchet, Fayol, & Cleeremans, 2001), vocabulary learning in adults, in the first language (Godfroid et al., 2017) or in a foreign one (Bisson, van Heuven, Conklin, & Tunney, 2013), and, more generally, in the field of oral language acquisition (Reber, 1993). In the first paper of this issue, Hélène Labat and her colleagues showed that implicit exposure to grapheme-to-phoneme correspondences (GPCs) significantly increased GPC knowledge but not decoding abilities in 5-year-old French children (Experiment 1). The authors also showed that an implicit training to GPCs that included a motor experience (through the tracing of the letter with a finger) led to better GPC knowledge but also decoding abilities, compared to a similar training without a motor experience (Experiment 2), adding evidence for the benefits of a haptic exploration in the integration of multi-sensory representations when learning in educational settings (Bara, Gentaz, Colé, & Sprenger-Charolles, 2004; Longcamp, Zerbato-Poudou, & Velay, 2005; Kiefer & Trumpp, 2012 and James, 2017 for synthesis); this finding also highlights the possibility that such benefit can be observed in the context of implicit learning, a mechanism described in the Act-In theoretical model by Versace et al. (2014).

While early literacy strongly depends on the understanding of the alphabetic principle, on metaphonological skills, and letter and GPC knowledge, developing readers also progressively need to develop lexical orthographic representations to achieve “sight word reading” (Ehri, 2014) and use a more direct route during reading aloud or silently (see the Dual Route model approach by DRC, Coltheart, Rastle, Perry, & Ziegler, 2001). Further literacy improvement thus involves that readers develop fluent and automatized reading, that will free up attentional resources for more high-level processes such as comprehension, an assumption in line with the “simple view of reading” (Gough & Tunmer, 1986). While some readers may struggle with decoding skills, others later encounter difficulties with the automation of reading and need training on reading fluency. This is the research topic addressed in the second paper of this special issue by Corinne Gallet and her colleagues who created, implemented and assessed a reading remediation program for elementary students with various difficulties. The authors looked at a wide range of reading profiles, recruiting children in grades 2 to 5 and having difficulty decoding and/or reading fluently; they developed an ecological intervention procedure that included grapho-syllabic training and repeated-reading exercises to improve decoding skills and reading fluency, respectively. Note that, if knowledge of small reading units such as letters or graphemes are decisive to grasp the alphabetic system and establish the orthographic-to-phonological mappings (Apel, Wolter, & Masterson, 2006), other larger units such as syllables may be especially important in French (Colé, Magnan, & Grainger, 1999; Maionchi-Pino, Magnan, & Ecalle, 2010). Training implied group-based remedial sessions conducted by participants’ teachers throughout the whole school year, which were designed to be short, intensive, and very frequent (20 minutes 2–3 times per week). The authors showed that children attending this remediation program were less likely to have reading difficulties at the end of the school year compared to the control group with no intervention.

This special issue also includes two papers on adult written language processing, one by Chaves, Ginestet and Bosse (in press) on orthographic learning and the next by Escorcía and Gimenes (in press) on writing planning. Both teams of researchers interestingly addressed the links between specific linguistic processes and more general cognitive and metacognitive processes. As previously pointed out, developing readers acquire GPC knowledge that enables them to decode newly encountered words, and rapidly construct a lexicon that contains the orthographic representations of these words. While one major theoretical model, the self-teaching hypothesis of orthographic learning developed by Share (1995)

suggests that the ability to decode new words is the main predictor of their orthographic learning (Cunningham, 2006; Nation, Angell, & Castles, 2007), other skills relating to visuo-attentional processes could also be implied in such orthographic learning ability. This would explain why, despite major interdependence between reading and spelling skills (Abbott et al., 2010), not all good readers are good spellers (and reciprocally, Fayol, Zorman, & Lété, 2009). In adults who have achieved successful reading skills, sources of variance in orthographic learning beyond that of decoding are particularly important to uncover given the lifelong exposure to novel words. In the third paper of this special issue, Nathalie Chaves et al. examined whether simultaneous visual processing that relates to the possibility to simultaneously process a large number of distinct elements at a glance (Bosse, Tainturier, & Valdois, 2007) has an impact on the learning of lexical orthographic new forms in French adults. In two experiments, participants had to briefly read disyllabic pseudowords displayed in either a simultaneous reading condition (SIM) in which all letters were displayed simultaneously for 200 ms, or in a sequential reading condition (SEQ) in which the two syllables of the pseudowords were presented in a sequential manner. Orthographic learning was tested via spelling dictation and an orthographic choice task. Overall, results showed an advantage of the SIM condition in spelling accuracy and orthographic choice performance, confirming similar studies with children (Bosse, Chaves, Largy, & Valdois, 2015) and the relevance of the “visual attention span” in learning to read, a conceptually related variable whose specific role in developmental dyslexia, beyond phonological deficits, has now been acknowledged (Valdois et al., 2003).

Finally, the relationship between metacognition and writing is raised in the fourth paper of this special issue. Writing is a highly cognitive demanding process that implies many different sub-components including reading (when revising the text that was produced), and accurate spelling of words (during the generation of the text) but also one preliminary process referred to as planning—all processes being involved in a dynamic fashion (Hayes, 2012). In this paper, Dyanne Escorcía and Manuel Gimenes (2019) describe the construction and validation of a tool referred to as the Metacognitive Components of Planning Writing Inventory (MCPW-I), to measure metacognitive processes involved in the planning of writing, and known to relate to writing performances and their improvement when trained (Harris, Graham, Brindle, & Sandmel, 2009). Indeed, written text production involves many processes among which planning plays a key role. Planning involves two main sub-processes: generating content that has to do with identifying, selecting, making decisions about the content of the text, and organizing ideas (Hayes, 2012; Kellogg, 2008), both of which require cognitive but also metacognitive mechanisms (Harris et al., 2009). Among the latter, three components were of interest to the authors: metacognitive conditional knowledge (MCK, knowledge about the conditions and requirements of the tasks, involving the use of specific strategies when writing), covert self-regulation (CSR, which aims to adjust cognitive and affective strategies to improve the writing, such as changing self-evaluation standards) and environmental self-regulation (ESR, that involves the modification of the context of writing, such as seeking help). The self-reported questionnaire, which was filled in by 1st and 3rd grades University students from diverse academic backgrounds, comprised a final set of 15 items and a three-factor internal structure, two of which correlated with each other. It had relatively good psychometric properties such as convergent validity (with the planning subtests of the WSQ2 inventory), test-retest reliability and good predictive validity of the actual writing performances of the participants.

To conclude, this set of scientific papers raises very relevant issues regarding applications in educational settings and sheds some light on innovative approaches to improve written language learning. Indeed, while explicit teaching of print-to-sound

correspondences along with reading fluency training remain very efficient tools for improving literacy, especially for poor readers (Gallet et al., in press), that some linguistic knowledge can also be acquired implicitly, that is with attention but without intention (Labat et al., in press), opens up opportunities for developing a variety of teaching tools that would be particularly relevant for some learners with special needs (e.g., with intellectual disability). Favoring learners' metacognition knowledge and regulation also help improve some academic writing skills throughout adulthood, as suggested by Escorcia and Gimenes (in press), and it has interestingly been shown to be relevant for younger children too (Harris et al., 2009). These papers thus interestingly emphasize the relevance of some mechanisms, whose role on written language learning will need to be explicitly communicated to the teaching community. For instance, despite that oral language precedes written language acquisition from both ontogenetic and phylogenetic points of view, hence the major role for abilities related to oral language (e.g., phonological awareness) during literacy acquisition, Chaves et al. (in press) highlighted the role of visual mechanisms during literacy acquisition; this should be further explored through longitudinal and intervention studies. More generally, the importance of multi-sensory integration during written language learning, and in particular of the involvement of motor/haptic explorations of learning materials, will need to be taken into account when considering educational policies on literacy teaching and the way digital innovations are integrated in school curricula for young learners.

Finally, some of these papers also contained important information about how individuals differ from each other. On the one hand, Gallet et al. (in press) highlighted the remedial difficulties of children with low socio-economic status (SES), a finding in line with the latest European and National studies such as PISA (OECD, 2018) and CEDRE (MENESR, 2016); note that this is possibly due to a variety of factors including students' vocabulary, but also environmental variables such as family (e.g., parental support, literacy activities, see Senechal & Lefevre, 2002) or school environments (Noble, McCandliss, & Farah, 2007). On the other hand, Escorcia and Gimenes (2019) observed higher perception of the metacognitive component involved in writing planning in women, a finding in line with previous work on sex differences in the field of language and learning (Clements et al., 2006; Reilly, Neumann, & Andrews, 2019) and which indirectly refers to the issue of the interactions between biological and environmental factors during development (Coates, 2016; Shaywitz et al., 1995). Although further work is needed to understand the mechanisms underlying these interindividual differences (Johnson, Riis, & Noble, 2016 and Wallentin, 2009 for critical reviews on SES and sex differences), this issue is taken seriously by education policy makers, particularly in France (MEN, 2013; MENESR, 2019), who are now promoting differentiated instruction and increase use of prevention programs for at-risk learners to improve literacy for all.

Disclosure of interest

The authors declare that they have no competing interest.

References

- Abbott, R. D., Berninger, V. W., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology*, 102(2), 281–298. <http://dx.doi.org/10.1037/a0019318>
- Altemeier, L. E., Abbott, R. D., & Berninger, V. W. (2008). Executive functions for reading and writing in typical literacy development and dyslexia. *Journal of Clinical and Experimental Neuropsychology*, 30(5), 588–606. <http://dx.doi.org/10.1080/13803390701562818>
- Apel, K., Wolter, J. A., & Masterson, J. J. (2006). Effects of phonotactic and orthotactic probabilities during fast mapping on 5-year-olds' learning to spell. *Developmental Neuropsychology*, 29(1), 21–42. http://dx.doi.org/10.1207/s15326942dn2901_3
- Arfé, B., Dockrell, J. E., & De Bernardi, B. (2016). The effect of language specific factors on early written composition: The role of spelling, oral language and text generation skills in a shallow orthography. *Reading and Writing: An Interdisciplinary Journal*, 29(3), 501–527. <http://dx.doi.org/10.1007/s11145-015-9617-5>
- Bara, F., Gentaz, E., Colé, P., & Sprenger-Charolles, L. (2004). The visuo-haptic and haptic exploration of letters increases the kindergarten children's reading acquisition. *Cognitive Development*, 19(3), 433–449. <http://dx.doi.org/10.1016/j.cogdev.2004.05.003>
- Berninger, V., Yates, C., Cartwright, A., Rutberg, J., Remy, E., & Abbott, R. (1992). Lower-level developmental skills in beginning writing. *Reading and Writing: An Interdisciplinary Journal*, 4, 257–280. <http://dx.doi.org/10.1007/BF01027151>
- Bisson, M.-J., van Heuven, W. J. B., Conklin, K., & Tunney, R. J. (2013). Incidental acquisition of foreign language vocabulary through brief multi-modal exposure. *PLoS ONE*, 8(4), e60912. <http://dx.doi.org/10.1371/journal.pone.0060912>
- Bosse, M.-L., Chaves, N., Largy, P., & Valdois, S. (2015). Orthographic learning during reading: The role of whole-word visual processing. *Journal of Research in Reading*, 38, 141–158. <http://dx.doi.org/10.1111/j.1467-9817.2012.01551.x>
- Bosse, M.-L., Tainturier, M.-J., & Valdois, S. (2007). Developmental dyslexia: The visual attention span hypothesis. *Cognition*, 104(2), 198–230. <http://dx.doi.org/10.1016/j.cognition.2006.05.009>
- Caravolas, M., Hulme, C., & Snowling, M. J. (2001). The foundations of spelling ability: Evidence from a 3-year longitudinal study. *Journal of Memory and Language*, 45(4), 751–774. <http://dx.doi.org/10.1006/jmla.2000.2785>
- Cataldo, S., & Ellis, N. C. (1988). Interactions in the development of spelling, reading and phonological skills. *Journal of Research in Reading*, 11(2), 86–109. <http://dx.doi.org/10.1111/j.1467-9817.1988.tb00153.x>
- Chaves, N., Ginestet, E., & Bosse, M.-L. (in press). Lexical orthographic knowledge acquisition in adults: The whole- word visual processing impact. *European Review of Applied Psychology*. Doi: 10.1016/j.erap.2019.100520.
- Clements, A. M., Rimrodt, S. L., Abel, J. R., Blankner, J. G., Mostofsky, S. H., Pekar, J. J., et al. (2006). Sex differences in cerebral laterality of language and visuospatial processing. *Brain and Language*, 98, 150–158. <http://dx.doi.org/10.1016/j.bandl.2006.04.007>
- Coates, J. (2016). *Women, men and language: A sociolinguistic account of gender differences in language*. London: Routledge.
- Colé, P., Magnan, A., & Grainger, J. (1999). Syllable-sized units in visual word recognition: Evidence from skilled and beginning readers. *Applied Psycholinguistics*, 20, 507–532. <http://dx.doi.org/10.1017/S0142716499004038>
- Coltheart, M., Rastle, K., Perry, C., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition. *Psychological Review*, 108(1), 204–256. <http://dx.doi.org/10.1037/0033-295X.108.1.204>
- Cordewener, K. A. H., Hasselman, F., Verhoeven, L., & Bosman, A. M. T. (2018). The role of instruction for spelling performance and spelling consciousness. *Journal of Experimental Education*, 86(2), 135–153. <http://dx.doi.org/10.1080/00220973.2017.1315711>
- Cunningham, A. E. (2006). Accounting for children's orthographic learning while reading text: Do children self-teach? *Journal of Experimental Child Psychology*, 95, 56–77. <http://dx.doi.org/10.1016/j.jecp.2006.03.008>
- Dębska, A., Chyl, K., Dzięgiel, G., Kacprzak, A., Łuniewska, M., Plewko, J., et al. (2019). Reading and spelling skills are differentially related to phonological processing: Behavioral and fMRI study. *Developmental Cognitive Neuroscience*, 39, 100683. <http://dx.doi.org/10.1016/j.dcn.2019.100683>
- Ecalte, J., & Magnan, A. (2010). *(Learning to read and its difficulties) L'apprentissage de la lecture et ses difficultés*. Paris: Dunod.
- Ecalte, J., Gomes, C., Auphan, P., Cros, L., & Magnan, A. (2019). Effects of policy and educational interventions intended to reduce difficulties in literacy skills in Grade 1. *Studies in Educational Evaluation*, 61, 12–20. <http://dx.doi.org/10.1016/j.stueduc.2019.02.001>
- Escorcia, D., & Gimenes, M. (in press). Metacognitive components of writing: construction and validation of the Metacognitive Components of Planning Writing Self-inventory (MCPW-I). *European Review of Applied Psychology*. Doi: 10.1016/j.erap.2019.100515.
- Ehri, L. C. (2014). Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning. *Scientific Studies of Reading*, 18(1), 5–21. <http://dx.doi.org/10.1080/10888438.2013.819356>
- Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly*, 36(3), 250–287. <http://dx.doi.org/10.1598/RRQ.36.3.2>
- Fayol, M., Zorman, M., & Lété, B. (2009). Associations and dissociations in reading and spelling French. Unexpectedly poor and good spellers. *British Journal of Educational Psychology*, 6, 63–75. <http://dx.doi.org/10.1348/000709909X421973>
- Foulin, J.-N. (2005). Why is letter-name knowledge such a good predictor of learning to read. *Reading and Writing: An Interdisciplinary Journal*, 18, 129–155. <http://dx.doi.org/10.1007/s11145-004-5892-2>
- Gallet, C., Viriot-Goeldel, C., & Leclercq, V. (in press). Effects of an early reading intervention based on grapho- syllabic decoding and fluency training in French elementary schools. *European Review of Applied Psychology*. Doi: 10.1016/j.erap.2019.100471.
- Gathercole, S. E., & Baddeley, A. D. (1993). *Working memory and language*. Hillsdale: Erlbaum.
- Godfroid, A., Ahn, J., Choi, I., Ballard, L., Cui, Y., Johnston, S., et al. (2017). Incidental vocabulary learning in a natural reading context: An

- eye-tracking study. *Bilingualism: Language and Cognition*, 21, 563–584. <http://dx.doi.org/10.1017/S1366728917000219>
- Gombert, J.-E. (1990). (*Metalinguistic development*) *Le Développement métalinguistique*. Paris: Presses Universitaires de France.
- Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education*, 7, 6–10. <http://dx.doi.org/10.1177/074193258600700104>
- Harris, K. R., Graham, S., Brindle, M., & Sandmel, K. (2009). *Metacognition and children's writing*. In D. Hacker, J. Dunlosky, & A. Graesser (Eds.), *Handbook of metacognition in education* (pp. 131–153). Mahwah, NJ: Erlbaum.
- Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication*, 29(3), 369–388. <http://dx.doi.org/10.1177/0741088312451260>
- Hoover, W., & Gough, P. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal*, 2, 127–160. <http://dx.doi.org/10.1007/BF00401799>
- James, K. H. (2017). The importance of handwriting experience on the development of the literate brain. *Current Directions in Psychological Science*, 26(6), 502–508. <http://dx.doi.org/10.1177/0963721417709821>
- Johnson, S. B., Riis, J. L., & Noble, K. G. (2016). State of the art review: Poverty and the developing brain. *Pediatrics*, 137(4). <http://dx.doi.org/10.1542/peds.2015-3075>
- Kellogg, R. T. (2008). Training writing skills: A cognitive developmental perspective. *Journal of Writing Research*, 1, 1–26. <http://dx.doi.org/10.17239/jowr-2008.01.01.1>
- Kiefer, M., & Trumpp, N. M. (2012). Embodiment theory and education: The foundations of cognition in perception and action. *Trends in Neuroscience and Education*, 1, 15–20. <http://dx.doi.org/10.1016/j.tine.2012.07.002>
- Kiefer, M., Schuler, S., Mayer, C., Trumpp, N. M., Hille, K., & Sachse, S. (2015). Handwriting or typewriting? The influence of pen- or keyboard-based writing training on reading and writing performance in preschool children. *Advances in Cognitive Psychology*, 11(4), 136–146. <http://dx.doi.org/10.5709/acp-0178-7>
- Labat, H., Boisson, A., Brunel, L., Ecalle, J., Versace, R., & Magnan, A. (in press). Multisensory letter integration and implicit learning of reading with 5 year-old children. *European Review of Applied Psychology*. Doi: 10.1016/j.erap.2019.100477.
- Longcamp, M., Zerbato-Poudou, M. T., & Velay, J.-L. (2005). The influence of writing practice on letter recognition in preschool children: A comparison between handwriting and typing. *Acta Psychologica*, 119(1), 67–79. <http://dx.doi.org/10.1016/j.actpsy.2004.10.019>
- Maionchi-Pino, N., Magnan, A., & Ecalle, J. (2010). Syllable frequency and word frequency effects in visual word recognition: Evidence from a developmental approach in French children. *Journal of Applied Developmental Psychology*, 31, 70–82. <http://dx.doi.org/10.1016/j.appdev.2009.08.003>
- Ministère de l'Éducation Nationale-Direction de l'évaluation de la prospective et de la performance. (2013). (*Priority education-State of play*) L'éducation prioritaire-État des lieux. https://www.cache.media.education.gouv.fr/file/2019/73/2/depp-2019-filles-et-garcons_1089732.pdf
- Ministère de l'Éducation Nationale, de l'Enseignement supérieur et de la Recherche-Direction de l'évaluation, de la prospective et de la performance. (2019). (*Girls and boys on the road to equality, from school to higher education*) Filles et garçons sur le chemin de l'égalité, de l'école à l'enseignement supérieur. https://www.cache.media.education.gouv.fr/file/2019/73/2/depp-2019-filles-et-garcons_1089732.pdf
- Ministère de l'Éducation Nationale, de l'Enseignement supérieur et de la Recherche-Direction de l'évaluation, de la prospective et de la performance. (2016). (*Language proficiency at the end of school: the gap is widening between girls and boys*) CEDRE 2003-2009-2015. Maîtrise de la langue en fin d'école : L'écart se creuse entre filles et garçons. https://cache.media.education.gouv.fr/file/2016/90/1/depp-ni-2016-20-cedre-2015-ecole_604901.pdf
- Muter, V., Hulme, C., Snowling, M., & Taylor, S. (1998). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of Experimental Child Psychology*, 71, 3–27. <http://dx.doi.org/10.1006/jecp.1998.2453>
- Nation, K., Angell, P., & Castles, A. (2007). Orthographic learning via self-teaching in children learning to read English: Effects of exposure, durability, and context. *Journal of Experimental Child Psychology*, 96, 71–84. <http://dx.doi.org/10.1016/j.jecp.2006.06.004>
- Noble, K. G., McCandliss, B. D., & Farah, M. J. (2007). Socioeconomic gradients predict individual differences in neurocognitive abilities. *Developmental Science*, 10(4), 464–480. <http://dx.doi.org/10.1111/j.1467-7687.2007.00600.x>
- OECD. (2018). PISA 2015 Results in focus. <http://www.oecd.org/pisa>
- Pacton, S., Perruchet, P., Fayol, M., & Cleeremans, A. (2001). Implicit learning out of the lab: The case of orthographic regularities. *Journal of Experimental Psychology: General*, 130(3), 401–426. <http://dx.doi.org/10.1037/0096-3445.130.3.401>
- Piasta, S. B., & Wagner, R. K. (2010). Developing early literacy skills: A meta-analysis of alphabet learning and instruction. *Reading Research Quarterly*, 45, 8–38. <http://dx.doi.org/10.1598/RRQ.45.1.2>
- Reber, A. S. (1993). *Implicit learning and tacit knowledge: An essay on the cognitive unconscious*. NY: Oxford University Press.
- Reilly, D., Neumann, D. L., & Andrews, G. (2019). Gender differences in reading and writing achievement: Evidence From the National Assessment of Educational Progress (NAEP). *American Psychologist*, 74(4), 445–458. <http://dx.doi.org/10.1037/amp0000356>
- Ritchey, K. D. (2008). The building blocks of writing: Learning to write letters and spell words. *Reading and Writing*, 21, 27–47. <http://dx.doi.org/10.1007/s11145-007-9063-0>
- Senchal, M., & Lefevre, J. (2002). Parental involvement in the development of child's reading skill: A five-year longitudinal study. *Child development*, 73(2), 445–460. <http://dx.doi.org/10.1111/1467-8624.00417>
- Share, D. L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition*, 55, 151–218. [http://dx.doi.org/10.1016/0010-0277\(94\)00645-2](http://dx.doi.org/10.1016/0010-0277(94)00645-2)
- Shaywitz, B. A., Shaywitz, S. E., Pugh, K. R., Constable, R. T., Skudlarski, P., Fulbright, R. K., et al. (1995). Sex differences in the functional organization of the brain for language. *Nature*, 373, 607–609. <http://dx.doi.org/10.1038/373607a0>
- Smith, L. E., Borkowski, J. G., & Whitman, T. L. (2008). From reading readiness to reading competence: The role of self-regulation in at-risk children. *Scientific Studies of Reading*, 12, 131–152. <http://dx.doi.org/10.1080/1088430801917167>
- Spencer, M., Kaschak, M. P., Jones, J. L., & Lonigan, C. J. (2015). Statistical learning is related to early literacy-related skills. *Reading and Writing: An Interdisciplinary Journal*, 28(4), 467–490. <http://dx.doi.org/10.1007/s11145-014-9533-0>
- Valdois, S., Bosse, M.-L., Ans, B., Zorman, M., Carbonnel, S., David, D., et al. (2003). Phonological and visual processing deficits are dissociated in developmental dyslexia: Evidence from two case studies. *Reading and Writing*, 16, 543–572. <http://dx.doi.org/10.1023/A:1025501406971>
- Verhoeven, L., & Perfetti, C. (2017). *Learning to read across languages and writing systems*. Cambridge: Cambridge University Press.
- Versace, R., Vallet, G. T., Riou, B., Lesourd, M., Labeye, É., & Brunel, L. (2014). Act-In: An integrated view of memory mechanisms. *Journal of Cognitive Psychology*, 26(3), 280–306. <http://dx.doi.org/10.1080/20445911.2014.892113>
- Vinter, A., & Perruchet, P. (2000). Implicit learning in children is not related to age: Evidence from drawing behavior. *Child Development*, 71(5), 1223–1240. <http://dx.doi.org/10.1111/1467-8624.00225>
- Wallentin, M. (2009). Putative sex differences in verbal abilities and language cortex: A critical review. *Brain Language*, 108, 175–183. <http://dx.doi.org/10.1016/j.bandl.2008.07.001>
- Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin*, 131, 3–29. <http://dx.doi.org/10.1037/0033-2909.131.1.3>

E. Commissaire *

E. Demont

A.-S. Besse

Laboratoire de psychologie des cognitions
(LPC-EA4440), faculté de psychologie, université de
Strasbourg, 12, rue Goethe, 67000 Strasbourg, France

* Corresponding author.

E-mail address: commissaire@unistra.fr

(E. Commissaire)

Received 17 November 2019

Received in revised form 21 January 2020

Accepted 22 January 2020