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# FOOTPRINTS FOR THE FUTURE: COGNITION, LITERACY AND SECOND LANGUAGE LEARNING BY ADULTS

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## Abstract

In this chapter we try to understand why second language (L2) and literacy acquisition seems to be so hard and time-consuming for adults who never went to school as children. We combine earlier and recent research on the relationships between literacy and cognition, and empirical data from L2 literacy acquisition and classroom practices. The historical review of the literacy and cognition debate shows that the initial view that literacy changes the way cognition operates was at first judged as grossly overestimated, while the latest neuropsychological studies do seem to suggest an impact of literacy on language and information processing. The available classroom research reveals that unschooled L2 learners progress at a slower pace and achieve lower levels of proficiency than schooled L2 learners, but also that tailored and contextualized teaching are strong predictors of success. This suggests a continuum ranging from concrete semantic-pragmatic embodied processing of language and information to abstract, symbolic processing at the other end, the latter being related to literacy and learning in school contexts.

Two general implications for the future are formulated: multisensory integration by using TELL systems and refocusing on literacy first to facilitate the cognitive language processing strategies that are so badly needed for enhancing L2 acquisition.

**Keywords:** literacy, (situated) cognition, (language) processing, multisensory

## 1. Introduction

Learning to read and write and learning a new, additional language at the same time is disproportionately hard for adults who seldom or never went to school as children. This particular problem has been a consistent focus of all LESSLA

conferences. It was a core issue at the 10th LESLLA conference at Radboud University, Nijmegen: What is the relationship between literacy, cognition and second language acquisition, in non- and low-educated adults? In this chapter we seek to connect research and classroom practice, by reviewing both earlier and more recent research outcomes and by highlighting recurrent observations and empirical data from classroom practice and relating them to each other. We shall begin with a historical overview of the way the relationship between literacy and cognition has been interpreted, starting in the 1960s. A series of well-known publications on the orality-literacy distinction addressed the pervasive consequences of literacy, not just for society (philogenesis), but also the individual mind (ontogenesis). Does literacy decisively change the way cognition operates? The answers in the sixties were affirmative, arguing that the holistic ear was replaced and succeeded by the analytic eye, the overall interpretation being summarized under the umbrella of the literacy hypothesis. Nevertheless, the arguments were not strong enough to prevent the reopening of the debate on the cognitive consequences of literacy in the eighties and nineties, leading to the conclusion that the impact of literacy on cognition was heavily overestimated. The line of thought taken at that time was that literacy and cognition are largely independent paths of development, but it remains a fundamental problem that it is hard to disentangle the impact of language development, cognitive development and literacy in research on young children.

Adults who are totally unschooled may provide a crucial source of information for estimating the impact of literacy. With the arrival of migrants and refugees, new groups of nonliterate adults entered western educational systems. The proceedings of the past ten LESLLA conferences amply demonstrated the many learning challenges they have in simultaneously becoming literate and acquiring the new language of their host country. We shall review the available classroom research, showing that, in general, unschooled second language (L2) learners progress at a much slower pace and achieve lower levels of proficiency than schooled L2 learners. They have fewer metalinguistic skills, a conclusion which takes us back to the relationship between literacy and cognition. The first decade of the new millennium brought new (neuro)psychological studies with new research methodologies for unschooled adult L2 learners. The conclusion to be drawn from these is that the eye is not replacing or succeeding the ear but that both sensory systems cooperate and converge in the processing of linguistic information in the brain. This leads to a continuum ranging from concrete semantic-pragmatic embodied processing of language and information to abstract, symbolic processing at the other end, the latter being related to literacy and learning in school contexts.

The classroom observation and research findings seem to make clear what their footprints for the future are: we are beginning to understand why second language and literacy acquisition for LESSLA groups take such a large amount of time. We also need to translate this knowledge into its implications for the educational system, in addition to and in combination with a transparent agenda of continuing research. We shall finally outline two general implications for the future: multisensory integration by using TELL<sup>1</sup> systems and refocusing on L1 literacy first, to facilitate the use of the cognitive language processing strategies that are so badly needed for enhancing L2 acquisition.

## 2. An eye for an ear: Literacy and cognition in the sixties

### 2.1. The swinging sixties

The early 1960s witnessed the start of a passionate debate on the impact of literacy on cognition. Over the space of a few years, several now well-known publications appeared about what would be portrayed as the 'orality-literacy' debate: *La pensée sauvage* by Levi-Strauss (1962), *The Gutenberg Galaxy* by McLuhan (1962), *Preface to Plato* by Havelock (1963) and *The Consequences of Literacy* by Goody and Watt (1963). All authors (and later also Ong 1977; 1982) presumed that the invention of the alphabet and the use of written language had brought about major, decisive changes in human cognition and led to the birth of modern, rational thought.

Levi-Strauss (1962) investigated the structure of myths, symbols and narratives in oral societies; the concrete, sensual ways of thinking in these societies contrasted with the abstract, formal ways of thinking in literate societies. McLuhan (1962) argued that the printing press had strengthened what had already started with the invention of the alphabet. He contended that reading silently instead of the usual reading aloud radically changed reading from an holistic and oral into a linear and analytic visual activity. This shift would have been impossible without the invention of the alphabet: "by the meaningless sign linked to the meaningless sound we have built the shape and meaning of Western man" (1962: 50). Havelock ascribed the changes from poetry to prose in Greece to the alphabetic script and Goody and Watt referred to the permanent character of writing.

Ong (1977; 1982) also presumed that the invention of the alphabetic script and the printing press caused a shift in thinking by replacing the holistic ear with the analytic eye. Because speech could be taken out of its context it became an object of thought and interpretation. All of the above authors were

proponents of the 'literacy hypothesis', which claims that changes in cognition (in individuals and societies at large) over time could be traced back to the invention and use of an alphabetic writing system.<sup>2</sup>

In the 1930s similar ideas about the relationship between literacy and cognition had been formulated in the Soviet Union. Vygotsky (1962; 1976) argued that the development of cognitive functions like memory, abstraction and reasoning was dependent on the type of symbols used. Writing is a secondary symbol system that raises awareness of language as a primary symbol system. Luria (1976) added that reading makes words and verbal relationships an object of consciousness. According to Vygotsky and Luria, this was the main impetus for changes in mental processes.

It is relevant to keep in mind a few core notions of these scholars: the importance of phoneme-based alphabetic writing, the analytic eye instead of the holistic ear, writing as decontextualized language that triggers awareness, and (formal) reasoning as deducing implications from linguistic relationships.

## **2.2. Investigating the literacy hypothesis**

The literacy hypothesis seemed to make sense on the basis of the earliest observations and research results. In the 1930s, Luria (1976) compared unschooled adults with two groups of (low-educated) literates. He expected the nonliterate to use a visual-functional reflection on reality, and the literates to use abstract, verbal and logical thinking. In a sorting task, he asked them to sort geometrical forms like circles and squares of dotted and straight lines. The vast majority of the nonliterate grouped the forms on object features ("these are clocks") or visual features ("these have dots"), the literates on geometrical features ("these are circles"). In a classification task he asked the subjects which words went together in a series, for example, saw, axe, wood and hammer. The nonliterate based their judgment on pragmatic-functional features ("saw, axe and wood belong together"), the literates on categories ("saw, axe and hammer are tools"). In a syllogistic reasoning task ("Cotton grows where it is hot and dry. England is cold and wet. Does cotton grow there?"), the nonliterate were not able to draw conclusions based on the premises in the syllogism. They said that they did not know, as they had never been to England. The literates, by contrast, were able to draw premise-based conclusions. The nonliterate solved problems in a concrete, context-bound way and were influenced more by perceptual and functional features of stimuli than the literates. Around one year of literacy education was apparently sufficient to make the switch to more formal reasoning.

### **2.3. The end of the debate?**

In the 1980s, the literacy hypothesis was gradually losing its strength, due to critical publications and the empirical investigation of, among others, Graff (1979), Street (1984), Finnegan (1988), and particularly Scribner and Cole (1981). Graff (1979) put forward the idea that the social and economic development seen during the 17<sup>th</sup> century in the Western world did not necessarily relate to literacy development and Finnegan (1988) argued that there was no clear-cut distinction between oral and literate discourse.

Scribner and Cole (1981) tested Vygotsky's claim that literacy impacts the cognition of the individual and found an ecologically valid context in Liberia to disentangle the impact of literacy as such from schooling in general. Alongside schooled literates in Arabic or English, there were unschooled literate Vai who had learned informally to read and write the syllabic Vai script. Like Luria (1976), Scribner and Cole used classification, memory and reasoning tasks to compare nonliterate adults with different groups of literates. In none of the tasks did they find systematic differences between the literates and the nonliterate. They concluded that there was no clear evidence for the supposed direct cognitive consequences of literacy, but the consequences could be related to the different literacy practices, such as memorizing sequences (Arabic literates) or talking about proper utterances (Vai literates).

The outcomes of Scribner and Cole's study seemed to mark the end of the debate. In her review, Greenfield (1983: 219) states that Scribner and Cole's book "should rid us once and for all of the ethnocentric and arrogant view that a single technology suffices to create in its users a distinct, let alone superior, set of cognitive processes". Gee (1986: 742) concluded that literacy as such "leads to no higher order global cognitive skills".

### **2.4. Re-opening the debate**

Olson (1994) again took up the thread of the debate about the cognitive consequences of literacy. According to him, McLuhan, Havelock, Ong and Goody & Watt had indeed used tempting metaphors, like 'an eye for an ear', but they did not really spell out how and why writing or the printing press triggered these cognitive effects. Why would the visual modality cause linear thinking or the eye bring about an analytic perspective? Why would writing make language an object of awareness and which specific features of language were involved? Olson exchanged the metaphors for 'operational theses'. He argued that writing raises awareness of those features of language that are represented in the writing system (like phonemes in alphabetic writing) and that

the development of western thought is caused by the fact that a writing system is not very good at exposing the intended meaning of a message/text. If the written text does not present that answer, the reader has to search for the intentions of the author. In that quest Olson saw the heart of the relationship between literacy and changes in cognition: it led to new concepts, like the differences between assertion, intention, supposition or deduction, between literally and metaphorically, or between fact and interpretation.

A huge body of research comparing pre-reading and reading young children confirmed Vygotsky's and Olson's ideas that literacy brings about awareness of those features of language that are presented in the writing system, with phonemic awareness standing out (for overviews see Adams 1990; Bradley & Bryant 1983; Byrne 1998; Ziegler & Goswami 2006). These studies, however, suffer from a methodological problem: in young children it is hard if not impossible to disentangle language development, cognitive development and literacy as possible sources of changes in metalinguistic awareness (Kurvers & Uri 2006).

Adding adults who are totally unschooled to L1 empirical research might have been helpful in disentangling these different sources, but nearly all adults in western countries would have attended school, even if they could not read and write well (cf. Barton 1985; Hamilton & Barton 1983; Scholes 1993; Scholes & Willis 1991; Viise 1996; Worthy & Viise 1996). Their phonological problems could have been the cause of their reading difficulties (rather than it being a consequence of literacy) so they cannot be conflated with 'true' nonliterate. A few exceptions (where nonliterate adults who had not gone to school were used as subjects), were the early studies by Morais et al. (1979) in Portugal: these revealed that nonliterate adults were not aware of sub-lexical units like phonemes. With the arrival of migrants and refugees from Mediterranean and African countries, new groups of unschooled nonliterate adults entered western educational territory. They had to learn to read and write for the first time in their lives in a new language while at the same time learning that language. Research in this area can only make progress if researchers succeed in disentangling literacy from other important learner characteristics that might affect L2 learning and L2 literacy learning (e.g., traumatic past, difficult lives). To that end, we provide an overview of research on unschooled LESLLA learners, focusing respectively on progress, metalinguistic skills and predictors of success.

### **3. Research on LESLLA learners**

The proceedings of the past ten LESLLA conferences amply testify that practitioners have repeatedly and emphatically asked that special attention be given to the extreme challenges they encountered in teaching unschooled and nonliterate L2 learners compared to literate L2 learners. They pointed to the slower pace in learning, to the difficulties this group had with standard exercises and two-dimensional pictures, to their problems with focusing on linguistic features in L2 learning, to the fact that fluency was hard to achieve and that talking about language kept triggering misunderstandings. These experiences even raised the question whether there might be a critical period for learning to read and write (Young-Scholten & Strom 2006). Researchers began to take up these observations of practitioners.

#### **3.1. Slow pace, low levels**

Kurvers and Van der Zouw's (1990) study revealed that nonliterate adults progressed more slowly in L2 reading compared to low-educated adults who could read in a non-Roman script. A slower development was also found in spelling and writing (Kurvers and Ketelaars (2011)). Gardner, Polyzou and Rampaul (1996) found that progress made by nonliterate (one level in oral and written English), was limited, compared to semi-literate (three/four levels) and high literates (nine levels).

In a large-scale study on 490 LESLLA learners, Condelli and Spruck Wrigley (2006) investigated which factors impacted growth in reading and second language skills. Entrance literacy level did have an impact: the nonliterate students showed hardly any growth in reading comprehension, while students who entered the classroom with basic reading skills showed significant growth.

Kurvers and Stockmann (2009) monitored the learning success of approximately 230 LESLLA students, about half of whom had received no schooling in their home countries. The study investigated how much time these learners had needed (in contact hours) to reach literacy levels A, B or C (see Stockmann 2006). Level C (equivalent to A1 in CEFR levels<sup>3</sup>) was achieved by about 12%, even after attending classes for more than 1200 classroom hours. After an average of 950 classroom hours, the majority of students emerged at or below literacy level A, which signifies competency in the decoding of simple monosyllabic words and very simple short texts. In other words, it took most nonliterate more than two years to be able to read a very simple short text. Kurvers and Van de Craats (2009) found even worse results in analyzing around 700 dossiers of immigrants who failed the literacy element of their Integration

Exam. After an average of 1300 hours' teaching, most of them stalled at a literacy level of reading simple monosyllabic words very slowly. Boon (2014) investigated the word-reading and spelling abilities of around 740 adult literacy learners in East Timor, the majority being L2 learners. About 50% of them could not read the words they had been practising in class. This correlates with Abadzi (2012) who points to the slow word-reading abilities of adults and high rates of falling back into illiteracy revealed in several World Bank evaluations of adult literacy courses.

Warren and Young (forthcoming) reviewed SLA research to investigate the role of L1 literacy in adult L2 acquisition studies. It emerged that most studies were done in the LESLLA domain. Their review revealed that the L1 literacy level had a high impact: low L1 literacy was related to low L2 proficiency in all aspects. Similar results were mentioned by Feldmeier (2008), Gehre and Schuurmans (2014) and Tammelin-Laine (2011).

These studies confirm that achieving the level of fluency needed for comprehension in a second language takes time and is only attained by a small percentage of the unschooled LESLLA learners.

### **3.2. Limited metalinguistic skills**

One of the reasons put forward for this slower pace of learning by the vast majority of unschooled L2 learners is their lack of metalinguistic skills, skills that require awareness of language features. These skills are normally presupposed in L2 teaching. As with most studies on pre-reading children, evidence of lack of phonemic awareness in nonliterate adults was also found in their first, and hence familiar, language (see also Tarone & Bigelow 2005, and Huettig, this volume). Morais, Cary, Alegria and Bertelson (1979) found that adult nonliterate performed much worse in isolating phonemes from spoken words in their L1 than adults who had been attending an adult literacy course. Read, Zhang, Nie and Ding (1986) stressed the importance of an alphabetic script; adult Chinese who had only learned the Chinese script were not able to isolate phonemes, whereas adults who had also learned the alphabetic pinyin script could. Using L1, Kurvers, Van Hout and Vallen (2006) compared 24 pre-reading children, 25 nonliterate adults and 25 low-educated adult readers on metalinguistic tasks such as sentence and word segmentation, word length judgment and rhyming. They found much more significant differences between readers and non-readers (irrespective of age) than between children and adults. A lack of phonemic awareness (of adults without alphabetic literacy) was also found in several other studies (Bertelson, De Gelder, Tfouni & Morais 1989; Holm & Dodd 1996; Lukatela, Carello, Shankweiler & Liberman 1995; Morais,

Bertelson, Cary & Alegria 1986; Reis et al. 2007). Other studies revealed limited awareness of word boundaries in spoken language, for example, in segmenting sentences in words or repeating the last word that was said (Homer 2009; Kurvers 2002; Kurvers, Van Hout & Vallen 2007; Onderdelinden, Van de Craats & Kurvers 2008; Rachmandra & Karanth 2007). In most of these studies even low educated readers significantly outperformed nonliterate in various phonemic and lexical awareness tasks, while an awareness of syllables and rhyme revealed less clear-cut differences between nonliterate and adult readers (Adrian, Alegria & Morais 1995; Kurvers 2002; Morais et al. 1986). This again seems to confirm that literacy brings about an awareness of those linguistic features that are represented in the writing system (such as the representation of phonemes in letters, or the representation of word boundaries in spaces in the alphabetic languages).

Similar findings that point to limited metalinguistic abilities were revealed in studies on the acquisition of oral L2 skills. Tarone, Bigelow and Hansen (2007; 2009) investigated the impact of alphabetic literacy on oral L2 acquisition. Their study revealed a strong impact of literacy on the ability to correctly recall a recast (corrective form of a student's faulty utterance in meaningful interaction), while accuracy of recall was not related to the length of the recast. They also found an impact of literacy on recall of less context-rich questions, and on the use of grammatical markers in oral L2 narratives. Strube (2014) investigated the teaching and learning of oral L2 skills in six groups of unschooled L2 learners. The study revealed that adult literacy learners found considerable difficulty in interpreting oral recasts, and very often did not react at all on oral recasts. Similar results on oral L2 skills are reported in Tarone, Bigelow and Hansen (2007), Van de Craats and Kurvers (2014), Young-Scholten and Naeb (2010).

Young-Scholten and Vainikka (2009) concluded that the unschooled Somali women in their study used hardly any L2 grammatical markers, or at least needed a considerable amount of time to start using them. Van de Craats and Kurvers (2014) asked low-literate learners whether the sentence 'Mother's bike is stolen again' was correct. Several learners replied that this sentence was not correct, for example because "one should not steal the bike of a mother. She needs the bike to bring her children to school". Kurvers (2002) also found grammaticality (L1) judgments given by nonliterate adults to be based on meaning or social convention, not on grammar.

Less research is available on metalinguistic tasks that look at verbal relations in discourse. Tarone, Bigelow and Hansen (2007) identified an impact of literacy in the use of grammatical markers in L2 storytelling. The study of Gardner, Polyzou and Rampaul (1996) revealed that the nonliterate mainly used content words, while the literates used much more words with a grammatical function.

Kurvers (2002) found similar results in the L1: the nonliterate used considerably fewer explicit markers of coherence (such as conjunctions) in telling a well-known folktale than did the low-educated readers.

Whiteside (2008) investigated the problems of five low-educated students in an adult L2 literacy class with different forms of deixis. The interactions in the classroom and the written exercises of the students clearly showed difficulties with deictic references to persons, place, and time or with deictic markers that connected parts of a text. They did not easily find out who was the 'I' in a text, or that 'here' in a text did not refer to the classroom they were sitting in. Markers referring to time in flashbacks and flash forwards were extremely difficult to interpret. Similar observations were presented in Kurvers and Van der Zouw (1990) with learners who confused the "I" in a text with themselves, or time in a text with the real time on their watch. Adult L2 literacy students often answered questions at the end of a text by using their knowledge of the world, not by searching in the text itself.

Although often associated with deductive reasoning, it makes sense to include the syllogism as a metalinguistic task. Ong (1982: 53) defines syllogism as self-contained literate discourse: "The syllogism is thus like a text, fixed, boxed off, isolated". This is nicely illustrated in Luria's observations. When the nonliterate answered that they could only talk about what they had seen, the repeatedly-asked question "but what do my words tell you?" did not trigger a further answer.

As previously stated, Luria (1976) found that nonliterate adults reacted in an experience-based, context-bound manner and literates more in accordance with the relationships among the premises. Scribner and Cole (1981) found a greater impact of schooling on syllogistic reasoning than literacy as such. Kurvers (2002) used similar syllogisms as Scribner and Cole had used: "All women in Markya are married. Fatma is not married. Does Fatma live in Markya?" The nonliterate participants used their own direct experience by answering: "I do not know Fatma", or "We have to ask Fatma." A few nonliterate explicitly used their knowledge of the world in questioning the premise: "It cannot be that there is a country where all women are married" (none of the literates did so). Most of the low-educated readers did use logical relationships among the premises. Counihan (2008) also found that South African nonliterate differed from literates in solving simple syllogisms. In all four studies the unschooled nonliterate tended to base their answers on their own knowledge and experience.

### 3.3. What works?

Up to now, we have mainly looked at studies that revealed results about what did *not* go well with nonliterate adults and in LESLLA classrooms. Some studies, however, investigated which features of instructional practices facilitate learning. Condelli and Spruck Wrigley (2004) reviewed several studies to identify promising interventions to improve adult ESL literacy. The most promising interventions they detected were respectively teaching literacy in the context of the students' daily lives, integrating multimedia into instruction, direct teaching of literacy and language strategies, the use of native language literacy, and connecting oral language skills and literacy. These promising results were by and large confirmed in two empirical studies on what works in LESLLA classrooms in the U.S. and the Netherlands. Condelli and Spruck Wrigley (2006) investigated what works in the LESLLA classroom. Their study revealed that variation in instruction and connecting the teaching 'to the outside', where teachers brought real world materials and examples of students' daily life into their instruction, were strong predictors of growth in basic reading and L2 skills. They also identified a clear and positive impact of using the students' L1 in adult L2 literacy classes.

Kurvers and Stockmann (2009) also found that contextualizing teaching to the daily experiences of the students, the use of the students' L1 as an additional supportive language in the classroom and the use of a portfolio (in which the every-day use of spoken and written language outside the classroom is reported) had a positive impact on success. Other studies also report the importance of using the daily context of the individual learners and the negative impact of 'one size fits all' (Boon 2014; see also Nuwenhoud, this volume; Stockmann 2006; Whiteside 2008;) and the use of the L1 in L2 learning (Feldmeier 2009; Levine 2003; Olshtain et al. this volume; Spruck Wrigley 2005; Young-Scholten 2006;). Condelli and Spruck Wrigley concluded their review by proposing intervention studies and the literacy outcomes they could affect. Several contributions in previous and the current proceedings illustrate how these suggestions have been put into practice.

In sum, the majority of nonliterate adult L2 learners are progressing slowly and reach low literacy and L2 proficiency levels (below A1 CEFR) after much effort; they possess limited metalinguistic skills and are less sensitive to form at all levels of language, including in their L1. These findings are indicative of particular challenges in learning (to read and write in) an L2. The 'accepted' teaching and learning strategies that are common in many classes for higher educated L2 learners do not seem to work well with LESLLA learners.

Connecting the teaching to what is already familiar to the learners (their daily life, use of L1 in instructions and explanations) seems to be promising.

Overall, the empirical findings seem convincing, but the question remains *why*. Why should so many unschooled L2 learners display a slow pace of learning and achieve a low L2 proficiency level compared to matched literates from the same background? It is not plausible that they all lack the potential to learn (many of them simply did not get the chance to attend school). Why is focusing on form, using grammatical markers or solving simple syllogisms so difficult? Metalinguistic skills, after all, should not be confused with intelligence or learning aptitude. These empirical findings bring us back to where we started: the relationship between literacy and cognition.

#### **4. An eye plus an ear: Literacy and cognition revisited**

The first decade of the millennium brought a renewed interest in challenging accepted ideas about the relationship between literacy and cognition. Several (neuro)psychological studies have been using new methodologies in information processing research, including online procedures that directly tap into the processing of language.

Reis and Castro-Caldas (1997) argued that if a skill is not learned early in development, the use of that skill might be limited later in life. They presumed that the processing of lexical-semantic information is acquired spontaneously, while the processing of phonological information might be dependent on the acquisition of reading, by learning to match letters with sounds. They compared 30 nonliterate adults with 30 adults who had learned to read in an adult literacy course. They found significant differences in repeating (nonexisting) pseudo-words, in memorizing pairs of phonologically related words, and in naming fluency based on a formal criterion (e.g., words beginning with *p*). Fewer or no differences were found in repeating existing words, in memorizing semantically related words and in naming fluency based on a semantic category (animals). Nonliterates performed equally well as literates in semantic processing, but were much less adequate in phonological analysis and processing. Similar results on processing phonological information and naming fluency were found in Manly et al. (1999), Ostrosky-Solis, Ardila and Rosselli (1998), Dellatolas et al. (2003) and Kosmidis et al. (2004): no significant differences between nonliterates and literates in tasks based on a semantic criterion (although overall performance was augmented by a greater level of education), but significant differences in tasks based on a formal phonological criterion. Kosmidis et al. (2004) also looked at hemispheric specialization for these processes in 20 literate

and nonliterate adults. Their results revealed that semantic processing strategies were qualitatively the same in both groups, although overall performance was augmented by a greater level of education. The processing of oral information based on phonological characteristics however, was qualitatively different for literates and nonliterates. The effective processing of phonological information turned out to be dependent upon having had a formal (literacy) education. Da Silva et al. (2004) argued that verbal fluency tasks might differ in ecological validity. They compared literate and nonliterate adults on two verbal fluency tasks using different semantic categories: food (supermarkets) and animals. Quantitative analysis revealed no differences between the two literacy groups on the supermarket fluency task but results differed significantly on the animal task. The literates used more clusters (pets, birds etc.) and were faster in completing the task. The results suggest that the principal difference lies not in the working of semantic memory but in its content (reflecting formal education).

These and other studies (also) investigated the processing of visual information, such as naming, recognizing or copying line drawings or abstract figures. Manly et al. (1999) compared neuropsychological test performance among 251 low-educated literate and nonliterate elderly people, about one third of whom were nonliterate. Nonliterates consistently obtained significantly lower scores on measures relating to naming line drawings and the recognition of abstract figures. Ostrosky-Solis, Ardila and Rosselli (1998) compared 64 nonliterate Mexican adults with two barely-schooled control groups. The subjects' ages ranged from 16 to 85 years. The study revealed the significant influence of education in relation to the copying of a figure. Schooling represented a stronger variable than age. In particular, the highest impact identified resulted from the first years of schooling. Similar results on visual recognition of abstract (nonsense) figures were also found by Dellatolas et al. (2003) and Kosmidis et al. (2004).

As for the impact of literacy on working memory, Da Silva et al. (2012) compared 19 adult nonliterate subjects with 19 matched literate controls on verbal and nonverbal working memory. The verbal part stores and rehearses phonological information (as with repeating digits or pseudowords): the nonverbal part temporarily stores visuospatial information. The study revealed that whereas verbal working memory was significantly influenced by literacy, with literates performing better, visual working memory was less affected or not at all.

Ostrosky-Solis and Lozano (2006) reviewed a range of studies on digit span (recall of 2 to 7 numbers) to identify the impact of age, education, and culture. An overall evaluation of 2574 Spanish-speaking subjects showed that the stronger predicting variable sample related to years of education, both for digits

forward and backward. Being able to read and write affects the development and use of working memory abilities that are measured by the digit span task. Similar results were also found by Kurvers and Van de Craats (2007).

Huettig, Singh and Mishra (2011) argue that most of the tasks used in the above-mentioned studies are only partially addressing the (online) implicit processing of language. They used an eye-tracking task in comparing high literates with low-literates (with, on average, two years of schooling). The results revealed that the high literates processed phonological information much faster and more efficiently than the low-literates (see Huettig, this volume).

In sum, adult nonliterates do not seem to differ much from matched literates in tasks that only require semantic processing, in recognizing and recalling known objects and figures, and in processing context-bound and familiar information. They do seem to differ, however, in aspects that are clearly literacy-related: processing phonological information, recalling and remembering pseudowords (see Huettig, this volume), judging word length when semantic information contrasts with phonological information, and in recognizing and reproducing abstract (nonsense) figures.<sup>4</sup>

It is interesting to observe how nicely the outcomes of (neuro)psychological studies and the results of empirical classroom studies seem to converge. Nonliterates can easily process semantic information embedded in a concrete, communicative context, while even those readers who have recently learned to read have additional formal mechanisms available to process spoken language.

Castro-Caldas and Reis (2003: 82) were among the first to offer a neurological explanation for these findings: "The knowledge of reading and writing appears to be a skill that requires the convergence of diverse neural support systems – those responsible for oral language, those responsible for writing, and those involved in visual pattern recognition". The eye and the ear of the sixties are back on stage, but now in simultaneous cooperation. Ardila et al. (2010: 689) conclude that literacy and schooling affect the networks and pathways in the brain used in cognitive processing: "Without written language, our knowledge of the external world is partially limited by immediate sensory information and concrete environmental conditions".

## **5. Situated cognition: Semantic-pragmatic processing of language and information**

All these studies clearly highlight the importance of the role of what is nowadays called *situated cognition* (Kirshner & Whitson 1997; Reder & Davila 2005; Robbins & Aydede 2009). Although theories on situated cognition differ,

most proponents of situated cognition argue that cognitive representations and processes emerge embodied (through the body) and embedded (in interaction with the local context). The symbol 'chair' gets its meaning by the bodily experience of sitting and perceiving objects that allow sitting (Anderson 2003, in Robbins & Aydede 2009). An utterance such as 'it is cold' gets its meaning in a very concrete local context. To explain the transfer to higher cognitive processes, Bereiter (1997) suggests a knowledge continuum with situated cognition at the one end and abstract, symbolic processing at the other. He argues that transfer is about abstracting from specific contexts. In a related way, Davila and Reder (2005) refer to written language that mediates remote contexts and transcends specific individual and local contexts. And although scholars dispute the precise nature of transfer (see Robbins & Aydede 2009), it seems likely that in becoming literate, cognitive processing has to transfer from the concrete extra-linguistic context to the linguistic context (from context to text).

Given this point of view, we can better understand the challenges LESLLA teachers have been describing. The above findings help to explain why nonliterates have difficulties with phonemes and word boundaries, with dealing with linguistic forms separately from the content of the message, with reference and coherence markers in texts, and why they interpret syllogisms not as self-contained packages of information. They enter the classroom relying on well-developed semantic and pragmatic language processing skills in a language and about topics that are familiar to them.

We can also better understand why Warren and Young (forthcoming) noticed a shift in the studies from 'metalinguistic awareness to context'. Most predictors of success in the LESLLA classroom do indeed point in one and the same direction: make use of the semantic-pragmatic information processing that is already familiar to the student. Or, as Whiteside (2008) nicely summarized, "teachers that rely on written input start from the students' weakness; they better start with language that is grounded in the familiar".

## **6. Future steps**

All the outcomes presented seem to converge on explaining why second language and literacy acquisition for LESLLA groups take an excessive amount of time. Studies on situated cognition point to the importance of providing a direct, concrete context in learning in general and on learning to read and write in a new, second language in particular. Becoming literate and learning a new language simultaneously requires the very capacities that are not part of concrete embodied and embedded situated cognition: handling the meaningless

sound (phoneme) and the meaningless sign (the letter) - both secondary symbols, discovering words in the new language that all sound like pseudowords, and the precise wording of sentences plus the use of deictic, grammatical and coherence markers that might have no immediate support from the extralinguistic context. Simultaneously learning to read / write and learning to speak a new language requires scrupulous attention to the precise make-up of words, sentences and texts, both in written and spoken language. These capacities are exactly what is less important in everyday, face-to-face communication about familiar topics.

How can we take LESSLA learners from one side of Bereiter's (1997) continuum (marked by processing information on the basis of situated knowledge) to the other end (marked by processing abstract, symbolic information), when learning to read the alphabetic script presupposes the ability of processing symbols right from the very beginning? Happily, the (neuro)psychological studies and the situated cognition theories both appear to offer us good news: the plasticity of the brain still possesses the capacity to respond to new information. Or, as Kirshner and Whitson (1998: 25) put it: "What is most promising for situated cognition theory about connectionist architectures and related neurological research is the remarkable responsiveness of the cognitive system to external stimuli."

Tarone and Bigelow (2012) identified five important, promising research strands for LESLLA research: (1) the kind of metalinguistic awareness that emergent readers use in SLA; (2) the longitudinal development of LESLLA(A) interlanguage, including the linguistics forms they acquire before, during and after becoming literate; (3) the impact of different forms of corrective feedback on noticing of different linguistics forms by learners with different degrees of print literacy; (4) the social contexts for SLA, and (5) classroom SLA research.

The remarkably high convergence in the LESLLA classrooms studies, the studies on the illiterate brain and on situated cognition clearly shows the importance of these research strands. A key implication for research on the nonliterate LESLLA learner (our focus here) is not to consider these research strands separately, but to search instead for ways of integrating these strands. This is important, since different points of view on the role of cognition seem to go along with different views on research methodology and on what learning is. If, for example, cognition is viewed as originating in the individual mind, learning will more likely be seen as a consequence of providing a learner with new knowledge, to be measured by quantitative methods and tests. If on the other hand, cognition is considered to be situated locally, operating concretely, learning is to be defined as actively participating in a community of practice and

the preferred research methodology will be an ethnographic case study (Hodkinson & Mcleod 2010).

One of the problems that arise here is that LESLLA research cannot avoid investigating formal educational settings, while situated cognition researchers often prefer out-of-school communities of practice to study 'true' learning (Kirshner & Whitson 1997). Another problem is that research on learning to read and write in an alphabetic script (including the meaningless sound and the meaningless sign) unavoidably has to deal with abstract representations and research on learning a new language with formal as well as meaningful content. There is ample evidence that learning to read with only meaningful units as whole words or stories is less successful than methods that combine reading meaningful units with scrupulous attention to the phonological make-up of words (Adams 1990; Chall 1999; Ziegler & Goswami 2006).

Next to Warren and Young's (forthcoming) recommendations that more systematic attention is required for methodological strength in defining concepts and variables and the strong appeal of Tarone and Bigelow (2005) that LESLLA research needs to enter mainstream SLA research in order to bring about a "paradigm shift in how language is conceptualized, measured, taught, and learned in instructed setting", we want to conclude by adding two general implications for future research and practice that are in fact revisited in several chapters in this volume.

### **6.1. Multisensory integration: TELL for LESLLA learners**

Reis and Castro Caldas (1997) pointed to the gradual convergence of diverse neural support systems that are responsible for oral language, for writing, and for visual pattern recognition. LESLLA classroom studies and situated cognition research revealed the importance of starting from the familiar context in learning. When we seek to address and stimulate the combined and parallel use of different neural support systems, the use of TELL in L2 literacy learning seems to offer great opportunities. A computer screen can (probably more easily than a teacher or a textbook) trigger simultaneous, multisensory information processing: it can offer the LESLLA learner the information required for visual processing of abstract figures (written letters, words, and sentences) and processing spoken language (the same letters, words and sentences in spoken form) while at the same time photographs, pictures and videos can represent the familiar context and meanings that address the semantic-pragmatic information processing (L1 could be added to this).

As shown in the example of Figure 1, a computer screen can also be helpful to beginning-readers because it can show in a very clear way what sound-letter

correspondences are, how a written word can be split up into graphemes, and the spoken word into phonemes and how these two are connected. The semantic-pragmatic information can easily be added by hovering over or clicking on a button on the screen. Motor skills are practiced by dragging, dropping, clicking, hovering over, while the digital skills required for using such software are minimal. The software can be made available in libraries and computer labs. The student can call on these functions as many times as are needed because the computer will never complain when a student is endlessly repeating them. Using advanced speech recognition technology, the computer can even immediately provide feedback to the literacy learner's attempts to read a word aloud.

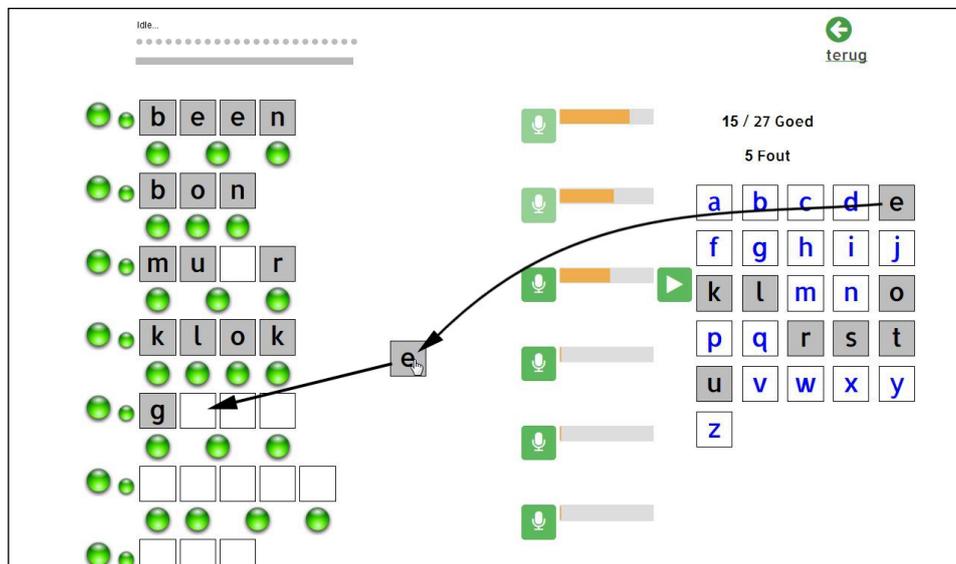


Figure 1: A screenshot from the experimental software DigLin (<http://diglin.eu>). Letters can be dragged from the alphabetic box to the blankets at the left. Here the <e> is being dragged but not yet dropped at the right blanket. Each phoneme can be heard by clicking on the specific green button below a blanket. The whole word can be listened to by pushing the leftmost button and the word can be shown by hovering over the smallest button. The word can be said aloud and if the learner activates the microphone button, he gets feedback on his pronunciation/reading aloud through the length of the orange bar.

TELL, then, can offer spoken language, written language and meaning as an integrated package; furthermore, speech technology creates more possibilities

for immediate feedback. We believe that this presents a promising future for the nonliterate L2 learner and that we are only at the beginning of new advances in research. Some materials are already available for LESLLA classrooms in several countries (see Olshtain et al.; and Cucchiaroni et al., this volume). There is, however, not much research yet that thoroughly investigates the learner-computer interaction and the way in which the new learner processes this information and reflects on it. We need longitudinal research that traces information processing strategies of nonliterate and low-educated adults while learning to read in a new, additional language.

## **6.2. Literacy first?**

One could argue that nonliterate LESLLA learners should not start learning to read and write in an L2 context, until their oral L2 proficiency has reached a certain level (A1 of the Common European Framework, for example). Most studies, however, revealed that acquiring oral L2 skills without literacy skills is extremely hard. A key implication of the findings presented in this chapter is that an adult should learn to read and write first, because literacy offers the proper language processing strategies badly needed for a faster and more efficient trajectory towards fluency in oral and written L2. Letters, after all, trigger an awareness of phonemes and an awareness of phonemes adds phonological processing to semantic processing. In the same way, written morphemes and spaces seem to trigger a conscious awareness of words and grammatical features. The repeated practice of reading and writing letters and decoding and recoding words adds to pattern recognition and fluency. In contrast to young children, many LESLLA learners need basic literacy to accelerate their L2 acquisition.

Most L2 acquisition studies focusing on the role of the L1 have investigated the impact of previous literacy in a retrospective way (but see Condelli & Spruck Wrigley 2004; 2006; Kurvers & Stockmann 2009). Future LESLLA research should also investigate what the impact is of first learning to read in a familiar language, before LESLLA learners start learning in an L2 framework. The studies discussed in this chapter seem to indicate that this is a more promising route than the alternative, waiting for a good oral command at L2.

The big challenge for future LESLLA research is that of solving the following paradox: the learner entering a classroom equipped with mainly semantic-pragmatic cognitive skills has to learn an abstract visual symbol system (that does not represent meaning directly) and formal features in a new and unfamiliar language. In other words, the two ends of Bereiter's (1997) continuum have to be addressed simultaneously, right from the very beginning.<sup>5</sup>

### Notes

- 1 TELL or Technology-Enhanced Language Learning deals with the impact of technology on teaching and learning an L2. TELL refers to the use of the computer as a technological innovation to display multimedia as a means of complementing the teaching method of language teachers.
- 2 See Coulmas (1994) and Taylor and Olson (1995) for critical comments on the presupposed uniqueness of the alphabet.
- 3 CEFR: The Common European Framework of Reference for Languages (European Council, 2001) distinguishes six language levels, from the very basic A1 to the near native C2.
- 4 Other outcomes, such as differences in semantic fluency, lexical decision of real words, calculation or comprehension skills, are probably more related to education than to literacy as such (but see Huettig, this volume).
- 5 That differs from practice learning in local communities where learning can involve the gradual change from situated cognitive skills (how to cook an egg) to more complex skills (how to prepare and cook a dinner for ten).

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