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Implicit and Explicit Learning to Read : Implication as for Subtypes of Dyslexia

Jean-Emile Gombert

- 1 A simple view of learning to read reduces acquisition of reading skills to decoding and phonological assembly, followed by the automation of these processes and articulation with visio-orthographic processing. It is for instance the case in Frith (1985)'s model.
- 2 According to her, three main stages are involved in the establishment of readers' ability to recognise written words.
- 3 During a first (logographic) stage, which occurs before learning to read, the children attempt to recognize words in the same way that they recognize non-linguistic objects.
- 4 The second (alphabetical) stage is characterized by the use of phonological mediation by beginning readers. At this learning level, the attentional effort is devoted to linking print with speech. This linkage uses grapheme-to-phoneme correspondence (GPC) rules and demands: knowledge of the alphabet; a consciousness of phonemic units; and an awareness of the relation between these two types of units.
- 5 In the third and last (orthographic) stage, the existence of a mental lexicon built during the alphabetical stage permits the direct pairing of familiar written words with their correspondents in memory. At this orthographic level the information processing system directly and automatically activates the relevant lexical element on the basis of a linguistic analysis.
- 6 One factor plays a central role throughout the whole of this development. This is the explicit teaching of GPC and of its metaphonological correlates. Within this perspective, reading acquisition goes from non-linguistic processing to direct written word recognition via the understanding, the application and then the automation of the alphabetical principle. Sensitivity to phonology is a prerequisite to learning to read, and learning to read triggers awareness of phonemes.

- 7 GPC obviously constitute the essence of the Latin alphabetical code. Nevertheless, increasing numbers of studies have concentrated on orthography-morpheme correspondences. In fact, besides the possibility of analysing written words into units corresponding to phonemes, it is also possible to analyse words into units that correspond to morphemes. For example, in the French word “*oursons*” (little bears), there are three morphemes: “*ours-*” corresponds to the root of the word; “*-on-*” is a diminutive, which exists in other words (e.g. “*chaton*” -kitten-); and “*s*” is the plural inflection. As 80% of French words consist of multiple morphemes, it is unlikely that this dimension is totally irrelevant in learning to read.
- 8 In the classical view of literacy acquisition, morphology is only taken into account at very advanced levels of learning, generally in connection with learning to spell (for instance, see Seymour, 1997). By contrast, some preliminary results (Colé, Marec-Breton, Royer, Gombert, in press) show an earlier and more systematic role of morphology in learning to read.
- 9 First, sensitivity to the morphology of oral words exists before learning to read. In an oral “wordlikeness task”, we asked 5-year-old prereaders to chose, between two pseudo-words “ *which looks more like a real word?*”. In each pair, one pseudo-word consisted of a prefix + root (for example: /prefade/, /pre-/ being a frequent prefix in French as in English) while the other was constructed using the same phonological elements (/pradefe/) but did not have this morphological structure (/pra/ is not a prefix). As early as age 5, preliterate children found that prefixed items looked more like real words than the other items (67.25%).
- 10 Second, learning to read triggers a consciousness of certain morphological features. The same children and beginning readers (1st to 3rd grade) were asked to perform an oral explicit oddity task: After they had seen several examples, the children had to detect the odd item in a number of triplets (for example “*dévorer*” -to devour- which is a pseudo-prefixed word -in this word “*dé-*” is not a prefix, among two prefixed words “*défaire*” -to undo- and “*démonter*” -to dismantle-). While preliterate, 1st and 2nd graders are at chance level, 3rd graders detected the odd item at a significant level.
- 11 Finally, at a very early stage of learning to read, morphology has an impact on reading performances. Beginning readers (1st and 2nd grade) read prefixed words (e.g. “*décoller*” -to unstick-) better (faster and more accurately) than pseudo-prefixed words (“*dévorer*” -to devour-), and pseudo-words constructed on the principle prefix + real word (“*décuire*” -to uncook-) better than those constructed on the principle prefix + pseudo-word (“*déconvir*”). In other words, it seems that, as early as the beginning of learning to read, the morphological structure of words is taken into account, while, at the same time, the recognition of significant elements in a new word facilitates its processing.
- 12 Globally, these results suggest that, when children are learning to read, the cognitive system does not ignore graphomorphological regularities, the importance of which has already been demonstrated in the recognition of written words in skilful readers (Colé, Segui, and Taft, 1997). Thus, these regularities should be accorded a position in the general schema of learning to read other than that the of late mastered knowledge, which makes it possible to correct spellings (Seymour, 1997).
- 13 The schema is here the same than the one found for phonology: a precocious sensitivity in prereaders, a role of this linguistic dimension in beginning reading, then a late awareness of this dimension triggered by learning to read and to spell.

- 14 In 1992, I proposed a model of metalinguistic development designed to shed light on certain links between the development of oral language in children and learning to read (Gombert, 1992). The type of development proposed in this model distinguishes between two levels of cognitive control over the individual's own linguistic knowledge. The first of these (epilinguistic level) is the control automatically exerted on linguistic processing by the linguistic organizations present in memory. The second (metalinguistic level) is the control consciously chosen, decided on and applied by the individual.
- 15 While the first level of control is automatically present in all behaviour involving linguistic processing, the second level depends on external demands or individual decisions.
- 16 In my view, there is a developmental hierarchy between epilinguistic control and metalinguistic awareness. These two levels of control are included in a larger developmental model.
- 17 The first three phases in this model are: 1) The phase of acquisition of first linguistic skills, in which, on the basis of pre-programmed formats, correspondences between linguistic forms and reinforced pragmatic contexts are stored in an implicit and instance-bound format; 2) the phase of acquisition of epilinguistic control in which linguistic knowledge is reorganized in a multifunctional format which cannot be consciously accessed; 3) the phase of acquisition of metalinguistic awareness, triggered by an external demand for intentional control of the organization established in phase 2.
- 18 For our purposes, the most important thing is that, in this model, the emergence of meta-awareness covering specific knowledge depends on both the prior existence of that knowledge at the epilinguistic level and the intervention of an "external demand" which compels the child to make the cognitive effort necessary for conscious monitoring. The teaching of reading, which compels children to reflection on oral language, constitutes such a pressure.
- 19 In that perspective, to explain in full how children's prior linguistic knowledge plays a role in learning to read we must first explain how implicit linguistic knowledge develops in prereaders and then identify what knowledge has to become conscious at each level of learning to read (and spell).
- 20 People's behaviour is sensitive to the structural features of the environment in such a way that their behaviour becomes more and more adapted without any intentional use of an explicit knowledge of these features. This process is known as "implicit learning".
- 21 As writing systems exhibit very many regularities, it is inconceivable that contact with such systems does not induce any implicit learning. Indeed, several studies of children's spelling have shown that they are sensitive to lexical orthographic regularities that have not been explicitly taught (for instance see Cassar and Treiman, 1997).
- 22 Pacton et al. (2001) used a written wordlikeness task with children from 1st grade to 5th grade. Of two pseudowords presented to them, the children had to draw a circle around the one that looked more like a real word. The items included double consonants or double vowels, which either do or do not occur in real French words. It appears that, as early as 1st grade, children consider, at a level of 85%, that an item with a double consonant that actually exists in French (for example "tillos" or "bummer") looks more

like a real word than an item with a double vowel which does not occur in French (for example "tiilos" or "buumer). Similarly, they consider, at a level of 80%, that items with double consonants that genuinely exist in French ("befful" or "ullate") look more like real words than items with double consonants that do not ("bekkul" or "ujjate"). They are equally reluctant to choose items which start or end with a double consonant, and indeed such items do not exist in the French language: for example, they reject the items "nnulor" or "golirr" but accept "nullor" and "gollir".

- 23 Thus, as early as 1st grade, children possess some orthographic knowledge, which they have never been taught. In fact, what we know about implicit learning suggests that children begin to extract implicit knowledge of the structural features of the written system as soon as they are exposed to it and possibly even before formal instruction begins. This implicit knowledge is involved in preliterate "reading" and "spelling" behavior. It can also explain children's early ability to make analogies when reading and spelling (see Gombert, Bryant, & Warrick et al, 1997).
- 24 The different points that I have emphasized throughout this paper can be integrated within a global view of learning to read.
- 25 I believe that implicit learning plays a central role in learning to read. As set out diagrammatically in Figure 1, this aspect of learning might progress as follows:
- 26 1- Linguistic knowledge and the capacity to categorize visually perceived objects do exist before children encounter writing. They are the bases of implicit learning of print.
- 27 2- As soon as children repeatedly encounter stable written words, the regularities present in these words generate implicit learning processes. These regularities may take the form of: visual patterns (orthography); oral words associated with these patterns (phonology and lexicon) or the meaning activated by these patterns (morphology and lexicon). In other words, three implicit knowledge play a role: the orthographic regularities, the graphophonological regularities and the graphomorphological regularities. In the case of the early contact with print, implicit learning begins before the teaching of reading.
- 28 3- One of the consequences of reading instruction is a huge increase in print-related activities. Attention to written words, previously occasional, becomes systematic and frequent. Therefore reading instruction boosts implicit learning.
- 29 4- Implicit learning continues as long as the individual reads. It does not stop with the end of reading lessons at school.

Figure 1 : A simple view of learning to read

- 30 To give a place to the implicit aspect of learning does not diminish the importance of the cognitive efforts the child has to make in order to learn to read.
- 31 The explicit learning of GPC is absolutely necessary in order to equip children with the tools they need for reading, as long as their implicit knowledge is not sufficient to allow automatic reading. And even when it becomes so, explicit knowledge is still necessary when readers have to consciously control their reading (for example, when reading unknown words).
- 32 The explicit learning of written morphology may be important for giving beginning readers a tool for managing GPC irregularities (or silent letters in French) and helping beginning spellers to write, as long as their implicit knowledge is not sufficient to permit automatic reading and spelling. Subsequently, this explicit knowledge will remain available for the application of sophisticated spelling rules (morpho-syntax) and orthographic checking.
- 33 Overall, direct teaching is essential both in order to permit the elaboration of a control system which readers can use for conscious monitoring, and in order to boost implicit learning by multiplying the number of print-related activities they are engaged in (see Figure 1).
- 34 As far as automaticity is concerned, this exists at every level of reading as a behavioural counterpart of the actual level of implicit knowledge. The internal and contextual regularities perceived in written words progressively change the weight of the connections within the cognitive system. As a consequence, responses automatically evoked by written words gradually change in the direction of expert reading.
- 35 Explicit learning of reading (and spelling), together with the child's hypotheses, progressively elaborates the explicit knowledge, which children can use to replace or control the product of automatic processes. Although permitting the development of automatic responses through implicit learning, this knowledge does not itself become automatic. What is automatic is the reproduction of what has been frequently encountered and implicitly learnt.
- 36 This theoretical framework can throw light on developmental dyslexia. Many research suggested that a phonological deficit is many often involved in dyslexia (cf. Ramus et al,

submitted). As a matter of fact, despite of the multicode nature of writing systems, it is definitely established that the mastery of GPC and its metaphonological correlates are the core of learning to read an alphabetical language. The question is: How does the double process of learning use readers' phonological skill when learning to read is not impaired?

- 37 Before learning to read, on the basis of language pre-programming and under the influence of linguistic context, epiphonological organizations are elaborated in memory. These organizations are the basis of metaphonological awareness triggered by learning to read (explicit learning) on the one hand, of automatic processing of grapho-phonological links developed by the repetitions of attention to print (one aspect of implicit learning) on the other hand.
- 38 What can be the consequences of a phonological deficit on this double process? Two cases can be distinguished:
- 39 In both cases, phonological deficit leads to under-specified epiphonological organization in memory, but the consequence on reading performances can vary as function of the severity of the deficit and/or as a function of the difficulty of the learning task.
- 40 In the case when the deficit is very severe and/or when the child has to learn a very difficult code (e.g. deep orthography as English), or also when training is very inefficient, the beginning reader both fails to master GCP, too difficult to understand, and cannot develop automatic processing of grapho-phonological links because of the lack of phonological sensitivity. In such a case, decoding is not efficient and, as a consequence, awareness of phonemes does not develop. The only modality available is a logographic recognition of known words. This pattern corresponds to phonological dyslexia.
- 41 In the case when the deficit is less severe and/or when the child has to learn a very easy code (e.g. shallow orthography as Italian), or also when training is very efficient, again, because of the lack of (epi)phonological sensitivity, she cannot develop automatic processing of grapho-phonological links, however she can understand and master GCP.
- 42 In fact, in such a case, the child used orthographic representations in order to help phoneme identification in oral word. As a consequence she can decode and she develops awareness of phonemes. Conscious monitoring of segmental analysis of speech and sequential reading become possible. Nevertheless, at the implicit level, phonological organizations remain underspecified and, for this reason, unavailable for automatic association with orthographic patterns in an implicit learning process. In other words, when processing involves phonemes it can be monitored only at an explicit and conscious level.
- 43 Moreover, by the fact of its attentional cost, the alphabetical modality used by this reader hinders him from switching to a more economical way of recognition even when he encounters words he could recognize without decoding. This pattern corresponds to surface dyslexia.
- 44 At least theoretically, different sub-types of dyslexia (phonological, surface, mixed) can thus be the consequence of a unique deficit. The characteristics of impaired reading would depend from: the severity of the deficit; the transparency of the orthography to be learnt, the efficiency of the pedagogical or reeducational help.

- 45 The symptom common to the different sub-types would be a lack of automatism due to a deficit (very likely of phonological nature), which affects implicit learning.

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ABSTRACTS

Grapheme-phoneme correspondences constitute the essence of alphabetical code. Nevertheless, increasing numbers of studies showed the importance of orthography-morpheme correspondences. These two types of correspondences might be taken into account when modelling reading development. Moreover, whatever the code concerned, it is likely that two types of processes are involved in learning to read. Most research has focused on the direct effect of teaching, it might also be important to consider implicit learning, by means of which the cognitive system changes under the frequency-related influence of the regular letter patterns and print-speech relationships. This theoretical framework leads to a view of learning to read which considers the dual nature of the written code and includes both the explicit and implicit aspects of learning. As a conclusion, the effect of an original phonological deficit on such a double process of learning is examined. It is suggested that, depending from different factors, this unique deficit can lead to phonological or surface profiles of dyslexia.

Le principe alphabétique repose sur la correspondance graphème-phonème. Toutefois, de nouvelles recherches montrent également l'importance des correspondances entre configurations orthographiques et morphèmes. Ces deux types de correspondances doivent être pris en compte dans la modélisation de l'apprentissage de la lecture. De plus, quel que soit le code concerné, deux types de processus sont impliqués dans l'apprentissage de la lecture. La plupart des recherches ont ciblé les effets directs de l'enseignement, il convient de prendre également en considération l'apprentissage implicite qui rend compte des modifications du système cognitif sous l'influence de la répétition de la rencontre des patrons orthographiques fréquents et des cooccurrences entre orthographe et propriétés orales associées. Ce cadre théorique engendre une conception de l'apprentissage de la lecture prenant en compte la double nature du code écrit et qui inclut les dimensions explicites et implicites de l'apprentissage. En conclusion, l'effet d'un déficit phonologique initial sur un tel double processus d'apprentissage est envisagé. Il est suggéré qu'en fonction de différents facteurs ce même déficit initial peut être à l'origine d'un profil de dyslexie phonologique ou de dyslexie de surface.

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