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Phonological skills and writing of presyllabic children

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The discovery of the relationship between phonological awareness and the process of learning to read is one of the most important contributions of the last 30 years of research in the domain of the acquisition of literacy. Despite the significance of this discovery, for many years the texts on the subject focused exclusively on a debate about the meaning of the causal relationship between phonological awareness and learning to read (Goswami & Bryant, 1990; Morais, 1994). This theoretical discussion, in which oral analytical abilities were seen sometimes as a cause and sometimes as a consequence of learning to read, may well have arisen as a result of disparities between the evaluative tasks that were used in research in this field and the inconsistency in the way in which the concept of phonological awareness was operationalized.

The concept of phonological awareness implies the existence of a general capability with multiple dimensions that influence the difficulty experienced in the various tasks. The best way to look at this capability is probably to see it as part of a *continuum* (Stanovich, 1992). Skills such as detecting and producing rhymes are considered to be on a lower level of the continuum as they require few analytical capabilities and simply an awareness of similar phonological sequences, while the abilities to segment and invert the phonemes in words are placed on a higher level because they imply an analytical attitude and an explicit representation of phonetic segments. Some skills, like the ability to detect rhymes

and the awareness of syllabic and intrasyllabic units (Liberman, Shankweiler, Fischer, & Carter, 1974; Sim-Sim, 1997; Treiman, 1992), may develop spontaneously over the course of the preschool years, whereas for most children proficiency in more complex abilities, such as synthesis or phonemic segmentation, which require phonemic awareness, occurs when they learn to read (Morais, 1994; Perfetti, Beck, Bell, & Huges, 1987).

The argument about the meaning of the relationship between phonological awareness and reading acquisition has been replaced gradually by a finer analysis concerning the type of minimum skills required to understand the alphabetic characteristics of written language on the one hand and the definition of those that result from the process of learning to read on the other (Byrne, 1992, 1997; Goswami, 1998; Murray, 1998; Stahl & Murray, 1994, 1998). For example, works by Stahl and Murray (1994, 1998) tell us that the capacity to identify common phonemes in different words is a skill that is critical to children's understanding of the way in which written code functions, while the abilities to segment and blend phonemes essentially develop once the alphabet has been learnt.

At the same time, the role phonological awareness plays in learning to read was redefined when it was conjugated with letter-name familiarity as a fundamental basis for understanding the alphabetic principle. The latter is defined as the understanding of the nature of the relationships between sounds and the letters in the written code.

Phonological skills and writing of presyllabic children

The objective of this study was to identify causal relationships between the development of phonological abilities and progress in knowledge about writing in preschool children. The study looked at 71 preschool-aged children, who were divided into three groups and whose writing was governed by presyllabic criteria. The children in the first group were subjected to an experimental intervention that focused on writing and was intended to lead them to evolve in such a way as to produce syllabic writing. The second group was the object of phonological training aimed at syllabic units. The third set of children served as a control group. All three groups were at equivalent intellectual levels and were familiar with a similar number of letters. The two experimental intervention programs also proved equiv-

alent in terms of the conceptual evolution they triggered, to the extent that the children in both experimental groups started writing in accordance with syllabic criteria; the writing of the children in the control group continued to be guided by presyllabic criteria. In phonological tests the children in the two experimental groups achieved results that revealed a similar degree of progress (greater than that attained by the control group children) in the initial-syllable deletion and the initial-phoneme classification tests. The second experimental group displayed more statistically significant advances in the initial-phoneme deletion test than either of the other two groups.

Habilidades fonológicas y escritura en niños pre-silábicos

El objetivo de este estudio fue identificar las relaciones causales entre el desarrollo de las habilidades fonológicas y el progreso de los conocimientos sobre la escritura en niños pre-silábicos. El estudio examinó a 71 niños en edad pre-escolar que fueron divididos en tres grupos y cuya escritura estaba gobernada por criterios pre-silábicos. Los niños del primer grupo estuvieron expuestos a una intervención experimental que se centró en la escritura y tuvo como propósito guiarlos hacia la producción de escritura silábica. El segundo grupo recibió entrenamiento fonológico centrado en las unidades silábicas. El tercer grupo de niños funcionó como grupo de control. Los tres grupos tenían niveles intelectuales equivalentes y estaban familiarizados con una cantidad similar de letras. Los dos programas

experimentales de intervención también resultaron equivalentes en términos de la evolución conceptual que promovieron, al punto de que los niños de ambos grupos experimentales comenzaron a escribir de acuerdo a criterios silábicos; la escritura de los niños del grupo de control continuó guiada por criterios pre-silábicos. En las pruebas fonológicas, los niños de ambos grupos experimentales lograron resultados que revelaron un cierto grado de progreso (mayor que el alcanzado por los niños del grupo de control) en la omisión de sílaba inicial y en la clasificación de fonema inicial. El segundo grupo experimental mostró progresos estadísticamente más significativos en la prueba de omisión de fonema inicial que los otros dos grupos.

Phonologische Fertigkeiten und das Schreiben von prä-syllabischen Kindern

Ziel dieser Studie war es, kausale Zusammenhänge zwischen der Entwicklung von phonologischen Fähigkeiten und Fortschritten im Wissen um das Schreiben der Vorschulkinder zu identifizieren. Die Studie richtete sich auf 71 Vorschulkinder, die in drei Gruppen eingeteilt und deren Schreibarbeiten durch prä-syllabische Kriterien bestimmt waren. Die Kinder in der ersten Gruppe wurden einer experimentellen Beeinflussung ausgesetzt, die sich aufs Schreiben konzentrierte und dazu bestimmt war, sie dergestalt anzuleiten, daß sie syllabisches Schreiben produzierten. Die zweite Gruppe wurde das Objekt phonologischen Trainings, ausgerichtet auf syllabische Einheiten. Die dritte Auswahl an Kindern diente als eine Kontrollgruppe. Alle drei Gruppen befanden sich auf vergleichbaren intellektuellen Stufen und waren mit einer ähnlichen Anzahl von Buchstaben vertraut. Die zwei experimentellen Interventions-

programme erwiesen sich als ebenbürtig im Sinne der konzeptuellen Entwicklung, die sie hervorriefen, insoweit, daß die Kinder in beiden Experimentiergruppen in Übereinstimmung mit syllabischen Kriterien zu schreiben begannen; das Schreiben der Kinder in der Kontrollgruppe wurde unter fortgesetzter Anleitung von prä-syllabischen Kriterien weitergeführt. In den phonologischen Tests erreichten die Kinder in beiden experimentellen Gruppen Ergebnisse, die einen jeweils ähnlichen Grad an Fortschritten offenbarten (größer als jener, der von den Kindern der Kontrollgruppe erreicht wurde), in der anfänglich-syllabischen Ausmerzung und bei der anfänglich-phonemischen Unterteilung der Tests. Die zweite Experimentiergruppe zeigte mehr statistisch auffällige Fortschritte in dem Test zur anfänglich-phonemischen Ausmerzung als jede der beiden anderen Gruppen.

音節以前の子供の音声スキルとライティング

本研究の目的は、学齢前の子供の音声能力の発達とライティングに関する知識の進歩との間の因果関係を調べることだった。本研究は、3グループに分けられた学齢前の71人を対象に行われたわけだが、この子供達のライティングは、音節以前の基準によって支配されていた。第1グループの子供達は、ライティングに焦点を当て、音節表記ができるように進歩させる事を意図した実験的介入を受けた。2つ目のグループは、音声単位をねらった音声トレーニングの対象だった。3つ目のグループは、制御群だった。3つのグループはすべて同等の知能レベルで、同じような数の文字を知っていた。

2つの実験的介入プログラムは、実験群の子供達が音節基準に従ってライティングを始めた程度に、プログラムが引き金となる概念の変容において同意義のものだという事も判明した。制御群の子供のライティングは、音節以前の基準に影響され続けた。音声テストにおいて、2つの実験群の子供達は、語頭音節削除と語頭音素分類で似通った度合の進歩（制御群の子供達より大きなもの）をみせる結果を出した。2つ目の実験群は、語頭音素削除テストにおいて、残りのグループと比べ統計学的により有意な進歩を見せた。

Compétences phonologiques et écriture d'enfants pré-syllabiques

Cette étude avait pour objectif d'identifier les relations causales entre le développement des compétences phonologiques et le progrès des connaissances relatives à l'écriture chez des enfants d'âge préscolaire. L'étude a porté sur 71 enfants d'âge préscolaire divisés en trois groupes et dont l'écriture répondait à des critères pré-syllabiques. Les enfants du premier groupe ont été soumis à une intervention expérimentale centrée sur l'écriture qui a été conduite de façon à les amener à produire une écriture syllabique. Le second groupe a fait l'objet d'un entraînement phonologique centré sur des unités syllabiques. Le troisième ensemble d'enfants a servi de groupe contrôle. Les trois groupes avaient un niveau intellectuel équivalent et étaient familiarisés avec un nombre de lettres semblable. Les deux programmes d'intervention se sont révélés équivalents en ce qui

concerne l'évolution intellectuelle qu'ils ont déclenchée, dans la mesure où les enfants des deux groupes expérimentaux ont commencé à écrire avec des critères syllabiques, tandis que l'écriture des enfants du groupe contrôle a continué à répondre à des critères pré-syllabiques. Dans les tests phonologiques les enfants des deux groupes expérimentaux ont atteint des résultats manifestant des progrès comparables (supérieurs à ceux atteints par les enfants du groupe contrôle) dans des tests demandant la suppression de la première syllabe ou du phonème initial. Le second groupe expérimental a présenté des progrès statistiquement plus significatifs que chacun des deux autres groupes dans le test de suppression du phonème initial.

Фонологические навыки и письмо у детей, не знающих деления на слоги

Цель настоящего исследования состояла в том, чтобы выявить причинно-следственные связи между развитием фонологических способностей и представлений о письме у дошкольников. Исследование базировалось на наблюдении за тремя группами дошкольников общим числом 71 человек, чье письмо основывалось на дослоговом подходе. Дети в первой группе были подвергнуты экспериментальному вмешательству, направленному на письмо и предназначенному для подготовки детей к силлабическому письму. Вторая группа была объектом фонологического обучения, нацеленного на дифференциацию силлабических единиц. Третья группа детей была контрольной. Все три группы имели одинаковый интеллектуальный уровень и знали одинаковое количество букв. Обе экспериментальные интервенционные программы также были равнозначны в плане эволюции понятий, которые они развивали. В итоге дети в обеих экспериментальных группах начали писать в соответствии с силлабическими критериями, в то время как дети из контрольной группы продолжали руководствоваться при письме дословыми критериями. В классификационных фонологических тестах дети из двух экспериментальных групп не опускали начальный слог и определяли начальную фонему одинаково успешно (показав более высокие результаты, чем дети из контрольной группы). Вторая группа показала более статистически значимую динамику при выполнении тестов выявлению начальной фонемы, чем остальные группы.

Byrne (1998) showed that the awareness of phonemic units and familiarity with letters do not of themselves guarantee that a child will manage to make use of the alphabetic principle in real reading contexts, but rather that it is the combination of the former two that proves crucial to the discovery of the latter. In turn, understanding the alphabetic principle enables children to gain access to decoding procedures that form part of the reading activity.

Phonemic awareness is thus now seen as a skill that is necessary to obtain, albeit of itself insufficient to ensure, a full conceptual understanding of the alphabetic principle; children may possess an adequate notion of the phonemic structure of oral speech without this in itself leading to an understanding of the alphabetic nature of written language. This understanding not only requires phonemic analytical skills, but also means that children must possess a concept of writing that leads them to representation of the phonemic structure of words.

In the 1970s, Read (1971, 1975) was already calling attention to the creative spelling of preschool-age children, showing that they are not all at the same level in terms of the way in which they look at written language. Since then, a large number of works (Ferreiro, 1988; Pontecorvo & Orsolini, 1996; Read, 1986; Sulzby, 1989) have shown that an understanding of the abstract rules that underlie the organisation of alphabetic systems is a process that begins early on, via the informal contacts that children gradually make with written language. In their efforts to understand the meanings of graphic marks and to interact with others (both peers and adults), children ask themselves questions about the correspondences between objects and writing and about the relationships between the oral and the written forms of language. In this way they build up unconventional ideas about the properties of writing and what it represents. They construct a series of conceptual hypotheses that can be more or less close to the real alphabetic system.

Ferreiro's work (1988) on preschool children's invented spellings suggests that children's knowledge of written language evolves through three essential levels of conceptualisation. The first level can be characterised by the search for criteria that make it possible to differentiate between drawings and written language, and by the gradual perception that a sequence of letters constitutes an object that stands in for the real thing. In parallel with this differentiation process, the child also elaborates criteria that make a series of letters into something that can transmit a message. He or she considers that there must be a minimum number of letters for it to be possible to read and write a message, and also that the letters must vary. The latter criterion leads him or her not to use the same sequence of letters to spell different words.

A second level involves refining the forms of qualitative (diversification of the order of letters in his or her attempts at writing) and quantitative (the minimum number of letters needed to make writing understandable) differentiation between chains of letters, in such a way as to ensure differences in how different words are represented.

The ideas that children form about writing reflect the images that they build up from the examples they see around them, in which words are generically composed of various letters and those letters are set out in different sequences for different words. It is these merely graphic characteristics that children seek to take into account in their invented spellings. At these levels children have not yet established any relationship between oral and written language. Generically speaking, it is possible to call these first two levels presyllabic.

On a third level children begin to relate oral language to written language. This level consists of a number of stages, beginning with the search for correspondences between letters and the syllabic segments in words. In their invented spellings children write a letter with which to represent each of the syllables in a word, even though they establish the letter/syllable correspondence on a purely random basis—syllabic writing without phonetization.

Subsequently they establish this correspondence using conventional letters to represent one of the sounds in a given syllable—syllabic writing with phonetization. This syllabic writing is particularly apparent in languages such as Spanish and Portuguese. The frequency with which this type of writing appears in Portuguese probably is explained by its structure in which there are many polysyllabic words and the syllabic structure that predominates is one of open syllables of the consonant/vowel type (Andrade & Viana, 1993; Vigário & Falé, 1993).

Later still, children begin to analyse oral language in a way that goes beyond the syllabic level. This gives rise to invented spellings in which children represent all the phonemes in some of the syllables of a word yet continue to use single letters to denote other syllables in the same word—syllabic-alphabetic writing.

The third conceptual level culminates in an understanding of the alphabetic nature of written language reflected in invented spellings in which the phonetic structure of the word is fully learnt and codified, even though not all the applicable orthographic conventions are respected—alphabetic writing.

This evolutionary path, which has been identified in relation to a variety of languages—French (Besse, 1993, 1995, 1996; Chauveau & Rogovas-Chauveau, 1994; Fijalkow, 1993), Portuguese (Alves-Martins, 1994; Alves-Martins & Mendes, 1987), Italian (Pontecorvo & Zuchermaglio, 1988, 1995), Hebrew (Tolchinsky, 1995;

Tolchinsky & Levin, 1988), and English (Sulzby, 1989)—has not, however, been taken into account in the majority of research into phonological awareness.

This developmental path does not require passing through all the various stages. There may even coexist forms of writing that imply different ways of looking at the written code (Besse, 1995; Sulzby, 1986). Sulzby, for example, considered “that there is no one identical developmental sequence in the way in which children use the written system” (p. 70). Inasmuch as certain written forms appear, disappear, and reappear during the course of the process of acquiring writing, she argued for the existence of a developmental dialectic that is both continuous and discontinuous.

There are points on this evolutionary path that are similar to the stages in the development of writing put forward by Henderson and Beers (1980) and Gentry (1982). The latter identified five stages in children’s spelling. During the first or precommunicative stage, children randomly combine letters and pseudoletters without paying attention to correspondences between letters and sounds. There would appear to be similarities between this initial stage and the first two levels defined by Ferreiro (1988)—that is to say the presyllabic levels.

During the second or semiphonetic stage, children begin to phonetically represent some of the components in words by choosing letters with which they are familiar. The letters that are employed in this way may represent both sounds and syllables in the word in question.

This second stage has similarities to Ferreiro’s (1988) initial phases of the phonetization of writing—namely those that involve syllabic writing with phonetization, in which children use conventional letters to represent one of the sounds in a syllable, and those that correspond to syllabic-alphabetic writing.

The third or phonetic stage is characterised by a systematic correspondence between letters and sounds, but without any respect for orthographic conventions. It is thus equivalent to the alphabetic writing noted by Ferreiro (1988).

The next two stages form the backdrop to children’s progress in relation to their language’s orthography—aspects that Ferreiro (1988) did not address. In this transitional phase children begin to take account of the fact that the way in which they are supposed to write may be influenced by morphemic factors. Finally they reach the last stage of the process, which is to say that they write correctly.

To the extent that it constitutes a form of oral language analysis, preconventional writing introduces a metalinguistic practice that undoubtedly has some important consequences in learning the oral segments of words. These consequences probably are enhanced by the

process of phonetizing writing, in which children’s attempts to match the letters in and the sounds of words constitute a concrete support for the gradual identification of the successive phonemes that form part of the words. Various authors (Stahl & Murray, 1998; Treiman, 1998) considered that children’s invented spellings, in which a few conventional letters represent sounds, stimulate phonemic awareness. Within the context of invented writing, the activation of letters seems in turn to be governed by a word’s phonological characteristics, in the sense that it is easier when the words contain phonetic sequences that actually represent the names of the letters (Mann, 1993; Quintero, 1994). Set against this background, writing-related activities may lead to a process of appropriating or constructing the alphabetic principle via a complex developmental interaction between a child’s capability to segment words into phonemes and the use of the graphic support underlying the letters in order to represent them. Consequently children’s preconventional writing may constitute a way in which to organise and expand oral analytical capabilities and promote an even more precise understanding of the relationships between the oral and the graphic elements. This point of view can be confirmed by Richgels’s study (1995), which showed that preschool-age children who were classified as being good at phonetizing in their invented writing found it easier to read words that were simple from a phonetic standpoint than did children whose written output was not as rich.

Along similar lines, various authors (Adams, 1998; Mann, 1993; Treiman, 1998) began to view children’s invented spellings as an understanding of the alphabetic principle, but the knowledge about written code that children reveal in their attempts at writing has often been seen as just one more indicator of phonological awareness (Mann, 1993; Vale & Cary, 1998). Consequently, few studies (Alvarado, 1998; Pontecorvo & Orsolini, 1996; Vernon, 1998) have assessed the relationship between the evolution of knowledge about writing on the one hand and progress in phonological skills on the other.

Alvarado (1998) tested children at different conceptual levels in writing by giving them the task of deleting the initial phoneme in words presented in both oral and written form. As expected, children at the alphabetic level achieved the highest success rates—around 50% in the oral format and 95% in the written format. The children at the syllabic-alphabetic and syllabic with conventional sound correspondence conceptual levels attained similar degrees of success—60% and 57% respectively—when the words were presented to them in conjunction with the written form. However, these levels fell significantly—to 16% and 8%—in the exclusively oral format.

The comparison between children whose writing is governed by letter/syllable correspondence on a purely random basis and those who choose conventional letters with which to represent one of the sounds in a syllable suggests the importance of the role of conventional letters as a factor that increases phonemic awareness. The former group displayed success rates of only 15% and 7% (with and without the written version) in the phonemic test. Children at the presyllabic level achieved zero rates of success in both versions of the tests.

Similarly Vernon (1998) showed that children at a less evolved conceptual level display fewer analytical responses to a task involving the segmentation of words than do their more advanced counterparts. This study also confirmed that children perform better when they are asked to segment words if the words are presented to them in a written format rather than an oral format.

These studies, which show that phonological capabilities gradually improve until alphabetic understanding of writing is achieved, do suffer from a limitation as they centre their analysis on a single phonological task and consequently do not look upon phonological awareness as a multidimensional ability (Schatschneider, Francis, Foorman, Fletcher, & Mehta, 1999; Stahl & Murray, 1994; Stanovich, 1992). This point of view may, however, be put into perspective if we bear in mind the fact that some elementary forms of phonological awareness, such as sensitivity to syllables and rhymes and the capability to detect the initial phonemes in words, can develop more or less spontaneously over the course of the preschool years (Lieberman et al., 1974; Treiman, 1992). More sophisticated phonological skills, such as segmentation or phonemic deletion, may be stimulated at these ages by training programs that are oriented toward fostering this type of capacity (Goswami & Bryant, 1990; Lundberg, 1991; Troia, 1999).

It is also important to mention that some—albeit not many—studies have shown that phonological training leads to progress in children's invented writing (Manrique, 1997; Tangel & Blachman, 1992). Manrique conducted a phonological intervention program in a preschool class that included rhyming games, games that involved the initial and final sounds of words, and phonemic analysis games. At the end of the year, 65% of the children not only had evolved significantly in terms of their phonological skills, but also were capable of writing words and texts in accordance with alphabetic criteria.

If the results obtained by Alvarado (1998) and Vernon (1998) are combined with the latest set of data, it is possible to see that children's phonological abilities may have some effect on the way in which they look upon writing and that their phonological skills may develop as they build up more knowledge about written

code. It seems to us that this hypothetical reciprocal ability-enhancing action has not yet received much attention from researchers and that it is therefore useful to analyse it, starting with the initial levels of knowledge about writing and working within the framework of a multidimensional concept of phonological abilities.

Research questions

We have formulated the following research questions:

1. Will the conceptual hypotheses about written language of presyllabic children evolve when they are subjected to a writing training program intended to alter the way in which they represent writing?

2. Will the conceptual hypotheses about written language of presyllabic children evolve when they are subjected to a phonological training program designed to work on syllabic units?

3. Are there any differences between the two types of training in terms of the effects they have on the conceptual hypotheses about written language?

4. Will the phonological skills of presyllabic children undergo evolution when they are subjected to a writing training program intended to alter the way in which they represent writing?

5. Will the phonological skills of presyllabic children undergo evolution when they are subjected to a phonological training program designed to work on syllabic units?

6. Are there any differences between the two types of training in terms of the effects they have on phonological skills?

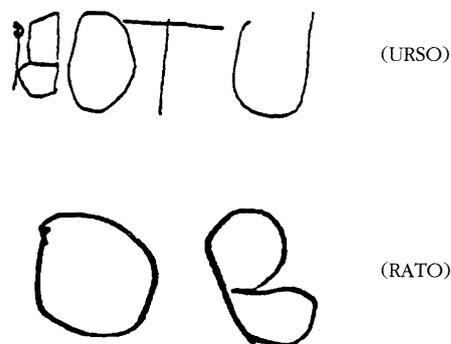
Method

Participants

Participants were 90 middle-class Portuguese children with an average age of 5 years and 8 months, a standard deviation of 3 months, a lower limit of 5 years and 1 month, and an upper limit of 6 years and 4 months. They attended various kindergartens and had not received any formal training in reading and writing. In those kindergarten classes there were no regular classroom activities or instruction relating to phonological awareness or invented spelling. None of the children knew how to read—a fact that was verified by means of individual reading tests. All children's names are pseudonyms.

Only children who displayed presyllabic invented spellings in the pretest were selected for the study. The children were then randomly divided up into three groups—two experimental groups and one control group.

Figure 1 Example of Samuel's presyllabic writing



Nineteen children ended up not taking part in the entire experiment and were therefore eliminated from the results. The final groups were thus made up as follows: experimental group 1 ($N = 21$); experimental group 2 ($N = 23$); control group ($N = 27$).

Design

This was an experimental study in which children were assessed on a pre- and posttest basis, both in terms of the way in which they saw written language and of their phonological skills. In between the pre- and the posttests, experimental group 1 was subjected to a writing training program intended to lead to a restructuring of the way in which they saw and employed written language, while experimental group 2 was subjected to a phonological training program designed to work on syllabic units. The control group took part in exercises involving the categorisation of geometric figures in accordance with criteria such as shape, size, and colour.

The experimental- and control-group programs began a week after the pretest and lasted for 2 weeks. In order to ensure that any progress made was of a lasting nature, the posttest was carried out 1 month after the programs were concluded.

Because a knowledge of letters can serve as an intermediary and an instrument that makes it easier to become aware of phonemic entities (Stahl & Murray, 1998; Treiman & Cassar, 1997), we checked how many letters the children were familiar with. We also determined the level of their intelligence.

Procedure

The evaluation of children's conceptual levels

In order to assess the children's conceptual levels, we asked them to spell their name and then to spell a set of words to the best of their ability. After spelling each

word they were asked to read what they had written. The verbal responses that frequently accompanied the act of spelling were recorded.

We dictated 21 pairs of words: words of identical size from a linguistic point of view but refer to items of different size (e.g., *urso/rato* [bear/mouse]); words of a different size from a linguistic perspective but refer to items of a similar size (e.g., *hipopótamo/boi* [hippopotamus/ox]); and singular and plural pairs of words (see Appendix A).

These choices were designed to enable us to understand whether the reasoning behind the children's writing was based on the items to which the words refer, or on the linguistic characteristics of the words themselves. If a child used nonlinguistic or presyllabic criteria to govern his or her writing, it might be expected that inasmuch as bears are big animals and mice are small ones, he or she wrote the word *urso* (bear) with more or bigger letters than he or she used for the word *rato* (mouse) and justified his or her choice by referring to the size of the reference items. If the form of reasoning that governs the writing was linguistic, we expected that both words would be written using approximately the same number of letters and that this would be justified (for example) with reference to the size of the words concerned and especially to the number of syllables they contain.

Our classification of the children's responses was inspired by the classification grids drawn up by Alves-Martins (1994), Besse (1995), and Ferreiro (1988). We employed the following categories: presyllabic writing, syllabic writing without phonetization, and syllabic writing with phonetization.

Presyllabic writing. This category was used to classify spellings in which the children made no attempt to connect oral and written language. In spelling the different words children took account of factors such as a minimum number of letters for each word and a different combination of letters with which to discriminate between different words. The way in which they spelled some words took account of the properties of the reference items—for example, by using more letters for words that referred to large items. Generally speaking, the children did not verbalise at all when spelling, and they read their words globally, as a single whole. Figure 1 shows the writing of Samuel, a presyllabic child.

The following are some extracts from Samuel's interview.

- Adult: Try to write *urso* (bear).
Samuel: (Writes five letters.)
Adult: Now read what you wrote to me and show me with your finger.
Samuel: *Urso* (reads globally).
Adult: Why did you write the word *urso* like that?

Samuel: Because *urso* is a big animal.
 Adult: Now write *rato* (mouse).
 Samuel: (Writes 2 letters.)
 Adult: Now read what you wrote to me and show me with your finger.
 Samuel: *Rato* (reads globally).
 Adult: Why did you write the word *rato* like that?
 Samuel: Because *rato* is a little animal it has to be written with a few letters.

Syllabic writing without phonetization. This category was used for spellings in which the correspondence between oral and written language was based on syllabic units. When they produced this type of spelling, the children often syllabically segmented what was said to them orally before they spelled anything and then represented each syllable using a random letter. They read the words syllabically.

Now let us look at some extracts from an interview with Isabel who wrote syllabically. Figure 2 portrays some of her writing.

Adult: Try to write *urso*.
 Isabel: *Ur* (writes I) *so* (writes A).
 Adult: Now read what you wrote to me and show me with your finger.
 Isabel: *Ur* (points to the I) *so* (points to the A).
 Adult: Why did you write the word *urso* like that?
 Isabel: (Reads the word out again, pointing to each of the letters) *ur/so*, there are two.
 Adult: Now write *rato*.
 Isabel: *Ra* (writes S) *to* (writes F).
 Adult: Now read what you wrote to me and show me with your finger.
 Isabel: *Ra* (points to the S) *to* (points to the F).
 Adult: Why did you write the word *rato* like that?
 Isabel: (Reads the word out again, pointing to each of the letters) *ra/to*, there are two.

Syllabic writing with phonetization. This category was reserved for syllabic writing where the children phonically analysed part of the spoken words by selecting a letter from their repertoire that adequately represented the sounds they had identified. They continued to read words syllabically, and in their verbal output the children tried to identify not only the quantity of letters that they ought to use, but also—in some cases—the most suitable ones.

Finally we have some extracts from an interview with Pedro in which some of the words were written in this way. Figure 3 illustrates his writing.

Adult: Now write *urso*.
 Pedro: *Ur...ur...u* (writes U) *so* (writes I).
 Adult: Now read me what you have just written and show me with your finger.
 Pedro: *Ur/so* (points to the U and then to the I).

Figure 2 Example of Isabel's syllabic writing without phonetization

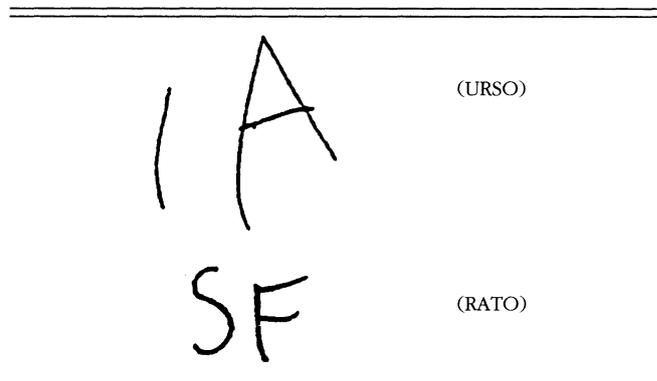
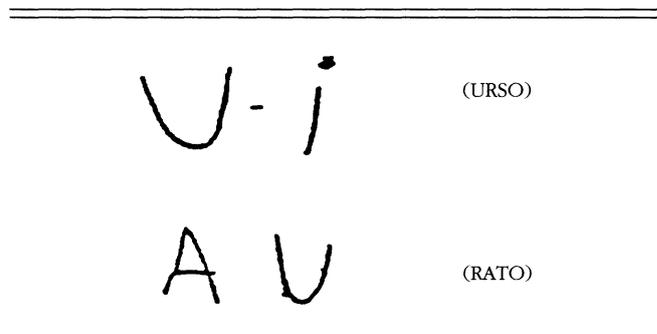


Figure 3 Example of Pedro's syllabic writing with phonetization



Adult: Now write *rato*.
 Pedro: *Ra...ra...ra*, it's A (writes A), *ra/tu*, *tu* it's U (writes U).
 Adult: Now read me what you have just written again and show me with your finger.
 Pedro: *Ra/to* (points first to the first letter and then to the last one).

When we analysed the protocols, we calculated the number of words in each of the categories. On the basis of this analysis we determined the percentile distribution of the various types of spelling between the protocols and classified the children by evolutionary level—for a child to qualify for a given level, around 90% of his or her spellings had to match the applicable criteria.

The evaluation of children's phonological awareness

In order to evaluate the children's phonological awareness, we gave them a battery of four phonological subtests with differing levels of difficulty (so as to address the heterogeneous nature of this particular capability). When we created this battery of tests, we sought to take account of the size of the units (syllables and phonemes) and the phonological properties of the initial phonemes

in each word. The battery included two classification and two deletion tests (see Appendix B).

Each of the classification tests, one of which was based on the initial syllable and the other on the initial phoneme, was composed of 14 items preceded by 2 examples. In each item the children were presented with four drawings representing four oral words (there were no written words). In the case of the initial-syllable classification test two of the words in each item began with the same syllable, while the other two started with different ones (e.g., *girafa* [giraffe]/*panela* [cooking pot]/*cenoura* [carrot]/*palhaço* [clown]), and the children had to identify the words that began with the same syllable. In the initial-phoneme classification test two of the words in each item began with the same phoneme, whereas the others started with different ones, and the children again had to identify the words that began with the same one (e.g., *fvêla* [buckle]/*telhado* [roof]/*janela* [window]/*fogueira* [bonfire]).

The children were given the following instructions when they took the initial-syllable classification test:

“We’re going to play a kind of card game in which we have to find two words that begin with the same syllable, from among a total of four words. First, can you tell me what each of these drawings represents?” The child was shown the first example. When he or she found it difficult to identify any of the words that corresponded to the drawings, the researcher named the word and asked the child to repeat it as many times as was necessary until he or she was automatically able to identify all four words. The adult then went on by saying, “Two of these words in the drawings begin with the same syllable. Let’s play, but this time it doesn’t count—it’s just for you to see how the game works. Which are the two words that begin with the same syllable?” When the child got it wrong the researcher asked him or her to pronounce all the words slowly, emphasising the initial syllable and leading him or her to realise the similarity between the initial syllables of two of the words. This procedure was then repeated for the second example. When both examples were over the researcher added, “Now that I’ve told you how the game is played, let’s start. But be careful—this time you have to find out which words begin with the same syllable on your own.”

The instructions for the initial-phoneme classification test were similar. They only differed in one respect—instead of saying that the children had to find the words that began with the same syllable, they were told that they had to find those that began with the same sound. When a child got the first example item wrong, the researcher asked him or her to pronounce all the words slowly, emphasising the initial phoneme and leading him or her to see the similarity between the initial phonemes

in two of the words. This procedure was then repeated for the second example item.

In the tests involving the deletion of an initial syllable and an initial phoneme, the children were asked to pronounce in isolation each of the syllables or phonemes of words that were presented in a figurative format (i.e., each oral word was again represented by a drawing), and to say what remained of the word without the initial segment, the deletion of which might result in something that was not a word in terms of the Portuguese language (e.g., *no/ta*; *ta*, in the initial-syllable deletion test; or *r/io*; *io*, in the initial-phoneme deletion test). The initial-syllable deletion test was made up of 14 items, half of which were composed of two syllables each and the other half of three syllables each, preceded by two examples; the initial-phoneme deletion test was made up of 24 items (also preceded by two examples), half of which were composed of monosyllabic words and the remainder were disyllabic.

The children were given the following instructions for the initial-syllable deletion test:

“Do you see these cards? Do you know what this drawing shows?” When a child found it difficult to identify one of the words that corresponded to the drawings, the researcher named the word and got the child to repeat it as many times as was necessary until he or she was automatically able to identify the word. “This game is like this: We’re going to take away the first syllable of the word and say what’s left. Let’s play, but this time it doesn’t count—it’s just for you to see how the game works. Tell me what the first syllable of the word *nota* (bank note) is.” If the child was unable to answer, he or she was asked to pronounce the word slowly along with the researcher in such a way as to isolate the first syllable. “Now let’s take the *no* away from the word. What’s left of the word *nota* if we take away *no*?” In the event that the child was unable to comply with the instruction the researcher said, “Well, if we take away the first syllable of the word *nota* we’re left with *ta*. Listen carefully: *no/ta*; *ta*.” The same procedure was then followed for the word in the second example, after which the researcher added, “Now that you’ve understood how the game works, let’s play for real. You’re going to tell me the first syllable in each word and then say what is left of the word once we have taken away this little bit.”

The instructions for the initial-phoneme deletion test were similar, except that instead of saying that the idea was to take away the first syllable, we said that we were going to take away the first sound. In the event that a child was unable to complete one of the example items correctly, he or she was asked to pronounce the word slowly along with the researcher in such a way as to isolate the initial phoneme and then say what was left of the word without that sound.

Whenever the researcher was in any doubt as to whether the child had understood the term “syllable,” he or she always used the term “little bit” instead. In all the tests one point was awarded for each correct answer.

The evaluation of children's knowledge of letters

In order to determine how many and which letters the children were familiar with, they were given a set of cards bearing the letters of the alphabet in capitals (*K*, *W*, and *Y* were excluded, as they are not formally part of the Portuguese alphabet), which they were asked to name. They were then asked to write down the letters they had recognised. The total number of possible points in this test varied between 0 and 23.

The evaluation of children's intelligence

The level of the children's intelligence was evaluated using the coloured version of Raven's Progressive Matrices test (1947—as revised in 1956), because it is not very dependent on verbal aspects.

The writing training program

The writing training program was organised around situations that led the child to think about the rules of writing from two points of view: His or hers, and that of a hypothetical boy or girl of the same age whose spellings were syllabic. In each session the children were asked to spell a set of words to the best of their ability. After spelling each word they were asked to read out what they had written. They were then confronted with the same word, as spelled in accordance with syllabic criteria—one letter/one syllable correspondence—by a hypothetical child from another school. The children were asked to say which of the two versions was better. Before deciding, they had to try to slowly read both what they had written and the writing of the hypothetical child and to try to justify why they had written the word as they had and why the other child had written it in another way. From the second session onward, in addition to these instructions, before they wrote down the words the children were asked to say in advance how many letters they were going to use.

In this way, we created the conditions that would arouse a cognitive conflict in the children between two approaches to writing, inasmuch as the situation itself led them to confront the two ways of writing and to try to expound the hypotheses underlying each of the two approaches. The objective of these spelling situations was to lead children with presyllabic writing to evolve toward syllabic writing.

The phonological training program

The phonological training program involved oral and aural exercises of identification, segmentation, and manipulation of syllabic units. It did not include any written words. In designing it we sought to take account of a number of principles that we considered to be important to research in this domain. They included factors such as the use of drawings to represent sounds (Ball & Blachman, 1991); the use of an object to denote each sound (O'Connor, Jenkins, & Slocum, 1993); the modeling of sounds, with their reproduction by the child and with the researcher calling attention to their articulatory characteristics (Lie, 1991); explicit instructions for the tasks employed; and the graduation of linguistic complexity, particularly in terms of the size of the words and the articulatory properties of the phonemes.

The following tasks were performed over the course of the eight sessions that made up the training program:

1. Syllabic segmentation games in which the child first had to pronounce each syllabic unit and denote it by beating time with a pencil, and then identify the number of syllables that made up each word. The children were given the oral words in a series of four. Each series was composed of words that varied between one and four syllables (e.g., *sol* [sun]/*fada* [fairy]/*camelo* [camel]/*borboleta* [butterfly]). Whenever a child was unable to carry out the task, the correct response was modelled and he or she was again asked to reproduce it.

2. Initial-syllable classification games in which the child had to identify two words that began with the same syllable from among four that were presented to him or her in figurative form (each oral word was represented by a drawing). This task was organised into 12 series. Each one was made up of six items of four words each. In one of the series the initial syllables were vowels (e.g., *anel* [ring]/*irmã* [sister]/*avô* [grandfather]/*óculos* [spectacles]; in the others the target syllables in all six items began with the same consonant (e.g., *bota* [boot]/*carro* [car]/*rato* [mouse]/*raquete* [racket]; or *circo* [circus]/*rosa* [rose]/*mapa* [map]/*rede* [net]).

We employed the following procedure in playing this type of game. The children were asked to indicate the initial syllable of each of the four words in such a way as to identify words that possessed the same initial syllable. When the children found it difficult to carry out this operation, the researcher got them to repeat the word slowly and to stop after they had said the first syllable. Once they were able to isolate the syllable they pointed to each of the words, indicating only the first syllable and identifying the words that shared the common initial segment.

Table 1 Number of children whose writing was presyllabic and syllabic at the posttest

	Children with presyllabic writing	Children with syllabic writing
Experimental Group 1 ($n = 21$)	0	21
Experimental Group 2 ($n = 23$)	0	23
Control Group ($n = 27$)	26	1

3. Initial-syllable deletion games in which the children were asked to pronounce in isolation each of the syllables of 20 words, and to say what remained of the word without the initial segment. It should be noted that in order to facilitate the children's task, the deletion of the first syllable of the words that we used always gave rise to a new word. For 10 of the words we used a game with a figurative support (each oral word was represented by a drawing). For the remaining 10, the words were presented orally (without pictures).

We employed the following procedure in playing this type of game. The children were told that there was a word hidden within another word and that they could find it if they took away the first "little bit." They had to try to find out which of three words that were presented to them corresponded to the hidden one (e.g., for the word *fiavel* [buckle] they were given the words *vela* [candle]/*vaca* [cow]/*dado* [die]; while for *espinha* [bone] they were given *linha* [line]/*pinha* [pine]/*pot* [pot]). Even when the child was immediately successful, the researcher modelled the operation that the child had just carried out in order to show him or her that he or she was right. When the child was unable to give the correct answer, the researcher led him or her to identify the first syllable, modelled the deletion operation, and made the child repeat it.

The control group program

We organised a set of exercises with the control group using material of the logical blocks type. The children were asked to classify geometric shapes in accordance with criteria such as identical shape, size, or colour. The three programs involved eight approximately 15-minute sessions and were individually conducted by us with the children over the course of 2 weeks.

Results

We will begin by presenting the data concerning the knowledge of letters and the level of intelligence of the children in the three groups. We carried out ANOVA with the group as the independent variable and either the number of letters known or the level of intelligence as the

dependent variables. We obtained a figure of $F(2,68) = .02, p = .978$ for the number of letters known and $F(2,68) = 1.80, p = 1.78$ for the level of intelligence. There were no statistically significant differences between the three groups.

In order to assess the effect of the two types of training on the children's concepts of written language (research questions 1, 2, and 3), we looked at the number of children in the three groups whose writing was more highly evolved in conceptual terms at the posttest moment. Table 1 suggests that both forms of training contributed to an expansion of the children's knowledge about written code, inasmuch as the posttest writing of the children in both these groups was systematically governed by linguistic principles. When we look at this table we do not need any statistical procedure to tell us that the two types of training had a similar impact in terms of their role as a factor in the progress of the children's concepts about written language.

Analysis of the children's individual protocols at the posttest shows that all the children in the two experimental groups began to govern their attempts at writing in accordance with syllabic criteria. Only two children in experimental group 1 and four in experimental group 2 began to phonetize some of the syllables in the words. These phonetization procedures principally began to be applied to the first syllable in a word and were used more often in relation to vowels than to consonants. At the same time they almost always occurred with words in which the initial syllable was accentuated. These children were the ones who were familiar with the greatest number of letters.

The children in the control group continued to obey presyllabic criteria in their spelling. Just one child in this group spelled a few words using syllabic criteria (more precisely, 22% of all the words she wrote).

Figure 4, which contains extracts from Vera's (a member of experimental group 1) protocol, exemplifies the presyllabic forms of writing that she produced in the pretest.

- Adult: Now write *urso* (bear).
Vera: (Writes in silence.)
Adult: Now read me what you have just written and show it to me with your finger.
Vera: (Reads globally while simultaneously passing her finger over the writing.)
Adult: Now write *rato* (mouse).
Vera: (Again writes in silence.)
Adult: Read it to me again and show me with your finger at the same time as you read.
Vera: (Reads as before.)
Adult: Why did you use different letters for *urso* and *rato*?

Figure 4 Example of Vera's presyllabic writing in the pretest

ACT EV (URSO)
 DRIBT (RATO)

Figure 5 Example of Vera's syllabic writing in the posttest

O A (URSO)
 O S (RATO)

Vera: Because a bear is a bear—it's not the same thing as a mouse, is it?

Now let us look at extracts from Vera's posttest, which are illustrative of the characteristics of the children's spellings at that point. Vera spelled all the words in accordance with the syllabic hypothesis. Figure 5 shows some of the words she spelled.

Adult: Now write *urso*.
 Vera: *Ur* (writes O) *so* (writes A).
 Adult: Now read me what you wrote and show me with your finger.
 Vera: *Ur* (points to the O) *so* (points to the A); it has to be two, don't you see...*ur/so* (reads the word again).
 Adult: Now write *rato*.
 Vera: *Ra* (writes O) *to* (writes S).
 Adult: Now read what you wrote to me and show me with your finger.
 Vera: *Ra* (points to the O) *to* (points to the S).
 Researcher: Why did you write the word *rato* like that?
 Vera: (Reads the word out again, pointing to each of the letters) *ra/to*, there are two of them.

In order to assess the effect of the two types of training on the children's phonological skills (research questions 4, 5, and 6) we used ANOVA with repeated measures to compare the children's performance in the

Table 2 Mean scores and standard deviations for the initial-syllable classification test

	Pretest		Posttest	
	Mean	SD	Mean	SD
Experimental Group 1	11.47	2.24	13.85	.35
Experimental Group 2	9.43	3.57	13.73	.31
Control Group	10.55	2.72	12.11	2.27

This test was composed of 14 items.

Table 3 Mean scores and standard deviations for the initial-phoneme classification test

	Pretest		Posttest	
	Mean	SD	Mean	SD
Experimental Group 1	5.95	2.61	8.28	1.90
Experimental Group 2	6.73	2.41	9.86	1.96
Control Group	5.33	1.50	5.60	2.10

This test was composed of 14 items.

various phonological tasks that the children were set on the pre- and posttest. In order to deepen our understanding of the differences between the groups, we subsequently carried out a post hoc analysis using a version of the Tukey test that applies to situations involving different-sized groups. In those cases in which we could not assume that variances were homogeneous, we performed the same analysis using the Games-Howell procedure.

We will now present the children's results in each of the tests. In the initial-syllable classification test, the descriptive statistics included in Table 2 suggest that the results obtained by the two experimental groups on the posttest are close to one another and slightly better than those of the control group.

The results of the ANOVA reveal that there was only a statistically significant evolution in the children's results in this classification test between the two evaluation moments, $F(1,68) = 68.84$, $p = .001$. There were no statistically significant differences between the groups.

When we come to the initial-phoneme classification test, an analysis of Table 3 enables us to see that the averages that the two experimental groups obtained at the posttest are close to each other and are higher than those of the control group. There had not been much difference between the average results achieved by the three groups in the pretest. The results of the ANOVA show that the moment $F(1,68) = 46.72$, $p = .001$; group $F(2,68) = 16.38$, $p = .001$; and group x moment interaction $F(2,68) = 9.72$, $p = .001$ variables produced statistically significant effects.

The post hoc procedure revealed that both types of training led to statistically significant effects on the chil-

Table 4 Mean scores and standard deviations for the initial-syllable deletion test

	Pretest		Posttest	
	Mean	SD	Mean	SD
Experimental Group 1	4.76	4.42	12.90	1.99
Experimental Group 2	3.69	3.59	11.86	2.18
Control Group	3.59	3.72	6.70	5.23

This test was composed of 14 items.

Table 5 Mean scores and standard deviations for the initial-phoneme deletion test

	Pretest		Posttest	
	Mean	SD	Mean	SD
Experimental Group 1	3.14	6.49	3.95	7.12
Experimental Group 2	5.52	6.49	13.78	7.12
Control Group	1.44	3.64	1.74	2.95

This test was composed of 24 items.

dren's performance in this phonological task, inasmuch as there were statistically significant differences between the results achieved by the two experimental groups on the one hand and those of the control group on the other, whereas there were no differences between the results of the experimental groups themselves.

The averages achieved in the initial-syllable deletion test (see Table 4) clearly indicate that the two experimental groups obtained much better results on the posttest than did the control group. The same table also shows that the averages the three groups scored on the pretest did not differ greatly from one another, albeit Experimental Group 1 did slightly better than the others.

The results of the ANOVA corroborate the idea that the children's results in this test evolved significantly, from a statistical point of view, between the pretest and posttest moments $F(1,68) = 202.44, p = .001$. They also show that there are statistically significant differences depending on the group $F(2,68) = 8.48, p = .001$ and the moment x group interaction $F(2,68) = 14.05, p = .001$. Post hoc analysis showed that both types of training produced an impact, inasmuch as we recorded statistically significant differences between the experimental groups on the one hand and the control group on the other, but not between the two experimental groups.

As regards the initial-phoneme deletion test, we can see from Table 5 that experimental group 2's results in the posttest were far superior to those of the other two groups and there was a considerable evolution between the two evaluation moments. The averages attained by

the other two groups were practically identical on the pretest and the posttest.

The results of the ANOVA show that the children's performance in the initial-phoneme deletion test evolved significantly, from a statistical point of view, between the pretest and posttest $F(1,68) = 29.95, p = .001$. The group $F(2,68) = 13.52, p = .001$ and moment x group interaction $F(2,68) = 20.43, p = .001$ variables also produced substantial effects. Post hoc analysis showed that this difference in evolution is due to the impact of the phonological training, inasmuch as the averages that the members of experimental group 2 obtained in this test differ significantly, from a statistical point of view, from those obtained by experimental group 1 and the control group. On the other hand the same analysis reveals no differences between the averages obtained by experimental group 1 and those of the control group.

Discussion

One of the aspects we sought to assess in this study was to what extent presyllabic children who are subjected to a writing training program evolve, not only in their conceptualisations of writing, but also in their phonological skills.

Our data confirm that a writing training program designed to alter the way in which presyllabic children see and use writing such that they begin to employ syllabic criteria not only leads presyllabic children to progress in their invented spellings, but also improves their phonological skills. The children's performance in phonological tasks on the posttest did indeed improve significantly from a statistical point of view, both in terms of their manipulation of syllabic units (as we can see from the results they obtained in the initial-syllable deletion tests) and as regards their awareness of the presence of common phonemic elements in different words (shown by the results of the initial-phoneme classification test). The progress we recorded in the latter test is particularly significant in light of the fact that children's ability to identify common phonemes in different words is critical to an understanding of the alphabetic nature of writing (Stahl & Murray, 1998). The results obtained in this test also suggest that establishing systematic relationships between segments of speech and written units may contribute to the conceptual emergence of phonemic entities along lines that are similar to the way put forward by Byrne and Fielding-Barnsley (1989), who looked upon evolution in the performance of this task as concept formation.

The evolution we observed in the phonological tasks, in the children who underwent the writing training program, fits into the overall line of thought that Treiman

(1998) and Adams (1998) suggested about the role invented writing plays in enabling children to grasp the oral structure of words.

We also sought to investigate whether presyllabic children who underwent a phonological training program would evolve, not only in their phonological abilities, but also in their conceptualisations of writing. The data we obtained indicate that the phonological training program led not only to statistically significant progress in the children's phonological skills (as may be seen from the results they obtained in the initial-syllable deletion, initial-phoneme classification, and initial-phoneme deletion tests), but also to changes in the characteristics of their invented spellings. Our study confirms the data that Manrique (1997) and Tangel and Blachman (1992) produced that phonological training leads to progress in the nature of children's invented spelling.

Finally, we sought to investigate whether the two types of training would have identical effects on both children's conceptualisations of writing and their phonological skills. When it came to the way in which the children represented writing, the data show that the two types had equivalent effects (at the posttest all the children in both experimental groups had begun to govern their writing in accordance with the syllabic hypothesis).

One element that warrants particular note is the case of the children who, besides beginning to write in accordance with the syllabic hypothesis, also started to employ conventional letters to represent some of the sounds in words. As we said earlier, these children were those members of the experimental groups who were familiar with the largest number of letters. Besides this, on the pretest these children had achieved success rates that were above the average scored by the other children in the tests involving classification based on common phonemes and the deletion of the initial phoneme. It was probably the conjugation of their knowledge of letters and a higher level of phonemic awareness that led to the appearance of phonetization processes in these children.

The fact that phonetization procedures only occurred in these children confirms Byrne's (1998) view about the need for coordination between knowledge of letters and phonological abilities if children are to make progress in learning the written code. However, in our case we found that this was already true of children at a less evolved level.

It is also important to add that in the relatively isolated examples of phonetization processes we came across, vowels were used more often than consonants. This can probably be explained by the fact that in Portuguese the sound value of some vowels in syllables corresponds to the name of the letter concerned (e.g., the *i* in *livro* [book] or the *u* in *urso* [bear]). This match be-

tween the name of a letter and its sound value occurs much more often in vowels than it does in consonants. This circumstance makes it easier to remember the letter in question, given that various authors have shown that one of the factors that influence children's ability to establish a relationship between letters and phonemes is that the phoneme forms part of the name of the letter in question (Mann, 1993; Treiman & Cassar, 1997; Treiman et al., 1998).

As far as phonological skills are concerned, the data show that there were both similarities and differences between the groups. Let us begin by emphasising the fact that when set against the results of the control group, neither of the two training programs seems to have had a statistically significant impact on the initial-syllable classification test. The relatively good results that the children in the control group achieved in this test indicate that these types of skills develop spontaneously over the course of the preschool years and do not involve any development in the way in which children look at and use writing, as has been shown in many other studies (Lieberman et al., 1974; Sim-Sim, 1997; Treiman, 1992).

At the same time the two programs had more or less identical effects on the initial-syllable deletion test and the initial-phoneme classification test, but not on the initial-phoneme deletion test. In the latter the results obtained by the children who underwent the phonological training program (experimental group 2) were clearly superior to those achieved by the group that took the writing training program (experimental group 1).

If we bear in mind the fact that the training only addressed syllabic units and did not include any form of activity aimed at appropriating segmental units, these results raise a number of questions. There is not a lot of literature to help interpret them, given that when phonological intervention programs employ games with syllables or other suprasegmental units, most of them do so as a prior step to the use of games that address phonemic units (Byrne & Fielding-Barnsley, 1989; Lundberg, Frost, & Peterson, 1988). Reviews of recent works on phonological training programs (Bus, Marinus, & Ijzendoorn, 1999; Troia, 1999), in which the characteristics and the impact of intervention programs conducted as part of the last 20 years' research in this domain are analysed, do not contain a single reference to a program that has been exclusively centred on syllabic units.

The results that the children in experimental group 2 obtained in the initial-phoneme deletion test may perhaps have been precipitated by the way in which the deletion operation was modelled at syllable level. In light of the fact that "the concept of phoneme identity is closely related to the ability to segment a part of a spoken word" (Stahl & Murray, 1998, p. 83), this aspect of the

program, which was coordinated with the children's progress in forming the identity of phonemes, may have contributed to the statistically significant evolution in their scores in this test. In addition, the progress we observed in the performance of this task may also have been facilitated by the characteristics of the test itself. The test included many items that were composed of monosyllabic words in which the initial phoneme corresponds to the onset of the syllable. Treiman (1992) said that in these circumstances preschool-age children can achieve a certain amount of success in this test on the basis of the intrasyllabic components.

In summary, the results of this study confirm the point of view put forward by various authors (Byrne, 1997, 1998; Pontecorvo & Orsolini, 1996; Stahl & Murray, 1998; Tolchinsky & Teberosky, 1998) who said that there is a complex interaction between the processes involved in becoming aware of the oral units in speech and understanding the way in which written code works. This interaction, which has primarily been noted when children begin to see conventional correspondences between the sounds of words and the letters they need to use (Adams, 1998; Treiman, 1998), seems to be true even at earlier levels.

This conclusion is one of the most innovative aspects of the results we obtained, inasmuch as the interactive dynamic between oral learning processes and the processes involved in understanding writing have previously been taken into consideration only when children have begun to establish some graphic-phonetic correspondences in their preconventional writing (Treiman, 1998). Our study confirms that the skills that enable children to think about oral language and the way in which children represent the written code begin to influence one another at quite early stages.

This means that within the context of a language like Portuguese, in which there are a lot of polysyllabic words and open syllables of the consonant-vowel type, phonological training programs that work on syllabic units lead children to establish relationships between speech and writing that are themselves based on syllabic units. At the same time, inducing children to think about syllabic components as units that codify writing favours the development of phonological skills. It should be noted that this evolution also occurs at the level of the awareness of phonemes—a skill that Byrne (1998) and Stahl and Murray (1998) consider critical to grasping the alphabetic characteristics of writing.

Our study also reveals that there may be two ways in which it is possible to transition from forms of presyllabic writing to syllabic writing formats: one derived from the application to writing of the various ways to manipulate syllabic units, and one of reflection on the relation-

ship between the various parts of the written word and the word as a whole.

From the pedagogical point of view our results strengthen the stance that various authors (Adams, 1998; Treiman, 1998) have taken about the importance of the early stimulation of invented spelling activities to promote both phonological awareness and the gradual learning of the alphabetic principle. This implication becomes even more important if we remember that although they were not yet establishing graphic-phonetic correspondences, the children who underwent the syllabic writing program experienced statistically significant evolution in terms of their awareness of phonemic entities—a capability that is considered fundamental to an understanding of the alphabetic principle (Byrne, 1998; Stahl & Murray, 1998)

At the same time the results of our study also seem to indicate that programs designed to train syllabic unit identification, segmentation, and manipulation capabilities may have an impact at the phoneme awareness level, quite apart from the impact they have in terms of children's representations of written language. Given that both these types of program are easily applied to children in this age group, it seems to us that they should be more systematically used to help children understand the alphabetic principle.

To conclude, we would also like to point out some limitations of this study and a few directions for future research. One of the limitations is that we did not control the general language ability of the children in our sample group—a factor that can be important, given that some studies have shown the existence of a relationship between this variable and phonological awareness (e.g., Webster & Plante, 1992).

Another limitation is that although there is some similarity between the pre- and posttest and the training programs, the children may simply have imitated learned behaviours rather than reorganized their conceptual understandings. However, it seems to us that the fact that the posttest was carried out a month after the training program offers at least some guarantee that what took place really was a number of conceptual reorganisations. At the same time, the fact that the writing training program had an impact on the phonological tests and that the phonological training program had an effect on the children's representations of writing would appear to confirm that the outcome did not constitute an imitation of learned behaviours.

As far as developments for future research are concerned, it would be interesting to manipulate the number of letters with which the experimental groups are familiar in such a way as to be able to specify the mediating function this knowledge performs in terms of the training's effectiveness. Another pertinent aspect that re-

quires more in-depth investigation in the future is the need to clarify the capabilities that, within the framework of this type of intervention, may well have enabled some children to evolve to the use of phonetization processes in their writing.

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APPENDIX A

Words used to evaluate children's conceptual levels

Pairs of words that are of an identical size from a syllabic point of view, but which refer to items that possess different sizes

urso/rato (bear/mouse)

vaca/mosca (cow/fly)

galo/pinto (cock/chick)

tigre/sapo (tiger/toad)

elefante/lagarto (elephant/lizard)

dinossauro/borboleta (dinosaur/butterfly)

cavalo/formiga (horse/ant)

Pairs of words that are of a different size from a syllabic perspective, but which refer to items of a similar size

raposa/cão (fox/dog)

hipopótamo/boi (hippopotamus/ox)

leopardo/dragão (leopard/dragon)

macaco/foca (monkey/seal)

sardinha/rã (sardine/frog)

gafanhoto/vespa (grasshopper/wasp)

abelha/pulga (bee/flea)

Singular/plural pairs of words

ovelha/ovelhas (sheep/sheep)

zebra/zebras (zebra/zebras)

janela/janelas (window/windows)

uva/uvras (grape/grapes)

navio/ navios (ship/ships)

igreja/igrejas (church/churches)

gato/gatos (cat/cats)

APPENDIX B

Battery of phonological tests

Initial-syllable classification test

Cards with representative drawings:

Examples:

- bolo/nariz/navio/moinho (cake/nose/ship/mill)
- igreja/ouro/arroz/iogurte (church/gold/rice/yogurt)

Items:

- uva/asa/unha/ilha (grape/wing/nail/island)
- enxada/ourico/agulha/apito
(hoe/urchin/needle/whistle)
- rolo/sapo/figo/roupa (roll/toad/fig/clothes)
- coelho/machado/piano/macaco
(rabbit/axe/piano/monkey)
- garrafa/galinha/pijama/moeda
(bottle/hen/pyjama/coin)
- tesoura/casaco/moinho/cavalo
(scissors/coat/mill/horse)
- vaso/pipa/mesa/vaca (vase/barrel/table/cow)
- chupa/fato/faca/bico (lolly pop/suit/knife/brook)
- janela/menina/tomate/torrada
(window/girl/tomato/toast)
- girafa/panela/cenoura/palhaço
(giraffe/pot/carrot/clown)
- bota/jarro/ninho/bola (boot/jar/nest/ball)
- saco/sapo/burro/mota (bag/toad/donkey/motorcycle)
- laranja/medalha/lagarto/pinheiro
(orange/medal/lizard/pine)
- sino/data/dado/folha (bell/date/die/leaf)

Initial-phoneme classification test

Cards with representative drawings:

Examples:

- colher/chave/chuva/bola (spoon/key/rain/ball)
- jóia/nó/jipe/pá (jewel/knot/jeep/shovel)

Items:

- alce/urso/arca/ovo (moose/bear/arch/egg)
- orelha/alface/árvore/igreja (ear/lettuce/tree/church)
- raposa/regador/viola/boneca (fox/watering
can/guitar/doll)
- mala/peixe/chucha/mota (bag/fish/doll/motorcycle)
- sumo/gola/leite/gato (juice/collar/milk/cat)
- buzina/cegonha/vassoura/veado
(horn/stork/broom/deer)
- serra/copo/cama/lupa (saw/glass/bed/magnifying
glass)
- fivela/telhado/janela/fogueira
(buckle/roof/window/bonfire)
- boca/tigre/selo/tacho (mouth/tiger/stamp/pot)
- pato/pêra/milho/chuva (duck/pear/corn/rain)
- tijolo/bolacha/seringa/banana
(brick/biscuit/syringe/banana)
- cebola/toalha/gaveta/cigarro
(onion/towel/drawer/cigarette)
- lata/luva/roda/fita (can/glove/wheel/ribbon)

- desenho/camisa/dominó/novelo
(drawing/shirt/domino/ball of wool)

Initial-syllable deletion test

Cards with representative drawings:

Examples:

- nota (bank note)
- ameixa (plum)

Items:

- avó (grandmother)
- orelha (ear)
- rádio (radio)
- morango (strawberry)
- gorila (gorilla)
- vela (candle)
- caneta (pen)
- foca (seal)
- tapete (carpet)
- pássaro (bird)
- boca (mouth)
- seta (arrow)
- laço (tie)
- dedal (thimble)

Initial-phoneme deletion test

Cards with representative drawings:

Examples:

- noz (nut)
- bóia (life buoy)

Items:

- rio (river)
 - rosa (rose)
 - mel (honey)
 - mola (clothespin)
 - gás (gas)
 - galo (cock)
 - vale (valley)
 - vila (village)
 - cão (dog)
 - capa (overcoat)
 - fio (thread)
 - fava (bean)
 - torre (tower)
 - telha (tile)
 - pão (bread)
 - pipa (barrel)
 - boi (ox)
 - bolo (cake)
 - sal (salt)
 - sumo (juice)
 - lua (moon)
 - lula (squid)
 - dente (tooth)
 - dedo (finger)
-