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ORTHOGRAPHIC KNOWLEDGE, THE "VISUAL IDENTITY EFFECT" AND PHONEMIC TRANSCRIPTION. PRELIMINARY RESULTS FROM A STUDY WITH PORTUGUESE SUBJECTS

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ORTHOGRAPHIC KNOWLEDGE, THE "VISUAL IDENTITY EFFECT" AND PHONEMIC TRANSCRIPTION. PRELIMINARY RESULTS FROM A STUDY WITH PORTUGUESE SUBJECTS(*)

1 – Introduction

The influence of literacy and orthographic knowledge on the awareness of sounds and sound properties, as well as on a wide range of metaphonological abilities, has long been an important topic for psycholinguistics.

Within this field of interest, the most commonly explored issue has been the relationship between alphabetic knowledge – i. e., the explicit knowledge of the written form of words in languages that use an alphabetic script – and phoneme awareness (that is to say, the awareness that words may be split into phoneme-like chunks). This interrelation was first brought into evidence by Liberman, Shankweiler, Fischer & Carter (1974), who showed that phoneme awareness differs from syllable awareness in that the former, contrarily to the latter, needs the mediation of alphabetic knowledge. Later studies, especially those from the so-called "Brussels Group", have also shown this effect, as they contributed to the view that only speakers with alphabetic knowledge can break words into their constituting phonemes or perform in experimental tasks (such as counting, deleting, order-reversal, and so on – see, e. g., Catts, Wilcox, Wood-Jackson, Larrivee & Scott, 1997:48-52) based upon the phoneme as a manipulation criterion (see, among others: Alegria & Morais, 1979; Morais, Cary, Alegria & Bertelson, 1979; Alegria, Pignot & Morais, 1982; Content, 1985; Read, Yun-Fei, Hong-Yin & Bao-Qing, 1986; Kolinsky, Cary & Morais, 1987; Morais, Alegria & Content, 1987; Bertelson, De Gelder, Tfouni & Morais, 1989; Adrián, Alegria & Morais, 1995; Morais, Kolinsky & Nakamura, 1996; Scliar-Cabral, Morais, Nepomuceno & Kolinsky, 1997; Morais, Kolinsky, Alegria & Scliar-Cabral, 1998; Nakamura, Kolinsky, Spagnoletti & Morais, 1998; Li, Anderson, Nagy & Zhang, 2002; Miller, 2002; Taylor, 2002).

In addition, other studies have shed light on our understanding of the relationships between orthographic knowledge and metaphonological abilities such as speech perception (Frost, Repp & Katz, 1988; Castro, 1992), lexical processing (Zuck, 1996; Jared, 1997; Peereman & Content, 1997; Dijkstra, Grainger & Van Heuven, 1999; Dijkstra, Timmermans & Schriefers, 2000; Grainger, Spinelli & Ferrand, 2000), rhyme detection (Seidenberg & Tanenhaus, 1979), phoneme detection (Ehri & Wilce, 1980; Taft & Hambly, 1985; Hallé, Chéreau & Segui, 2000), categorical discrimination of sounds (Ehri, Wilce & Taylor, 1987) and syllabic segmentation of words (Treiman &

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Danis, 1988; Ventura, Kolinsky, Brito-Mendes & Morais, 2001; Veloso, 2003). All these studies suggest that subjects with alphabetic knowledge perform in phonemic tasks differently from those who do not possess it, and that subjects with alphabetic knowledge perform differently when their alphabetic knowledge is activated and when it is not.

In the specific domain of how orthographic knowledge can bias phonemic transcription, Crookston (1999; 2001) found that, when transcribing English fricatives phonemically, native speakers of British English show consistent accuracy when faced with fricatives with regular orthographic counterparts ([f], [v]); on the other hand, they show make more errors and inconsistencies when they are asked to phonemically transcribe fricatives without one-to-one orthographic correspondents ([θ], [ð], [s], [z], [ʃ], [ʒ]) (see Crookston, 1999:24-25; 2001:9-10).

These effects of alphabetic knowledge on certain external manifestations of the subjects' phonological knowledge have led Pinto (1994:94) to suggest the existence of a "filtering" effect of the knowledge of the words' written form on phonological awareness.

In this paper, we assume therefore that the effects of alphabetic knowledge on the subjects' performance in metaphonological tasks are evidenced in a number of manifestations. Bearing this assumption in mind, our main aim is to see whether we can find for Portuguese subjects' phonemic transcriptions some effects similar to those that Crookston (1999; 2001) found for English speakers (see above).

For this purpose, we have chosen the case of the European Portuguese (EP) sounds [ʃ] and [ʒ], which under certain circumstances share the same orthographic symbol but, in other cases, are spelt with specific orthographic notations:

- as for the spelling of [ʃ], this sound can be spelt either with specific symbols, never used for the spelling of [ʒ] – like "ch" (e.g.: "cheio" ['ʃeju], *"plenty"*) or "x" (e.g.: "xícara" ['ʃikɐrɐ], *"cup"*) –, or, in syllable-final position before a voiceless consonant, with the letter "s", which can be also used in the spelling of [ʒ], in words such as "pesca" ['pɛʃkɐ] *("fishing")*, for instance;

- similarly, [ʒ] can be spelt with specific orthographic symbols, never used in the spelling of [ʃ] – in such case, the letters "j" or "g" (the latter, only before "e" or "i") are used, as in the words "jogo" ['ʒogu] *("play")* and "gelo" ['ʒelu] *("ice")* –, or with the same letter "s" used for the spelling of [ʃ] too, also syllable-finally but before a voiced consonant (for example: "mesmo" ['meʒmu], *"same"*).

Hereafter, we will refer to these two orthographic conditions by calling them **"SAME SPELLING CONDITION" (SSC)** – i. e., the situation where both sounds are spelt with a "common" "s" – and **"DIFFERENT SPELLING CONDITION" (DSC)**, when [ʃ] is spelt by means of "ch" or "x" and [ʒ] is spelt with "j" or "g(e, i)".

2 – Rationale

Based upon the arguments presented above, we hypothesised that, if orthographic knowledge can actually bias tasks like phonemic transcription, one could expect that:

- when Portuguese [ʃ] and [ʒ] are spelt with the same orthographic symbol (SSC), the same IPA symbol will be often used in phonemic transcription by unskilled transcribers[1];

- however, when Portuguese [ʃ] and [ʒ] are spelt with distinct orthographic symbols (DSC), different IPA symbols will be consistently used in phonemic transcription, even by unskilled transcribers.

3 – Experiment

In order to test our hypotheses, the following experiment was carried out.

Method

Subjects

The subjects were 42 undergraduate students of Portuguese Linguistics at the University of Porto (Portugal). All were native speakers of EP and had a very rough knowledge of phonetic/phonemic transcription, as the experiment took place during their first week of course. This meant they knew only the basic value of each IPA symbol for the sounds of their mother tongue and the basic IPA conventions, such as using square brackets and marking the primary stress of words.

Procedure

The subjects were asked to give a broad phonetic transcription of a list of words presented to them in written form. Each subject was asked to transcribe each word according to his/her own dialect and idiolect, attempting to transcribe it as closely as possible to what s/he considered to be the most usual pronunciation of the word in his/her individual norm.

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[1] We refer here to unskilled transcribers only since we assume that skilled transcribers are expected to be more aware of any phonetic details (more capable, then, of "escaping" the influence of variables other than the specific conventions associated with phonetic/phonemic transcription).

No further explanations of the aims and procedures of the experiment were given to the subjects.

Linguistic material

The subjects were presented a list of 55 Portuguese words. Among these words, 24 words contained either a [ʃ] or a [ʒ] sound. For each of these two sounds, 6 words observed the SSC, while the other 6 were in accordance with the DSC.

These 24 words, split into the 4 different groups resulting from the combination of these two conditions, are shown in Table 1.

TABLE 1: Linguistic material presented to the subjects: [ʃ]-words and [ʒ]-words

[ʃ]-WORDS		[ʒ]-WORDS	
SSC	DSC	SSC	DSC
cospe, '(s/he) spits': ['kɔʃpi]	**gancho**, 'hook': ['gɐ̃ʃu]	**fisga**, 'catapult': ['fiʒgɐ]	**jaula**, 'cage': ['ʒawlɐ]
rosto, 'face': ['Roʃtu]	**roxo**, 'purple': ['Roʃu]	**asma**, 'asthma': ['aʒmɐ]	**geleia**, 'jam': [ʒi'lɐjɐ]
lasca, 'bit of wood': ['laʃkɐ]	**lixo**, 'rubbish': ['liʃu]	**asno**, 'donkey': ['aʒnu]	**gente**, 'people': ['ʒẽtɨ]
despe, '(s/he) takes his/her clothes off': ['dɛʃpi]	**acha**, '(s/he) finds': ['aʃɐ]	**sismo**, 'earthquake': ['siʒmu]	**jóia**, 'jewel': ['ʒɔjɐ]
pesca, 'fishing': ['pɛʃkɐ]	**coxa**, 'thigh': ['koʃɐ]	**desdém**, 'scorn': [diʒ'dẽj]	**jogo**, 'play': ['ʒogu]
pasta, 'suitcase': ['paʃtɐ]	**mocho**, 'owl': ['moʃu]	**rasga**, '(s/he) tears': ['Raʒgɐ]	**girafa**, 'giraffe': [ʒi'rafɐ]

SSC=Same Spelling Condition; DSC=Different Spelling Condition.

4 – Results

For the 24 words shown at Table 1, 1008 transcriptions (=24 words X 42 subjects) were obtained. For each of the four groups of words, 252 transcriptions were collected (=6 words X 42 subjects).

The results are presented below. For each sound under analysis (i. e., for [ʃ] and [ʒ] separately), we will take into consideration the IPA symbols presented by the subjects in their phonetic transcriptions.

[ʃ]-words

As for the words with a [ʃ] sound, either under SSC or DSC, the results are displayed in Table 2.

TABLE 2: [ʃ]-words: Percentage and mean number of transcriptions with different IPA symbols

WORDS →	SSC (e.g. "cospe")		DSC (e.g. "gancho")	
TRANSCRIPTIONS ↓	Nr (%) (*)	Mean (SD) (**)	Nr (%) (*)	Mean (SD) (**)
[ʃ]	219 (86,9%)	5,21 (1,73)	239 (94,5%)	5,69 (0,92)
[s]	22 (8,7%)	0,52 (1,42)	1 (0,4%)	0,02 (0,15)
OTHER	11 (4,4%)		12 (5,1%)	

SSC=Same Spelling Condition; DSC=Different Spelling Condition.
(*) – In relation to the 252 transcriptions obtained within these groups of words.
(**) – Mean nr (and standard-deviation) of transcriptions for the 6 words of each group presented by each subject.

[ʒ]-words

Looking into the words that contained a [ʒ] sound (spelt also under SSC or DSC), the results are shown in Table 3.

TABLE 3: [ʒ]-words: Percentage and mean number of transcriptions with different IPA symbols

WORDS →	SSC (e.g. "fisga")		DSC (e.g. "jogo")	
TRANSCRIPTIONS ↓	Nr (%) (*)	Mean (SD) (**)	Nr (%) (*)	Mean (SD) (**)
[ʃ]	140 (55,6%)	3,33 (2,48)	1 (0,4%)	0,02 (0,15)
[s]	23 (9,1%)	0,55 (1,27)	0 (0%)	0,00 (0,00)
[ʒ]	84 (33,3%)	2,00 (2,33)	233 (92,5%)	5,55 (1,33)
OTHER	5 (2%)		18 (7,1%)	

SSC=Same Spelling Condition; DSC=Different Spelling Condition.
(*) – In relation to the 252 transcriptions obtained within these groups of words.
(**) – Mean nr (and standard-deviation) of transcriptions for the 6 words of each group presented by each subject.

5 – Discussion

In order to evaluate the role of orthographic knowledge on the tasks our subjects were asked to perform, we will start by looking once again at the results obtained with [ʃ]-words and [ʒ]-words separately. Some comparisons will be made: at first, the results obtained within each group of words (i. e., usage of different IPA symbols with [ʃ]-words and [ʒ]-words separately) will be compared. Then, the results and their comparisons will be critically reviewed and confronted with the hypotheses formulated in section 2.

[ʃ]-words

As for the 6 words with a [ʃ] sound spelt under SSC (such as "cospe" ['kɔʃpɨ], *"(s/he) spits"* – see Table 1), we can see (Table 2) that the use of IPA symbols [ʃ] and [s] differs: [ʃ] is used more often (mean=5,21 words, SD=1,73) than [s] (mean=0,52 words, SD=1,42). This difference is statistically significant: $t(41)=10,160$; $p<0,005$.

Similarly, within the group of 6 words with a [ʃ] sound spelt under DSC (such as "ganc<u>h</u>o" ['gɐ̃ʃu], *"hook"*, for instance – see Table 1), it can also be seen that the IPA symbol [ʃ] is used by the subjects more often than the IPA symbol [s]: as is shown by Table 2, IPA [ʃ] is used on average in 5,69 words (SD=0,92) and IPA [s] is used on average in 0,02 words (SD=0,15). A statistically significant difference has been found for this result too ($t(41)=37,494$; $p<0,005$).

If we compare the use of these two phonetic symbols, within [ʃ]-words only under SSC and DSC, we see that:

- there is no significant difference between the use of IPA [ʃ] in SSC (mean=5,21 words, SD=1,73) *vs.* DSC (mean=5,69, SD=0,92): $t(41)=-1,550$; n.s.;

- otherwise, as far as the use of IPA [s] is concerned, there is a significant difference between SSC (mean=0,52 words, SD=1,42) and DSC (mean=0,02 words, SD=0,15): $t(41)=2,342$; $p<0,05$.

That is to say, within [ʃ]-words, IPA [ʃ] seems to be used regardless of the word's being spelt with "s" (SSC) or with a specific orthographic symbol or convention such as "ch" or "x" (DSC). IPA [s], though, seems to be used more often when an orthographic "s" is found in the word (SSC).

[ʒ]-words

When we compare the use of IPA [ʃ], [s] and [ʒ] in [ʒ]-words written under SSC (see results in Table 3), significant differences are found between the use of IPA [s] and any other IPA symbol under consideration: [s] (mean=0,55 words, SD=1,27) is used

less often than [ʃ] (mean=3,33 words, SD=2,48) (t(41)=5,744; p<0,005) and [ʒ] (mean=2,00 words, SD=2,33) (t(41)=-3,286; p<0,005). The difference regarding the use of [ʃ] and [ʒ], instead, is not statistically significant (t(41)=1,879; n.s.).

With [ʒ]-words under DSC, statistical differences were found in the comparison between the use of IPA [ʃ] (mean=0,02 words, SD=0,15) *vs.* [ʒ] (mean=5,55 words, SD=1,33) (t(41)=-26,561; p<0,005). [s], as can be seen in Table 3, was never used in the transcription of these words.

Comparing the use of IPA [ʃ] and [ʒ] in SSC *vs.* DSC[2], it should be noticed that:

- [ʃ] is more often used under SSC (mean=3,33 words, SD=2,48) than under DSC [ʃ] (mean=0,02 words, SD=0,15) (t(41)=8,567; p<0,005);

- concomitantly, [ʒ] is more frequent under DSC (mean=5,55 words, SD=1,33) than under SSC (mean=2,00 words, SD=2,33) (t(41)=-8,855; p<0,005).

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A first glance over our data and these comparisons could lead us to the conclusion that our findings agree, at least partially, with the basic proposal of the rationale formulated in section 2.

As a matter of fact, some hints of the influence of orthographic knowledge on phonemic transcription seem to be implied in our results:

(i). In [ʃ]-words under DSC, IPA [s] is almost never used by the subjects. On the contrary, in this group of words [ʃ] is the most frequent, almost exclusive, phonetic symbol to transcribe this sound. This effect could be due to the fact that in this group of words the sound [ʃ] is "orthographically marked", i. e., spelt with specific letters that may facilitate its distinction and categorisation even in tasks that focus primarily on the subjects' auditory abilities and not on their knowledge of written forms.

(ii). Also in [ʃ]-words, the use of IPA [s] differs statistically from words under SSC and DSC: as mentioned, [s] is used more often with SSC [ʃ]-words than with DSC [ʃ]-words (even if the percentage of [s] usage is not very high in the case of words spelt under SSC: 8,7%). Apart from the fact that this difference somehow confirms the basic assumption of our rationale (specific spelling conditions lead to specific phonetic symbols), this seems to be suggestive evidence of the effect of orthographic knowledge on phonemic transcription, if one considers the great visual similarity between Roman alphabet's "s" and IPA [s]. We could even propose the effectiveness of a "visual identity effect" (VIE) in such cases.

[2] [s] is never used in [ʒ]-words under DSC. For this reason, no comparison involving the use of this symbol is possible at this stage.

(iii). The same VIE could then explain that no [s] has been found in the transcription of [ʒ] under DSC (i. e., in the transcription of words where [ʒ] is never spelt with "s").

(iv). In addition to the effect mentioned in (iii), it should be noticed that [ʃ] is very rarely used (1 single case) in the transcription of [ʒ]-words under DSC.

From these two findings taken globally, one could infer that when [ʒ] is spelt with a specific orthographic symbol or convention it is consistently transcribed with a specific phonetic symbol ([ʒ]), as previously suggested by our hypotheses.

(v). Finally, it should be emphasised that the use of [ʒ] increases significantly when we compare the transcription of [ʒ]-words under SSC with the same words under DSC. The more specific the orthography of these words, the more consistent the use of the specific IPA [ʒ], as assumed by our rationale.

Viewed as a whole, these results – specially those obtained with [ʒ]-words, seemingly more consistent than those obtained with [ʃ]-words – are probably acceptable as a rough confirmation of our rationale: the use of specific alphabetic conventions leads to the use of specific phonetic symbols.

Nevertheless, some of our results do not support this view:

(vi). In [ʃ]-words under SSC, [ʃ] is used even more often than [s], contrarily to what could be expected from the VIE mentioned earlier.

(vii). The usage of IPA [ʃ] does not differ statistically when we compare the transcription of [ʃ]-words under SSC and DSC. According to our hypothesis, [ʃ] would be expected to be more frequent under DSC than under SSC.

(viii). In [ʒ]-words under SSC a higher score of [s]-transcriptions was expected. Though, the usage of IPA [s] in these words was even lower than the use of [ʃ] and [ʒ], this result not being in accordance either to the rationale or to the above suggested VIE.

The answers to the questions raised by (vi), (vii) and (viii) need further research. Indeed, a convincing explanation has not been reached for the contradiction between the evidence that orthographic knowledge can influence the task our subjects were faced with (see (i)-(v)) and the suggestion that this influence can be limited, as shown in (vi)-(viii).

Among the causes that could explain this contradiction and, moreover, the cases where the bias of orthographic knowledge is not as strong as suggested by the cases of (i)-(v), attention should be paid to the phonemic status of the distinctions involved in the phonetic contrast [ʃ]≠[ʒ] of European Portuguese.

Indeed, it should be borne in mind that the contrast between [ʃ] and [ʒ] in words written under DSC is always a **phonemic** contrast which allows minimal pairs such as "queixo" ['kejʃu] (*"chin"*) ≠ "queijo" ['kejʒu] (*"cheese"*). That is to say, apart from the orthographic contrast this opposition realises a phonemic contrast as well: yet, the phonemic contrast is the reason why the orthographic distinction is maintained, for morphophonological properties and relations are among the linguistic properties more often kept by official orthographies, which in turn tend to ignore purely phonetic (non-phonemic) distinctions (see, for instance: Chomsky & Halle, 1968:40, 48, 49, 80, 131; Klima, 1972:57 ff.; Booij, 1987:215; Pinto, 1994:169-170; Perfetti, 1997:35 ff.).

On the contrary, the same phonetic contrast ([ʃ]≠[ʒ]) in words written under SSC is always an **allophonic (subphonemic)** contrast. No minimal pairs involving words belonging to this category are possible, since [ʃ] and [ʒ] are here the surface realisation of an underlying phoneme (or archiphoneme) /s/ (or /S/) (Barbosa, 1965:182; 1994:152-153, Mateus & D'Andrade, 2000:12-13) whose phonological voicing is totally determined by the voicing of the following consonant. It is for this very reason that they cannot contrast at the surface level, since only [ʃ] is possible immediately preceding unvoiced consonants and only [ʒ] is found before voiced consonants (see, for example, the difference between "deste" ['dɛʃtɨ] *("(you) gave")* and "desde" ['deʒdɨ] *("since")* and the non-existence, in this language, of words such as *['dɛʒtɨ] or *['dɛʃdɨ]).

In psycholinguistics, as well-known as the effect of literacy on the subjects' performance in a wide range of metaphonological abilities (see section 1) is another important effect of higher level variables on language speech processing. We are referring to the effect of phonological categories on speech perception and processing, put in evidence by a considerable amount of experimental research since the 1970s (for a general background and/or experimental work, see, among others: Miyawaki, Strange, Verbrugge, Liberman, Jenkins & Fujimura, 1975; Pisoni & Sawusch, 1975: 16-17; Kuhl, Williams, Lacerda, Stevens & Lindblom, 1992; Kuhl, 1993; 1995; Lacerda, 1995; Strange (ed.), 1995; Veloso, 1999). The main conclusion which all these works share in common is that the only sounds that the native listeners of a language can discriminate easily are those which correspond to different phoneme categories in their mother-tongue: subphonemic contrasts (such as the European Portuguese [ʃ]≠[ʒ] contrast in words written under SSC) are not easily accessible to the native listeners of any language.

In fact, in addition to the orthographic effects discussed earlier in this paper, the just mentioned effect of phoneme categories on speech perception" could also explain the inconsistencies found in our study when the transcription of these words is asked.

How this last effect possibly interacts with the orthographic effect remains to be explained in the further developments of our research.

6 – Final observations and implications

Even if further research is admitted here as necessary to a deeper understanding of the literacy's role on the metaphonological ability under consideration in this study, this paper may be seen as a new contribution to the idea that alphabetic knowledge biases some aspects of the subjects' knowledge of language (more precisely, of their phonological knowledge, theorised as part of the listeners'/speakers' internal grammar – see Burton-Roberts, Carr & Docherty, eds., 2000).

In addition to this main, general conclusion – whose interest is mainly psycholinguistic –, we could underline two other important implications underlying this kind of research:

- from a purely linguistic perspective, this research could contribute to the understanding of the relationship between knowledge of language (according to generative linguistics, *the* very object of linguistics – see Chomksy, 1986) and social and cultural variables (remember that in generative linguistics knowledge of language is genetically programmed and shaped, and that the role of social and cultural variables is seen by the theory as very diminished – see Chomsky, 1965:3; 1975:9; 1986:22; 1988:4; Halle, 1990:65; Pinker, 1994:18-19.);

- finally, for the teaching of phonetics these results show how important ear-training skills can be so that subjects (students) become capable of "erasing" their visuographic representations of words in order to achieve a good standard of phonetic transcription based on the sound reality solely.

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