Patterns of Blind Users' Hand Movements: The Case of Typographic Signals of Documents rendered by Eight-dot and Six-dot Braille Code

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Representation of typographic meta-data embedded in rich texts documents

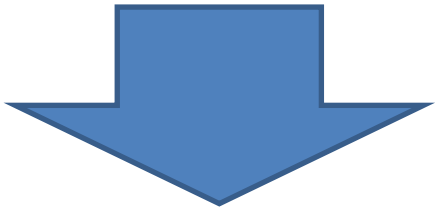
Typographic signals is the information that sighted readers get from the documents at the typographic layer such as:

- font type,
  - font size,
  - font color /background color,
  - …..

- font style:
  - bold,
  - italics,
  - underline
  - …….

Typographic signals and comprehension Main Focus of the Study

- The previous attributes play a crucial role in text reading comprehension
- The way blind people's hands are moved while reading has been considered a critical parameter in braille reading and comprehension



The main focus of the present study lies on patterns and characteristics of hand movements when participants with blindness receive typographic meta-data (bold and italic) by touch in 6- and 8-dot Braille.

Research objectives

a. to compare the type of reading errors when braille readers use six-dot braille and eight-dot braille respectively through a braille display,

b. to investigate the hand movements that braille readers conduct when use 6-dot braille and 8-dot braille respectively through a braille display.

Selected typographic meta-data

Both research objectives refer to typographic meta-data and specifically to

- bold
- italic

The reason of choosing these specific typographic signals is their frequency of use in documents (text books, newspapers, etc):

We have contacted a statistical analysis of a corpus with 2.000 articles from Greek newspapers.

Participants

- Twelve individuals with blindness
- All participants had a visual acuity of no better than light perception
- All were good Braillists and had no additional diagnosed disabilities
- Their age range was from 20 to 40 years (mean= 31.58, SD= 4.79).

Research design (1/3)

Strict structured experiments

where

participants were asked to read from a braille display different scripts within which meta-data was included such as:

- bold
- italic

Research design (2/3)

Two categories of scripts

1st: bold and italic were rendered by the 8-dot braille code

2nd: bold and italic were rendered by the 6-dot braille code

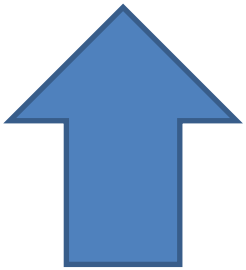
Research design (3/3)

- participants were invited to read aloud every single script and mention all the bold and italcs meta-data they met.
- All experiments were conducted with the same braille display and after a training period.
- the whole process was video-recorded.

Data analysis (1/5)

For the first research objective:

- Compare type of reading errors when readers use six-dot braille and eight-dot braille respectively through a braille display



The analysis was based on a classification system which met the peculiarities of the Greek language

Data analysis (2/5)

- The error pattern used was a synthesis of other similar patterns and consists of two broad categories.

  - ❖ First, errors of phonological type and
  - ❖ Second errors of non-phonological type.

Data analysis (3/5)

Categories of Errors of Phonological Type

- Addition of Letters
- Omission of Letters
- Letter Transpositions
- Letter Substitutions
- Addition of Syllables
- Omission of Syllables
- Syllable Transpositions (e. g. reversals)
- Syllable Substitutions

Data analysis (4/5)

Categories of Errors of Non-Phonological Type

(they do not alter the auditory representation of the word)

- incorrect spelling of the word in terms of the historical evolution of the language and
- errors of morphological type

Data analysis (5/5)

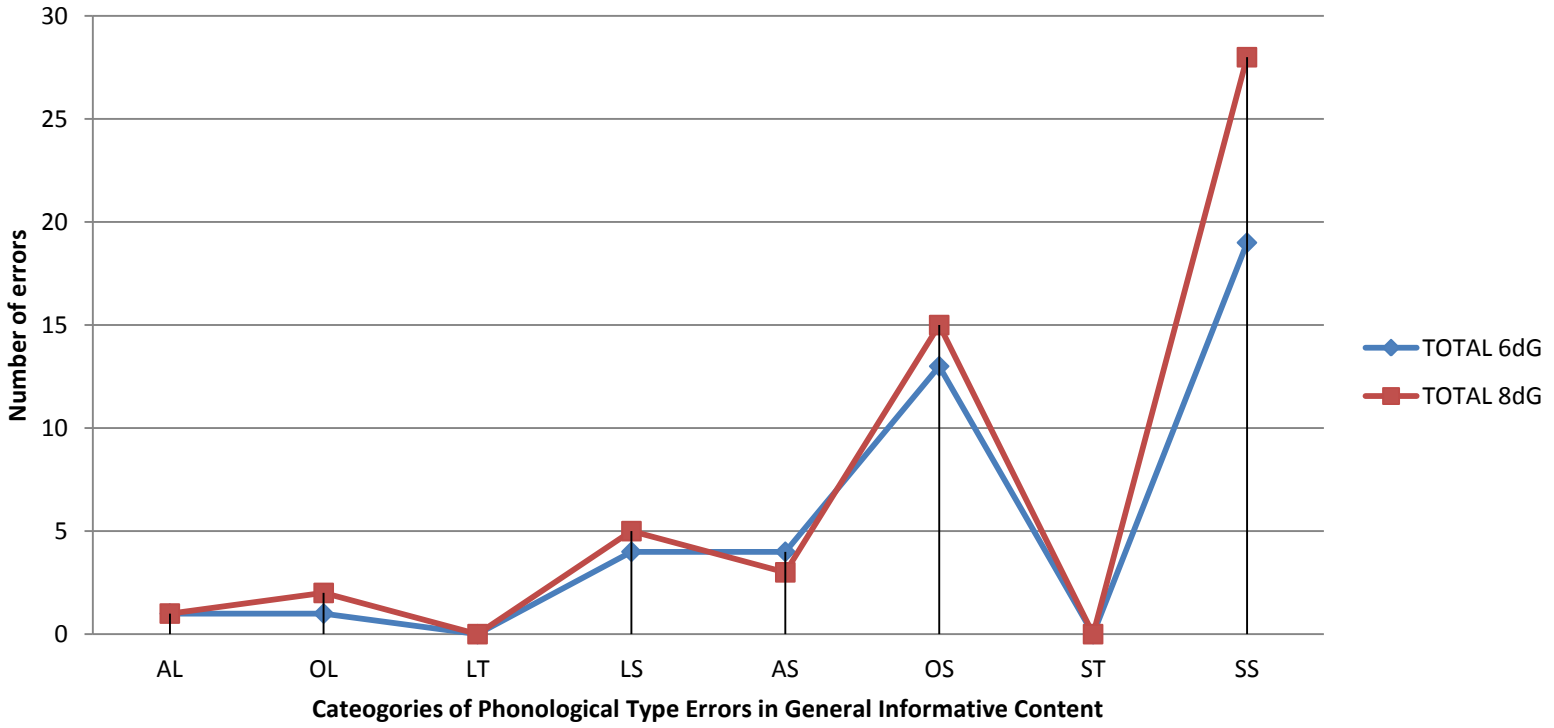
For the Second research objective

The analysis was based on Wormsley's study

- Scrubbing (Sc)
- Regression (R)
- Searching (Se)
- Pausing (P)
- Erratic movements (EM)
- Normal Braille Reading (NBR)

Results_1 (1st research objective)

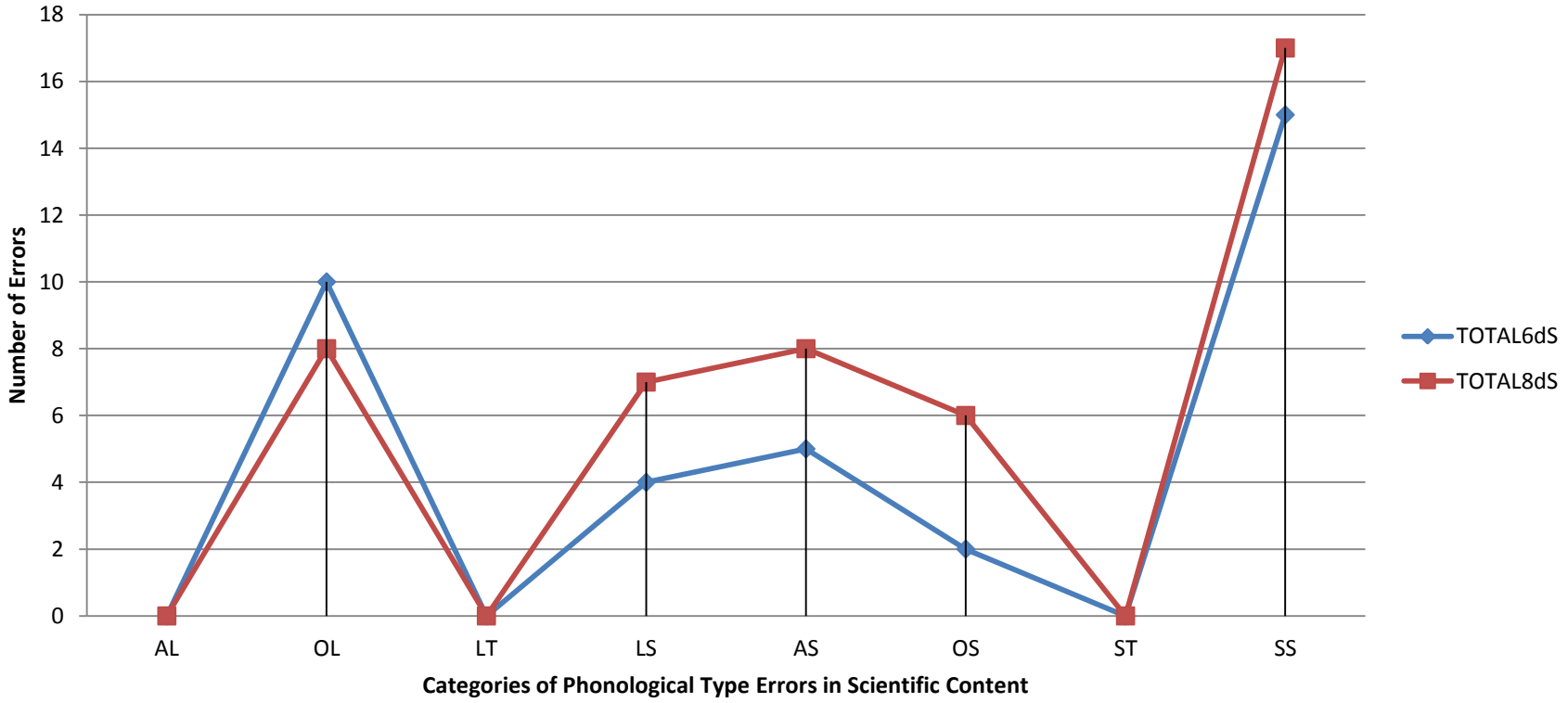
Type of Reading errors in General informative text (G)
by the 8-dot (8d) and the 6-dot (6d) Braille code



it was noticed that the participants' Phonological Errors (PE) were similar in both Braille codes. The only noticeable divergence that was found between the two Braille codes was in the category Syllable Substitution (SS) (min.PE6dG$_{SS}$=19 & max.PE8dG$_{SS}$=28

Results_2 (1st research objective)

Type of Reading errors in Scientific text (S) by the 8-dot (8d) and the 6-dot (6d) Braille code



it was noticed that the participants' Phonological Errors (PE) were similar in both Braille codes.

Results_3 (2nd research objective) “patterns of hand movements”

- participants spent less time to read through the 8-dot Braille code in both general informative and science texts.
- participants performed more fluid movements when they used the 6-dot Braille code for both informative and scientific content.

Results_4 (2nd research objective) "patterns of hand movements"

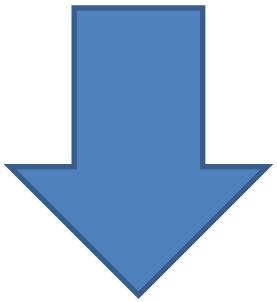
General Informative Texts

The pattern of regression was found to be more frequent in the General informative texts (47R and 5R-Sc) for the 8-dot Braille code compared to the 6-dot Braille code (34R and 23R-Sc).

Scientific content

The pattern of regression was found (36R and 14R-Sc) for the 6-dot Braille code compared to the 8-dot Braille code which was (37R and 8R-Sc).

Discussion_1 (1st research objective)



- The participants' Phonological Errors (PE) did not differ significantly in both Braille codes and for both type of content (G & S).

- It may be argued that the different renderings of the specific typographic meta-data (bold & italic) did not have an impact on the participants' Braille reading accuracy.

Discussion_2 (1st research objective)

- It seems that the prevalent PE type was captured by the category Syllable Substitution (SS).
- it seems that the type of reading errors may be attributed to the specific location of the dots as well as their density in the braille cell.
- The different renderings of the meta-data occupy a neutral role in the reading process.

Discussion_3 (2nd research objective)

Participants' hand movements were more fluid with the 6-dot Braille, but less time was spent reading by the 8-dot Braille.

Two contradictory results???

In the 8-dot Braille code there were 84R and less "Normal Braille Reading" movements (26NBR) compared to the 6-dot Braille code

(70R and 34NBR)

Discussion_4 (2nd research objective)

It may be argued that the big number of regressions in the 8-dot braille was unsatisfactory to the participants and may led them to:

a. ineffective reading scanning, and
b. the trend to predict the word instead of decoding it

Conclusions

- Typographic signals act as a kind of signal to structure the argument of text and eventually facilitate comprehension.

- It is suggested that the focus of research should be placed on the educational implications of the results in favor of better perception and comprehension

Thank you for your attention