

Body, movement and space for a simplex didactics: a pilot study on the realization of a font for Specific Learning Disabilities

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Riassunto: *Gli insegnanti della scuola primaria italiana hanno una grande responsabilità perché durante i primi anni di bambini della scuola elementare imparare a leggere e scrivere. Un passo fondamentale per sviluppare capacità di lettura e scrittura è imparare “a riconoscere, denominare e distinguere le lettere dell’alfabeto” (Reid, 2004) e alcuni studi (Bond, 1967; Beery, 1989; Snow, 1998; Barker, 2001; Di Tore, 2012) hanno dimostrato come miglior predittore, di quelli che saranno i lettori fluenti e i buoni scrittori alla fine della scuola primaria, la conoscenza delle lettere in termini di nomi, forme e suoni. Lo scopo del progetto è quello di illustrare alcune strategie all’interno della semplicità per i Bisogni Educativi Speciali (Sibilio, 2013) che stiamo sviluppando per migliorare le abilità di lettura/scrittura nei bambini con Disturbi Specifici dell’Apprendimento. In questo articolo vi presenteremo: un tool (font) progettato per facilitare il processo di riconoscimento delle lettere; una metodologia progettata per facilitare il processo di codifica spaziale delle lettere e di collegamento ai loro corrispondenti fonemi.*

Abstract: *The teachers of the Italian primary school have a great responsibility because during the first years of primary school children learn how to read and write. A critical step to develop reading and writing skills is learning “to recognize, name and distinguish letters of the alphabet” (Reid, 2004) and some studies (Bond, 1967; Beery, 1989; Snow, 1998; Barker, 2001; Di Tore, 2012) have shown that one of the best predictor of those who will be fluent readers and good writers at the end of primary school is the knowledge of letters in terms of naming, shapes and sounds. The aim of the project presented here, is to illustrate some simplex strategies for special educational needs (Sibilio, 2013) that we are developing to enhance the reading/writing skills in children with specific learning disabilities.*

In this paper we will present: a tool (a font) designed to facilitate the process of recognizing letters; a methodology designed to facilitate the process of spatial encoding of the letters and to link them to their corresponding phonemes.

Keywords: *body, specific learning disabilities, reading, writing, simplicity.*

Introduction

We can write the word *love* with the finger, with an hand, or even with a foot (Berthoz, 2011), with this example of motor equivalence, Berthoz introduces the *simplex* property of the *generalization* that, from a didactic point of view, is the ability to use the acquired competence in different fields (Sibilio, 2012).

The concept of *motor equivalence*, used by Berthoz, is a scientific topic since the 40s (Lashley, 1942; Bernstein, 1947; Merton, 1972; Raibert, 1977; Keele, 1990; Bruce, 1994) and a classic example to illustrate this concept is given by the handwriting experiments.

The figure 1 shows the results of one of this kind of experiments (Keelenel, 1990).

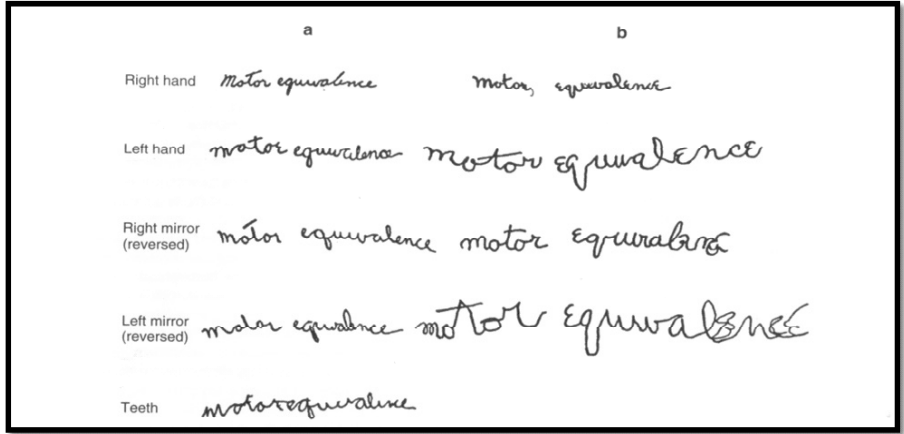


Figure 1: The figure shows an experiment that was conducted on two subjects (a and b). In the experiment, the subjects had to write the sentence “motor equivalence” with the right hand, the left hand, with the right hand from right to left, with the left hand from right to left, and with the teeth.

In the figure 1 is possible to see that some parameters of the handwriting remain invariants independently from the effector used to perform the task (for example, the vertical line of the letter *q* is the same in all the tasks, similarly the way in which the letter *e* is drawn seems to be analogue in all the tasks). According to Berthoz, these results seem to support the hypoth-

esis that the geometry of the movement is encoded in a very general way and that the space can be the *common code* through which this geometry is structured (Berthoz, 2011, 65). In terms of teaching this hypothesis suggests that we have to act on the way in which children encode the shapes of the letters to enhance their reading and writing skills (Carlomagno, 2013). This didactic assumption can be considered valid, in general, for all the children that are novice readers, but it can be particularly useful for children with reading disorders, such as dyslexia, or with disorder of written language, such as dysorthography.

To enhance the reading/writing skills in children with specific learning disabilities we can act through the design and the development of tools and methodologies able to facilitate the process of spatial encoding of the letters. Furthermore these ones have also to be able to foster the process of recognizing letters and the capacity to link them to their corresponding phonemes.

In this paper we will present both a tool (a font) designed to facilitate the process of recognizing letters and a methodology designed to facilitate the process of spatial encoding of the letters and to link them to their corresponding phonemes.

Furthermore it is necessary to specify that the present project is part of a wider research aiming to develop a *simplex didactic* for the specific learning disabilities (Sibilio, 2013; Aiello, 2012).

Aims

The aims of the project are:

- the development of an open-source font to enhance the reading skill in children with specific learning disabilities.
- The drawing of a theoretical framework for the design of a didactic methodology to enhance the reading/writing skills in children with specific learning disabilities.

The current scenario

In a literate society, such as our society, learning to read and write is one of major educational aims. The teachers of the Italian primary school

have a great responsibility for the achievement of this aim, because it is during the first years of primary school that children learn how to read and write. A critical step to develop reading and writing skills is learning «to recognize, name and distinguish letters of the alphabet» (Reid, 2004) and some studies (Bond, 1967; Beery, 1989; Snow, 1998; Barker, 2001; Di Tore, 2012) has shown that one of the best predictor of those who will be fluent readers and good writers at the end of primary school is the knowledge of letters in terms of names, shapes and sounds.

Furthermore the research has shown that problems in early development of reading and writing skills are usually related to future problems and failures in school career (Stanovich, 1992; Adams, 1990). Thus, teaching to read and write is one of most important issue that primary school teachers have to face up.

Obviously teaching to read and write is particularly hard in case of children with reading disorder, such as dyslexia.

Now, it is necessary to specify that there are several theories about the origins of dyslexia, and consequently, there are several definitions of this reading disorder.

In this paper, we will refer to the dyslexia in a general way, referring to the term “dyslexic” as someone who has a significantly low reading performance, in relation to his intelligence, age, and education, and who has not neurological damages that may cause his reading disability (Lyon, Shaywitz, Shaywitz, 2003).

These difficulties, thus, have not a pathological nature but represent «an individual variant of development that hinder the acquisition and development of certain skills» (Stella, 2003).

As regards dyslexics children, learning to recognize, name and distinguish letters of the alphabet is particularly hard and there are different theories that suggest to consider different aspects of this reading disorder to enhance the development of reading and writing skills.

Some of this aspects are related to:

- the reversal errors. “that is, dyslexics tend to confuse letters having the same shapes but different spatial orientation, e.g., p / q; b / d; p / d” (Rusiak, 2007) as showed from different studies based on the magnocellular theory (Fisher, 1978; Miles, 1993; Willows, 1993; Stein, 1997; Brendler, 2001; Terepocki, 2002; Lachmann, 2003; Rusiak, 2007).
- The problem of crowding (Chung, 2002; Perea *et al.*, 2012), that is a

problem related to the separation of letters and words. Some dyslexic children have problems to separate letters and words.

- The phonological awareness, that is the awareness that spoken words consist of individual phonemes (Van der Leij, 2003; Vellutino *et al.*, 2004). The phonological theory explains that some dyslexic children have problems, due to deficit in the phonological processing, to identify phonemes, to link phonemes and graphemes and to link phonemes for building and recognizing spoken words.
- The orthographic awareness, that is the ability to remember where the letters are placed in a written word. There are some evidences showing the superior orthographic skills in dyslexics, however, «the less developed orthographic awareness of normal readers does not pose a significant problem. Both phonological and orthographic coding are required for fluent and efficient reading» (Siegel, 1995). According to Siegel (1995) the problems of dyslexics are caused by a deficit in the integration between the orthographic and the phonological skills.

From a didactical point of view, in relation to the first two problems, that are related to shapes, orientation, spacing and position of the letters, the hypothesis presented in this pilot study is that a font, specifically designed to face up these issues, can be a useful tool to increase the reading accuracy and the readability of texts for dyslexics.

While, in relation to the last two problems, that are related to writing and phonological skills, the hypothesis presented in this pilot study is that the development of an embodied teaching methodology, specifically designed to face up these issues, can be useful to enhance the development of reading skills.


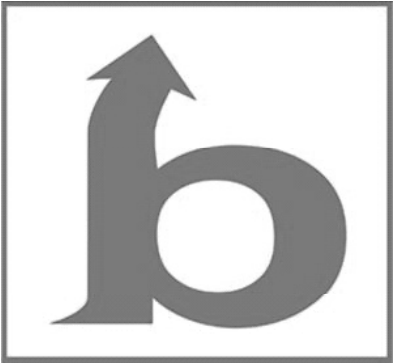


D-FONT

In typography and computer science a font is a set of typefaces characterized by a particular graphic style and intended to perform a given function. There are several fonts (Dyslexie, OpenDyslexic, Sylexiad, the fonts can be downloaded at the links provided in the Sitography) specifically created to increase the readability of texts for dyslexics. However, none of these fonts is realized also to enhance the writing skill and none is designed

to be part of a didactic methodology. Instead, the font here presented is designed to enhance both reading and writing skills through a specific didactic methodology. The font, named D-Font, currently in development, is based on the Arial font because this one is a font having a significant impact on readability for people with dyslexia (Rello, 2013; Trott, 2003; Evett, 2005).

During the design of a font, the tendency to use for many times the same graphic element to create visual and aesthetic coherence across the entire font makes more difficult the reading in dyslexic children, particularly in novice readers with dyslexia.

That’s why we have marked the differences between the letters within the D-Font as shown in the table 1.

Lowercase	
Arial	D-Font
	
	





	
	

Table 1.

As shown in table 1, the letters of the D-font have more marked differences in comparison to the letters of the *arial* font. Furthermore each letter is equipped with a graphic element that defines its orientation and each letter is inserted in a square to reduce the crowing effect. As concerns the metrics and the spacing of the letters, the D-Font has a spacing that is about three time bigger than the spacing of Arial font and the character “space” is about six time bigger than the same character of the Arial font.

We hope that these aspects of the D-Font can be useful to reduce the crowing effect and the reversal effect. Moreover, the letters of the D-Font are bigger than the Arial Font ones, the characters of the D-font with dimension 12pt are almost equivalent to the letters of the Arial characters with dimension 16pt.

The D-Font:

- supports lowercase, uppercase, number and different symbols (comma, point, double point, etc).
- Is based on vector graphics.
- Is available in True Type Font (TTF), Apple Advanced Typography (AAT) and OpenType format.
- Is compatible with Windows, with Mac systems, and with some of the news smartphones.

Currently the D-Font is in development, it will be an open-source font and will be soon available for download and testing at www.labh.it/dfont.

The following are some examples of possible uses of the D-FONT.

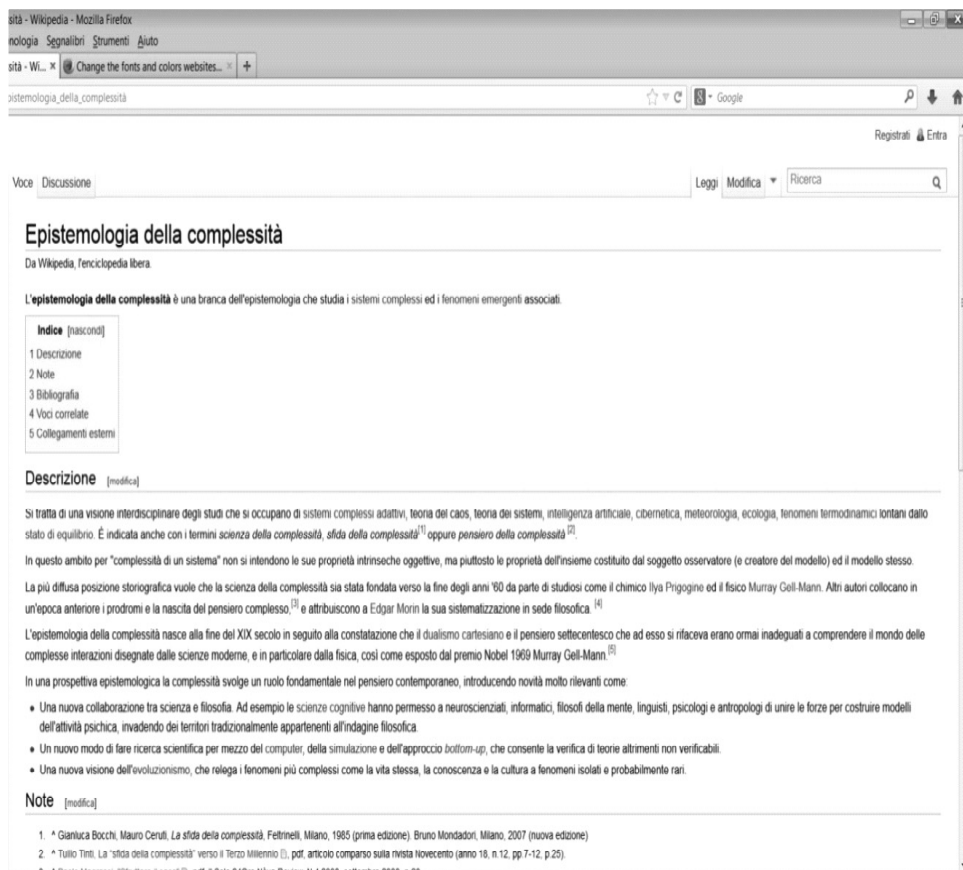


Figure 2

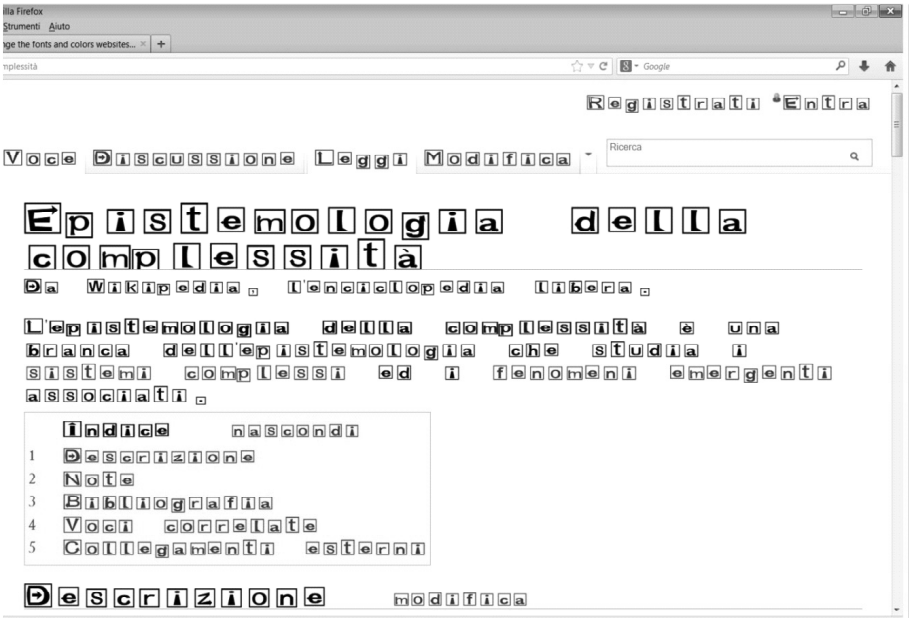


Figure 3

Table 2: The table shows the same internet page. In the figure 2 the browser uses the “Arial” font, in the figure 3 the browser uses “D-Font”, the dimensions of the letters is 12pt for both.

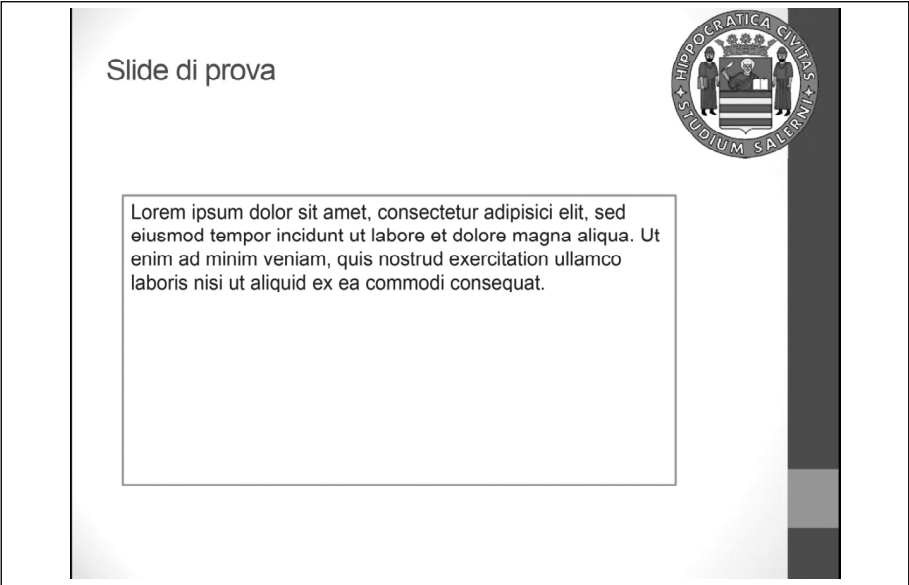


Figure 4

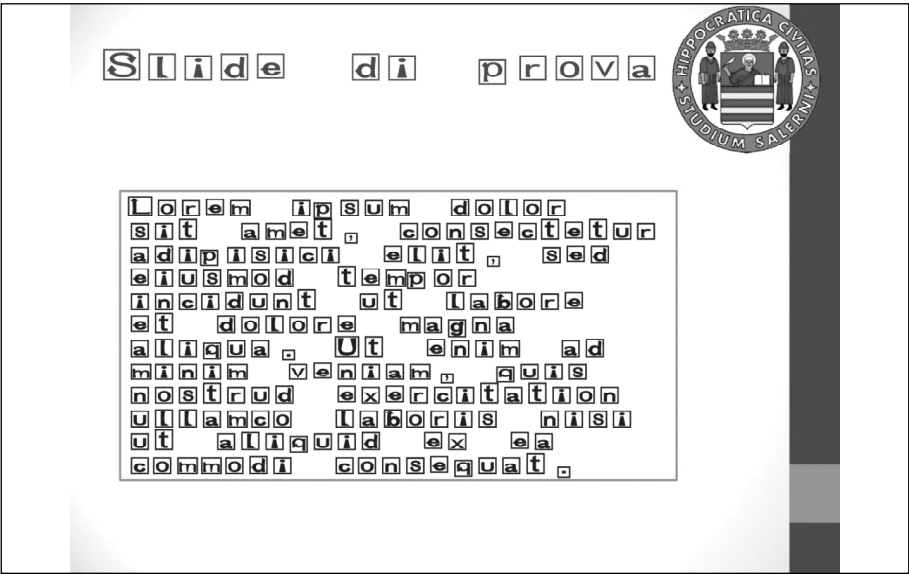


Figure 5

Table 3: The table shows the same slide made with Microsoft PowerPoint. In the figure 4 PowerPoint uses the “Arial” font, in the figure 5 PowerPoint uses “D-Font”, the dimensions of the letters is 12pt for both.

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Figure 6: The figure shows a table, realized in Microsoft Word, with the same text.

The text on the left is written with the D-Font and the text on the right is written with the ARIAL font. The dimensions of the letters is 12pt for both.

The body and the act

«Disorder of Written Expression is commonly found in combination with Reading Disorder» (American Psychiatric, 1996). Usually dyslexic children have problems not only to read but also to write. As claimed before, some of the possible difficulties that can affect the development of the reading and writing skills are:

- The integration between the orthographic awareness and the phonological awareness.
- The difficulty to spatially encode the shape of the letters.

In this sense, the D-Font can be a useful tool for helping children to recognize and identify letters, but, to enhance the development of reading and writing skills it has to be included in a specific didactic methodology.

The didactic methodology that we are developing is based on the assumption that letters of the font have to be visually linked to the gesture required to trace them.

By this way we want to facilitate the process of spatially encoding of the letters.

For this reason we are currently re-design some of the letters of the D-Font to make a link between the gesture required to trace the letter and the corresponding font letter. Furthermore we are developing a software that shows how the letters have to be traced and that pronounces, through vocal synthesis, the corresponding phonemes of the traced letters.

The table 4 shows 4 frames of the software during the tracing of the letter “c”. When the tracing task is finished, the software pronounces the phonemes of the traced letter, in this case “c”.

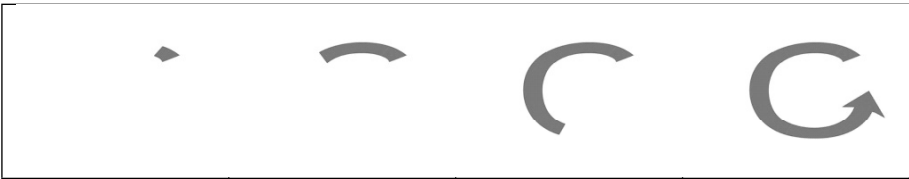


Table 4

As shown by the table 4, the letter *c* of the D-Font is designed to virtually recreate the gesture required to trace the letter *c*.

Currently we are working on the design of the letters to make their shapes able to remind the gesture required to trace them.

Conclusion

The present work is still far from being considered as concluded.

Basically, the foregoing is only a draft of the project that is currently in the design phase.

It is necessary to precise that the font is currently in development and that no tests has been conducted until now.

The next step of the project will be:

- Complete the re-design of the shapes of the font letters.
- Test the font to check if its effectiveness in enhancing reading speed and accuracy in children with specific learning disabilities.
- Complete the development of the software.
- Check if our didactic methodology can be useful to enhance reading and writing skills in children with specific learning disabilities.

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Stefano Di Tore, co-author, PhD, he has designed the font and the didactic methodology.

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Sitography

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- <http://opendyslexic.org>.
- www.labh.it/dfont.