Statistical Analysis of Textual Data from Corpora of Written Communication – New Results from an Italian Interdisciplinary Research Program (EASIEST)

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1. Introduction

Autism spectrum disorder (ASD) is a form of pervasive developmental disorder characterized by complex communication needs and early onset. The "triad" of symptoms for diagnosing ASD includes three areas: (a) social interaction; (b) language and communication; (c) behavior, activities, and interests (American Psychiatric Association, 2000). Complex qualitative and quantitative language and communication needs are acknowledged among the specific characteristics of this disorder, though defining and identifying these "needs" often proves a difficult task (Boucher, 2003; Sikora, Hartley, Mccoy, Gerrard-Morris, & Dill, 2008; Snyder, Miller, & Stein, 2008). Enhancing effective communication in everyday life and investigating new ways to help individuals with ASD (IWA) to communicate are fundamental issues (Tager-Flusberg & Caronna, 2007; Ostryn, 2008; Koegel & Brown, 2007) and, more in general, recent results (Rapin & Tuchman, 2008) stress the growing need for special services and treatments for an increasing number of children (and adults).

1.1 The EASIEST project

The EASIEST project ("Espressione Autistica. Studio Interdisciplinare con Elaborazione Statistico-Testuale" [*Autistic expression. An interdisciplinary study based on statistical and textual analysis*]) is an Italian interdisciplinary research program (Bernardi, 2008) aiming to study the linguistic features of texts written by IWA and facilitators (without disabilities).

The acronym giving the project its name refers to three terms coinciding with the three research areas characterizing the study, i.e.

1. *Autistic expression*: the program focuses on a particular form of communication used by IWA, achieved by means of a dedicated commitment to facilitated communication (FC), a method adopted and taught by specially-trained personnel in the course of a lengthy process requiring a great deal of effort. We are therefore dealing with a practice that is useful for taking action on just one of the three conditions that have to be met to establish a diagnosis of ASD, i.e. the qualitative impairment of an individual's capacity for communication and imagination (Wing & Gould, 1979);

2. *Statistical and textual analysis*: methodological advances made in recent years in the statistical methods for analyzing qualitative materials (and text in particular) afford new opportunities for studying materials generated in the FC setting; in many ways, this provides the load-bearing support for any analyses conducted using complementary disciplinary approaches in this project;

3. *Interdisciplinary study*: expertise in analytical methods is not enough in itself to ensure that the analyses of texts generated in the FC setting are relevant, or to suggest at least one roughly appropriate interpretation of the results that does not seem either pointless or even misleading; hence our recourse to different types of expert, who contributed to defining the theoretical grounds for our research, and subsequently prompted and arranged the considerations that emerged in the appropriate and pertinent scientific contexts (linguistics, neuropsychiatry, psychology, sociology, statistics, text mining and computer-aided text processing).

In this frame, the EASIEST research group made every effort to develop a plan of action that would lead to the production of consistent quantitative references and could thus serve as a precious archive, also providing materials relating to more or less lengthy periods of participation in FC schemes. The general founding assumption was as follows: with adequate (albeit laborious) training on the shared use of a "mechanical" medium (the computer), IWA can unleash their often only potential expressive skills to best effect, somehow "formalizing", or rather "encoding" the very core of their way of thinking.

The analysis focused along three lines:

- first of all, to ensure that we started by building grounds as solid as possible for the subsequent stages, we needed to prepare a lexical analysis designed to bring out the frequency and nature of the words and compounds (multiwords) contained in the texts examined: this statistical approach precedes consequential qualitative lines of research and, to some degree, it provides the necessary input and it can orient subsequent syntactic and semantic assessments;

- to examine the syntactic structure of expressions written by IWA, i.e. to start identifying and recognizing any regularities in sentence structure for comparison with that of their respective facilitators, and also more in general with the structure of their language (Italian in this case), and written language in particular;

- to examine the semantic specificities of their language, pinpointing any regularities in the frequent use of metaphor (often referring to concrete elements) seen in the more "creative" texts.

To ensure the best conditions for managing these research goals, several methodological coordinates had to be imposed on the process for producing the materials to analyze, i.e.

i. a large number of subjects had to be considered;

ii. a large amount of material had to be collected;

iii. several centers needed to be involved, where FC is a well-established and accredited practice;

iv. it was essential to rely on expert, habitual facilitators;

v. the IWA involved had to have reached a good level of independence;

vi. the IWA-facilitator relationship had to be demonstrable and well-established, and capable of generating a good degree of fluidity in the written word;

vii. steps had to be taken so that each pair would produce texts meeting the minimum requirements in terms of quality (variety of content and topics considered) and quantity

(volume of pages and words), while the material generated by particularly fecund subjects had to be contained;

viii. it was advisable for more than one facilitator to work with the same IWA, partly to check for any influence of the former, and partly to ascertain the expressive stability of the latter even in the presence of several facilitators;

ix. subjects and materials useful for longitudinal studies should also be included.

With these aims and behavioral rules, the work plan were characterized by:

a. reference to four accredited centers;

b. the collection of texts from three different groups of subjects, giving rise to three corresponding corpora:

b1) 13 subjects with a known history of FC training, from the introductory phase to full and independent control of the method; these subjects were supported by 33 facilitators and the mass of material available for analysis consisted of approximately 400 pages, corresponding to 130,142 word tokens;

b2) 37 subjects who had reached a high level of independence, whose texts were collected during the course of the present project under conditions of "reduced facilitation" (beyond arm/shoulder level) with at least three different facilitators. In all, 92 facilitators were involved (some of them worked with more than one IWA) and about 900 pages were generated, corresponding to 290,496 word tokens;

b3) a case-control experiment was arranged, involving 6 IWA and 6 individuals without disabilities, comparing their performance in a given essay. The corpus obtained in this case was naturally much more limited (14 pages containing 4,360 word tokens).

c. In short, the project's methodological coordinates can be summarized as follows:

c1) construction of a very large database;

c2) three analytical approaches, i.e.

c2.1) transversal on 37 cases;

c2.2) longitudinal on 13 cases;

c2.3) experimental on 6 cases versus 6 controls;

and more specifically, from the point of view of the knowledge goals:

c3) a study on the stylistic and lexical characteristics of homogeneous groups:

c3.1) IWA versus facilitators;

c3.2) IWA versus controls;

c4) a study on particular individual traits:

c4.1) chronological analysis of language development;

c4.2) comparison between texts written by the same IWA with different facilitators.

Finally, to achieve these study goals, different types of text were used, differing in nature and origin, i.e. the texts were drawn from:

a. conversations in daily life;

b. questioning about school-related experiences and topics;

c. training interviews;

d. text composition proper (essays, prose, etc.).

In conclusion, the fundamental goals of the research project are briefly recalled below:

- *on the problem of using written language*: to identify the semantic and syntactic characteristics of texts produced by IWA and by their facilitators;

- *on the learning problem*: to analyze the temporal development of linguistic structures from the point of view of learning theories;
- *on the problem of the statistical method adopted*: to ascertain the applicability of lexical-textual methods and the interpretative capacity of the indicators derivable therefrom;
- *on the debate concerning the authenticity of texts generated using FC*: to retrace the issues in the discussion between convinced supporters of its utility as a method capable of facilitating the free expression of IWA, on the one hand, and scholars who firmly deny its efficacy or even its appropriateness), sometimes based on solid experimental assessment methods.

1.2 Facilitated communication

Facilitated communication (FC) is a form of augmentative and alternative communication that first attracted attention in Australia at the end of the 1970s, thanks to Rosemary Crossley (Crossley & McDonald, 1984); it was introduced in the United States by Douglas Biklen (1993), who helped popularize the method. Proponents of FC (Crossley, 1997; Crossley & Remington-Gurney, 1992) claim that it is an alternative means of expression for people with complex communication needs who are unable to speak (or whose speech is seriously limited) and cannot point reliably owing to developmental disabilities or other significant neuromotor impairments. FC entails learning to communicate by typing on a keyboard and requires a combination of physical and emotional support measures. People resorting to FC may need to be supported in various ways: to contain their emotional reactions, coordinate their movements (pointing), help them focus on activities, etc.

Support is provided according to the specific needs of individual FC users and depends on habits they develop in years of practice. The person providing such support is called a facilitator and may be a teacher, a professional trainer, a relative, a friend, etc. Facilitators provide emotional support because they are trained to manage possible reactions from the individuals with whom they write. They also encourage and stimulate FC users both orally and in writing. Facilitators may touch different parts of the FC user's body. During the first sessions, the facilitator's hand usually touches the FC user's hand or wrist, then moves up towards the elbow, upper arm, shoulder, and so on. This upward movement depends on how well FC users can type unassisted. The facilitator's aim is to encourage them to write as autonomously as possible, sometimes up until they can do so alone (Rossetti, Ashby, Arndt, Chadwick, & Kasahara, 2008). Both facilitators and other people who use FC need extensive, individualized training and the support of professional trainers before they can start using the method. FC can be used by people with a variety of communication needs, and many IWA are candidates for this augmentative and alternative form of communication.

1.3 The debate on FC

FC has met with sharp criticism and its usefulness as an alternative means of communication is still an extremely controversial issue. Researchers have yet to agree on a validation method and the scientific controversy on the validity of FC remains unsettled (Beck & Pirovano, 1996; Biklen & Cardinal, 1997; Bomba, O'Donnell, Markowitz, & Holmes, 1996; Braman, Brady, Linehan, & Williams, 1995; Jacobson, Mulick, & Schwartz, 1995; Montee, Miltenberger, & Wittrock, 1995; Mostert, 2001; Probst, 2005; Sbalchiero & Neresini, 2008; Sheehan & Matuozzi, 1996; Simpson & Myles, 1995; Weiss, Wagner, & Bauman, 1996). Biklen and Cardinal (1997) attempted to explain why some controlled studies support FC

while others do not. According to Biklen (2005), naturalistic settings foster positive results, while more controlled settings lead to negative results. Sbalchiero and Neresini (2008) endeavored to pinpoint the basic elements of this scientific controversy from the viewpoint of the sociology of science.

FC has presented scholars with an ethical dilemma: either to run the risk of denying FC users the right to communicate, or to adopt a method that has yet to be fully validated by scientific studies. The crucial issue concerns the number of individuals with complex communication needs who may or may not benefit from an alternative means of communication. Given the fundamental role of expert practitioners in providing people with treatment, rehabilitation and education for the life-long management of their disorders, some proponents of this method - rather than focusing on the scientific controversy over the validity of FC - stress the importance of "how", "why" and "when" FC training should be implemented, identifying "best practices" and developing practice guidelines (Calculator, 1999; Duchan, 1993; Duchan, 1999; Duchan, Calculator, Sonnenmeier, Diehl, & Cumley, 2001; Koegel, 2000).

Since the facilitator's support is liable to influence the movements and pointing of an IWA, whether it is the facilitator who is communicating or the IWA remains debatable (for a review, cfr. Jacobson et al. 1995; Mostert, 2001). The issue of authorship attribution in the context of written conversations produced during FC sessions derives from two contrasting views: communication may be the outcome of a facilitator's cueing (Green, 1994, Wheeler, Jacobson, Paglieri, & Schwartz, 1993), or it may be the genuine, intentional output of an IWA; for the latter to be true, the IWA must presumably have the necessary competence (Biklen & Burke, 2006; Biklen, Saha, & Kliewer, 1995; Cardinal, Hanson, & Wakeham, 1996; Mirenda, 2008). Controlled studies have established that the facilitator does have an influence (Mostert, 2001) and proponents of FC have acknowledged that cueing (be it deliberate or subconscious) does occur, but controlled studies have also established authentic authorship (Weiss et al. 1996; Cardinal et al. 1996). Certain texts produced in specific settings prove genuine, even though the same person may be influenced by the facilitator in different settings (Emerson, Grayson, & Griffiths, 2001). Further studies and observation of cases of independent typing demonstrated that FC may be effective, but it is impossible to establish how often and in which cases (Beukelman & Mirenda, 1998; Mirenda & Beukelman, 2006). Based on the analysis of texts retrieved on-line and written by IWA, Davidson (2008) even goes so far as to take authorship for granted and claim the existence of distinctive autistic styles of communication as part of an emerging "autistic culture".

Few studies aiming to solve the authorship issue have focused directly on texts written during FC sessions (Niemi & Kärnä-Lin, 2002; Niemi & Kärnä-Lin, 2003; Saloviita & Sariola, 2003; Scopesi, Zanobini, & Cresci, 2003; Zanobini & Scopesi, 2001), and few considered large corpora (i.e. exceeding a hundred thousand words) and several individuals. The studies conducted so far nonetheless stress the need to identify the distinctive linguistic (lexical and morpho-syntactical) features of texts written by IWA, and they tend to support the case for their authenticity.

1.4 Ongoing research

The EASIEST Project collected large corpora of texts written at four accredited FC centers in Italy. It is of paramount importance to consider a large body of words, i.e. a large corpus of texts, in order to analyze the distinctive language features of a group of writers. Written

conversations retrieved from material produced during FC sessions enable researchers to collect large corpora of texts written by several individuals. The fact that the research is conducted in a setting of spontaneous written conversation and a semi-controlled environment is a major advantage (Rutter, 2005; Tager-Flusberg, 2004).

A recent study developed in the frame of the EASIEST Project had already shown that the lexis used by IWA only partially overlapped with that of facilitators (Tuzzi, 2009). When lexical richness, i.e. the number of different words (NDW) (Duràn, Malvern, Richards, & Chipere, 2004; McKee, Malvern, & Richards, 2000; Watkins, Kelly, & Harbers, 1995) was measured, it emerged that the group including IWA used more different words and therefore had a greater lexical richness than the group of facilitators (Tuzzi, 2009).

The present study was designed as a natural continuation of the mainstrain EASIEST research, involving a detailed analysis of several specific lexical features of a large corpus of texts and measuring to what extent the words used by IWA differ from those used by facilitators. A novel approach was used, based on the concept of intertextual distance, i.e. the strategy chosen to implement text clustering (texts that are lexically homogeneous within clusters and non-homogeneous between clusters). The aim of this study was to show that even mere quantitative lexical data (word frequency) can draw a clear distinction between texts written by IWA and those written by facilitators. We also expected to identify two distinct clusters that could support text authorship.

2. Method: Textual data analysis

The main focus of this further study was a quantitative analysis of textual data from a corpus of texts written during FC sessions by IWA and facilitators (without disabilities). The aim was to analyze the writers' lexicon and contribute to the debate on the authorship issue. The analysis was conducted on 91 texts comprising 1,000 words sampled from the corpus of written conversations produced by 37 IWA who had reached a high level of independence. The ideal situation would include only IWA who had already mastered independent typing, but they are very rare and we preferred to involve a large number of individuals.

2.1 Participants

The 37 IWA involved in this study were diagnosed by neuropsychiatrists and assessed according to the DSM-IV-TR (2000) at the four accredited FC centers involved in the project. The group included 29 males and 8 females (table 1). At the beginning of the EASIEST project their age ranged between 9 and 32 years; 59.4% of the IWA were between 11 and 20 years old. The majority had started using FC by the age of 15 (84.8%), 35.1% by the age of 7. Their verbal communication was absent (21 out of 37) or severely impaired (16 out of 37). The group included no individuals diagnosed with Asperger syndrome or high-functioning autism.

All these IWA had reached a good degree of self-sufficiency in written communication and were capable of writing with little facilitation, i.e. the support provided by facilitators was limited to contact between the facilitator's hand and the individual's upper arm, shoulder, neck, head, back or leg; contact was intermittent, occasional or absent in some cases. The facilitators involved were professionals, supervisors, teachers or parents specifically trained in this technique at the four accredited Italian FC centers. For each IWA there were three different facilitators (typically a professional facilitator, a parent

and a teacher), for a total of 92 (some professional facilitators worked with more than one IWA at the same center). All IWA involved in the EASIEST project had used this communication method regularly in different settings (with teachers at school, with parents at home, etc.).

IWA and facilitator selection was based on their "familiarity" with FC with a view to obtaining texts that would be satisfactory in terms of their length and complexity, and to reducing the "noise" in the initial training period (facilitators have to learn to manage physical and emotional reactions; IWA are unfamiliar with keyboards; both need to refine their coordination, etc.).

Variable	n	%
Gender		
Male	29	78.4
Female	8	21.6
Age (years)		
Up to 10	3	8.1
11 to 15	11	29.7
16 to 20	11	29.7
21 to 25	7	18.9
Over 25	5	13.5
Age of starting FC		
Before 7 years old	13	35.1
8 to 15 years old	18	48.6
Over 15 years old	6	16.2
Years of FC training		
Up to 5	10	27.0
6 to 10	23	62.2
More than 10	4	10.8

Table 1. Distribution of study variables for IWA involved in producing the corpus

2.2 Corpus

The texts produced during FC sessions were open-ended, non-structured, non-standardized, non-compulsory conversations between an IWA and a facilitator, written on PCs. These exchanges were partly educational in nature and partly for communicating day-to-day routine information. The topics concerned private matters, school activities, essays, etc.

For the purposes of the statistical analysis on the textual data, each FC session produced a very short text and lasted a very long time. To obtain large corpora, some of the texts collected during the EASIEST project in 2005-2006 were considered and additional texts were retrieved from the FC centers' archives. The texts produced by each IWA were the result of several sessions, written at different ages and with different levels of ability, but all with a good degree of self-sufficiency; by the time the sessions took place, all the IWA were able to write with little facilitation and had already been using FC for years (62.2%

for 6-10 years and 10.8% for over a decade). The texts written as part of the project and those retrieved from the archives both met the requirements of our research protocol, having been collected at the four accredited FC centers according to guidelines that suited our needs.

Corpus analysis can focus on letters, syllables, words, word groups or lexemes, as well as phonemes, morphemes, etc. For the statistical analysis of textual data, the statistical units are generally word tokens (or tokens), which are identified and treated by software. Tokens are defined as sequences of letters taken from the alphabet and isolated by means of blanks and punctuation marks. The size N of a corpus is the total number of tokens. A token is a particular occurrence of a word type (e.g. the word type *the* has many tokens in any English text) and the list of word types constitutes the vocabulary of a corpus.

The whole corpus included 290,496 tokens: 159,243 (54.8%) written by facilitators and 131,253 (45.2%) by IWA; both these sub-corpora were large (over 100,000 tokens) and they were well balanced in terms of their size. The tokens written by IWA were distributed by level of facilitation as follows: upper arm, 27.0%; arm, 16.2%; shoulder, 35.0%; neck/head, 5.2%; back, 5.5%; leg, 4.6%; independent typing, 2.3%.

2.3 Text chunk selection

First, all conversational turns within the whole corpus written by the same writers were grouped to obtain 129 sub-corpora (37 IWA and 92 facilitator). Sub-corpora composed of less than 1,000 tokens were discarded to avoid working on texts that were too short, and consequently unsuitable for a quantitative-lexical approach. The analysis thus involved 91 (of the 129) writers who had produced sub-corpora including at least 1,000 tokens (table 2), i.e. all 37 IWA and 54 facilitators (out of 92).

Center	Before selection			After selection		
	IWA	*FAC*	Total	*IWA*	*FAC*	Total
1	9	18	27	9	18	27
2	9	25	34	9	10	19
3	10	25	35	10	10	20
4	9	24	33	9	16	25
Corpus	37	92	129	37	54	91

Table 2. Number of participants before and after selection

In any text, consecutive words produce clauses, sentences, paragraphs, etc. This study considered text chunks resulting from the combination of whole segments or sentences written by the same author. Segments and sentences were selected by random sampling without replacement. Text chunks are the result of a random sampling not of words but of whole sentences and segments, so their original structure is maintained. The resulting 91 text chunks included a mean 1,003 tokens, with minor variations because the conversational turns were not cut. The text chunks ranged between 990 and 1,010 tokens for each writer, with an approximately 5-token standard deviation (table 3).

	Min	Max	Mean	Std.Dev.
IWA	991	1,010	1,004	5.02
FAC	990	1,010	1,003	4.96
Corpus	990	1,010	1,003	5.02

Table 3. Size of text chunks in word tokens

2.4 Lemmatization

A word type can be defined as a higher-rank unit called a lemma type (e.g. *tooth* and *teeth* are both associated with the lemma *tooth* and the category "noun"; *go*, *goes*, *went*, *gone* are associated with the lemma *to go* and the category "verb", etc.) and the list of lemma types constitutes the lemma vocabulary of a corpus. The frequency of each lemma type is given by the number of corresponding tokens. The lemma vocabulary with frequencies produces the lexical profile of the corpus and reflects its lexicon. The lexical profile includes all information about the type and number of lemmas and their frequency in the corpus.

Since the study was conducted on texts written in Italian and its aim was to analyze lexical features, the statistical unit chosen was the lemma type, so a preliminary lemmatization of the corpus was needed. Lemmatization generally has an important role in Italian (more so than in other languages) because it overcomes the limitation imposed by the contingent nature of some lexical choices (e.g. tenses) and variations (masculine, feminine and plural forms, six different persons, verb conjugations, clitic pronouns, etc.), which do not depend on an individual's lexical features. The lemmatization process associated each token with a pair including a lemma and a grammatical category; for instance, in Italian the token *faccia* is associated with either the lemma *fare* [to do] and the grammatical category "verb" or the lemma *faccia* [face] and the category "noun". Lemmatization was conducted on the whole corpus using a partly manual, partly automatic process. The researchers' manual intervention is necessary when the software fails to disambiguate or identify a lemma or grammatical category. For example, Italian adjectives and past participles can often only be distinguished after a qualitative/semantic evaluation of the context in which they occur (they are homographs), which cannot always be translated into an algorithm and the state-of-the-art software tools currently available cannot ensure the full and accurate lemmatization of Italian texts.

2.5 Measures

The frequency of a lemma type in the corpus was given by the sum of its occurrences in the 91 text chunks comprising the sample. The frequency of each lemma type in each text chunk was given by the number of corresponding tokens in the text chunk. The lemma vocabularies of the text chunks with frequencies produced 91 lexical profiles, i.e. a lexical profile for each writer. Each lexical profile reflected its writer's lexical range, including all information about the lemmas and their frequency in the text chunks.

The concept of the intertextual distance between texts can be used to compare lexical profiles and ascertain to what extent they may be similar (or dissimilar). To position the 91 text chunks in terms of reciprocal proximity, we adopted the concept of intertextual distance based on lexical connection, first introduced by Brunet (1988) and recently developed by Labbé (Labbé, 2007; Labbé & Labbé, 2001; Tuzzi, Popescu, Altmann, 2010). Following the

mentioned studies and consistently with the strategy described in the previous paragraph, our calculations were lemma-based (Pauli & Tuzzi, 2009).

Given a pair of texts A and B of size N_A and N_B with $N_A \leq N_B$, the frequency $f_{l,B}$ of each lemma type l in the larger text B was reduced according to the size of the shorter text A in estimating the mathematical expectancy $f_{l,B}^*$ of the frequency of the lemma type l in A by means of a simple proportion:

$$f_{l,B}^* = f_{l,B}\frac{N_A}{N_B} \tag{1}$$

thus $N_B^* = N_A$. The distance d between text A and text B was obtained as follows:

$$d(A,B) = \frac{\sum_{l \in L_{A \cup B}} \left| f_{l,A} - f_{l,B}^* \right|}{2N_A} \tag{2}$$

where $L_{A \cup B}$ was the lemma vocabulary of text A and text B, i.e. all the lemmas present in at least one of the texts.

If two texts were identical, they contained the same words with the same frequency and their distance amounted to zero. If two texts had no words in common, they were separated by a distance amounting to 1 (maximum theoretical distance). The generic element of the matrix D is such that $d_{ij} = d_{ji}$ since the distance between A and B is the same as the distance between B and A. The generic element of the main diagonal is $d_{ii} = 0 = d(A,A)$ because the distance between each writer and him/herself amounts to zero.

Briefly, the intertextual distance was obtained by calculating the difference between the frequency of any lemma in text A and its (estimated) frequency in text B. In our case, the calculation concerned the distance between a pair of text chunks approximately including 1,000 tokens each and no $f_{l,B}^*$ correction was necessary. The intertextual distance was calculated according to the lexical profiles of all possible text chunk pairs (i.e. all pairs of writers). The distances between text pairs was expressed by a square matrix of dimensions $n \times n$ ($n = 91$) with rows and columns assigned to writers. The total number of pairs to consider was 4,095, as expressed through $n(n-1)/2$.

From a statistical standpoint, the writers' lexicon was measured by means of simple indicators of the presence, absence or (more generally) the frequency of lemmas in their written texts. The intertextual distance is a composite indicator that reflected the lexical distance between two writers (texts).

2.6 Comparisons

Labbé and Labbé (2001) have provided a standardized scale of intertextual distance. According to the authors, an intertextual distance below 0.20 suffices for a reliable attribution of authorship, whereas distances beyond 0.30 point to different authors, text genres and topics. We preferred to proceed according to a comparative approach within our matrix because we were not interested in the absolute values of intertextual distances; we focused instead on all pairs of writers to establish who was more or less close to whom. The

intertextual distances contained in the matrix provided information on similarities and differences between all text chunk pairs. These distances also enabled us to represent the 91 text chunks in a dendrogram typical of cluster analysis. Clustering depends on the type of metrics used, so we considered the results of different types of agglomeration.

A first cluster analysis of the 91 text chunks was performed using a square matrix of distances and an agglomerative hierarchical cluster algorithm with complete linkage (Everitt, 1980), i.e. the distance between pairs of clusters was obtained as the maximum distance between all pairs of elements in the two clusters; pairs of clusters with a minimum distance were aggregated. We first used a complete linkage because we expected to find clearly separate, tight (convex-shaped) clusters.

A second agglomerative hierarchical cluster analysis was performed on the same data using Ward's method, where the distance between cluster pairs was Euclidean; cluster pairs minimizing the deviance between centroids were aggregated (Ward, 1963; Ward & Hook, 1963).

Textual data were processed with the Taltac2 dedicated software (Bolasco, Baiocchi, & Morrone, 2009) and statistical analyses were conducted with the R (R Development Core Team, 2009). Taltac2 is a program developed by a research team from "La Sapienza" University in Rome using statistical and linguistic resources for the purposes of textual data analysis (Cortelazzo & Tuzzi, 2008; Lebart, Salem, & Berry, 1998; Tuzzi, 2003) and text mining (Bolasco, Canzonetti, & Capo, 2005; Sirmakessis, 2004). R is a language and environment for statistical computing and graphics available as free software under the terms of the Free Software Foundation's GNU General Public License in source code form.

3. Results

Table 4 shows the main summaries of the data in the matrix of intertextual distances between all 4,095 text chunk pairs. Distances ranged between 0.37 and 0.82 and the mean distance was 0.55. Interpreted according to Labbé and Labbé (2007), these figures point to different authors writing on different topics. Analyzing the matrix blocks showed that the distances between pairs of facilitators were slightly smaller than the mean and the distances between pairs of IWA were more variable.

Pairs	n	Min	Max	Mean	Std.Dev.
IWA versus *IWA*	666	0.45	0.80	0.58	0.059
FAC versus *FAC*	1,431	0.37	0.71	0.50	0.055
IWA versus *FAC*	1,998	0.42	0.82	0.58	0.050
Corpus	4,095	0.37	0.82	0.55	0.067

Table 4. Intertextual distances between pairs of writers

The first dendrogram (fig. 1) shows the mutual positions of the 91 text chunks according to the agglomerative hierarchical cluster algorithm with complete linkage. For the sake of clarity, the letter "a" marks all 37 text chunks written by IWA and "f" the 54 text chunks

written by facilitators. Cutting the dendrogram at a height of approximately 0.66 gave rise to five clusters (numbered from 1 to 5) and one singleton (number 6). Cluster No. 1 was composed of text chunks written by IWA and, together with singleton No. 6, produced a cluster including text chunks written exclusively by IWA (20 out of 37) and clearly different from all the others in lexical terms. Cluster No. 3 was also composed almost entirely of text chunks written by IWA (13 out of 37) with the exception of one written by a facilitator.

The central part of the dendrogram contained cluster No. 4, 100% of which consisted of text chunks written by facilitators. Cluster No. 5 was also almost wholly composed of text chunks written by facilitators. Clusters No. 5 and No. 4 formed a homogeneous group of 50 out of 54 facilitators, the only exception being a text chunk written by an IWA. No. 2 was the only cluster that may be described as mixed, since it included text chunks written by 3 facilitators and 3 IWA.

The second dendrogram (fig. 2) shows the mutual positions of the 91 text chunks according to the agglomerative hierarchical cluster algorithm based on Ward's method. This second representation of the matrix of distances identified two clusters: one (A) almost entirely composed of text chunks written by IWA, the other (B) containing two sub-clusters, the vast majority of which consisted of text chunks written by facilitators (B1 and B2). After cropping the dendrogram at an approximate height of 1.45, cluster A included 33 IWA (out of 37), plus one facilitator (cluster A represented the same text chunks as in clusters No. 1 and No. 3 and singleton No. 6 in the previous dendrogram); cluster B included 53 facilitators (out of 54) and 4 IWA, the latter all belonging to cluster B2 (clusters B1 and B2 together represented the same text chunks as in clusters No. 2, 4 and 5 in the previous dendrogram).

To sum up, the combination of the two cluster analyses differentiated between the group of IWA and the group of facilitators, with only 5 out of 91 text chunks misclassified (4 written by IWA, and 1 by a facilitator). Retrieving the original texts might enable further comment on these 5 cases and on the members of the clusters classified as similar in terms of intertextual distance.

In figure 3, the 5 writers are identified by a black dot and alphanumerical codes are used to identify adjacent writers (in the code, the numbers 1 to 4 after the letters "a" or "f" refer to the FC center to which the IWA or facilitator belonged).

Some remarks might be made on the misclassification of four IWA in cluster B2 and one facilitator in cluster A. The IWA a2AL was included in cluster B2, which also contained many facilitators, but only two of the latter belonged to the same FC center (No. 2) as the IWA and neither of them had been among the IWA's facilitators (who were in B1). The IWA a4GG was much closer to facilitator f4RS, who belonged to the same FC center (No. 4), but was not one of the IWA's facilitators (who were in B1); the facilitator f4RS worked with one IWA included in cluster A.

There were only two cases showing a certain proximity between members of the pair (facilitator and IWA) writing together. The IWA a4DN was near facilitator f4LC, who wrote only with that particular IWA, whereas a4DN also wrote with two other facilitators included in B1. In all the analyses, a2AF was isolated in a small group of facilitators that also included one of the IWA's facilitators (f2BG) and another facilitator from the same FC center. The facilitator was included among the IWA in cluster A, near a4CO, for whom f4GF acted as facilitator; f4GF only wrote with a4CO, however, whereas a4CO also wrote with another two facilitators included in cluster B.
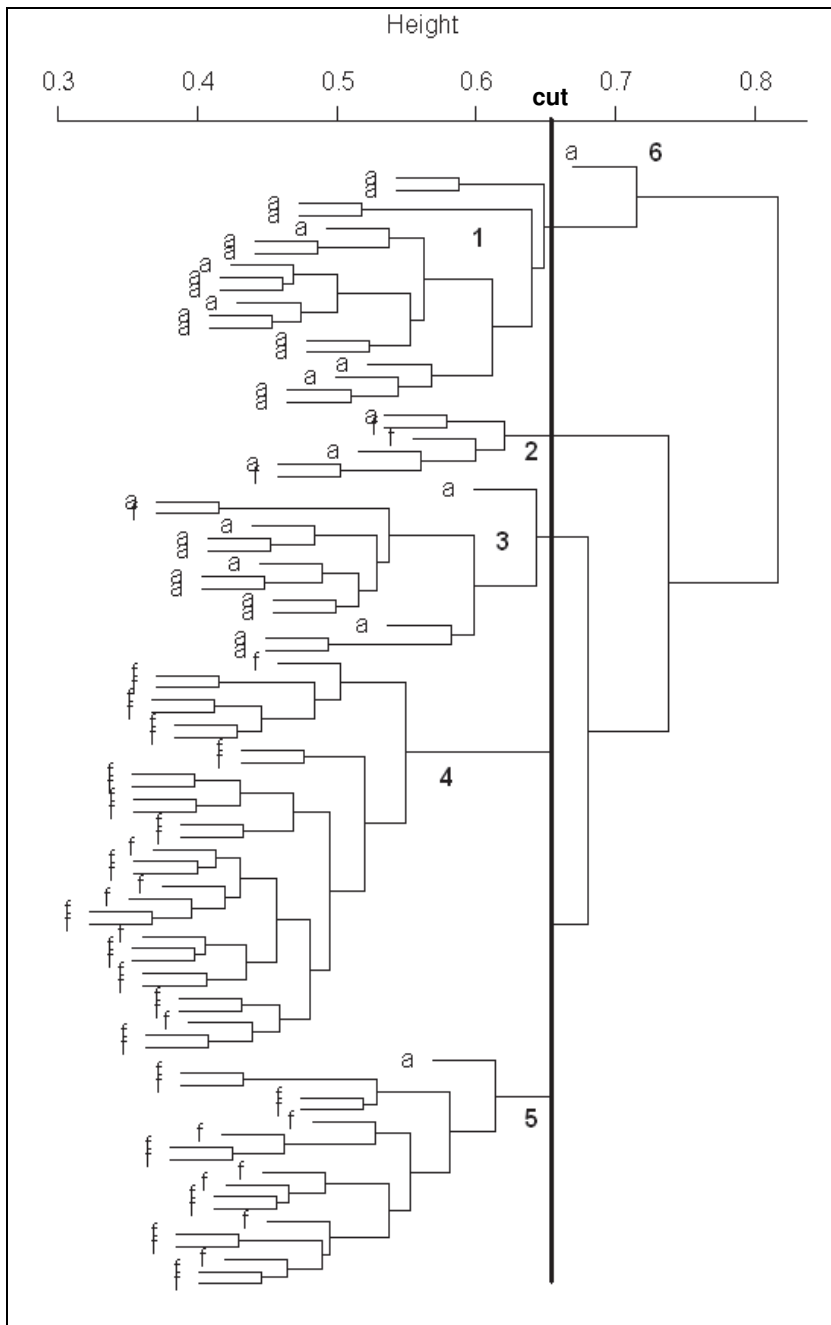
Fig. 1. Agglomerative hierarchical cluster algorithm with complete linkage. Dendrogram and clusters.
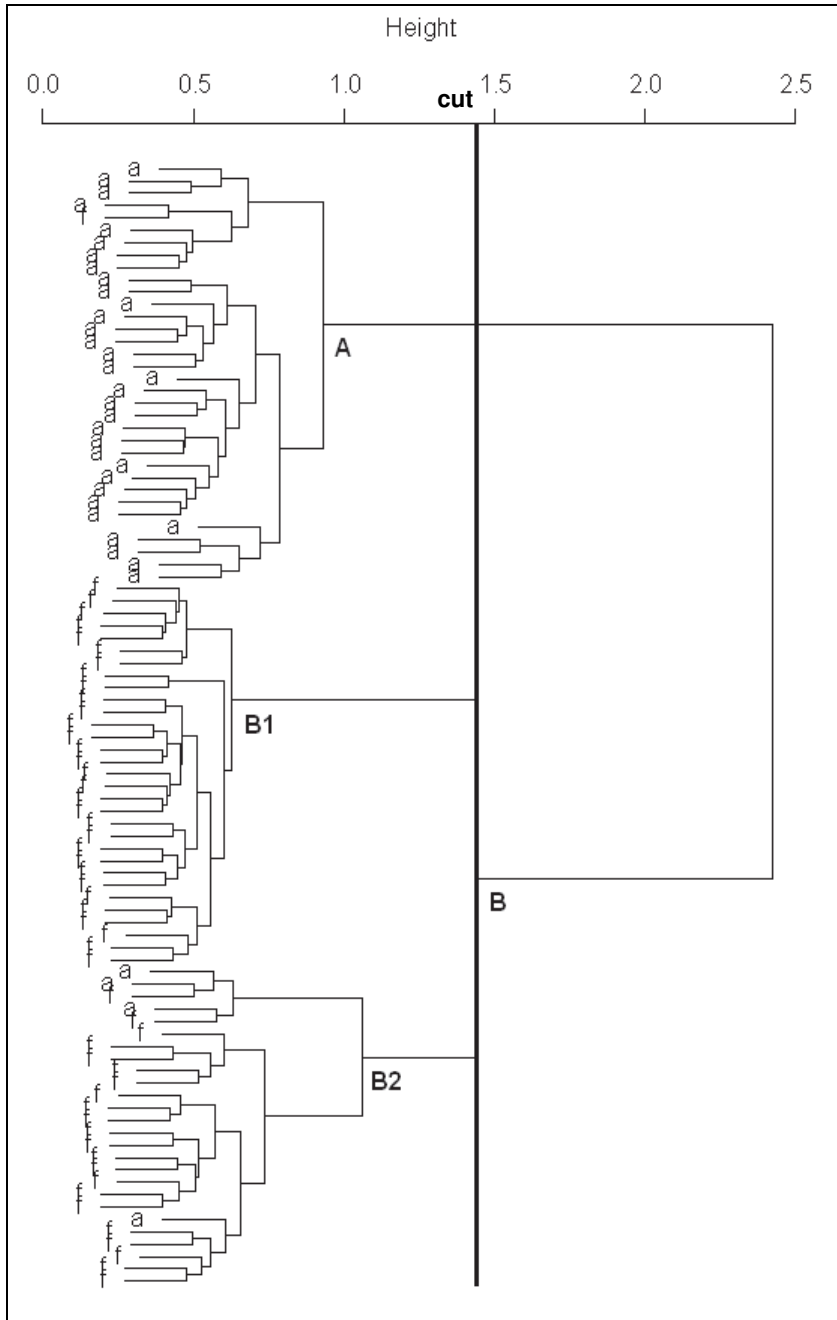
Fig. 2. Agglomerative hierarchical cluster algorithm according to Ward's method.
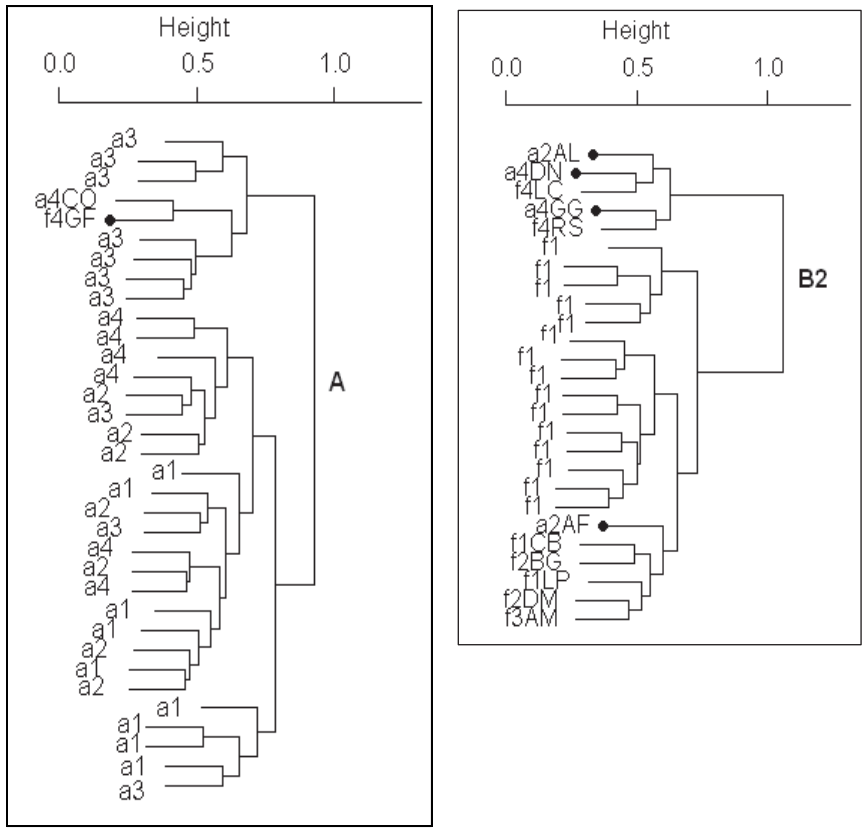Dendrogram and clusters.

Fig. 3. Agglomerative hierarchical cluster algorithm according to Ward's method. Zoom on clusters A and B2.

4. Discussion and conclusion

The present study analyzed samples of texts generated at FC sessions to see whether distinctive lexical features emerged that could clearly differentiate between IWA and facilitators. The outcome of cluster analysis (dendrogram) graphically showed that the texts written by IWA were similar to each other and differed from the texts produced by their facilitators, which also resembled each other. These findings support the hypothesis that texts written by IWA are characterized by distinctive and consistent lexical features. As already explained by Tuzzi (2009) and Niemi and Kärnä-Lin (2003), the hypothesis that the majority of facilitators managed to imitate such a specific style while remaining consistent would be difficult to support. Our findings are also in favor of distinct authorship, since it is unlikely that such a large number of facilitators could produce texts characterized by two different lexicons (giving rise to two distinct and homogenous clusters) in a real-time dialogical context. In our analysis, the misclassified cases did not support the hypothesis of non-authenticity because no proximity emerged between the parties involved in the conversations (the facilitator and IWA writing together during the same FC sessions). There were only three cases of people writing in pairs and proving very similar in terms of intertextual distance. Two of the three cases involved a facilitator who wrote only with one particular IWA and in one of the two the facilitator seemed to adopt communication modes less like those of facilitators and more like those of IWA. The third case concerned an IWA displaying communication modes similar to those characterizing one group of facilitators.

The distinctive linguistic features identified by the statistical analysis of lexical data derive from the greater complexity of the texts written by the IWA in terms of both lexis and morphological and syntactic structures. Grammatical categories (nouns, adjectives, verbs, adverbs, etc.) show a particular distribution (Tuzzi, 2009) and particular syntactic structures tend to emerge in texts written by IWA (Fratter, 2008). For example, IWA tend to resort more frequently than facilitators to modifiers (Benelli & Cemin 2008; Ursini, 2008): adverbs (e.g. *ti sono autisticamente vicino* [I am autistically close to you], *finisco l'anno scolastico vitalmente e filmicamente* [I complete the school year vitally and filmically]) and adjectives (*mio rotto gretto perduto corpo* [my broken coarse lost body], *miei incoerenti prodi prodigati provetti Lucia lenti fetenti maledetti oscuri professori* [my inconsistent brave generous experienced Lucy slow stinky damned obscure teachers]; note the alliteration in the Italian version). They also tend (Di Benedetto, 2008) to omit grammatical words (prepositions, conjunctions, articles, pronouns) when this does not hamper the understanding of the sentence's meaning (e.g. *non ho parole bocca* [I have no words mouth], or the definition of a volcano as *montagna rotta lava fuori* [broken mountain lava out]).

As stressed in other studies, the lemmas used by IWA were qualitatively different from those used by facilitators (Cortelazzo, 2008). High-register words that do not belong to a basic vocabulary (Marconi, Ott, Pesenti, Ratti, & Tavella, 1993) were used by children under 10 years of age (e.g. *asserire* [to affirm], *auspicare* [to foretell], *bramare* [to yearn], *diffidare* [to mistrust], *inibire* [to inhibit], *stereotipo* [stereotype]). Stylized language also emerges from creative expressions (e.g. *diverbio generazionale* [generational row], *sondare le persone* [to probe people]) and the creation of neologisms (e.g. *ditodipendente* [fingerdependent], *iperrumore* [hypernoise]).

4.1 Future directions

One of the advantages of intertextual distance lay in that it is a very simple comparative tool and, with a few exceptions, it led to a clear differentiation between the groups of IWA and facilitators. The values obtained cannot be compared with theoretical thresholds to assess the results, however, because intertextual distance has been widely tested in the French language, but further investigations are needed to develop a standardized scale for the evaluation of Italian texts.

The results of this study are encouraging and suggest that we are moving in the right direction, but further studies based on large corpora are needed for an overall comparison between the written language of IWA and the language of people without disabilities. Moreover, because textual data analysis calls for large corpora, our study fails to consider the effect of other variables because grouping texts by writer's age, FC training, facilitation level, etc. would make the resulting sub-corpora too small for significant comparative analyses. Further studies are needed to establish which factors can help describe the written language of IWA.

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6. References

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders DSM-IV text revision*. (4th ed.). Washington, DC: American Psychiatric Association.

Beck, A.R., & Pirovano, C.M. (1996). Facilitated communicators' performance on a task of receptive language. *Journal of Autism and Developmental Disorders*, 26, 5, 497-512.

Benelli, B., & Cemin, M. (2008). Rappresentazioni semantiche nel linguaggio degli autistici: il caso degli avverbi [Semantic Representations of the Language of Individuals with Autism: the Case of Adverbs]. In: L. Bernardi (Ed), *Il delta dei significati* (pp. 105-124). Rome: Carocci.

Bernardi, L. (Ed.) (2008). *Il delta dei significati*. [The Delta of Meanings]. Rome: Carocci.

Beukelman, D. R., Mirenda, P. (1998). *Augmentative and Alternative Communication: Management of Severe Communication Disorders in Children and Adults*. Baltimore: Paul H Brookes Pub Co.

Biklen, D. (1993). *Communication unbound: how facilitated communication is challenging traditional views of autism and ability/disability*. New York: Teachers College Press.

Biklen, D. (2005). *Autism and the myth of the person alone*. Cambridge: University Press.

Biklen, D., & Burke, J. (2006). Presuming competence. *Equity and Excellence in Education*, 39, 166-175.

Biklen, D., & Cardinal, D. (Eds.) (1997). *Contested words, contested science: unraveling the facilitated communication controversy*. New York: Teachers College Press.

Biklen, D., Saha, N.; & Kliewer, C. (1995). How teachers confirm the authorship of facilitated communication: a portfolio approach. *Journal of the Association for Persons with Severe Handicaps*, 20, 1, 45-56.

Bolasco, S., Baiocchi, F., & Morrone, A. (2009). *TaLTaC²: Trattamento automatico Lessicale e Testuale per l'analisi del Contenuto di un Corpus* (rel. 2.9) [Software: *Lexical and Textual Automatic Treatment for Content Analysis of a Corpus*]. Rome, Italy. Retrieved (July 2008) from http://www.taltac.it

Bolasco, S., Canzonetti, A., & Capo, F. M. (Eds) (2005). *Text Mining*. Rome: CISU.

Bomba, C., O'Donnell, L., Markowitz, C., Holmes, D.L. (1996). Evaluating the impact of facilitated communication on the communicative competence of fourteen students with autism. *Journal of Autism and Developmental Disorders*, 26, 1, 43-58.

Boucher, J. (2003). Language development in autism. *International Journal of Pediatric Otorhinolaryngology*, 67, S159-S163.

Braman, B.J., Brady, M.P., Linehan, S.L., & Williams, R.E. (1995). Facilitated communication for children with autism: an examination of face validity. *Behavioral Disorders*, 21, 1, 110-118.

Brunet, E. (1988). Une mesure de la distance intertextuelle: la connexion lexicale. Le nombre et le texte. *Revue informatique et statistique dans les sciences humaines*, Université de Liége.

Calculator, S.N. (1999). Facilitated communication - Look who's pointing now: cautions related to the clinical use of facilitated communication. *Language Speech and Hearing Services in Schools*, 30, 4, 408-414.

Cardinal, D. N., Hanson, D., & Wakeham, J. (1996). Investigation of authorship in facilitated communication. *Metal Retardation*, 34, 4, 231-242.

Cortelazzo, M., & Tuzzi, A. (2008). *Metodi statistici applicati all'italiano*. [Statistical Methods Applied to Italian]. Bologna: Zanichelli.

Cortelazzo, M.A. (2008). Ricchezza del lessico nel corpus EASIEST. [Lexical richness in the EASIEST corpus]. In: L. Bernardi (Ed), *Il delta dei significati* (pp. 66-79). Rome: Carocci.

Crossley, R., & McDonald, A. (1984). *Annie's Coming Out*. New York: Viking Penguin.

Crossley, R. (1997). *Speechless: facilitating communication for people without voices*. New York: Dutton.

Crossley, R., & Remington-Gurney, J. (1992). Getting the words out: facilitated communication training. *Topics in Language Disorders*, 12, 29-45.

Davidson, J. (2008). Autistic culture online: virtual communication and cultural expression on the spectrum. *Social & Cultural Geography*, 9, 7, 791-806.

Di Benedetto, C. (2008). Isole semantiche nell'emotivo mare: un'analisi lessicale, retorica e sintattica. [Semantic islands in the emotional sea: a lexical, rhetorical and syntactic analysis]. In: L. Bernardi (Ed), *Il delta dei significati* (pp. 80-96). Rome: Carocci.

DSM-IV-TR (2000). American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed., text revision, APA, Washington D.C. (trad. it. DSM-IV-TR Manuale diagnostico e statistico dei disturbi mentali - text revision, Masson Editore, 2001).

Duchan, J.F. (1993). Issues raised by facilitated communication for theorizing and research on autism. *Journal of Speech and Hearing Research*, 36, 6, 1108-1119.

Duchan, J.F. (1999). Facilitated communication - views of facilitated communication: what's the point? *Language Speech and Hearing Services in Schools*, 30, 4, 401-407.

Duchan, J.F., Calculator, S., Sonnenmeier, R., Diehl, S., & Cumley, G.D. (2001). A framework for managing controversial practices. *Language Speech and Hearing Services in Schools*, 32, 3, 133-141.

Duràn, P., Malvern, D., Richards, B., & Chipere, N. (2004). Developmental trends in lexical diversity. *Applied Linguistics*, 25,2, 220-242.

Emerson, A., Grayson, A., & Griffiths, A. (2001). Can't or won't? Evidence relating to authorship in facilitated communication. *International Journal of Language & Communication Disorders*, 36 (Supp), 98-103.

Everitt, B. (1980). *Cluster Analysis*. New York.

Fratter, I. (2008). «Palombaro ero in fondo al mare»: uno studio di caso sull'analisi diacronica dei costituenti nella CF. ["Diver I was on the sea floor": a case study of facilitated communication factors in time]. In: L. Bernardi (Ed), *Il delta dei significati* (pp. 97-104). Rome: Carocci.

Green, G. (1994). Facilitated communication: mental miracle or sleight of hand? *Skeptic*, 2, 3, 68-76.

Jacobson, J.W., Mulick, J.A., & Schwartz, A.A. (1995). History of facilitated communication - science, pseudoscience, and antiscience - Science Working Group on Facilitated Communication. *American Psychologist*, 50, 9, 750-765.

Koegel, L.K. (2000). Interventions to facilitate communication in autism. *Journal of Autism and Developmental Disorders*, 30, 5, 383-391.

Koegel, L.K., & Brown, F. (2007). Autism spectrum disorders: trends, treatments, and diversity. *Research and Practice for Persons with Severe Disabilities*, 32, 2, 87-88.

Labbé, C., & Labbé D. (2001). Inter-textual distance and authorship attribution. Corneille and Moliére. *Journal of Quantitative Linguistics* 8, 213-231.

Labbé, D. (2007). Experiments on authorship attribution by intertextual distance in English. *Journal of Quantitative Linguistics* 14, 33-80.

Lebart, L., Salem, A., & Berry, L. (1998). *Exploring Textual Data*. Dordrecht: Kluwer-Academic Pub.

Marconi, L., Ott, M., Pesenti, E., Ratti, D., & Tavella, M. (1993), *Lessico Elementare. Dati statistici sull'italiano letto e scritto dai bambini delle elementari*, Bologna: Zanichelli. [Elementary lexicon. Statistical data on how Italian pupils read and write in primary school].

McKee, G., Malvern, D., & Richards, B. (2000). Measuring vocabulary diversity using dedicated software. *Literary and Linguistic Computing*, 15, 3, 323-337.

Mirenda, P. (2008). A back door approach to autism and AAC. *Augmentative and Alternative Communication*, 24, 3, 220-234.

Mirenda, P., Beukelman, D. (2006), *Augmentative & Alternative Communication: Supporting Children & Adults With Complex Communication Needs*. Baltimore: Paul H Brookes Pub Co.

Montee, B.B., Miltenberger, R.G., & Wittrock, D. (1995). An experimental-analysis of facilitated communication. *Journal of Applied Behavior Analysis*, 28, 2, 189-200.

Mostert, M.P. (2001). Facilitated communication since 1995: A review of published studies. *Journal of Autism and Developmental Disorders*, 31, 3, 287-313.

Niemi, J., & Karna-Lin, E. (2002). Grammar and lexicon in facilitated communication: a linguistic authorship analysis of a Finnish case, *Mental Retardation*, 40, 5, 347-357.

Niemi, J., & Kärnä-Lin, E. (2003). Four vantage points to the language performance and capacity of human beings: response to Saloviita and Sariola. *Mental Retardation*, 41, 5, 380-385.

Ostryn, C. (2008). Autism spectrum disorders and AAC. *Research and Practice for Persons with Severe Disabilities*, 33-34, 273-274.

Pauli, F., & Tuzzi, A. (2009). The end of year addresses of the Presidents of the Italian Republic (1948-2006): discoursal similarities and differences, Glottometrics, 18, 40-51.

Probst, P. (2005). Communication unbound - or unfound? An integrative review on the effectiveness of facilitated communication (FC) in non-verbal persons with autism and mental retardation. *Zeitschrift fur Klinische Psychologie Psychiatrie und Psychotherapie*, 53, 2, 93-128.

R Development Core Team. (2008). *R: A language and environment for statistical computing* (Ver. 2.8.1) [Software]. Vienna, Austria: R Foundation for Statistical Computing. Retrieved [December, 2008] from http://www.R-project.org.

Rapin, I., & Tuchman, R.F. (2008). What is new in autism? *Current Opinion in Neurology*, 21, 2, 143-149.

Rossetti, Z., Ashby, C., Arndt, K., Chadwick, M., & Kasahara, M. (2008). I like others to not try to fix me: agency, independence, and autism. *Intellectual and Developmental Disabilities*, 46, 5, 364-375.

Rutter, M. (2005). Autism research: lessons from the past and prospects for the future. *Journal of Autism and Developmental Disorders*, 35, 2, 241-257.

Saloviita, T., & Sariola, H. (2003). Authorship in facilitated communication: a re-analysis of a case of assumed representative authentic writing. *Mental Retardation*, 41, 5, 374-379.

Sbalchiero, S., & Neresini, F. (2008). La scienza e l'eresia: il controverso caso della Comunicazione Facilitata. [Science and heresy: the controversial case of facilitated communication]. In: L. Bernardi (Ed), *Il delta dei significati* (pp. 125-135). Rome: Carocci.

Scopesi, A., Zanobini, M., & Cresci, L.R. (2003). Aspetti semantici e stilistici della produzione di un bambino autistico in situazione di Comunicazione Facilitata. [Semantic and stylistic aspects of the production of a child with autism in a facilitated communication environment]. *Rivista di psicolinguistica applicata*, 2-3, 83-105.

Sheehan, C.M., & Matuozzi, R.T. (1996). Investigation of the validity of facilitated communication through the disclosure of unknown information. *Mental Retardation*, 34, 2, 94-107.

Sikora, D.M., Hartley, S.L., Mccoy, R., Gerrard-Morris, A.E., & Dill, K. (2008). The performance of children with mental health disorders on the ADOS-G: a question of diagnostic utility. *Research in Autism Spectrum Disorders*, 2, 1, 188-197.

Simpson, R.L., & Myles, B.S. (1995). Effectiveness of facilitated communication with children and youth with autism. *Journal of Special Education*, 28, 4, 424-439.

Sirmakessis, S. (Ed.) (2004). *Text Mining and its Applications*. Berlin: Springer.

Snyder, D.M., Miller, K., & Stein, M.T. (2008). It looks like autism: caution in diagnosis. *Journal of Developmental and Behavioral Pediatrics*, 29, 1, 47-50.

Tager-Flusberg, H. (2004). Strategies for conducting research on language in autism. *Journal of Autism and Developmental Disorders*, 34, 1, 75-80.

Tager-Flusberg, H., & Caronna, E. (2007). Language disorders: autism and other pervasive developmental disorders. *Pediatric Clinics of North America*, 54, 3, 469.

Tuzzi, A. (2003). *L'analisi del contenuto. Introduzione ai metodi e alle tecniche di ricerca*, [Content analysis. An introduction to research methods and techniques], Rome: Carocci.

Tuzzi, A. (2009). Grammar and lexicon in texts written by individuals with autism: a statistical analysis of a large Italian corpus. *Intellectual and Developmental Disabilities*, 47, 5, 373-385.

Tuzzi A., Popescu I.-I., Altmann G. (2010). *Quantitative Analysis of Italian Texts*. Lüdenscheid, Germany: RAM-Verlag.

Ursini, F. (2008). Le parole tra noi leggère cadono. [Words between us lightly fall]. In: L. Bernardi (Ed), *Il delta dei significati* (pp. 56-65). Rome: Carocci.

Ward, J.H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 58, 236-244.

Ward, J.H., & Hook, M.E. (1963). Application of an hierarchical grouping procedure to a problem of grouping profiles. *Educational Psychological Measurement*, 23, 69-81.

Watkins, R.V., Kelly, D. J., & Harbers, H.M. (1995). Measuring children's lexical diversity. Differentiating typical and impaired language learners. *Journal of Speech and Hearing Research*, 38, 1349-1355.

Weiss, M.J.S., Wagner, S.H., & Bauman, M.L. (1996). A validated case study of facilitated communication. *Mental Retardation*, 34, 4, 220-230.

Wheeler, D.L., Jacobson, J.W., Paglieri, R.A., & Schwartz, A.A. (1993). An experimental assessment of facilitated communication. *Mental Retardation*, 31, 49-60.

Wing L., Gould J. (1979), Severe impairments of social interaction and associated anormalities in children: epidemiology and classification. *Journal of Autism and Developmental Disorders*, 9, 11-29.

Zanobini M., Scopesi A. (2001). La comunicazione facilitata in un bambino autistico. [Facilitated communication: the case of a child with autism]. *Psicologia clinica dello Sviluppo*, 3, 395-421.

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