

# THE RADIO-DRAMA AS ARTISTIC MODALITY TO IMPROVE THE EXPRESSIVENESS SKILLS IN INTELLECTUAL DISABILITY AND AUTISM: AN EXPERIMENTAL STUDY

Licia Sbattella<sup>1</sup>, Sonia Cenceschi<sup>1</sup>, Antonella Imperatori Gelosa<sup>2</sup>

## 1. INTRODUCTION

The paper presents an artistic work aiming at developing the vocal and emotional expressiveness of young persons with intellectual, relational and physical disabilities. Following the Esagramma<sup>®</sup> methodology, called Affective Vocal Education (EVA)<sup>®</sup>, speech activities and session contents designed an immersive storytelling environment where high quality materials have been proposed, and a specific qualitative test has been developed to investigate its indirect potential in enhancing vocal expressiveness.

The work focuses on the production of a radio-drama, realized by an actor and a sound engineer together with 5 girls and 1 boy with various diagnosis affecting their verbal and relational skills. An extract of the *Roman de la Rose* by Guillaume de Lorris and Jean de Meun, has been acoustically represented, producing a high-level result from a linguistic, expressive and technological point of view. The next year two other mixed groups participated in this program producing two more radio-dramas: *The Tempest* by W. Shakespeare and the *Italiana in Algeri* (the Italian Girl in Algiers) by G. Rossini.

A specific methodology has been planned to provide psychologists and tutors with an objective assessment tool for vocal skills. It permitted to quantify macroscopic dialogic and prosodic variations before and after the artistic path, by extracting a set of suprasegmental features with pre- and a post-test recording of spontaneous and elicited speech. Moreover, the paper describes the development of the theatrical script, the executive and artistic choices and the analysis of the complexity of the radio-drama from a linguistic point of view.

The entire research fits into the studies carried out for the Esagramma and Politecnico di Milano Land Your Voice (LYV) Project (Sbattella, Guinea, 2016), which invited young protagonists to lend their voices to the characters of the represented stories to stimulate and improve the prosodic skills of Italian young speakers with autism, intellectual and linguistic disabilities through the use of vocal, and technological mediated, prosodic storytelling sessions.

For more than thirty years the Esagramma Centre in Milan (Italy) has involved thousands of kids, young and adults with autism, intellectual impairments, sensorial, motoric and relational disabilities in original pathways of Orchestral Music Therapy<sup>®</sup> (OMT) and Multimedia Multimodal Interaction (MMI) detailed in Sbattella (2006, 2013, 2015b). Unique artistic and therapeutic results have been obtained thanks to the development of an artistic passion and to methodologies actively involving everybody into Inclusive Symphonic Orchestras (Sbattella, 2013; Sbattella *et al.*, 2013) and

<sup>1</sup> Department of Electronics Information and Bioengineering (DEIB), Politecnico di Milano.

<sup>2</sup> Fondazione Sequeri Esagramma Onlus, Milan, Italy.

Multimodal Ensembles (Sbattella, 2013, 2016; Sbattella *et al.*, 2010, 2017) to play re-written and re-orchestrated classical scores.

During the last 20 years spent at improving verbal competencies and self-narrating experiences of young adults with autism and intellectual disabilities, Esagramma's action-research created new pathway explicitly dedicated to Affective Vocal Education (EVA)<sup>®</sup>. Esagramma's work is done with mixed groups composed of experts (musicians, actors, psychologists, computer scientists and bioengineering) and "extra-ordinary children and adults" and is based on the following Esagramma main principles:

- the usage of prestigious narrative operas;
- the production of prestigious final exhibitions or products;
- the usage of real symphonic musical instrument and high-level technological devices.
- the usage of innovative methods to stimulate expressiveness, attention over time and teamwork skills, mainly dealing with music, sounds, and voiced aspects;
- Structured protocol to design pathways, to observe results (Sbattella, 2013), and to train the involved specialists (Sbattella, 2013).

The present investigation is therefore fully central in this context based on action-research. In particular, the goal of EVA<sup>®</sup> is the development of *the desire for vocal expression and of personalized vocal opportunities*. The chosen working methodology has been the Social Theatre (Thompson, Schechner 2004); it allows to bring into play body, space, movement, interactive dynamics of single persons *in* and *with* those of the performant group.

The desire of self-exposure and of leadership, the emergence of actions and emotions, the possibility of improvisation and representation have always been encouraged and developed. These characteristics were appreciated by the whole Team and considered fundamental respect to the important results we are going to describe.

## 2. STATE OF THE ART

Despite an extensive scientific literature exists concerning Psychodrama or Theatrical Techniques involving children and adults with intellectual disabilities and autism, a very few articles focus on the use of radio-drama in the special pedagogical and linguistic-communicative rehabilitation fields. Interesting confirmations regarding this work are presented in Cattaneo *et al.* (2017), Maiullo (2018), and Pantaleo (2013).

Into the first paper, Cattaneo *et al.* underline the importance of radio-dramas that allow to evoke and stimulate the imagination of the listener (not being able to rely on visual constraints) through a combination of spoken words, music, sound effects, and silences.

The authors propose a methodological supports for students during the production and evaluation steps, highlighting (without detailing) the importance of phonetic, rhythm and intonation care. In agreement with Pian (2009), the paper also stress the importance of differentiated characters and of simple but emotionally rich stories, suggesting the use of radio-drama as an original instrument for oral and linguistic rehabilitation.

In fact, the absence of visual elements (e.g. costumes, theatrical sets, gestural interactions, etc.) and the consequent enhancement of the available communicative channels, is particularly interesting for those children who need to enhance prosodic and emotional aspects of speech.

Maiullo (2018) worked with students of English in Thailand, starting her project from what her students favored: the receptive skills of listening and reading over the active skills of speaking and writing. The project *Radiodrama for Speaking Practice* allowed to create

a “warm embracing climate” where students could practice speaking with minimal errors and embarrassment. Inspired by *nang yai* puppets (Thai shadow puppets shows) she could work on giving more value to voice, avoiding the stress of physical exposure. Students could speak fluently, while actors and public were fully involved in what have been said (without visual and visuo-gestural component). She also emphasizes the importance of the structure, emotional contents and characters of the chosen radio-drama, and describes a methodology to support students during the construction, the performance and publication steps.

Finally, Pantaleo (2013) presents RADIOSTAR, a project carried out in a fifth grade of a primary school to include students with difficulties in reading and writing. The author underlines the formativity of the radio language and the good results they obtained promoting children’s resilience skills.

The emphasis given to spoken words, paralinguistic aspects, voice modulation, and silence’s management, has been combined with the usage of music, microphones and audio-editing software. The methodological pathways allowed to involve kids and teachers into different steps of production and evaluation. Main results are described in terms of multimodal development of creativity, accessibility, inclusion, active involvement, and attention, always associated to improved competences on the management of the prosodic dimension.

Summarizing, the limited existing researches introduce some theories and advantages of the radio-drama with disability, but do not deepen expressive and inclusive methodologies, evaluations, and obtained results. In this paper we will go into details, also dealing with the assessment of initial and final vocal skills, the management of the groups, the rewriting of stories, and the acoustic features of speech considered when evaluating the results.

### 3. STRUCTURE AND METHODOLOGIES

According to the EVA<sup>®</sup> methodology, small mixed groups have been six boys and girls of the 50 who carried out vocal courses in Esagramma over 3 years (Sbattella *et al.*, 2017). This sub-group followed a homogeneous path leading to the realization of a complete high-level artistic product. The final result has been an inclusive radio-drama performance, presented to friends and parents, tracing the route of the entire course. To support and monitor the development of vocal expressive skills, the course used high quality tools, like professional microphones and advanced software (such as Praat, iZotope RX). In particular, Praat has been used to extract meaningful features (with semi-automatic extraction) in order to quantify expressiveness evolutions of the group over time, flanking the observations of the psychologists with quantitative and objective measures. Data collection regarded both the relationship with technology and vocal expressive skills. For each participant, data collection has been realized in three steps:

- a Taking-in-charge Technological session (that used qualitative evaluation forms);
- a Pre-test Recording session;
- a Post-test Recording session.

Pre- and post-test analyses rely on the same vocal script, composed of different tasks. The purpose was to provide an objective overview based on comparable data (useful to psychologists, therapists and relatives) on the potential speech improvements provided by complex and technological group activities to persons with physical, relational and intellectual disabilities.

The study starts describing subjects' diagnoses and speech production skills, as well as the global relational situation of the whole group; moreover, subjects' previous experiences done at the beginning of the EVA activity have been considered.

In the following, we describe how we did relationship evaluation, by means of technology and pre- and post-test tests, for the analysis of verbal production. Then, we describe the poem chosen for the radio drama, with the related method of synthesis and reworking for the creation of the final script.

Moreover, we present an in-depth analysis of the artistic management of the proposal and the group performances we obtained. A brief overview about pre- and post-test results is then presented, accompanied by examples related to individual speakers' vocal improvements at the end of the EVA course. The final chapter regards discussion, conclusion and future work.

#### 4. GROUP DESCRIPTION

The average age of participants is 19 years; they are affected by Down syndrome, Cohen syndrome or cerebral palsy, with influence on cognitive and movement functions. Speakers' diagnoses in detail are (hereinafter, "Px" identifies the speaker):

- P1. Girl with Cognitive delay and Autistic syndrome;
- P2. Girl with Cohen syndrome and Autistic traits;
- P3. Girl with Down syndrome and Autistic traits;
- P4. Girl with Down syndrome;
- P5. Boy with Cerebral palsy;
- P6. Girl with Down syndrome.

P1, P2 and P3 developed limited skills in spontaneous speech production, while other three (P4, P5, P6) build well-structured sentences (pragmatically and grammatically) with various issues in phonation and timbre quality. Only the boy, despite being slow in speaking because of a cerebral palsy involving the phonatory system, is able if concentrated to use expressively the spoken language. We report the following observations to provide an overview of their main expressiveness issues:

- P1: she rarely builds complete sentences, normally speaking using one or two words and repeating a small set of them. She does not manage the intensity and often utters with a too high volume;
- P2: she takes a long time to start talking and usually speaks in a monotonous way, unclearly and with low intensity with irregular volume peaks. The vocabulary is appropriate for her age and can manage complete sentences;
- P3: almost always, she repeats the same words, but understands really well dialogs and requests. She can change terminology by completing words pronounced by others. Her vocabulary is really poor, and she does not build complete sentences but can just associate two-three words;
- P4: she has a rich vocabulary and a good management of the conversation. She tends to not be comprehensible because of issues in uttering consonants and a really high speech rate. She has also a hoarse voice;
- P5: he has a rich vocabulary and a good management of the conversation, but with strong problems in answering delay. He often speaks really monotonous and with a low speech rate.

- P6: she has a rich vocabulary and a good management of the conversation. She has a strong hoarse voice and tends to use always the same prosodic patterns and contours;

#### 4.1. *Previous experience as a group*

The components of the group shared for at least 4 years the experience of the Esagramma Inclusive Symphonic Orchestra (related to the *Orchestral Music Therapy*<sup>®</sup> OMT pathways): music therapy, rehearsals and concerts gave them the opportunity to increase both their intra-psychic and relational skills. They had “a story” as a group, ability to inhabit the collective dimensions and musical competences that included familiarity with the exhibition plan in front of a huge public.

The group already completed a first year of EVA pathway before to start the work on the radio-drama and already experienced – via Social Theatre techniques – the activation of the vocal and verbal skills solicited within a playful, artistic, symbolic, and non-rehabilitative dimension.

#### 4.2. *Speech issues in disability*

The group involved into the project was inhomogeneous with regards to vocal skills. Despite wide range of individual differences, great difficulties in language and communication characterized both Intellectual Disability (that includes Down Syndromes), Autism, and Cohen Syndromes, compromising for all of them the relational dimensions, self-image, and adult skills.

We provide here a brief overview on their speech and communication difficulties also referring to the DSM-5<sup>®</sup> (2013), and with specific attention to factors that hinder or alter prosody and its correct development.

##### 4.2.1. *Intellectual disability*

The speaker with intellectual disability presents critical components of intellectual functions that include: verbal comprehension, working memory, perceptual reasoning, quantitative reasoning, abstract thinking, and cognitive effectiveness. Persons with Down Syndromes belong to this group even if huge differences can be detected at cognitive and communicative level. In presence of Intellectual Disabilities the development of vocal and linguistics skills is often delayed for several factors including cognitive deficit, hearing loss and anatomic differences. Basically, the problems are predominantly a delayed development of vocabulary in infancy, a wide difficulty at articulation and phonology level (e.g. hoarse voice, low intelligibility, difficulty in uttering specific phonemes), and monotonous intonation (a phonological deepening of the speech of the person with Down Syndrome is described by Stoel-Gammon, 2001). In some case the diagnoses of Intellectual Disability (and Down Syndromes as subgroup) can be associated to the presence of autistic traits and communication deficits.

Persons with Intellectual Disabilities often present rigid mechanisms for interpreting reality that determine: basic anxiety respect to dominant emotions, the withdraw from communication or the usage of repetitive patterns.

The major consequences on spoken communication skills can be described as follows:

- discrepancy between intellectual abilities and language;
- discrepancy between understanding and speech production;
- vocabulary poverty;
- sometimes rich vocabulary but disconnected from the context;
- stereotypy in communication;
- poor prosodic modulation;
- poverty of grammatical structures;
- speech disorders such as articulation issues, bad pronunciation, substitution or omission of letters, disorder of rhythm of emission, etc.;
- difficulties to use and understand complex constructs and correct references to semantics or pragmatics;
- difficulties to use paralinguistic features and prosodic intonation

For a deepen analysis see DSM-5® (2013), Stoel-Gammon C. (2001), Roberts J. E., Price J., Malkin C. (2007), Kumin L. (1996), Sbattella (2013), and Montobbio, Lepri (2000).

#### 4.2.2. *Autistic Syndromes*

Relational and communicative difficulties (both linguistic then paralinguistic) characterize Autistic Syndromes contributing to the diagnoses of the syndrome itself (DSM-5®, 2013). But the literature often underlines the specific attention to sonic, musical, and prosodic component that persons with autism give to the intonated expressiveness of others and of dialogues.

Being the theme of vocal expressiveness skills in autism very wide, we limit to present the main autistic traits concerning the three girls described in this work. Looking at the relational and interactional point of view, we identified difficulties in:

- making of language the main instrument of relationship and affective communication;
- living emotionally and subjectively the speech to themselves and to others;
- taking from language the specifically human way of symbolization.

The following characteristics have been detected and identified as more related to the verbal production:

- an incomplete achievement of linguistic competences;
- the presence of strict silence or only few phrases in extreme situations;
- the use of stereotypes, echolalia, and pronominal inversion;
- the presence of formal and idiosyncratic quirk;
- prosodic and tonal difficulties;
- the use of video clips and cartoons (intimate personal and at the same time impersonal repertoire);
- melodic and musical components of quotations, refrains, or nursery rhymes.

For further insights regarding the emotional and relational spheres in Autistic Syndromes, see Joly *et al.* (2015), Micheli (1998), Alvarez (1999), Yirmiya (1992), Fonagy, Target (2005), Sbattella (2006, 2013), Ballerini (2006).

### 4.2.3. Cohen Syndrome

As well highlighted by Howling et. Al (2005), the Cohen Syndrome diagnosis is mainly based on physical features, and despite it is usually associated to sociable characters, persons with this syndrome often also satisfy criteria for re-entering the autism spectrum. In this case, children with Cohen syndrome will show the speech issues listed into the previous paragraph. This is the case of girl P2 involved into the project.

## 5. TECHNOLOGICAL PRELIMINARY SESSION

We started proposing to each participant a preliminary technological session. Each participant faced the session according to his/her possibilities and emotional mood. They were asked to use microphones, headphones, try to dub a simple cartoon and re-listen their own voice (both real and modified in pitch and amplitude), as deepened in Sbattella *et al.* (2017).

Considering the activities listed in Table 1, let us note that we asked the participants to carry out some tasks, such as the following ones, to monitor their degree of involvement and technical skills:

- during the first task we invited the participant to switch ON or OFF the radio microphone and to put ON or OFF the headphones by themselves;
- during the second task with the stand-microphone the subject has been invited to position him/her in front of the vertical high-quality microphone, speaking and then re-listening his/her voice;
- the dubbing activity has been made on the cartoon “The Line”<sup>3</sup>. The involved character speaks in a grammelot language (Jaffe-Berg, 2001), but their prosodies and actions are highly recognizable by intonation and gestures. The subject has been invited to dub a character, using meaningful sentences, to listen, to change, and to re-listen his/her recording.

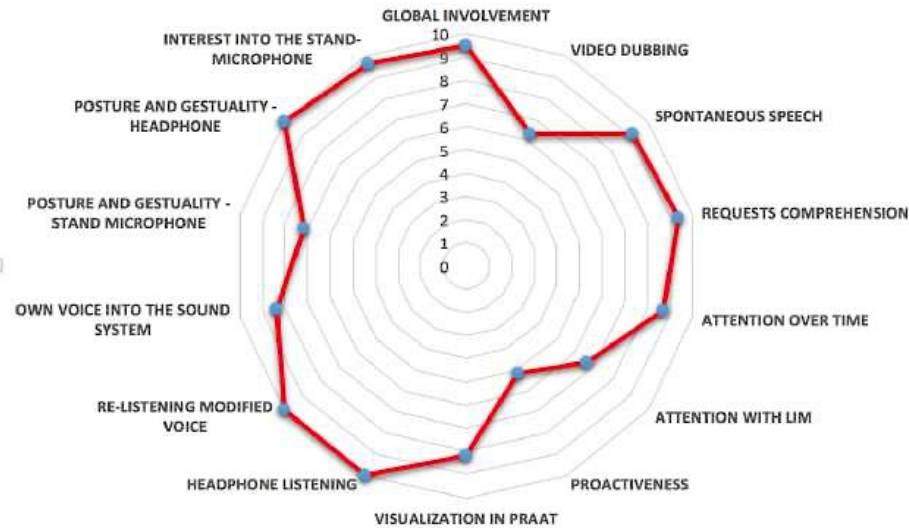
Table 1. *Technological session activities*

	<b>Activity</b>	<b>Technology</b>	<b>Speech modality</b>
<b>1</b>	Recording Re-listening	Radio-microphone Audio-speakers & closed headphones	Spontaneous speech
			Real & edited speech
<b>2</b>	Recording Re-listening Visualization	Radio-microphone & Praat Audio-speakers & closed headphones	Elicited speech & Repetitions
<b>3</b>	Recording Re-listening	Stand-microphone Audio-speakers	Spontaneous & elicited speech
<b>4</b>	Cartoon Dubbing	Stand-microphone	Spontaneous speech
		Projector	

<sup>3</sup> <http://www.quipos.net/en/famous-characters/la-linea/>.

Behaviours, reaction and feedbacks have been evaluated and appointed both discursively and numerically on a 1-10 scale, by experts, and audio materials saved for future analysis. The assessment was made considering the subject's usual behaviour.

Figure 1. *Synthetic graph of the technological response: average of the expert evaluations on the single participant*



Each participant has been quantitatively evaluated and the average group values have been represented in *Figure 1* showing a very high interest, even involving those who had never used a microphone. The evaluation points can be summarized as follows:

- global involvement: participation demonstrated during the entire session;
- video dubbing: ability to manage verbal production with video inputs and time alignment skills;
- spontaneous speech: voluntary speech expression skills in the absence of reference models;
- request comprehension: demonstration of understanding the tutor's request;
- Attention over time: ability to maintain adequate attention on activities during the session;
- attention with Lim: ability to maintain adequate attention during the dubbing;
- visualization in Praat: understanding of prosodic concepts visually show via software;
- headphone listening: demonstration of satisfaction and involvement in the use of headphones;
- re-listening modified voice: demonstration of satisfaction and involvement in listening to one's recorded voice (in headphone);
- own voice into the sound system: demonstration of satisfaction and involvement in listening to one's spatialized recorded voice;
- posture and gestures – stand microphone: physical relationship management;
- posture and gestures – headphone: physical relationship management;
- interest into the stand microphone: demonstration of appreciation and involvement.



## 6. ANAMNESIS

The expressive and relational skills of each participant were investigated before starting the path, through surveys (involving family members) and specific pre-test recordings. Such recordings have been also repeated at the end of the course (post-test) in order to allow the qualitative and quantitative analysis of any changes in speech production.

### 6.1. *Questionnaire for subject's relatives*

The relatives of the 6 participants were asked to complete a questionnaire, useful for preparing the anamnesis of their expressive vocal skills, with the aim of “photographing” the situation at the beginning of the EVA course. The test is composed of the following sections and joins the results of the pre-test recordings:

- 20 open-ended questions concerning expressive skills;
- IPDA Observation Questionnaire (Terreni, 2011): 43 multiple choice questions concerning different behavioural and communication aspects.

### 6.2. *Pre and Post-test recordings on vocal expressiveness*

Pre- and post-test recordings follow the same script, composed of three sections for a total duration of about 45 minutes:

- spontaneous dialogic speech: the subject is asked to present himself/herself answering to some simple questions (e.g. “What’s your name?”, “Do you have brothers or sisters?”);
- spontaneous speech: he/she is asked to describe what’s happening in three short comics without words;
- elicited speech (or imitative speech): a list of sentences (with related situation) to be repeated, based on the Italian script of the Interactive Atlas of Romance Intonation, IARI (Prieto *et al.*, 2010-2014);
- the IARI script has been readapted to make pragmatic contents accessible to the group, and it comprises 31 different Information Units (Cresti, 1995). The prosodic request remains the same as the original scripts, because the IARI list was considered a good solution. In fact, it presents common, daily situations easily adaptable to people with different degree of disabilities (comprises short and long sentences, with 1 or more intonative units etc.). P1, P2 and P4 found it difficult to identify the context: they were then asked to repeat the actor’s example after two unsuccessful attempts.

#### 6.2.1. *Speech features*

Audio recordings allow to monitor several acoustic features related to the suprasegmental quality of speech (Teixeira *et al.*, 2013). This study focuses on a general characterization of verbal production providing an objective observation method on a heterogeneous group for clinical diagnosis that has followed a course aimed at enhancing the subjective qualities of each speaker. Macro qualities, such as rhythm, modulation, response times and harmonicity were taken into consideration as closely related to the

most evident expressiveness issues of the subjects. Their complete list is shown in *Table 2*: each one is associated with its main digital features that have been extrapolated from the recordings.

Table 2. *Prosodic behaviours and corresponding low-level features*

Prosodic behaviour	Low-level digital features
Intonation	Average pitch Pitch range
Modulation	Average Intensity
Voice quality	HNR Jitter Shimmer
Disfluencies	Pauses
Turn taking time	Answering time
Rhythm & rate	Syllables/second

Jitter, Shimmer and HNR (Harmonic-to-noise ratio, hereafter called Harmonicity) are interesting indexes to monitor voice quality (in particular they are linked to the articulation and physical management of the phonatory apparatus) as explained in Shinohara *et al.* (2017). In order to observe the global behaviour of the group, their values were extracted from the vocalized component of the elicited speech only, averaging all the values derived from each single IU for each participant.

Instead, the intra-speaker comparison have been done comparing the pre- and post-test speech production for each IU, in order to underline any interesting change, task by task. The same procedures have been applied for other features, too. Praat (Boersma, Weenink, 2012) and the additional scripts of the Vocal Toolkit (Corretge, 2012) were used for all the steps.

Complex features more strictly related to the phonetic field such as formants, vowel areas, production of single phonemes, are deliberately overlooked at this stage for three reasons. The first reason is that we want to focus on features that can be easily analysed by non-experts. The second is more specific: as the group is so heterogeneous, large differences in expressiveness skills make it meaningless to extrapolate *global* relevant phenomena; thus, only speaker-related features make sense. Third, in too many cases the vocal material is too short to allow for the analysis on segmental characteristics and target-words.

## 7. THE POEM

The *Roman De La Rose* is an allegorical poem of 21780 octosyllables (or novenary, in the Italian language) written in two distinct parts, by two different authors and at a distance of 40 years. The work was started in 1237 by Guillaume de Lorris, resumed, and completed later, by Jean de Meun between 1275 and 1280. For the following work the Italian version of the Einaudi edition was used (Turin, 2014) edited by Mariantonia Liborio. The verses we used come from the de Lorris' part. The de Meun's part was not included.

### 7.1. *Adapting the book to the radio drama modality*

The peculiarity of the project, from the first year, was its focus on the vocal and prosodic elements, a theme rarely addressed in the courses dedicated to disability. The body movement is usually preferred (for example, focusing on dance) in theatrical working with people with intellectual/physical disabilities, while expressiveness and speech are usually less present in special methodologies despite being a fundamental element of the relationship with the other.

Esagramma undertakes a challenge with the EVA course, choosing, at the opposite, the radio drama as a high-level and prestigious proposal. It is a dramaturgical form that, more than any other, is centred on the voice and the complexity of human interaction and expression.

As visual and gestural dimensions are not comprised into the final product, the prosody of speech has to be stressed and the subjects are induced to take care and improve prosodic behaviours. During rehearsals and voice production, body, space and visual feedbacks are used, but the final product must be “evident” and perceivable by “blind” and “distant” persons (i.e., the public). Thus, the prosodic vocal expression will be responsible for more aspects than in the traditional theatre activity.

The access to the radio drama has not been immediate, and was planned for the second year of the course. For the whole first year of Vocal and Affective Education, the group had the comfort and pleasure of getting to know the work on the voice as a personal new “musical instrument”. It was also chosen not to use an already-edited radio-drama, but to rework a famous poem, in order to compose an ad-hoc piece *with the group*, and *for the group*. The starting point was therefore the *Roman de la Rose*, a score we chose listening to what was expressed by the group in the previous year, where *love* emerged as a central theme.

From a formal point of view, the *Roman de la Rose* was selected, among the myriad of texts about love, because it is the story of a dream, inside which what the protagonist is dreaming of were true.

In fact, it was considered that the *dreamlike dimension* would have guaranteed the possibility of playing the vocal element in an unexpected, imaginative but also significant way despite the ethereal characterisation of its contents. The oneiric dimension of the story made it possible to contextualize the voice of each participant, taking into account the following points:

- **structural complexity of the story:** the story is made up of successive scenes (see section 6.2);
- **linguistic structural complexity:** single words were proposed to speakers with more expressiveness issues, while complete sentences were used for other subjects;
- **linguistic complexity:** although the reduction of the poem implies a simplification, complex terminologies have been maintained;
- **prosodic complexity:** an important variability of intonations and accents, modulations and phrasing has been deliberately maintained.

It is important to underline that limiting the structural linguistic complexity does not imply limiting prosodic variability. For example, the word “*Avarice*”, certainly not typical of an everyday language, has been used. It has been interpreted and almost personified through the voice, taking advantage of a whole range of prosodic possibilities never explored before by the group.

The used excerpts of the original text were about forty verses out of a total of more than four thousand, and yet the extrapolated verses were used while remaining extremely

faithful to the original in its lexicon and complexity. The script produced and written by the EVA expert for the group had in the end the following characteristics:

- sentences: 72;
- medium sentence length: 11,4 words;
- total words: 820; Average word length: 5 characters;
- unusual high-level words: 44 (courtly terminology);
- Gulpease Index: 69; i.e., between the “very difficult” and “difficult” levels for the elementary school, and an “easy” level for the secondary school.

The script reduced the opera to an accessible script suitable for the average school level of the participants. In fact, from the lexical and grammatical point of view, the girls (P1, P2, P3, P4 and P6) have a level comprised between the third and the fifth year of primary school, while the boy (P5) about a first year of the secondary school. On the other hand, from a prosodic point of view, the challenge has been higher: to bring all their slow, altered in rhythm and speed, monotonous speech, towards a richer and more emotional production.

All the participants lent their voices, even people with the most severe phonation difficulties. The story is in first person and the protagonist had a “voice made up of many voices”, which – chasing and overlapping each other – emphasize the dreamlike dimension and accompany with poetic intensity into the garden of Guillaume de Lorris. About the assembly and post-production phases, the actor chooses the best vocal performance among several takes, for each participant. The final result was an 18-minute radio play.

## 7.2. *The structure of the radio-drama, according to the Propp’s model*

The proposal is part of an allegorical poem, which is abstract, descriptive and strongly based on emotions and feelings. However, the experts focused the radio-drama script on maintaining well-defined characters, actions and structure components. The main elements maintained in the radio-drama are reported in the Tables 3, 4 and 5. They have been obtained analysing the final script following the Propp’s theory (Propp *et al.*, 1966). Such theory has been useful for understanding whether the story reflected a certain type of structure (protagonist roles, actions, elements, etc.) in line with the traditional structure of the fairy tale model.

The Propp’s structural formula of the opera comprises the “difficult task” and the “overcoming”, but lacks the “fighting” step.

$$A B C \uparrow D G Z R \text{—————} Y O T H C^*$$

$$\circ F S K P L \downarrow Pr Sp$$

The reduction to radio-drama is however descriptive, and lacks some components being an extract of the whole poem. The final formula is simplified in:

$$A \wedge B D G R C$$

Table 3. *Propp elements maintained in the radio-drama*

Propp element	Elements in the radio-drama
Characters	Protagonist (first person, the hero) Inanimate antagonist: the wall The assistant: Idle the woman
Scenery	Bedroom City (only mentioned) Garden protected by wall Indoor garden

Table 4. *Propp structure components maintained in the radio-drama*

Structure component	Elements in the radio-drama
Initial balance (debut)	The Protagonist is sleeping
Breakdown of the initial balance (motive or complication)	The protagonist finds a garden belted by walls and does not know how to enter
Adventures of the hero	He looks at the engravings, listen to the birds and turns around the garden's wall
Reestablishment of balance (conclusion)	He enters the garden, moving towards the "pleasure"

Table 5. *Propp functions maintained in the radio-drama*

Functions	Elements in the radio-drama
Debut: departure from balance	He falls asleep and finds himself away from home
A	He wants to get out of the city
^ : Departure of the hero	
D: The hero is tested	He must enter the garden
G: Hero's reaction	He looks for the entrance
R: test resolution	"Idle" (a beautiful woman) opens the door and leads him into the garden
C: happy ending (episode)	The protagonist enjoys the beauty of the garden

## 8. MANAGING THE GROUP'S WORK

The procedure described above, which leads to a progressive and shared composition of the final product, is typical of Esagramma Methodologies (see the re-orchestrated symphonic scores and the multimodal rewritten stories) and of Social Theatre.

The conductor chooses a particular situation and proposes that the group immerses into it, in order to play with improvisation: a powerful tool for the group “*To have a say*”. This lays the ground to work on a theme, based on what has been expressed by the group in the previous year. In this way the group will be identified as “*having a voice*”.

The group also explored theatrically the whole portion of the story used for the radio drama allowing each participant to be aware of the story (a lot of space and time was devoted to the appropriation of the text of the poem) allowing the components, related to affects and desires of each actor, to properly develop. It also ensured the fundamental possibility of prosodic exploration of the verses, which gave the group great enjoyment and great wonder in being able to listen to it again.

A possible problem could be, like in any group, the presence of different *timing of attention*, but using Social Theatre, technology, and something as often overlooked *and fun as the human voice*, has made it possible to overcome these issues.

### 8.1. *Dealing with technological equipment and disability*

- The access to technology – microphones, PCs, headphones, speakers, etc. – was mediated by a theatrical method making it possible to overcome the embarrassment and the difficulty that various people (even non-disabled ones) experience in front of such devices, and in particular in front of the microphone, and/or in re-listening to their recorded voice.
- Once we entered the game and obtained the recordings, the possibility to listen to ourselves, to feel our own voice returned and to feel it as beautiful, was remarkable. This chance had a very strong and positive impact already in the laboratory sessions, and even more during the public performance (section 7.3).
- This may be surprising, because almost all people do not love their recorded voice, and do not feel it as their own but as a different and foreign one. Yet, during the laboratory sessions, the recognition of one’s own voice (coming out amplified from the speakers) procured expectation, smiles and complacency.
- Even more surprisingly, it also happened to people who during the pre-test had explicitly declared that they did not like their voice. It can therefore be concluded that it is precisely the path of artistic research and relational attention that produced this result, and that technology offers an important surplus in terms of cognitive fallout and growth *of self-esteem*.

### 8.2. *Mixing the radio-drama*

From the second half of the course onwards, the collection of voices began, following the roles defined by the actor. Each participant was able to record different takes of their part (individually or in groups, according to their feelings and abilities) in full awareness of their role and the contents of the story. This was possible because each sentence was not recorded in a decontextualized way but, on the contrary, the context permitted participants to identify with their roles, “*living*” the extract of the story. Then, each scene was linked to the following one, providing continuity and direction to the work.

For each part, an average of ten recordings were collected from which to choose the best one for narrative purposes. The sound engineer then followed a specific script, created by the actor specifically for the audio editing, assembling the narrative vocal and musical components. The radio drama was therefore created through the open-source

Audacity software<sup>4</sup>, normalizing the volumes, adding slight echo effects to the narratively more ethereal characters, and maintaining a *WAV* format, sampled at *44100 Hz* on *16-bit*.

### 8.3. *The public performance*

The radio drama was presented to a close audience of about 30 people, within a performance illustrating the different composition steps. In our opinion, the artistic product was both simple and visionary and, perhaps for this very reasons, extremely innovative.

The very act of being together, around a broadcaster, for a moment of pure listening to a disembodied voice, was something extremely strong in its delicacy. It was a cultural experience that it is not appropriate to name as “show”, precisely because the visual element is completely missing and, on the other hand, cannot be called “concert”.

The public and shared use of the radio play has not only caused the enthusiasm of the audience or reinforced the satisfaction of the working group, but it has also allowed us to glimpse a little explored but very intense cultural ritual: all together around “*the radio*”, as in the past, imaging the story relying on the images evoked to each listener by the voices of the group. On this occasion “extra-ordinary children and adults” have been protagonists that guide others through the lesson.

## 9. PRE AND POST-TEST COMPARISON RESULT

We reported here results obtained on the entire test for session, making averages on the pronounced sentence’s values for the entire test. This section is devoted to give a simple overview on the global possible activity and trends, and all these values have been accompanied by expert’s auditory and psychological evaluations.

The **total number of complete IUs pronounced** by each speaker during the pre-test is reported in Table 6 (spontaneous descriptive recordings are excluded from this count).

The global number of complete IUs pronounced by each speaker does not decrease. P1 complete much more IUs in the post-test. P2 and P3 faced strong difficulties, but they increased their global attention, with impressive improvements on the spontaneous speech side.

The most important global improvement has been in **turn-taking timings** (see Table 7), validating the excellent relationship acquired with technology and greater confidence with one’s own voice. Turn-taking times have been measured simply considering the temporal distance between the last letter of the tutor task description and the beginning of the subject’s pronounced sentence.

Table 6. *Cognitive issue plus Pre and Post-test complete IUs pronounced by every participant*

Participant	Cognitive issue	IUs pre-test	IUs post-test
P1	Cognitive delay and Autism	17	27
P2	Cohen syndrome and Autistic traits	3	7
P3	Down syndrome and Autistic traits	7	7

<sup>4</sup> <https://www.audacityteam.org/>.

Participant	Cognitive issue	IUs pre-test	IUs post-test
P4	Down syndrome	33	33
P5	Cerebral palsy	34	35
P6	Down syndrome	34	35

Table 7. *Turn-taking time comparison: pre and post-test averages*

Participant	Pre-test (s)	Post-test (s)	Δ%
P1	0,93	0,68	-26,8
P2	1,13	0,02	-98,2
P3	0,43	0,036	-15,5
P4	1,52	1,02	-32,6
P5	1,88	1,26	-33,3
P6	1,64	1,28	-22,0

Table 8. *Intensity range (Ir) comparison: pre and post-test averages*

Participant	Ir Pre-test (dB)	Ir Post-test (dB)
P1	6,10	9,20
P2	19,03	23,54
P3	6,17	8,86
P4	11,88	21,74
P5	20,46	23,49
P6	38,03	35,97

Only right answers to questions were considered (no pragmatically disconnected answers), and it must be underlined that in many cases the improvement was also in the **terminology and improvisation skills**. The average turn-taking timing is among 0.2s (Strömbergsson *et al.*, 2013). However, in this context, an answering time close to zero is an indication of failure in the dialogue, but it is probably preferable to a prolonged waiting.

Table 8 shows the **intensity range (Ir) increases for pre and post-test**. Just P6's range decreases but remains on good values. *Ir* is lower for monotonous voices, while above 20 can be considered a sufficient value, considering that we are observing single sentences made of just a few words.

Table 9 is focused on **voice quality** and in particular on **Harmonic (H), Jitter (J) and Shimmer (Sh)** values. It is interesting to observe that harmonic of P1, P3 and P4 decreases. This result is justified by the fact they tended not to pronounce consonants in pre-test sessions, with a consequent preponderance of vowel and harmonic material. On



the opposite, P2, P5 and P6 have the contrary problem and their values increase because in post-test sessions, they tend to pronounce the vowels more clearly.

Table 9. *Harmonicity (H), Jitter (J) and Shimmer (Sh) comparison: pre- and post-test averages*

Participant	H Pre	H Post	J Pre %	J Post %	Sh Pre %	Sh Post %
P1	9,27	7,45	2,25	2,60	1,38	1,37
P2	4,52	7,80	3,30	1,65	1,59	1,34
P3	7,21	7,07	3,09	3,83	1,67	1,52
P4	12,35	5,48	2,16	2,82	1,25	1,61
P5	3,79	4,61	4,12	3,66	1,39	1,33
P6	4,37	6,39	2,65	2,36	1,41	1,32

Table 10. *Syllables number (S) and Speech Rate (R) comparison: pre- and post-test averages*

Participant	S Pre	S Post	R Pre	R Post
P1	-	-	2,17	2,60
P2	-	-	1,83	3,30
P3	-	-	4,36	3,56
P4	8,91	10,47	5,10	4,27
P5	9,43	8,26	3,30	3,34
P6	7,97	16,94	2,76	2,76

Table 10 contains **number of syllables** and **speech rate values** for pre- and post-test, for each participant. They are not indicated for P1, P2 and P3 because their answers were both in pre- and post-sessions composed by one or two syllables, without particular improvements. Here, the interesting result is for both P4 and P6, who have learnt how to improvise new and long answers. P5's result is aligned with expert observations: during the pre-test she was often babbling, producing useless syllables, while in post-test she was more precise.

Figure 2 shows the **speech rate comparison**, task by task, pre- and post-test, for P4. As previously cited, she speaks really fast, often "compressing" words and being not very intelligible. The red line shows post-test lower values and a clear downward translation of the global answering profile.

Figure 3 shows the same complete **pre- and post-test profile** for P6, and her **harmonicity values**. P6 demonstrated the conscious managing of speech in the post-test, with greater emphasis leading to higher harmonicity values for all the tasks.

Figure 2. P4 - Rate comparison between pre- and post-test, task by task

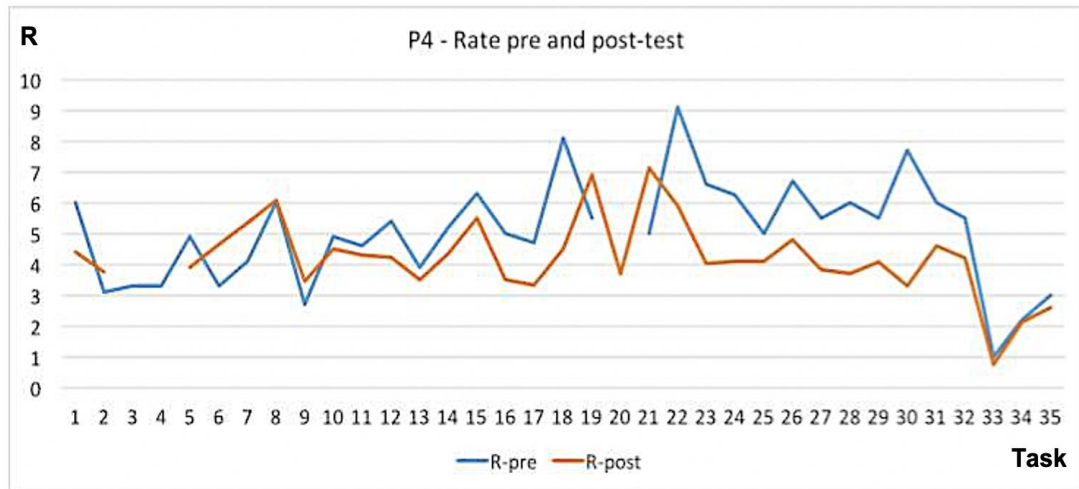
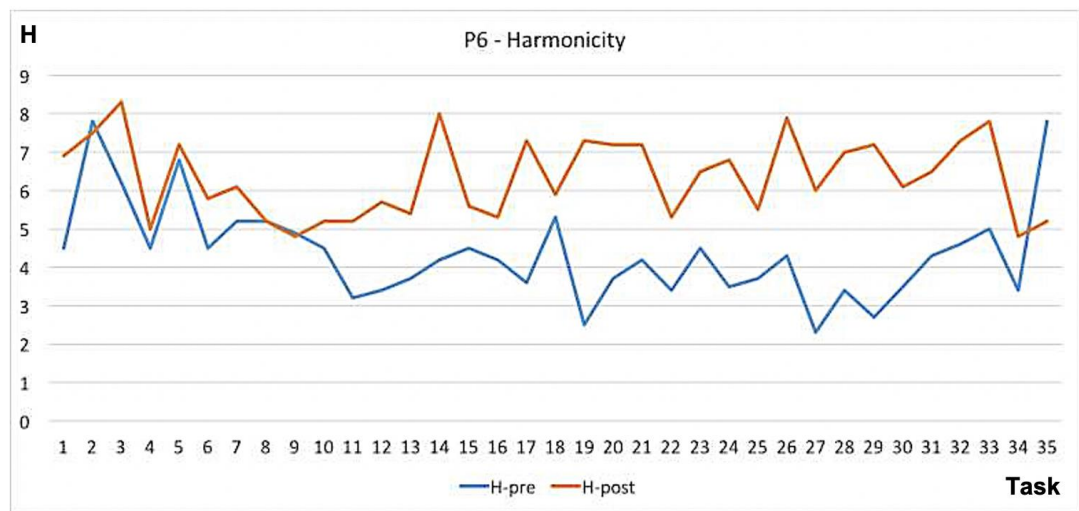


Figure 3. P6 - Harmonicity comparison between pre and post-test, task by task



## 10. DISCUSSION AND FUTURE WORKS

The main purpose of this work is to present the Esagramma Affective Vocal Education (EVA)<sup>®</sup> methodology and the contributes in support to the realization of an artistic radio-drama. The enriched methodology allowed to observe the speech evolution of participants exploiting the semi-automatic analysis of speech recordings, usable from psychologists and non-linguistic expert tutors before, during and after the pathway.

In particular, in this first proposal the following macroscopic dialogic and prosodic parameters have been taken into account: turn-taking timing, intensity range, pronounced syllables, speech rate, voice quality (*Jitter*, *Shimmer*, *Harmonicity*). The average pitch and the pitch range will instead be deepened in future specific intra-speaker studies which will also deepen the segmental level (e.g. realization of the pragmatic accent).

The specific results of this case study show the added value of the EVA methodology in the comprehension of prosodic phenomena and in helping expressiveness skills evaluation of people with intellectual and expressiveness difficulties.

The collected recordings will be used for further deeper phonetic investigations on vowel variability, voice quality, and evaluations on spectral features in order to better understand behavioral and vocal improvements. Future studies will be carried out on the groups that are working to the construction of the other two radio dramas mentioned in the introduction. We are working with more participants and more groups, with other radio-dramas, in order to achieve statistical significance for groups of people with the same diagnosis and/or similar expressiveness issues. More data will allow to support conductors in choosing and structuring the pathway and analyzing the obtained results. More work is going to be done to design a structured protocol for the creation of dramas and for the quantitative evaluation of results with respect to diagnosis and the initial competence evaluation.

## REFERENCES

- Alvarez A., Reid S. (Eds.) (1999), *Autism and personality: Findings from the Tavistock autism workshop*, Psychology Press, Hove, East Sussex, U. K.
- Ballerini A., Barale F., Gallese V., Uccelli S. (2006), *Autismo. L'umanità nascosta*, Mistura S. (a cura di), Einaudi, Torino.
- Boersma P., Weenik D. (1996), *Praat: a system for doing phonetics by computer*. Report of the institute of phonetic sciences of the university of Amsterdam, Amsterdam.
- Cattaneo V., Grechi G., Rocco V. G. (2017). "Il radiodramma come strumento didattico". *Italiano LinguaDue*, 9, 2, pp. 524-544:  
<https://riviste.unimi.it/index.php/promoitals/article/view/9908>.
- Cenceschi S., Sbattella L., Tedesco R. (2018), "Verso il riconoscimento della prosodia", in *Studi AISV 2*, vol. 2, pp. 433-440.
- Corrette R. (2012), *Praat vocal toolkit*. <http://www.praatvocaltoolkit.com/>.
- Cresti E. (1995), "Speech act units and informational units", in E. Fava (haz.), *Speech Acts and Linguistic Research, Proceedings of the Workshop, Center for Cognitive Science*, State University of New York at Buffalo, Nemo, Padova, pp. 89-107.
- American Psychiatric Association (2013), *Diagnostic and statistical manual of mental disorders (DSM-5®)*, American Psychiatric Pub., Arlington, VA.
- Fassone G., Valcella F., Pallini S., Scarcella F., Tombolini F., Ivaldi A., Prunetti E., Manaresi F., Liotti G. (2012), "Assessment of interpersonal motivation in transcripts (aimit): an inter- and intra-rater reliability study of a new method of detection of interpersonal motivational systems in psychotherapy", in *Clinical psychology & psychotherapy*, 19, 3, pp. 224-234.
- Fonagy P., Target M. (2005), *Regolazione affettiva, mentalizzazione e sviluppo del sé*, Raffaello Cortina editore, Milano.
- Howlin P., Karpf J., Turk J. (2005), "Behavioural characteristics and autistic features in individuals with Cohen Syndrome", in *European child & adolescent psychiatry*, 14, 2, pp. 57-64.
- Kumin L. (1996), "Speech and language skills in children with Down syndrome", in *Mental Retardation and Developmental Disabilities Research Reviews*, 2, 2, pp. 109-115.
- Jaffe-Berg E. (2001), "Forays into grammelot: the language of nonsense", in *Journal of Dramatic Theory and Criticism*, pp. 3-16.

- Joly F., Touati B., Laznik M. C. (2015), *Langage, voix et parole dans l'autisme*, Presses Universitaires de France, Paris.
- Lolli F. (2004), *L'ingorgo del corpo: insufficienza mentale e psicoanalisi*, FrancoAngeli, Milano.
- Maiullo J. (2018), "Radio Drama for Speaking Practice", in *English Teaching Forum*, 56, 2, pp. 16-25.
- Micheli, E. (Ed.). (1998), *La comunicazione spontanea nell'autismo*, Edizioni Centro Studi Erickson, Trento.
- Montobbio E., Lepri C. (2000), "Chi sarei se potessi essere: la condizione adulta del disabile mentale", Edizioni del Cerro.
- Pantaleo L. L., (2013), "RADIOSTAR. Il linguaggio radiofonico come stimolo inclusivo", in *Media education, Studi, ricerche e buone pratiche*, 1, 2, pp. 56-66.
- Pian A. (2009), *Didattica con il podcasting*, Laterza, Bari-Roma.
- Prieto P., Borràs-Comes J., Roseano P. (Coords.) (2010-2014), *Interactive Atlas of Romance Intonation*: <http://prosodia.upf.edu/iari/>.
- Propp V. J. (1966), *Morfologia della fiaba*, a cura di Bravo G. L. e un intervento di Lévi-Strauss C., Einaudi, Torino.
- Roberts J. E., Price J., Malkin C. (2007), "Language and communication development in Down syndrome", in *Mental retardation and developmental disabilities research reviews*, 13, 1, pp. 26-35.
- Sbattella L. (2006), *La mente orchestra. Elaborazione della risonanza e autismo*, Vita e Pensiero, Milano.
- Sbattella L., Despontin M., Tedesco R. (2010), "Natural language processing for storytelling and role playing: a training system based on the Propp model", in *Proceedings of the International Conference of Education, Research and Innovation (ICERI)*, Madrid, pp. 5036-5045.
- Sbattella L. (2013), *Ti penso, dunque suono. Costrutti cognitivi e relazionali del comportamento musicale*, Vita e Pensiero, Milano.
- Sbattella L., Cordaro G., Tarantino B., Tedesco R. (2013), "OrchestralMusicTherapy® and Autism. The application of the OMT observation protocol to evaluate the cognitive and relational development of four autistic children", in *ICERI 2013*, pp. 1154-1163.
- Sbattella L., Tedesco R., Trivilini A. (2012), "Multimodal Interaction Experience for Users with Autism in a 3D Environment", in *6th European Conference on Games Based Learning*, ECGBL 2012, Cork, Ireland.
- Sbattella L. (2015b), "Réécriture du temps et modulation de soi dans les parcours du Jeu D'Orchestre®", in Lassus M. P., M. Le Piouff M., Sbattella L. (eds.), *Le Jeu d'Orchestre. Recherche-action dans les lieux de privation de liberté*, Presses Universitaires du Septentrion, Villeneuve d'Ascq, pp. 131-154.
- Sbattella L. (2016), "Educazione Vocale e Affettiva. L'accompagnamento dell'adulto con disabilità intellettiva tra espressione artistica e psicoterapia", in Brebbia G., Minazzi F. (a cura di), *La Persona Down. Atti del Convegno La Persona Down. Incontro con il futuro*, Varese, Mimesis Edizioni, Milano-Udine, pp. 1-12.
- Sbattella L., Guinea S. (2016), "LYV, Lend Your Voice project", in *Polisocial award 2016-2017*: <http://www.polisocial.polimi.it/it/home/>.
- Sbattella, L., Cenceschi, S., Cordaro, G., Imperatori Gelosa, A., Pagliardini, C. (2017), "Speech improvement for intellectual disabilities and autism: an experimental study on technological supports", in *EDULEARN 2017*, pp. 2527-2534.
- Shinohara S., Omiya Y., Nakamura M., Hagiwara N., Higuchi M., Mitsuyoshi S., Tokuno S. (2017), "Multilingual evaluation of voice disability index using pitch rate", in *ASTESJ*, 2, 3, pp. 765-772.

- Stoel-Gammon C. (2001), “Down syndrome phonology: Developmental patterns and intervention strategies”, in *Down syndrome research and practice*, 7, 3, pp. 93-100.
- Teixeira, J. P., Oliveira, C., Lopes, C. (2013), “Vocal Acoustic Analysis – Jitter, Shimmer and HNR Parameters”, in *Procedia Technology*, 9, pp. 1112-1122:  
<https://www.sciencedirect.com/science/article/pii/S2212017313002788>.
- Terreni A. (2011). *IPDA. Questionario osservativo per l'identificazione precoce delle difficoltà di apprendimento*. Con CD-ROM. Edizioni Erickson, Trento.
- Yirmiya N., Sigman M. D., Kasari C., Mundy P. (1992), “Empathy and cognition in high-functioning children with autism”, in *Child development*, 63, 1, pp. 150-160.