Listening Training for Children: Method, Application, and Outcomes
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Introduction

In this presentation, I intend to describe a program called "Listening Training". This program, which is based on the Tomatis Method and which we have further developed at The Listening Centre in Toronto for the past twenty years, has been offered to people of all ages. In the context of this conference, however, I will concentrate on the application of Listening Training to children, especially those with developmental delays or disorders affecting their communication and learning skills. My assumption here is that many such delays or disorders are related to a problem in the listening function of these children, in whom the possibility of hearing impairment has already been ruled out.

We define listening as the ability to attune specifically to what one chooses to hear, while at the same time "de-selecting" other sounds and relegating them, so to speak, to "the background". Furthermore, the whole body participates in active listening, not just the ear.

Before going on to discuss our own clinical experience at The Listening Centre, I will review the results, reported in three research evaluation papers, of other applications of Tomatis based listening programs. I will then propose six categories of qualitative change that we observe among children who have participated in Listening Training, with an emphasis on children with autistic spectrum disorders. In our view, these categories suggest tentative hypotheses that point the way toward new avenues of research and clinical application in the field.

The Tomatis Method

Background

Alfred A. Tomatis is a French physician who, in addition to being an ear, nose and throat specialist, is also the son of an opera singer. Tomatis became interested in understanding why so many professional opera singers tended to suffer a significant reduction in their vocal quality at arelatively early age-a handicap that forced many either to interrupt, or to prematurely end, their musical careers. In the late 1940s, Tomatis undertook a series of experiments, the results of which led him to conclude that the vocal and musical abilities of humans are directly linked to their ability to hear. In the early 1950s, he developed an electronic device designed to 'train the ear' and, thus, to improve both voice production and musical skill. Since that time, Tomatis has worked toward perfecting this 'Electronic Ear', with a view to helping individuals improve not only their vocal and musical abilities, but also their language, learning and communication skills.

The technology, program, and procedures that Tomatis developed are known as "AudioPsycho Phonology"; (Tomatis, 1963; 1996) or, more simply, as the Tomatis Method. This method was first introduced to North America in the 1960s at the University of Ottawa's Child Study Centre. Several years later, in 1978, The Listening Centre was established in Toronto. Inthe mid-1980s, other such centres began opening up across the United States and Mexico. Currently, there are approximately 200 facilities worldwide, of which twenty are located in North and Latin America (Madaule, 1993).

Description of the Tomatis Method

The Tomatis Method uses sound stimulation to train and develop listening and listeningrelated communication, language, and learning skills. Guidance counseling is also provided, both to the child and to parents, to help maximize the results of the child's newly acquired skills (Madaule, 1993). I will now go on to describe the initial assessment, the program itself, and the role of the Electronic Ear.

The Initial Assessment. All listening programs begin with an initial assessment, the purpose of which is to determine the following: [1] whether the problems presented by the child are related to some dysfunction in his or her ability to listen; [2] the type and duration of program that is needed to meet the special needs of that child; and [3] the probability of outcome, e.g., the progress that might reasonably be expected from the child's participation in the program, the realistic limitations of the program for that child and, finally, the possible need to complement the listening program with other kinds of interventions.

At the beginning of the initial assessment, a detailed case history questionnaire is completed, typically, by the parent. Next, all previous assessments, diagnoses, and interventions relating to the child are carefully reviewed. At this point, the child is tested, beginning with an application of the Tomatis Listening Test. Here, a modified tonal audiometer is used to assess theauditory threshold curves, both of air and bone conduction. Tonal differentiation, which is the ability to discriminate between various sound tones, is also evaluated. Other elements of testing include a Lateral Dominance Checklist and a drawing test, in which the child is asked to draw certain figures. Close observation of the child's listening style and communication behavior is made throughout. This aspect is particularly important in the case of children who cannot be tested fully, owing either to their very young age, or to the nature of their particular problem, typically, children with autistic spectrum disorder (Madaule, 1993).

The Program. The listening training program is designed to replicate, through sound, the various steps of the child's development with respect to listening, vocalization, speech, and language. It is based on an assumption that such a 're-patterning' or 're-run' will fill any gaps that may have occurred during that child's development. This process is assumed to begin with the child's pre-natal life (when the ear is already operational), up to his or her acquisition of written language (Madaule, 1993).

The program includes first a 'passive' and then an 'active' phase. In the passive phase, children receive selected sound information through headphones, without being asked to concentrate on what they perceive. The source of this sound information is their mother's recorded voice and/or selections of classical music (typically, the music of Mozart). During this phase, the children may play, paint, draw, write, or sleep, just as they wish. The objective here is to reproduce the earlier stages of their development, up to the onset of babbling.

During the active phase, the goal is to replicate the child's later stages of development, extending from the babbling or pre-linguistic stage, to the stage of speech acquisition and, finally, to the stage at which reading begins (i.e., the linguistic stage). In this second phase, children are asked to participate in a number of exercises that involve singing, humming, speaking, and reading. Through the use of a microphone, the child's voice is captured, modified through the Electronic Ear, and then fed back to the child's ear (Madaule, 1993). In children with autistic spectrum disorder, this phase is particularly important, for it makes them aware of, as well as encourages them to accept, their own voice. The purpose here is to encourage the child to vocalize and verbalize spontaneously and appropriately. Hence, for such children, I prefer to call this the 'interactive' (rather than 'active') phase.

While Listening Training may be adapted according to individual need, it is always intensively applied. Typically, each phase lasts about 30 hours (2 hours per day for 15 days), with a break of approximately one month in between. Reinforcement programs or "boosts", which last from 5 to 8 days, may be recommended every 3 to 6 months as a follow-up. Close monitoring and guidance are provided throughout the program, and for at least one year following its completion.

The Electronic Ear. Explaining the structure, function, and effect of the Electronic Ear in detail goes beyond the scope of this presentation. My intention here is simply to summarize the main functions of this device.

All sound information that eventually reaches the child's ears during a listening program must travel first through the Electronic Ear in order to undergo modification. This sound information, however, originates from two separate sources: a tape deck (which plays taped recordings of the mother's voice, of classical music, and of other training materials), and a microphone (which is placed in front of the child, and which picks up and transmits his or hervoice). Following their modification in the Electronic Ear, all such sounds eventually reach the child's ears via headphones positioned on his or her head.

The Electronic Ear includes an amplifier with two audio channels. One channel is set to amplify the low frequency content of incoming sound while decreasing, at the same time, the sound's high frequency content. This modification serves to simulate for the child the state of 'passive hearing'. When the sound reaches a certain volume, it activates a 'gate' that redirects the sound to the second audio channel. This second channel is set in exact opposition to the first. Thus, it decreases the low frequency content of the sound while increasing the high frequency content. This second modification serves to simulate for the child the state of 'active listening'.

As a result of this rapid alternation or 'flip flop' of sound from one channel to the other, the sound is perceived to be pulsating. These pulsating beats 'exercise' the auditory system and reinforce the stimulating impact of the sound. This, in short, is how listening is trained.

The Electronic Ear is also equipped with a variable output time delay mechanism that allows the clinician to improve the child's auditory processing time. Furthermore, through the use of an output sound attenuator, it is possible to reduce the intensity of the sound transmitted to each ear (independent of the other). This feature of the Electronic Ear helps establish or reinforce auditory lateral dominance.

Applications

As indicated earlier, we have applied Listening Training to people of all ages (Madaule, 1993). I will concentrate here, however, on its application to children. Most of the children we see tend to fall into two main categories: [1] those with listening-related learning problems and [2] those with autistic spectrum disorders.

Children with Listening-related Learning Problems. This group includes: children with auditory-language processing difficulties; children with written language difficulties, such as dyslexia; children with non-verbal learning disabilities; and children diagnosed with attention deficit disorder or ADD, who usually come to the Centre with a history of under-achievement in school. In the past three years, we have provided Listening Training to 169 children and adolescents who fall into this category, ranging in age from three to eighteen years.

Children with Autistic Spectrum Disorders. 'Purely autistic' children are rare. However, in the past few years, we have seen an increase in the number of children who fit the category of pervasive development disorder or PDD (which can include children with Asperger Syndrome). Many from this PDD group might also fall into the category of multi-system development disorder. In the past three years, a total of 106 children with autistic spectrum disorders, ranging in age from two to twelve years, have participated in Listening Training.

Program Outcomes

In this part of my presentation, I provide a summary of results obtained in children who have undergone a listening training program. I shall first report the findings of three independent research evaluation papers. This will be followed by a report of the outcomes I have observed in my own clinical practice at The Listening Centre.

Research Evaluation Papers

The Tomatis Method has been the subject of a number of research studies, the results of which have been summarized in three research evaluation papers: (Stutt, 1983; Van Jaarsveld and Du Plessis, 1988; Gilmor, 1995).

Stutt (1983) reviewed five studies that involved preschool children with language delays (Wilson et. al., 1982) and school age children with learning disabilities (Rourke et. al., 1982; Gilmor, 1982; Roy G.N., 1980; and Roy R.T., 1980). Stutt assessed these studies in terms of their implications for education.

A definite statement on the value of the audio-psycho-phonological approach (Tomatis Method) to the treatment of learning disabilities or dyslexia cannot yet be made. This view is clearly expressed by the authors of the papers reviewed. However, more can be said at this time than was possible just a few years ago. The evidence indicates that something of positive value is happening to those children who undergo this treatment program. There does not appear to be any evidence to suggest that it is harmful to the subject. While the time-cases, shown little or no improvement from whatever remedial procedure that was otherwise available to them in the preceding time period (Stutt, 1993, p. 14).

Van Jaarsveld and DuPlessis (1988) reviewed a series of studies conducted between 1973 and 1983 at the University of Potchefstroom in South Africa, on the respective subjects of laterality (Van Wyk, 1974; Banderhorst, 1975); stuttering (Van Jaarsveld, 1973; 1974); anxiety and depression (Peche, 1975; Botes, 1979; Du Plessis, 1982; Du Plessis and Van Jaarsveld, 1988); and profound mental retardation (De Bruto, 1983). While the reviewers insist that none of the findings can be considered conclusive because of weakness in experimental design, they cost factor is high using this method it would seem to be no higher than more traditional remedial teaching on an individual basis. We must also remember that the older children in the project have, in most cases, shown little or no improvement from whatever remedial procedure that was otherwise available to them in the preceding time period (Stutt, 1993, p. 14). Van Jaarsveld and DuPlessis (1988) reviewed a series of studies conducted between 1973 and 1983 at the University of Potchefstroom in South Africa, on the respective subjects of laterality (Van Wyk, 1974; Banderhorst, 1975); stuttering (Van Jaarsveld, 1973; 1974); anxiety and depression (Peche, 1975; Botes, 1979; Du Plessis, 1982; Du Plessis and Van Jaarsveld, 1988); and profound mental retardation (De Bruto, 1983). While the reviewers insist that none of the findings can be considered conclusive because of weakness in experimental design, they nevertheless note that each study draws positive results. Furthermore, in comparing the results of the University of Potchefstroom studies with those of other studies conducted during the same period in Canada and the U.S. (some of which were also reviewed by Stutt, 1983; Gilmor, 1995), a positive outcome was identified in the following areas: improved general adjustment, reduction of anxiety, improved self-control and self-concept, improved inter-personal relations and, finally, improved achievement functioning.

Gilmor (1995), going one step further than the other reviewers, carried out a metaanalysis of the data he obtained from five studies conducted in the 1980s, each of which undertook to evaluate the efficacy of the Tomatis Method (Gilmor, 1984; Gilmor and Mould, 1994; Kershner et al, 1990; Rourke and Russel, 1983; Wilson et al, 1982). Collectively, these studies involved 231 children.

In his analysis, Gilmor found positive results in the following five domains: linguistic; psychomotor; personal and social adjustment; cognitive; and auditory. He insists that, taken individually, none of the studies can be considered conclusive, again, owing to their design weaknesses (including their relatively small number of subjects). He argues, however, that "considering the context in which these studies were carried out, the outcome can be considered supportive of the efficacy of the Tomatis Method"; (Gilmor, 1995, p.11).

An important obstacle to applying a statistical methodology in evaluating the results of listening training programs is the breadth and diversity both of the presenting problems, as well as of the areas in which progress may clinically be demonstrated. In short, statistical studies would tend to miss the more qualitative aspects of the results observed in actual clinical situations. This point was raised both by G.N. Roy (1980) and R.T. Roy (1980) in their respective (and complementary) doctoral dissertations, and in defending their decision to present longitudinal case studies involving five dyslexic children who had participated in a program using the Tomatis Method.

Clinical Findings at The Listening Centre

In this section, I include a classification and descriiption of the kinds of qualitative changes we have observed among children who have completed a program at The Listening Centre. These observations were made both during and following their participation in Listening Training. The classification that has evolved includes six categories of observed change. In our view, each of these categories suggests a tentative hypothesis that points the way toward future research and clinical application.

Prenatal Sound Perception. During the passive phase of Listening Training, children typically are presented with a recording of their mother's voice, in which the low and medium frequency content of the voice has been filtered out, thereby rendering it virtually unrecognizable to the child. A recording of classical music (typically, Mozart, and similarly filtered), is used alternatively, as well as whenever a recording of the mother's voice is unavailable.

During this phase, we observe both an increase in voice production (vocalization, babbling, words, or sentences), as well as a greater desire on the child's part to communicate, both verbally and non-verbally. In addition, we observe an increase in the child's expression of affection, and a greater predisposition toward bonding.

Tomatis argues that the mother's voice, modified in this manner, reproduces the sound environment of the child during its pre-natal and peri-natal life. In short, according to Tomatis(1963; 1997), the sensory memory allows the child to 'return' to the very root of language development. While this theory remains controversial, it is nevertheless interesting (and, in my own experience, often startling), to observe improvements in the child's communicative behavior during this passive phase, especially among children who exhibit the typical autistic symptoms of aloofness, remoteness, and absence of communicative speech. Equally interesting is that when filtered recordings of some of Mozart's music are used, similar

results have been obtained.

Listening (the active skill of focusing both the ear and the body). Parents and caregivers of the children in our program often comment on the changes they observe in their child's physical appearance and facial expression. While these changes may occur at any time during the course of Listening Training, they tend to occur most often in the earlier stages. One notes in particular an increase in eye contact and a more erect body posture, especially at the level of the neck and upper back. The face becomes more expressive, and the child seems to be become more 'with it', more 'present', and more 'in the here and now'.

We interpret these results to indicate an improvement in the child's listening skills. As indicated earlier, listening is the ability to attune specifically to what one chooses to hear, while at the same time 'deselecting' other sounds. It was also noted that listening involves not only theactive participation of the ear, but of the whole body as well. Here we are reminded of the image of a rabbit in a state of alertness. He not only perks up his ears, but his entire body becomes erect. Thus, in listening, we see the combined contribution of the auditory and vestibular systems. This 'cochlear-vestibular connection' will be discussed in greater detail further on.

Auditory Processing Time. We observe several interesting changes in auditory processing in the course of Listening Training. For example, the children's response time when they are being spoken to becomes shorter than at the beginning of the intervention. They also become better able to handle multiple commands. Moreover, their speech becomes less hesitant, less convoluted or 'chopped off', and more 'to the point'.

Tallal (1976) has shown that children with language-related learning problems sometimes demonstrate a slow auditory processing time. This finding was also described by Tomatis, who included in the design of his Electronic Ear a mechanism that permits one to delay the sound output information.

Tallal et al (1996) and Merzenic et al (1996) have contributed toward the development of the Fast ForWord program, a computer program that trains children to reduce their auditoryprocessing time. We feel that this program is compatible with our own, and provides a way to further refine the improvements achieved through Listening Training with respect to slow processing time.

Auditory Processing Clarity. During the listening program, many children spontaneously comment on their improved auditory perception: "I can hear more clearly", or "I now hear more sounds when I listen to a piece of music I already know". Sometimes this clarity is expressed at a cognitive level: "I think more clearly", "my mind is not as foggy" or, as one father commented about his child, "his head has come out of the clouds". Improved clarity in perception enhances, in turn, the clarity and intelligibility of speech. For example, the children's explanations and descriptions become increasingly precise and pertinent. Furthermore, a greater degree of phonological awareness is observed and, when reading out loud, the child becomes better able to self-correct phonetic errors.

Better auditory processing is one of the indicators of improved listening skill. At this point, children are able to benefit more fully from some of the more traditional remedial interventions, such as speech and language therapy, tutoring, or special education. Techniques that focus on the sensory-cognitive processes in speech and learning, such as Auditory Discrimination in Depth Program (Lindamood et al, 1997), provide an effective follow-up to Listening Training.

Auditory-Vestibular-Visual Interplay. The importance of the connection between the auditory and vestibular systems in the act of listening has already been mentioned. Other changes we observe during the course of the program tend to reinforce this association. Just as music induces body movement (as in dancing), so also does sound stimulation trigger numerous reactions at the motor and visual-ocular levels.

Changes are often reported at the level of balance and coordination, for example, in swimming, skating, or riding a bicycle. A greater sense of rhythm, a greater spatial awareness, and an improvement in motor planning are all commonly seen among the children, particularly those who tend to be physically awkward and clumsy. Furthermore, better visual-motor skills are both reported and observed in relation to sports performance.

In reading, decoding also improves, and in handwriting, one finds that there is greater control of the hand in keeping the line of writing horizontal, and in improving the shape of the words.

The Regulatory Effect of Sound Stimulation. Children who demonstrate hypersensitivity to sound, or who display tactile defensiveness, react well to Listening Training. The sound sensitivity progressively decreases in the first case, and in the second, the children become more tolerant of physical contact. Along with greater sensory tolerance comes an improvement in the self-control of affect. Moodiness, for example, tends to decrease. Furthermore, temper tantrums occur less frequently and, when they do occur, tend to be less intense. Also, what triggers the tantrum tends to become more evident to others, less 'out of the blue'. Some of these children become toilet trained spontaneously.

The child's activity level also becomes more self-regulated. The 'hyper' child tends to calm down and fidgeting decreases. The 'hypo' child, on the other hand, tends to become more energized, more 'with it', 'aware', and 'ready', often with a corresponding increase in motivation. Finally, for children who come to us with a diagnosis of ADD (either with or without hyperactivity), Listening Training offers an effective, non-drug alternative.

The concepts of sensory regulation and of multi-sensory interplay have been described as well as put into therapeutic practice (i.e., Sensory Integration Techniques) by Jean Ayres (1972; 1978). Both Sensory Integration and Listening Training are based on similar principles, suggesting an underlying complementarity. Such a combined approach was initiated in 1992 by Valerie Dejean (O.T.), at the Spectrum Centre in Bethesda, Maryland. Since 1995, The ListeningCentre has adopted certain aspects of Dejean's model in helping children five years of age and younger. For example, we now engage these children in activities that stimulate the

proprioceptive and vestibular systems (e.g., swings and trampolines), as well as the tactile system (paint brushes, foam, and materials of different textures). Floor and wall mirrors are also used for their stimulating visual effects. In our view, such multi-sensory stimulation is a highly valuable addition to the auditory stimulation the children receive.

Conclusion

In the context of this conference on multidisciplinary approaches to developmental and learning disorders, I think it is important to position Listening Training both as an essential as well as an initial approach. Based on results obtained during more than twenty years of clinical experience administering Listening Training, I believe that the value of such a program lies predominantly in its ability to optimize 'readiness'. Developmentally speaking, Listening Training 'prepares the ground' for all subsequent communication, language, and learning. Thus, I believe that a listening training program (ideally) should be recommended as an initial intervention. I would also propose that, in the case of children with multi-sensory developmental delays or disorders (such as autistic spectrum disorder), the initial intervention of listening training should be combined with other kinds of sensory interventions, such as Sensory Integration. Only when the sensory system is thus optimally prepared is the child fully able to benefit--emotionally, socially, and academically--from other types of intervention.

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