

Living Sound: human interaction and children with autism

Phil Ellis / Lieselotte van Leeuwen

Abstract:

This paper describes a pilot study which investigated the potential for using Sound Therapy with children with autism. Sound Therapy is a new approach which has been developed for children who have a range of disabilities, from severe learning difficulties to profound and multiple handicaps. It focuses on the inner world of the child through aesthetic resonance with sound. A development of this therapy has also been used successfully with the elderly frail and mentally infirm. Following a two-year case study of one child with autistic tendencies, the techniques of Sound Therapy are described together with the design of a research tool to provide rigorous evaluation of the methodology from the perspectives of education and developmental psychology. The experience of a pilot study in the Kuwait Autistic Centre is summarised, and the paper concludes with future plans to further develop the therapy for children with autism.

Keywords: Sound Therapy; communication; Soundbeam; aesthetic resonance; developmental psychology.

Biography

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Phil Ellis, PhD, MA, ARCM, Cert Ed, is Professor in the school of Arts, Design and Media at the University of Sunderland in England . His career has involved teaching music in schools, teaching electroacoustic music and composition in higher education, being Principal Research Fellow in Arts Education at the University of Warwick and subsequently Senior Lecturer in Music Education at the same university. His current position involves leading the research activity with the Performance Arts team and lecturing in the area of music technology and creativity.

His research interests have focused on aesthetics, technology and creativity. Since 1992 his research has led to the development of a new approach for children with profound and multiple learning difficulties, and this work is also being developed with the elderly. This project has recently been awarded significant funding for a two-year investigation. He is currently also co-ordinator of an EU funded project in the i3 ESPRIT programme.

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Lieselotte van Leeuwen is an experimental psychologist. The focus of her research has been the influence of environmental design on the development of perception and action. Her Ph.D. thesis from the University of Nijmegen, The Netherlands, was dedicated to the question how young children learn to use tools. She conducted several research projects concerning object-centered social interaction at the Department of Pediatrics at the University of Berne, Switzerland. In addition to these research activities she has worked as consultant for toy design within several companies and projects. Lieselotte van Leeuwen is currently part of the Nordic Center for Research on Toys and Educational Media (NCFL) in Halmstad, Sweden. In this context she is co-ordinator of KidsLab, a working group within a EU project initiative on Experimental School Environments (ESE). This interdisciplinary group develops methods and supports projects in integrating children in the design process. KidsLab organizes design sessions with children and workshops for design teams on child-related topics. Currently the development of toys and play environments for disabled children are a specific focus point of her work.

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Introduction

Annette¹ is fourteen years old. She has very few self-help skills and cannot communicate with words. She can be a danger to herself and to other children who are smaller than she is, who lack self-confidence or are in any way vulnerable. Annette does not always cooperate with teachers and will often remain quite isolated. She has to be provided with a full-time carer throughout the school day.

Walking into her classroom at about the same time, on the same day each week, Annette will often see me, look up with a welcoming smile, get up from her desk or chair and almost run from the classroom to the library, the room where Sound Therapy² sessions are always held. During the past two years Annette has chosen to use a synthesizer in her sessions with me. This is kept on a trolley, with two loudspeakers set at ear height. Annette sits down in front of the synthesizer, invites me to sit next to her at the keyboard, takes my hand and uses this to ‘play’ her music. This music has a beauty of its own: there is no tune, nor is there a steady beat or pulse, but the music clearly comes from inside the child and is deeply felt. After a time she indicates that she wants a different instrument to sound on the synthesizer. She does this by pointing to the panel on the top of the keyboard. I select another instrument which she has learnt to enjoy during previous sessions. She plays the keys again, but this is not the instrument she had in mind. I select another, and this time it is the right one. Again she plays her music, holding and using *my* right hand on the keyboard. After a time she turns to me, looks deeply into my eyes and smiles, her face about six inches from mine. No words have been spoken or sung – none need to be.

It was not always like this. Annette has Cornelia de Lange syndrome, a condition affecting perhaps one in 10,000 live births (Gilbert, 1996). She has physical mobility of a stilted kind, has severe developmental delay and lacks communication skills. Coming close to Annette can be hazardous for anyone wearing spectacles, as she may snatch them and throw them across the room. Annette enjoys music at home. She spontaneously went to the keyboard synthesizer in the initial sessions of Sound Therapy and through experimentation discovered the characteristics of a number of different sounds which are available. These range from percussion instruments to pizzicato-type sounds, (harps, koto, plucked strings for example), to vocal sounds, traditional-sounding orchestral instruments, instruments which combine piano-type beginnings and sustained string-like endings, long drones which sustain even when a key is no longer depressed, and so on.

¹ Pseudonyms have been used throughout.

² The techniques and approaches used in Sound Therapy are described later in this paper.

A two-year case study with Annette reveals clear progression and development³. This falls into three distinct phases:

1. Months 1 - 8

Solitary and individual exploration at the keyboard: there is a gradual development of different playing styles and responses to different instrumental characteristics and timbres.

Annette's initial approaches to the keyboard are experimental and exploratory. Over time she clearly develops several ways of playing and of responding to the different sounds. A slow sounding, sustained voice encourages her to play in a very contemplative way, for example - very slowly and carefully - whereas percussive sounds are played more staccato, with bouncy and vigorous movements, and not at all sustained. Her facial expression mirrors what she plays, indicating internal emotional response. A marked increase in eye-to-eye contact with me as an uninvolved observer, often accompanied by big open smiles suggests a desire to share, and possibly communicate her explorations.

2. Months 9 - 18:

During this phase, having invited me to sit beside her at the keyboard, Annette took my right hand and guided it, to play her own music, either by placing my whole hand on various areas of the keyboard, or by selecting my index finger to play specific single notes. There is a developing friendliness, and I am able to sit beside her safely and participate in her music in a passive way as I do not impose my ideas (musical or otherwise) on her activities. There is a growing frequency of eye contact and smiling, all of which is reciprocated.

3. Months 19 - 24

The development of interactive duet playing, with 'question and answer' passages and expressive and responsive playing.

During this phase Annette frequently asks me to sit beside her at the keyboard. She controls my playing by moving my hands on the keyboard as *she* wants, and also by playing duets with me in an interactive and sensitive way. Although I allow her to lead most of the time, there are occasions where she will wait for me to play, and then make her response to that.

Annette often seems extremely well motivated in these sessions and is very engrossed in what she is doing for extended periods of time. Outside of Sound Therapy sessions it is very difficult to involve her in any type of activity. The Head Teacher observes that

³ Part of this case study, together with other examples of children in Sound Therapy, can be seen in the Incidental Music video programme (1996) – see bibliography.

“normally this young girl is not self motivated apart from aggression towards others or in manipulating people. She finds little enjoyment in life apart from her dolls, a little book, and occasionally somebody singing to her. In the environment provided by Sound Therapy we see the management of a very difficult child. When looking at the video of her sessions there is clear evidence of progress in behaviour, control, response and communication”.

There are frequent moments of real inner happiness or joy – the ‘aesthetic resonance’ which is a cornerstone of this approach.

Her mother described her observations towards Annette’s activities:

“it is very difficult to teach a child to play set pieces, especially children like Annette, and I think it’s nice that they can express themselves. I don’t think that there are any hard and fast rules as to what music should be. Providing that the person making the music is getting something from it, and they get obvious enjoyment from making their music, then I can’t see why they can’t just express themselves. It opens up a whole doorway for Annette, and because she’s got very limited speech it’s another form of expression. It’s a way of her expressing her feelings to other people”.

Sound as Therapy

The above example of Sound Therapy in its early stages of development is representative of the response from children with severe learning difficulties (SLD), including those on the autistic spectrum. There are moments of inner delight shown perhaps through a wiggle of the shoulders, a smile, a light in the eyes. The importance of this ‘inner’ joy (Ellis, 1995), or ‘Flow experiences’ (Csikszentmihalyi 1992) – what I refer to as ‘aesthetic resonance’ - cannot be overestimated. Izard (1989) has identified three aspects which reinforce this importance, describing it as:

- a motivational force facilitating personal growth or self-actualisation:
- interacting with perception, cognition and action:
- creating openness and receptivity associated with intuition and creativity:

These aspects underpin the nature of Sound Therapy, its non-interventionist, non-invasive nature in practice, and its use of sound as the medium for experience and interchange. The approach has been developed over a number of years by working with a number of children with special educational needs. The therapy is grounded in a non-invasive philosophy of education in which the child is placed at the centre of learning activity. A carefully controlled acoustic environment is created within which children with severe learning difficulties (SLD), and profound and multiple learning difficulties (PMLD) have been able to take control of their world, sometimes for the only time in their lives, and

gradually learn and develop a range of skills - physical, cognitive, expressive and communicative. This is made possible partly through the use of carefully chosen technology, through the creation of a special and highly controlled sonic environment, and through a focus on aesthetic resonance --the inner world of the child.

There is no need for the 'therapist' to be musically trained in any formal way, and indeed a traditional musical training can be a hindrance to this approach. All sound has musical (expressive) potential, and all people have sound as a fundamental experience of life. From the moment of birth to the time of death we are surrounded by sound. Even if we are deaf, we still experience sound as vibration. It is central to our human condition with a unique importance recognised in many different areas. (Goddard, (1996), Storr, (1992, 1972), Springer and Deutsch, (1998), Truax, (1984)). Sound Therapy utilizes this, and the 'therapist' needs to be open to the expressive potential of sound, to recognising responses, and to be able to change the Sound Therapy environment so as to maximise the effectiveness for any particular activity the child is enjoying. The development of this new approach has been well documented elsewhere, (Ellis, 1994, 1995, 1997), but the essential features are worth summarising here:

A prerequisite for Sound Therapy is a (small) room which is quiet and not too acoustically resonant. A crucial part of this therapy is silence. Unlike other approaches, the child is allowed to be silent, to be within silence itself. No 'commentary' is imposed by the therapist, no 'interpretation' in sound or 'music' of the therapist's view of the child's mental state is offered. If a child wishes to sit still and experience quiet this is respected. There have been numerous occasions where I have sat motionless in the Sound Therapy room for several minutes whilst a child also sits very still. During this period I rely on peripheral vision to observe, as making direct eye contact would be another form of intrusion. Only after such a period of stillness can some children become ready to communicate from within - and this communication may best remain 'private' at this stage. Any response from me could easily stop or even destroy the process. Being present at these sessions can be viewed as a privilege and the individual has to be respected at all times, without intrusive intervention on the part of an outsider.

Electrifying Sound

Within the Sound Therapy environment there are three examples of sound (or music) technology which are essential:

a synthesizer as mentioned above, a sound processor and microphone, and a Soundbeam.

The Soundbeam (web site: www.soundbeam.co.uk).has been available for a number of years From April this year a new model has been released which greatly enhances the possibilities for working with children with disabilities. The Soundbeam sends out an invisible ultrasonic beam. Any physical movement which is made in this beam causes a sound to be 'played'. Moving a hand or fingers in space can result in the sound of a harp, the sea, an ensemble of voices, or bells for example. As the instruments 'played' by the

beam are available in the synthesizer, there are several hundred different sounds available for the child to explore and choose from. Limiting the therapeutic soundscape to a piano, cymbal and drum does not always provide for imaginative and sensitive response to sound. Moving in the Soundbeam can result in almost any timbre being played – a wide choice is available and so a set of sounds can be customised for each individual child according to their preferences, and not imposed from outside. The standard form of Western music – diatonic tuning, the ‘doh, ray, mi’ scale – which results when playing on a piano keyboard - is culturally laden, and may not accurately reflect a child’s needs. We can be expressive with this language, but the Western tonal system has to be learnt, including the acquisition of performing skills. Arguably such skills can be barriers to communication. Throughout the seven years of developing Sound Therapy I have used a whole-tone⁴ setting from the Soundbeam. This means that any note is as important as any other – there is no right or wrong – no pre-set, externally determined beginning or end. Again, the philosophy of non-invasion is being kept at the forefront.

A new research project, (CARESS) begun in January this year, is developing further possibilities through the development of new sensors to enable more direct, physical interaction to complement the beam itself (Web details: www.bris.ac.uk/caress/). Some of these developments may well be applied to the work with autistic children in the future.

The use of the synthesizer has already been described above, but it is important to realise that this instrument need not ‘sound like’ traditional instruments, nor need it be played in conventional ways. Some of the available sounds have real beauty, but without any specific pitch. The black and white keys of the keyboard belong to a former era (dating from the 1700s), and each key is merely a switch to turn on different sounds, or different pitches. These switches can be operated by fingers, or by the forehead, chin, elbow, toe, or any part of the anatomy a child cares to use. There need be no ‘right or wrong’ way to articulate sound from a keyboard, only appropriate ways for the individual. It is possible, with synthesizers, to make most expressive statements in sound by playing the keyboard in unconventional ways. New technology provides for variety of access and aural stimulation in ways not available when using conventional acoustic instruments.

Transforming Voices

The sound processor is used for the development of vocal communication, providing a range of different acoustics which can encourage the use of the voice in different ways (see also Ellis & Laufer, 2000). The creation of specific acoustic environments through using a digital sound processor can be a powerful tool when working with children with special needs. Reverberation is a wonderful effect, encountered naturally in everyday life, and this can significantly effect both children and adults. For example, many people will change their normal behaviour and sing or hum when in an acoustically ‘live’ bathroom environment. If a group of young children are taken for a walk and go through a tunnel, when in this reverberant space they will naturally vocalise, explore many

⁴ Whole-tone is one of a number of different settings available from the Soundbeam, each one providing a different type of musical scale or sequence of pitches.

different ways of making sounds and listen with enjoyment and delight. On a more fundamental level, take a very young child into the acoustic provided by an empty cathedral or abbey. The first time this is experienced can be revelatory, with the child being delighted and entranced by the results of sounds received, made and subsequently transformed by the acoustic environment. The attention span is likely to be extended significantly and the child may well become totally absorbed in this soundscape. We may also see signs of the aesthetic resonance which underpins Sound Therapy in changes in facial expression and body movement. Many adults will be indifferent, unmoved, unaware or non-responsive to such changes in sound. It is a sad reflection of the desensitising effects which can be observed as a result of our noisy world, and the general quality of life and experience is often sadly diminished.

Happily many children and young people still retain a naive or spontaneous response to such aural phenomena, and the use of reverberation, delay (echo) and other transformations form an important and powerfully effective part of Sound Therapy. These, and other 'effects' can be easily achieved through the use of a sound processor when used in conjunction with a microphone. The quietest vocalised sound, the smallest nuances, can be captured and become powerfully expressive, and also be given a high volume level if required. This can lead to the enhancement of self confidence, simultaneously enriching the expressive and communicative capability of the individual. The environment itself becomes a 'live' part of the communication in which the child has control of greatly extended and enhanced expressive vocal capabilities.

I have stored six programmes in a sound processor for use in this project:

Programme 1 reproduces the acoustic of a large hall and has a reverberation time of 19 seconds, the maximum possible with the equipment. Accordingly, even very short sounds will be extended over long periods of time, slowly dying away. The development of keen listening skills and aesthetic response is often clearly visible when using this programme.

Programme 2 is a simple delay programme. It is designed to give approximately 5 repetitions of any sound, each one being quieter than the last. This five-repetition cycle repeats a few times, each cycle being quieter than its predecessor.

Programme 3 is a fairly complicated pitch shifter. This means that a single sound is transposed to form a chord and there is in addition a slight delay function so that if a short sound is made this is transposed ever upwards fairly rapidly through a delay pattern. If a sustained vocal sound is made then a chord builds from the bottom up. When the sound stops it disappears in an ascending sequence.

Programme 4 is also a pitch shifter but without any delay. It is acoustically very 'dry', having no reverberation or delay characteristics. Because of this it only sounds when somebody is using their voice. Therefore if the resulting effect is pleasing, vocal sounds have to be made in 'real time'. As there is no repetition or reverberation to listen to, this tends to encourage an increase in vocal activity and can be particularly effective when

interacting with another person. It can lead to the development of inflection, control of pitch and volume, and also to the exploration of more sustained vocal activity and timbral changes, as here the results of making long sounds are more powerful than short sounds.

Programme 5 is a long delay pattern having a delay time of 2000 milliseconds (in other words a 2 second delay). The 'feed back' control is set so that there is no reduction in volume. The result is that all sounds repeat every 2 seconds and will continue to do so without becoming quieter. It thus becomes possible to easily build up very large and complex textures, to explore 'question and answer', humour, and other qualities through inflection, volume, pace, use of vowels, phonemes, etc.

Programme 6 is a multi delay setting. In this a rhythmic pattern lasting perhaps four seconds is created from a single sound. An additional feature is the stereo result, with rapid oscillation of sound between left and right loudspeakers, effectively exercising the neurological hearing mechanism.

Using a microphone and sound processor is of course far more interactive than the individualised activities using the Soundbeam and synthesizer. Nevertheless, the 'therapist' has to always adopt a listening mode wherever possible, allowing the child to initiate, listen, respond, express, and carefully resist the temptation to dominate in any way. Communication skills can be developed without the use of words. Indeed, the amount of meaning communicated between people in normal conversation is interesting: about 35-40% of meaning is taken from the words themselves with the remainder coming from use of inflection, volume, pace, timbre, physical gesture and body language. These latter attributes provide a telling focus to the work with non-verbal, as opposed to non-vocal, means of communication (Philipott, Feldman and McGee, (1992), Vargas, M.J. (1986)).

Feeling Sound

The remaining aspect of Sound Therapy is exploiting the physical vibrations which are caused by sound. Vibroacoustic therapy is a relatively new area of research (Wigram, Saperston and West, (1996), Wigram and Dileo (1997), Williams, (1997)), and for the last two years aspects of this therapy have been introduced into the Sound Therapy environment. A Soundbox (also produced by the Soundbeam Project) measures approximately 4 feet by 3 feet, being about 6 inches deep. Inside is a resonant cavity below which are two loudspeakers. The base of the box contains sound absorbing material so that all the energy from the loudspeakers is directed to the upper surface of the box.

In Sound Therapy sessions this box is connected to the amplifiers used, resulting in all sound made by the synthesizer, the Soundbeam or from the sound processor not only being heard through the loudspeakers, but also being felt as vibrations from the surface of the Soundbox. Standing or sitting directly on the surface of the box or sitting in a chair or wheelchair placed on the box means that any sound will be heard as normal, and also

'felt' throughout the body. This provides an additional powerful physical and psychological stimulus. You not only hear your own voice, or the sounds you are controlling through physical movements, you feel them directly as well. You are enveloped in a bath of sound, and cause and effect is significantly reinforced. This additional stimulation, caused only by the individual involved in Sound Therapy, is proving to be highly effective across a range of disabilities, including the autistic child.

Research Methodology

As every child with special needs is unique, great care has been taken to record and analyse data from the field in order to substantiate claims made with regard to the value of Sound Therapy. A longitudinal, qualitative research tool, *Layered Analysis* (Ellis, 1996a), has been developed as a way of disassembling video recordings made over several months, and reassembling the data in order to reveal a picture of developmental progression. By identifying particular physical movements, patterns of responses, or qualities of sound which provide a clear response in a child, it is possible to extract only data relevant to one particular phenomenon and to assemble a sequential account of that aspect of activity. Looking at several such 'layers' reveals a clear picture, providing an unambiguous and detailed record of developmental progression in various previously identified modes. In summary, the methodology involves:

1. recording on video each session of Sound Therapy;
2. copying extracts from each child's session onto a 'master' tape, so gradually building up a picture of behaviour for each individual. These tapes provide particular focus regarding significant or repeating/developing patterns of behaviour;
3. identifying different types of behaviour, reaction or response and occasionally isolating these. Developments over a period of months can be studied separately and in chronological order, and a detailed and comprehensive picture can be reassembled.
4. selecting only one extract every month or so from the available tapes and assembling these on another tape to create a sequence of 'snapshots' which can show progression most clearly. We can view four years' activity in perhaps ten minutes, and this focused compression of data can be very telling.

Evaluation of this data has been achieved by focusing analysis under a number of headings (first published in Ellis, 1994). These headings were devised for the work with children with SLD and PMLD:

- from involuntary to voluntary
- from accidental to intended
- from indifference to interest*
- from confined to expressive*
- from random to purposeful
- from gross to fine
- from exploratory to preconceived*
- from isolated to integrated*
- from solitary to individual*

These headings encapsulate the overall picture of development for each individual. Every child is different, and children have responded to Sound Therapy in different ways, according to their individual personalities and abilities. From this list, perhaps those marked * might be the most appropriate for evaluating behaviour with autistic children. Revisions and refinements will be made as more data become available.

Case study

John is a 13 year old boy who has been diagnosed as being severely autistic. In addition he has severe learning difficulties and developmental delay associated with hypotonic muscles, first recognised when he was 5 months old. He requires an individually planned educational programme to help him develop skills in all areas: physical, social communication and cognitive. He needs to be helped towards developing some independence.

As a focused case study into the effectiveness of Sound Therapy with this condition, John attended sessions for more than 6 months during 1999. Prior to the programme he was very tense, would grip people and objects with some ferocity, would make little eye contact nor show much concentration or co-operation. There were not many smiles in evidence. His walking gait was very stiff-legged and he would need constant encouragement both to walk, and also to leave objects untouched as he moved along corridors.

For these sessions two chairs were placed on the Soundbox, one for John and one for the therapist. All sounds made in the session, either through the sound processor and microphone, or generated from the Soundbeam, were both heard aurally and also experienced as vibration through the chairs. Significant feedback is thus experienced with every sound being felt physically and quite distinctly.

The positioning of the Soundbeam itself is of interest to this case study. With SLD and PMLD children the best place to focus the beam has been always on the back of the head. In experience with a number of autistic children (see below) the best place seems to be for the beam to be pointing towards the chest, face or the front/side of the head. The

reason for this remains obscure, but observing many sessions with autistic children, and trying several different beam positions, placing the beam in front, and slightly to the side of the child invariably seems to be successful.

At his first Sound Therapy session he was in a very, very disturbed, tense almost aggressive state and it was an achievement to get him to leave the classroom. The sessions were held in another room some distance from his classroom, but having arrived he staid for over 18 minutes – a significant achievement. There was quite a lot of lateral head movement and almost hyper-ventilation in this session and he seemed very tense at moments. But there were also moments of smiling and laughter, and these were interesting as this response was not common. He became extremely tense when we arrived back in the classroom at the end of the session.

Two weeks later he was very willing alert and happy during the session, which lasted for 20 minutes. There were lots of smiles and laughter, lots of vocalisation, eye contact and controlled physical movement as well.

Another month later and John seems to be developing a much more receptive approach to the sessions. He clearly anticipates the Sound Therapy time when collected from the classroom and often stands up from his chair with little or no ‘encouragement’ being needed. This is unusual for him, and shows a high degree of motivation. Sometimes there are also smiles and deliberate eye-contact when I arrive to collect him. Walking from the classroom to the Sound Therapy room has also become far less of a trial. Whereas at first his gait was very stiff-legged and awkwardly slow, progressively he walks more smoothly, with a flowing gait. Also, at first he would grip my hand with real force, quite painfully too, and try to tear pictures from the walls. This too gradually became less of a feature of his behaviour, and progressively he would hold my hand in a more ‘normal’ way as I led him to the room where we would work.

This growing relaxation and positive behaviour was increasingly mirrored during and beyond the Sound Therapy sessions. For example, in the fifth month prior to one session John had been very distressed during his lunchtime. He had been crying and was generally showing signs of discomfort and unhappiness. However he was quite acquiescent when he sat on the chair on top of the sound box ready to start the session. He quickly became quiet and seemed to have less difficulty with his breathing, particularly when the sound beam was turned on towards the end of the session. At the end of the session he patted the chair that I had been using and when he was told it was time to go he stood up and walked out without any fuss. He seemed a lot quieter, calmer and less troubled than before the session, and this mental state did not change significantly when he returned to his classroom.

Since starting Sound Therapy sessions Jack has made progress in a number of areas. Often when walking to and from the library he will now walk almost normally for a few steps rather than with stiff legs. He will be more cooperative on these journeys, holding one of my hands and without the painful grip of early times. During the sessions he has shown an increase both in eye contact and smiles. He will vocalise on occasion and clap

his hands with evident pleasure. He is also showing increasing interaction with the Soundbeam through controlled and deliberate physical movements. There seems to be an increasing awareness and subtle interaction throughout the session. These changes in behaviour have been noticed beyond the Sound Therapy sessions where there has been an increase in eye-contact, in smiling, responding to others, more relaxed physical movements and an increase in co-operative behaviour.

Observing change from the perspective of developmental psychology

The introduced concept of sound therapy requires methods of data analysis, which allow describing emerging patterns of behaviour and discovering the space for potential development. Since one goal of sound therapy is to scaffold self-discovery as a process controlled by the child, the direction and kind of change is not pre-determined by the therapist.

The Sound beam environment offers potential for a wide spectrum of action and interaction. In the beginning incidental movements lead to changes in sound. Becoming aware of the mutuality between action (e.g. head movement) and perception (hearing the sound) forms the seed and the cause for action control and with this the seed for self-awareness. Body movement becomes the means to a goal chosen by the child him or herself.

Through the years of intensive work in Sound Therapy behavioural changes became observable in the areas of

- Movement control
- Social interaction
- Expression and spectrum of emotions
- Attention span and focus
- Nesting of actions into higher-level units

Being able to describe those changes in the framework of developmental psychology will on one hand help to validate sound therapy as a method and on the other hopefully contribute to its refinement and deeper understanding of ways it can trigger self discovery.

Description of change

From the wide spectrum of concepts describing developmental processes we have chosen those that describe development as

- a changing relationship between an individual and its physical and social environment
- a participatory process

- a process of co-regulation
- a dynamic and non-linear process

Our efforts are imbedded in the work of numerous scientist but mainly by the works of Alan Fogel, Elenor & James Gibson, and Lev Vygotsky.

A main source of inspiration for our approach is the relatively young field of infancy research. Infants challenge our perception and communication skills because their action capacities differ largely from ours. In order to describe and understand early developmental processes we need to be able to observe the emerging relationship to the world around them in terms of their own action capacities. This claim holds very strongly for any understanding of change in severely disabled children or adults. Sound Therapy gives us the opportunity to support and become aware of the emergence of new relationships between disabled children and their sounding environment - the development of new action capacities.

Alan Fogel (1993) proposed three levels of describing change in the area of infant-mother interaction:

Level 1:

Local changes in the performance of movement patterns, which don't change the basic structure or outcome of this action. *Example: grasping an object is performed every time it happens slightly differently but the overall structure and outcome of grasping is the same.*

Level 2:

Qualitatively new action structures for achieving already existing goals. *Example; being able to grasp a cup with one hand instead of two.*

Level 3:

Qualitatively new action structures which expand the action system towards new goals. *Example: being able to walk as compared to crawl.*

The three levels describe the influence new emerging patterns of action can have for the functioning of the entire action system of an individual. In the context of sound therapy changes at Levels 1 and 2 are observable within the therapy sessions. Level 3 changes, however, extend towards more general action patterns outside the sessions.

In the following we'll demonstrate our way of working with an example of one case of a severely autistic child.

Awakenings of communication - Describing change in Sound Therapy with John

Symptoms of Autism in John:

- Very little eye contact
- No language
- Vocalization infrequently and only as negative expression
- Very infrequent laughter
- Non co-operative behaviour
- Extremely stiff gait
- Body movements are stiff and clumsy
- Patterns of breathing in and out are extremely unbalanced

The symptoms become expressed in different aspects of behaviour. Accordingly, their change needs to be described along those different aspects (See Table 1 for an overview). Note that this description is specific for autistic symptoms of John. For another autistic child or a child with different difficulties the symptoms as well as their appearance in the different aspects of behaviour might be different.

Table 2 shows how reported changes in John's behaviour can become accessible to systematic observation. The autism symptoms of John need to be translated into directly observable categories of observation. Frequency, duration and diversity of those categories provide one possible psychological account of change. More important, this fine-grained description gives insight not only in already occurred change but also in potential directions of change. Directions of potential change should function as a guide for therapists to optimise the possibilities for sound control according to new emerging perceptive and motor skills.

Table 1: John's autism symptoms and their change according to aspects which allow us to observe behavioural change at three levels (see text for further explanation).

Aspects of behaviour	Initial symptoms of John's autism	Changes	Level of change
Movement control	<ul style="list-style-type: none"> ▪ Extremely stiff gait 	Episodes of relaxation	3
	<ul style="list-style-type: none"> ▪ Body movements are stiff and clumsy 	Episodes of smoother and more integrated movements	3
	<ul style="list-style-type: none"> ▪ Patterns of breathing in and out are extremely unbalanced 	Periods of balanced breathing	2
Attention span & focus	Focus mainly self chosen;	20 minutes (sometimes longer) of focused attention in the session	2
	Guided focus only incidental and short	Guided attention	3
Social Interaction	Very little eye contact No language Vocalization infrequent and only as negative expression	Increasing eye contact Vocalizations with positive expression	2
	Non co-operative	Co-operative Responsive Engaging episodes	3
Spectrum and expression of emotions	Occasional laughter in one-to-one situations	Smiling and laughter increased	3
	Anger, high level of disturbance	Intended vocalizations	

Table 2: The translation of as meaningful perceived changes into directly observable categories of behaviour

MEANINGFUL CHANGES	ASPECTS OF OBSERVATION	OBSERVATIONAL CATEGORIES
• from indifference to interest*	▪ Focus of Attention	➤ Gaze attentive ➤ Eye contact
• from confined to expressive*	▪ Motor control	➤ Direction and timing of movement ➤ Integration between facial expression and body movement
	▪ Social Interaction	➤ Eye contact, Turn Taking
	▪ Expression of Emotions	➤ Laugh, Smile, Anger, Pain
• from random to purposeful	▪ Focus of Attention	➤ Gaze attentive, Eye contact
	▪ Attention Span	➤ Duration of sustained attention
	▪ Motor Control	➤ Level of contraction/relaxation ➤ Smoothness of movement
	▪ Nesting of Actions into higher-order Units	➤ Body parts involved ➤ Coordination of sub-actions
• from gross to fine	▪ Integration of Actions	➤ Smoothness of movements
	▪ Movement Control : Sound Control	➤ Tuning of movement : sound changes

MEANINGFUL CHANGES	ASPECTS OF OBSERVATION	UNITS OF ANALYSIS
<ul style="list-style-type: none"> • from exploratory to preconceived* 	<ul style="list-style-type: none"> ▪ Focus of Attention ▪ Nesting of Actions into higher-order Units 	<ul style="list-style-type: none"> ➤ Gaze, repetition ➤ Integration of earlier discrete movements into synchronous ones
<ul style="list-style-type: none"> • from isolated to integrated* 	<ul style="list-style-type: none"> ▪ Movement control ▪ Nesting of Actions into higher-order Units 	<ul style="list-style-type: none"> ➤ Integration of earlier discrete movements into synchronous ones ➤ Smoothness of movements ➤ Addition of new elements ➤ Expansion of relationships between body and environment
<ul style="list-style-type: none"> • from solitary to individual* 	<ul style="list-style-type: none"> ▪ Social Interaction ▪ Spectrum of Emotions ▪ Expression of Emotions 	<ul style="list-style-type: none"> ➤ Shared Attention ➤ Turn Taking ➤ Relaxation ➤ Laughter, smile ➤ Active movement control

Goals of the analysis

- a) Validation of Sound Therapy as a means to expand the possibilities for action and interaction of disabled people.
- b) The analysis can serve as a basis for investigating potential areas of increasing self awareness, action control and expression. We'll explore the possibility to describe the space for proximal development within those areas for an individual child.
- c) At the same moment the analysis provides requirements for expanding the sound system according to the needs of long term Sound Therapy .

Kuwait Autism Centre

Although children with various degrees of autism have been involved in the development of Sound Therapy, the opportunity to work exclusively with autistic children in Kuwait, albeit for a short period of time, was very welcome. It provided the opportunity to evaluate the potential for this approach, particularly as all the children involved were from a very different cultural background. During 1999 I was invited to work for one week with a number of severely autistic children in Kuwait. It was possible therefore to see each child on a daily basis, providing an intensive Sound Therapy experience as usually sessions are given weekly in England. The Kuwait Autism Centre was established in 1995 by the Director of the Centre Dr Samira Abdul Latif Al-Saad. The education centre programme seeks:

- to develop student's communication skills, social relationships and self-reliance;
- to develop an environment to accommodate with the student's weak points;
- to develop co-operation with parents;
- to instigate regular testing and measurement for individual training;
- to establish a systematic education;
- to recognise and identify latent and emerging skills and further develop these;
- to introduce behavioural and cognitive treatment.

The centre is located in a suburb of Kuwait city and has up-to-date equipment and facilities providing an educationally appropriate and stimulating environment with a team of caring teachers and support staff. There is a regular programme of visiting specialists and experts from abroad who sometimes work with the children alongside teachers. The school therefore keeps abreast of current and innovative developments in the field of education and autism, and my invitation was part of this programme..

My visit was for eight days during which I, and staff at the school, were able to evaluate the potential for Sound Therapy in a specialist environment for autistic children. I took with me a sound processor and microphone and the Soundbeam. It was not possible to transport a Soundbox for this visit.

A small room was made available for the therapy sessions. I placed the Soundbeam and sound processor on a table, with amplification and loudspeakers (at ear height) placed on shelving behind the table. Two chairs (for myself and the child) were placed in front of the table, facing the loudspeakers. An observer (usually a teacher) was present throughout, and most sessions were recorded on video tape. There were many challenges here. The children were all diagnosed as severely autistic and this was relatively unknown territory for me. Also, the cultural differences were significant and although great care is taken to make the sound world of the therapy as culturally neutral as possible, this was a real test of the theory that sound is a universal medium of communication and expression. The techniques of music are used, and the stuff of music itself - sound - is the medium, but stripped of traditional or cultural 'musical markers'.

Pilot Study

Eleven children were seen during the week, most on a daily basis. Of these, one child was unresponsive and only attended two sessions. It was then felt that it would be more productive for his time to be used by another child. There is no one way which is suitable for all, and although Sound Therapy has proved to be powerfully effective for many people, there are those for whom other approaches will be more suitable at any given time.

The vast majority of the remaining children were very responsive to the sound processor. Real delight, shown through facial expressions, laughter and extended vocalisms resulted from many of the programmes used, and eye contact, some beautiful facial expressions, and keen and sensitive listening were not uncommon. There is clearly considerable scope for developing the many vocal techniques used in communication, together with accepting and feeling comfortable with the physical presence of another person. A 'language barrier' did not exist in these sessions, and one boy took my hand and moved it towards the sound processor when he wished a new programme to be selected.

The Soundbeam sensor was positioned so as to point at the chest area of the child sitting next to me. By varying the length of the beam itself, any rocking movement from the child would result in sounds being changed (in pitch). The sound module being used gave me a wide range of instruments to choose from, and again children's responses were often of amazement, delight and happiness. Waving a hand in the beam was also another instantly successful way of controlling, exploring and delighting in sound, this delight being revealed through smiles, vocal responses, and repetition of movements to play the sound. A highlight of these sessions was on the last morning, when one boy kept moving into the beam (with an echoing marimba as the instrument sounding) and then hiding his face in my shirt front. When the sound stopped he would look up, smiling, then repeat the process. This continued for several minutes to his obvious delight, with my only regret being the tape having run out in the video recorder.

There is not space to describe the sessions in detail, but there was real potential for development for many of these severely autistic children. Recently the Centre has purchased the equipment needed for Sound Therapy and a room is being set up in the school. A long-term programme of monitoring the effectiveness with these children will then become possible.

Conclusion

Autism presents many challenges for children, teachers, parents and carers alike. The severely autistic child's mind is not 'turned off'. In a recent television broadcast it was likened not so much as having a light switch with on / off positions, but rather like having a dimmer switch which can gradually increase levels of perception, interaction and communication. No one approach can offer a magic cure for autistic children. Sound Therapy appears to have some beneficial effects – it may be a key to open the door, to turn the dimmer switch and provide more illumination which can then lead to further progress in other aspects of their educational experience. This is the task for the future – to explore potential, to develop techniques which seem effective, and to monitor carefully and evaluate the results of this work.

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