

Sound Therapy Restores Hearing – Fact of Fiction? A personal experience of an acoustician.

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ABSTRACT

The author suffered serious injuries including brain injury as a result of a fall. Part of the recovery treatment has involved sound therapy and neuro-feedback - with amazing results. There are different types of sound therapy and different processes that make significant claims. Not often is such work undertaken by an acoustic engineer who can progressively undertake hearing measurements to ascertain the resultant effect with the co-operation of the psychologist undertaking such work. Restoration of hearing due to Sound Therapy is examined and discussed to ascertain if the claims are fact or fiction, or is the terminology misused by those who do not understand what is being achieved?

In April 2008 the author fell off a ladder and broke his spine, pelvis and sternum requiring a long hospitalisation of 7½ weeks and then months of rehabilitation.

As a result of the fall (possibly up to 3 metres) some doctors consider that the brain was subject to impact with the long term effect unlikely to be ascertained for some time. With the first 12 months after the accident being related to physical rehabilitation and under the influence of heavy medication the primary focus was on the physical wellbeing. When physical recovery achieved an equilibrium point the effects of the alleged accident (as expressed by the insurance company) on the brain functions became apparent.

The author was aware of limited capability in high level concentration or undertaking mathematical exercises and was conscious of a cognitive awareness or spatial problem (which had not been present prior to the accident) that could not be explained by various medical persons.

Different physiologists were consulted with various conclusions of PTSD to no problems at all.

One physiologist conducted EEG test and found issues. Ultimately in seeking to ascertain the cause of the problem EEG testing revealed the absence of low frequency generated by the brain (less than 4 Hz) and significantly elevated current sources at 27 Hz. The results of Integrated Visual and Auditory (IVA) Continuous Performance Test found mild difficulties with visual stamina, moderate visual dominance and severely impaired auditory readiness [1].

That physiologist proposed a treatment involving sound therapy (with bone conduction) to address the auditory processing issues and neuro-feedback to address the operation of the brain. The author is able to advise that both

of these techniques gave rise to significant improvement in the brain function which has been readily observed by fellow acousticians and clients who were concerned about the author's wellbeing.

In addition to the review of the EEG patterns by experts in the field of neuro feedback [1, 2] the author has been involved in treatment by a behavioural optometrist [3] and researched different forms of sound therapy to reveal that, from an acoustician's view point there are some misconceptions or incorrect terminology in describing the matters of auditory processing and what becomes hearing improvement. As a consequence of utilising an acoustician's experience and knowledge there has been a frank and open discussion in terms of observations by practioners of various remediation techniques that leads to the context of this paper.

HEARING LOSS

As many other acousticians have a very large number of text books that discuss the issue of the mechanism of the ear and hearing loss. A general concept provided to practioners in the field of acoustics is that when one is exposed to high noise levels over a period of time one can develop a temporary threshold loss to which the ear will return but if the noise level and exposure continues then one can obtain a permanent noise – induced hearing loss. By definition permanent implies that the hearing cannot be restored.

Nelnick identifies in Chapter 18 of Handbook of Acoustical Measurements and Noise Control:

“In contrast to a cochlear injury from acoustic trauma damage from repeated noise exposures is not a result of the physical limits of the

effected structures being exceeded. Rather, the primary mechanism for chronic noise damage appears to be physicochemical metabolic stress exerted on the maximally stimulated cells. The end result is sensory cell dysfunction resulting in temporary hearing loss or sensory cell creating a permanent hearing loss, depending upon the degree of cellular injury.

Therefore from the learned studies that an acoustician undertakes, the concept of hearing being restored by the provision of high frequency sound as claimed by the proponents of sound therapy would in a general sense be considered quackery. That is exactly the position that I took some years ago when I was presented with the sound therapy concept nominated by P. Joudry [5] who introduced portable system based upon the work of the French ENT expert Dr A. Tomatis [6] who developed the Tomatis methodology of sound therapy. Music played through Dr Tomatis's Electronic Ear results in a reduction in low frequency and an emphasis on high frequencies.

There are a number of different Sound Therapy systems in use with various claims and counter claims. A number of years ago I tried one system and did find it enjoyable or gained any improvement.

Joudry [7] claims that sound therapy has the potential for miraculous recovery of hearing and originally utilised cassette recorders for providing a structured music that at times produced a burst of high frequency sound that the music suddenly became louder and also had an emphasis in the right ear. The methodology is to utilise tapes (now CDs) at a relatively low level and that after some time the person could experience a dramatic period of fatigue which then the subject would experience a pressure release in the ear canal and hearing improvement would occur. The mechanism as to how this result occurred was not expressed in any scientific terms in [5] and of the material that was issued some years ago the whole thing seemed to be very questionable.

Listening to the tapes or CDs as provided in the Joudry sound therapy format is not in my opinion a pleasant experience and certainly does not accord with acoustical texts. However one is left with the nagging concept that apparently many people by utilising this methodology have an improvement in their hearing [7], may have a reduction in tinnitus but apparently it does not work for person who are profoundly deaf.

So being faced with a physiologist who indicates she can fix my brain issues by in effect plugging me into a computer to do various things to my brain and at the same time I can get improvement by the use of sound therapy, the acoustician in me was very skeptical. But as it was the first physiologist who could actually identify what I was experiencing I was certainly prepared to give it a go.

SAMONAS METHOD

I found that the sound therapy used in my treatment was the method proposed by Ingo Steinbach [8] follows on from the work of Dr Tomatis but in this case has been developed by a person with post graduate qualifications and training in terms of both electronics and physics. There are a number of propriety matters in terms of the SAMONAS technique which when compared with the Joudry method is much more pleasant in listening, in that there are no irritating bursts of sound throughout the experience. There are periods that to the general listener there is no sound but in actual fact there

are some high frequency components generated outside the area of my hearing.

Steinbach [8] provides an explanation in terms of the SAMONAS method and whilst not giving the technical content of the envelope that he has used there are some very interesting aspects in terms of the perception of peoples' hearing and speaking of what they can hear. He provides in more detail the work of Tomatis, by repeating some of Tomatis's experiments and for acousticians provides frequency response graphs of various filters.

The matter of colouration of music with high frequency harmonics that extend past a person's nominal upper frequency limit of hearing is a fascinating discourse (in Part III) and an experiment I wish to conduct.

Ingo Steinbach explains Dr Tomatis's concept of "distinct learning" and his examination of the Joudry Sound Therapy method highlighted a number of the issues I observed.

He proposes a hypothesis that the effect that occurs from the use of sound therapy can be attributed to massaging the inner ear which by way of the external environment of noise and chemical /foods /toxins etc is likened to an organ or muscle which is under extreme stress. His hypothesis is that the stimulation of high frequency energy with the absence of low frequency in effect massages the muscle and allows it to relax. It is this relaxation that ultimately gives rise to an improvement in hearing.

Recently there a concept that has gained further public awareness and described as the plasticity of the brain? Are there sections of the brain responsible for hearing and the nerve interfaces between that section of the brain and the ear is a matter that by providing a high frequency stimulus results in a re mapping of the nerve path to bring about such a result?

MY EXPERIENCE

EEG testing determined the auditory processing time versus the visual processing time when subject to such external stimulus. That testing also revealed that I had an excessive auditory processing time which meant that my brain was not functioning at its optimum level but it also meant that there was likely to be an issue to interpreting what audible stimulus was provided to me which therefore would impact upon my comprehension.

I could tell that neuro feedback sessions without sound therapy were not as effective as with sound therapy.

A separate exercise conducted with the behavioral optometrist [3] looked at a difference in terms of a visual processing time and also a reaction time that was involved in me physically pressing buttons. By the various tests there were differences of how I was reacting to various stimuli.

Figure 1 reveals the results of the testing by the behavioural optometrist with a comparison between the visual signal and audio signal that indicates some probabilities in terms of brain function. This testing started various discussions as to auditory processing times and had any of my specialists looked at hearing loss/improvements that others claims can be achieved from Sound Therapy?

In considering the perspective of audiometric testing I raised the issue that if the auditory processing is too long then the subject can not necessarily hear the noise being tested. In this case could an audiogram reveal a hearing loss? If the time period for maintaining the tone was extended then there may be less of a loss?

Discussions with practitioners involved in the use of sound therapy have documented evidence of the effectiveness in reducing the auditory times. They have not conducted a study in terms of evaluating any hearing loss or improvement in the hearing of individuals because at the present time that is not the area in which they are working. They have revealed that for many subjects the result of the Samonas testing (for other medical issues) results in a reduction in the auditory processing time and when that time is decreased the subject then has a greater level of comprehension.

What was to be another paper was the use of bone conduction as an additional tool to sound therapy where there are transducers attached below the ear. I am advised that there can be up to 2½ standard deviation points of improvement by the use of bone conduction in addition to normal (Samonas) sound therapy.

The hypothesis as to how bone conduction benefits the patient has not been experimentally tested (in Australia) but the concept from an acoustician's view point is that the transfer of energy from the bone conduction to the brain center would be faster than the same signal being transferred through the ear canal by way of a difference in speed for the two mediums. If the bone conduction provides a stimulus to the brain earlier than the ear conduction then is it providing in effect a wakeup call to let the brain know the sound is coming? Does bone conduction enhance or speed up the improvement in auditory processing?

Time delay traces and frequency response of the various sound therapy/bone conduction mechanisms which the author has personally available for testing will be added to the presentation.

I know from testing on my son when he was a newborn that they could ascertain in an operating theater stimulus to sound even though the child was not reacting because there was mucous in the ear canals. We as parents have been through a number of sessions of grommets and therefore I have had the opportunity to observe various ENT specialists dealing with children. I also observed a number of ENT testing facilities used to establish the hearing performance of children to find that there is so much ambient noise in those spaces that I ever wonder how they could get valid results. I also found audiologist's reports that contradicted the written report - that was modified when I pointed out the errors.

Anecdotal evidence from practitioners using sound therapy, claim that there is an improvement in a person's hearing as a result of such treatment. In view of the work that I have personally undertaken I have found that there is an improvement in terms of my auditory processing times. There would appear anecdotally to be a greater degree of comprehension but yet it is too early to consider the matter of hearing improvement.

When the abstract of the paper was prepared I thought there was a possibility that some testing could be undertaken to determine any such improvements but setting up the testing was beyond the limits of the physiologists undertaking my rehabilitation.

CONCLUSION

The claims of sound therapy to improve or restore a person's hearing do not appear to have been scientifically validated.

Reliance is placed upon the pioneering work of Dr Tomatis who found improvement in people's hearing by the application of various high frequency sounds. There is in the literature material to indicate that the original filter set up by Dr Tomatis did not agree with his theoretical concept because it was limited by the instrumentation available at the time. To give credit where credit is due Dr Tomatis on realising the error later on revised his theoretical/scientific approach to examine why he was getting results that contradicted his original theory.

The psychologists and behavioural therapists that I have contacted who work primarily with children are all united in the concept that sound therapy when used in a proper clinical method results in a reduction in the auditory processing time of the individual. That improvement in the auditory processing leads to a significant improvement in the children's comprehension.

Whilst there is no specific testing in terms of hearing loss the anecdotal evidence from practitioners in this area when required to consider the probing questions of an acoustician confirm that there appears to be an improvement in the hearing of the individual after there is an improvement in the auditory processing.

That does not necessarily mean that sound therapy gives rise to an improvement in hearing but the question that I propose is whether the matter of hearing loss and/or the restoration of hearing is tied in with the with the auditory processing.

From my experience and I find the SAMONAS method is much more enjoyable and less disturbing than the Joudry method of sound therapy. That is a personal opinion. It is up to the individual to ascertain the difference.

However I have gone to the expense and trouble of also using bone conduction after having spoken to parents of children having been subject to the treatment, who confirmed the improvement the benefit of sound therapy with bone conduction versus without bone conduction.

I have also had the assistance of neuro feedback in improving the capability of my brain functions and therefore if that reaches a certain plateau it may also contribute to the increase in auditory processing.

I'm in the process of checking my own hearing utilising that extended tones to address the matter of auditory processing times.

Whilst it is outside the area of my field of acoustics in light of the above I propose in figure 2 an experiment that could be conducted to address the relationship of auditory processing to hearing loss and to consider on a scientific basis the validity of such claims.

There are a significant number of claims in the public domain to indicate that the use of sound therapy can improve or can reduce the level of a person's hearing loss which is contrary to the various textbooks in my office pertaining to acoustics. I anticipate that the outcome of further research will therefore be expected to require addendum to those textbooks in the not too distant future.

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- 4 W. Nelnick, "Hearing Loss from Noise Exposure" Handbook of Acoustical Measurements and Noise Control (3rd Edition), C.M. Harris (McGraw-Hill, 1991) pp 18.2
- 5 P Joudry, "Sound Therapy for the Walk Man" (Sound Therapy Canada, 1984),
- 6 A. A. Tomatis, "The Conscious Ear", (Station Hill Press, New York, 1991)
- 7 P. Joudry & R. Joudry, "Sound Therapy: Music to Recharge Your Brain" 12th Ed (Sound Therapy International, Gerringong, 2009)
- 8 I. Steinbach, "Samonas Sound Therapy" 3rd revised edition (Techau Verlag, Kellinhussen, 1999)

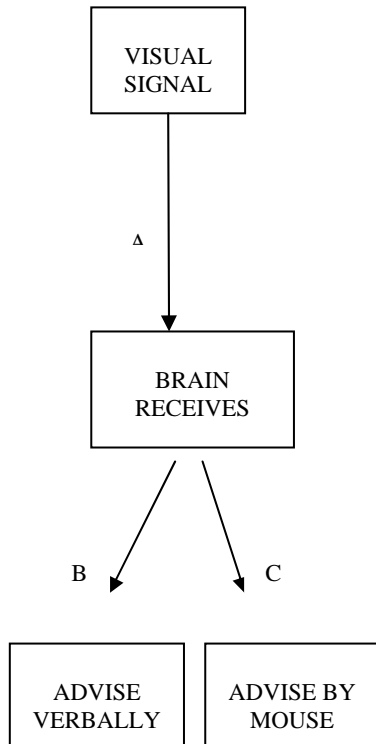


Figure 1 Visual Processing

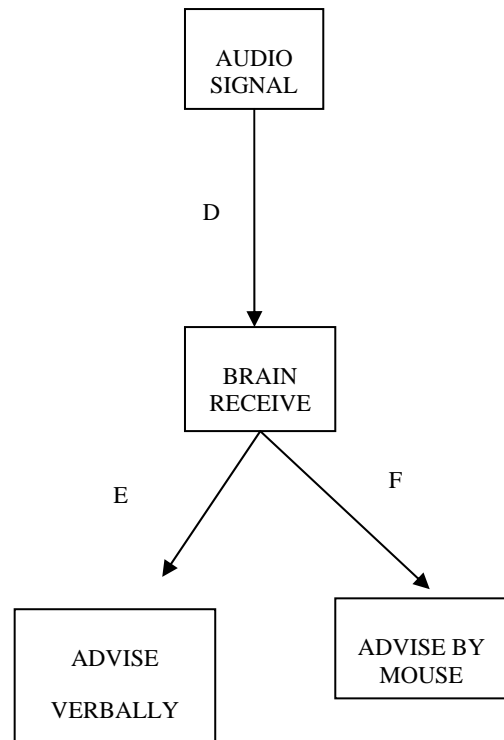


Figure 2 Auditory Processing

Notes to Figures

Visual Processing - if all ok $A + B \approx A + C$

if problem with brain to hand then $A+B < A + C$

if A too long then subject cannot register (or process) signal – but can see

Auditory Processing - if all ok $D + E \approx D + F$

if problem with brain to hand then $D+E < D + F$

if D too long then subject cannot register (or process) signal

Cooper hypothesis if D is too long (poor auditory processing) then a hearing test will reveal hearing loss

If sound therapy (distinct learning) then improves auditory processing – then hearing improvement

Possible Experiment

Test required: apply hearing signal whilst monitoring brain response.

Let D+E be auditory processing 1

and D+F be auditory processing 2

Find out that brain does receive auditory signal (D) and ascertain difference between D, D+E, and D+F.

Try hearing loss test.

Apply sound therapy - subject X with audio sound therapy and bone conduction
- subject Y with audio sound therapy only

Obtain improvement in auditory processing for both subjects after a period of time and retest