

Brain Cell Damage from Speech

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1. Abstract:

A special parameter detection from time and frequency representation of five spoken words on a telephone into the IMPAIRLYZER™ is devised using advanced techniques of word detection, signal conditioning, and field testing to provide detection of brain cell damage from excessive use/abuse of alcohol, drug/s, medicine/s, chemicals and inhalents. This research also confirms cell damage in subjects with hearing loss.

2. Speech Production:

Speech production requires the control and coordination of over 100 muscles at a rate of articulation of 14 phonemes per second [1] thus 140,000 neuromuscular events would be required for each second of motor speech production. These authors and many other authors [2,3] further show that speech production involves nearly 67.5% of the cerebral system. It involves even larger segment of brain when one includes the auditory feedback system used to correct incorrect utterances. The left brain has been thought of as the center of speech, but lately stroke patients with left brain damage have been found to have adapted in using right brain for speech. This is not surprising since all brain centers act in a very interconnected manner rather than being singularly supporting a particular output.

A first order feedback model would include auditory feedback into perception, which is also fed visual input. Chemical ingestion would through the sensory system directly affect the cognitive, motor, coordination functions as well as reaction time, and thus affect speech signal. This conforms to the fact that right and left brain interact and thus speech production is affected by psychological stress, fatigue, physiological disease, and chemical intake.

3. Neuro-chemical Effects

In this paper, the word chemical implies, illegal drugs, other chemicals, prescription drugs, inhalents, and alcohol. Chemical intake is immediately sensed by nerve ends [5] at the location of chemical entry into the body. These gustatory cells, cranial and spinal nerve cells instantaneously sense chemical intake and communicate this information to their corresponding cerebral systems. The standard toxicological model [6] has chemical enter the blood stream after a certain delay depending upon the mode of chemical ingestion. Then the chemically tainted blood stream enters brain and adversely affects all the brain centers. Both the immediate nerve end sensed and their associated sensory center affects as well as the delayed blood-brain barrier effects show up in the speech signal. This was the theoretical basis of IMPAIRLYZER™ which determines one's chemical impairment caused by the overwhelming chemical effect on the neuro-capacity to absorb the onslaught of chemicals. Their capacity to absorb a certain amount of chemicals without significant adverse affect is termed tolerance level, which vary from one individual to the next. No toxicological calculation or model has been able to account for tolerance level of individuals, which is exactly accounted in the said impairment measuring system, which taps the individual neurosystem response. The overwhelming action of excessive chemical intake overpowers the capacity to absorb the said chemical,

which results in brain cell damage if such occurrences are repeated often, and more so if there is lack of proper nutrition. This is also the case with varying quantities of food intake, altitude, height, and weight of the subject since all these factors are accounted by the individual physiological/neurological system and in the said chemical impairment measure.

4. Chemical Fitness Screening Yields Brain Cell Damage Detection

Impairlyzer™ is a patented and trademarked system, which requires the telephone caller to utter five words "one...one...two ...eight...nine" and yields chemical impairment report in less than a minute without any prior baseline on the subject. Over 6,000 subjects have been tested in W. Europe and North America, and a small number of individuals could not be tested. An analysis of the speech signals of such individuals in both time and frequency domain provided a new insight into distortion caused by the subject's abuse of alcohol and/or drugs. Numerous studies have documented cerebral damage from alcohol and drugs but there is no known simple method to detect or measure it. This paper presents a noninvasive, remote and telephone based technique to accomplish the same.

5. Brain Cell Damage Indicators

The time domain representation of speech signal for normal subjects, for instance, of word "one" has a smooth bell shaped envelop, whereas dips appear in it in the case of brain cell damaged individuals resembling an amplitude modulation superimposed on the frequency modulation with a bandpass filter effect. The frequency spectrum of the said word is so modified that its first formant may have one or more harmonics of F_0 missing or the formant harmonic structure is completely missing and instead a single blob of energy appears spread over a few harmonics in the case of moderate damage. In the most severe brain cell damage cases, the first formant shrivels down to a single peak located at a frequency determined by the chemical abused. This has been observed in every single case of excessive chemical abusers whose chemical impairment could not be tested by the IMPAIRLYZER™.

The spectral density effect may be characterized by frequency modulation followed by a bandpass filter whose bandwidth depends inversely on the severity of the cell damage. The center frequency of the resulting modified first formant spectrum is determined by the chemical most abused. For instance in the severe alcohol brain cell damaged cases, the only first format peak is located at a different frequency than that caused by cocaine.

MRI imaging is commonly used to scan brain images, and visual reading may not reveal moderate brain cell damage as was the case of a subject in Antwerp Medical school, but a digital analysis of the same should detect all levels of cell damage.. Extreme cases of brain cell damage cases have not been so far subjected to MRI scans but a computer analysis of the same should be helpful to determine the severity of brain cell damage by a radiologist.

6. Field Validation-Drugs/Alcohol Cases

Even though IMPAIRLYZER™ uses five specific words, one can get a reasonable idea of the extent of brain cell damage from a segment of general speech. For example an audio tape recording of a US presidential candidate in 2000 being interviewed on a national television station was analyzed by playing it into said system. It revealed significant brain cell damage, which corresponded to the public admission by the subject about his excessive alcohol abuse for many years.

Three University of California-Riverside students failed to test for chemical impairment, and were found to have suffered significant brain cell damage caused by excessive drug abuse in their high school years

Two males-one professor, and the other sports editor, and a female nurse-attorney, all from the sixties generation, were undergoing field test with alcohol ingestion to check their tolerance levels. The two males registered increased impairment with increased alcohol intake, but the lady could not be tested for chemical impairment after four drinks. At that point, a quick analysis of her speech records revealed major brain cell damage, and was told that she probably had too much fun in her earlier years. She pointed her finger toward the professor, who has been her boyfriend all along, and stated that he indulged in drugs as much as her. The professor retorted by saying that he ate all his meals whereas she did not while living at the border of USA with Mexico with easy access to drugs. This suggest that drug/ alcohol abusers would incur more brain cell damage if they were malnourished, since food tends to absorb some chemicals thus minimizing their adverse effect.

7. Medicine/s Caused Brain Cell Damage

Multiple medicine use resulting in chemical reactions/ interactions, medicine/s use with alcohol, or medicine abuse may also result in brain cell damage as well and further physiological complications. This has implications in the area fo elderly driver fitness. In particular population over 50 years of age is mostly using polymedicines, whereas the middle age and the stressed out younger generations are using psychotropic drugs while they also enjoy their beer, wine or whiskey. This is costing healthcare systems trillions of D-Marks and is begging for coordination of medicine use. This prompted our test battery to test elderly using five to nine medicines a day.

One of the most glaring example of such abuse was a 78 year old male taking nine medicines approved by his doctors, and he tested highly impaired. A further analysis of his speech records revealed significant brain cell damage, and was advised not to drive. It startled him since he thought that he was road fit to drive, a common illusion among the elderly, who are involved in many accidents, besides doing more damage than good to their neurology/physiology with all those medicines prescribed by three to four different physicians for different ailments without any information on their interaction or side effects when taken together..

8. Brain Cell Damage & Hearing Loss

Recent studies have shown [7] that the speech signal is amplitude modulated in the case of hearing impaired. A few subjects with permanent hearing loss were also tested by this researcher, and were found to have some brain cell damage, which is similar to but quite different from that caused by chemical use/abuse. This seems to suggest that this technique may also be useful in examining hearing impaired individuals.

9. Conclusion

Impairlyzer™ analysis of brain cell damage due to excessive use/abuse of alcohol, drugs, chemicals, medicines and inhalents is offered in a noninvasive remote manner from five telephone spoken words without a prior baseline on the subject.

10. References

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