EQUIPMENT REVIEWS

IBM Speechviewer.

The paucity of immediate and meaningful feedback systems to show speech performance levels has long been a problem in augmenting therapy in the range of speech disorders associated with acquired neurological deficits.

In the National Medical Rehabilitation Centre we have been using the IBM Speechviewer for the past 12 months and we have found it a powerful and effective tool in providing just this feedback.

The IBM Speechviewer was developed over a ten year period at the IBM France Scientific Centre with input from centres in several countries with many clinical case studies being reported on. It was launched in Ireland in May 1990 with the objective of increasing the effectiveness in certain applications of speech and language therapy, in special education and hearing disability programmes.

Used in conjunction with an IBM Personal Systems 2 computer, the Speechviewer consists of a graphic card which is inserted permanently into the system, a software programme which can be stored on hard disk, and a microphone and speaker for speech input and output. IBM supply a detailed manual and a checklist booklet outlining the operation of each module. The system is very easy to use once installed, even for the most computer - naive. The added advantage of high quality digitalised playback can give patients simultaneous visual and auditory feedback of their performance.

The acoustic elements of speech which can be generally displayed are

* pitch,
* amplitude,
* voicing (duration, timing, onset/offset) and
* monothong and diphthong production.

The system programmes are divided into three levels (twelve

modules) which can all be accessed very easily from a main Speechviewer menu;

* **Awareness:** whereby speech input (speaking into the microphone) causes **(cause and effect)** instant changes on the screen, using attention grabbing characters, such as a kaleidoscope, clown and frequency 'thermometer'.

* **Skill building:** specific tasks can be set up for particular goals such as improving pitch control or duration of phonation, using video game-type images.

* **Patterning:** whole screen and split screen facilities for recording, analysing and modelling speech samples with a graphical representation.

The graphics used have appealed immensely to young stroke and head injured patients and our initial apprehension as to how adult patients would receive these proved unfounded. The familiarity and popularity of video games with adults and/or the novelty and powerful reinforcement of instant visual feedback of speech with this system have possibly contributed to this.

Another excellent feature of the system, is the facility to customise (or adapt) and store some of the skill-building programmes for each patient. Short term goals can be jointly set for whichever parameter is being worked on. The facility for the clinician to preset the threshold/range and enable the patient to work on their own, has also proved very motivating and rewarding for the more cognitively intact patient. The system has not been designed to give feedback of consonants, nasality or dysphonic elements but familiarity with the system has allowed us to explore additional possibilities of working on some of these features using the patterning representations.

Although our experience in the Centre has been in using the Speechviewer with acquired speech disorders, its versatility suggests significant value with many caseloads in therapy in backing-up and reinforcing work on the features of pitch/

loudness/timing/voice onset/voice duration etc.

Financial restraints demands that the purchase of technological assistive devices be prudent and the range of applications of any piece of hardware a serious consideration. An IBM PS2 computer must be purchased to operate the IBM Speechviewer. The total package retails at £2,400 + V.A.T. This includes the offer of 40% discount on the computer itself, which IBM have been offering since the launch.

Other specific speech therapy packages can be used with the IBM such as the Nasometer, Electropalatograph, and Electrolaryngograph which are all visual bio-feedback systems. There is not, as yet, as wide a range of educational/therapy-type software programmes available for the IBM PC2 computer as for other less expensive models such as the BBC Master series. Recently some EFL software has been developed with literacy programmes for use with the PC2 that have hitherto only been available on the BBC. We have also used a powerful word processing package with the IBM which has been extremely useful and hope to purchase a database package for keeping records. In all we have been pleasantly surprised to keep finding new application for not just the computer itself but also the Speechviewer package. By endeavouring to utilise the IBM PS2 system as a maximally and optimally as possible, it can really prove a worthwhile investment.

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Exeter Nasal Anemometry System.

This system was devised for assessment and treatment of nasal emission. It consists of three versions:

1. The detailed Assessment equipment consists of a sensing head which is embedded in a nose mask, an anemometry control unit and

is used with a an audio tape recorder. The mask is placed over the patients nose and an indication of nasal airflow registered on the control unit which also provides a coded airflow signal to one channel of the stereo tape recorder. The second channel of the recorder is connected to a microphone and records the speech sounds with which the airflow is associated. The chart and tape are posted to a central processing centre in Exeter, where they are analysed. A dual traced chart is produced with speech along the upper line and nasal airflow along the lower line. The chart and tape are returned to the therapist.

2. The Computer Interfaced Nasal Anemometer eliminates the speech processing circuitry by producing a less detailed dual chart on computer display unit which can be printed. This version consists of the sensing mask, the control unit, necessary leads and plugs to connect to a BBC computer and a disc based program. A printer is necessary if a hard copy of the dual chart is required. The system allows for assessment of nasal airflow and can be used as a bio-feedback system for therapy.

3. The Exeter Bio feedback Nasal Anemometer consists of the sensor mask and the control unit containing a meter mounted on the front panal. Nasal airflow reading 0 to 10 is displayed on the meter. A graphic calibration of the meter reading can be provided. This tool is used for bio-feedback of nasal emission in sounds and words.

All three sections of the Exeter Anemometry system are cheap and easy to use. The detailed assessment system provides a reliable detailed graph of nasal airflow and oral sounds. One of the major drawbacks of this system is that tapes have to be posted to Exeter for analysis resulting in a delay obtaining assessment results. However the system is particularily useful for research as the graphs are detailed and reliable. The computer interfaced system has the advantage of providing graphic results immediately and is extremely useful for busy assessment clinics.

Both systems provide objective measures of nasal airflow during production of single words. They can indicate the extent, frequency and word position of nasal airflow and display the type of sounds

on which nasal airflow is excessive. The hardcopy provides an objective measure against which pre and post therapy/surgery results can be compared.

A disadvantage of the Exeter Assessment system is that only single words can be evaluated. Clinically many cases exist where the patient can produce normal airflow for single words but not for connected speech.

The thermistor which detects airflow is an extremely sensitive device and registers minute changes in airflow. As a result the readout can be contaminated by a draft in the room or by movement of the mask during testing. Results can also be contaminated be the slow reaction time of the thermistor, which takes time to return to the baseline value following nasal airflow, i.e. if there is nasal airflow on one sound, the following sound may indicate some nasal airflow when it does not exist. These problems can be overcome if care is taken during the assessment and results are interpreted with caution. These problems also apply to the Bio-feedback device and it is important that patients using the device for therapy understand how to obtain reliable feedback. Unfortunately there is no data available on the use of nasal anemometery on normal speakers, as one would expect variation in nasal airflow in this population.

In conclusion, the Exeter Nasal Anemometery System has some faults, but many problems can be overcome if results are interpreted with caution. It has proved to be an valuable asset in assessment and treatment of patients with nasal emission.

Further information is available from:
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ELECTROPALATOGRAPHY (EPG)

Electropalatography (EPG) is a technique that allows the recording of the position of the tongue in relation to the hard palate during speech. EPG provides real-time visual feedback of the tongue's contact with the hard palate to the client and therapist so that one is able to view the pattern of tongue movement in isolated sounds, single words and in connected speech.

The Reading EPG system has been developed for use with I.B.M. personal computers, or I.B.M. compatible models. The client and therapist are fitted with custom made, acrylic palates containing 64 silver electrodes arranged in a prescribed pattern. Thin wires from the electrodes are brought together at the posterior corners of the palate and pass behind the wisdom teeth (where present) . The wires, now plastic coated, pass forward to emerge at the corners of the lips. They are then connected to a "comb", which is inserted into a multiplexer unit worn around the neck of the user. An electrode, also inserted into the multiplexer, is held by the user . When the tongue touches the electrodes on the palate, a circuit is completed and the contact points are displayed on the screen at a rate of 100 - 200 frames per second. Two multiplexer units are provided to allow for interaction between the client and therapist. The EPG circuits are isolated from the mains supply to the computer to protect the user.

The electrodes appear on the screen as a series of dots in the configuration in which they are placed on the acrylic palate. As the tongue comes into contact with an electrode, it is highlighted, and the pattern of contact is visible. For example, on normal production of an alveolar plosive, the pattern will show highlighting of the alveolar rows of dots and the dots on the outer edges of the palate at the moment prior to release of the plosion. On production of the lingual fricatives, the central grooving of the tongue is clearly indicated.

A microphone may be used with the system to sample the acoustic signal concurrently with the EPG data. The acoustic sample is taken at 10,000 samples per second (bandwidth approximately 5 kHz). The bandwidth is displayed beneath the EPG data and allows direct correlation between the patterns. The data may be stored on disc and reviewed at a later stage, or analysed in a number of ways. For example, the data may be analysed to show the total number of contacts in the three regions (i.e. anterior, palatal and velar) or the frequency of contact in the these areas . It is possible to use other instruments in conjunction with the EPG (e.g. the pneumotachograph, electroglottograph etc) and to display information from these concurrently with EPG data.

There are three modes of operation, two of which are used in theraputic procedures. The therapy mode has a dual display facility which allows the therapist to place an example of a speech sound pattern on the screen tc be copied by the client. The experimental mode offers a number of options. One may display patterns of contact in real-time, one may store patterns on files in the computer storage system, or one may review previously recorded patterns. The third mode is used primarily for testing the electrodes.

In the area of research the EPG technique has been widely applied (see Hardcastle, Gibbon, & Jones, 1991). The technique has also been found useful in the assessment and treatment of a wide range of speech disorders. Hardcastle *et al.* (1991) list a wide range of applications, including dyspraxia , dysarthria , cleft palate, learned misarticulations (e. g. so called lateral /s/) and glossectomy.

According to Hardcastle *et al.* (1991) "In clinical practice, it is fundamental that EPG is viewed as an additional assessment tool, which can be used to provide detailed information of lingual movement, and which supplements information gathered from routine assessment procedures." Gibbon (1990), having examined the EPG data on two speech disordered subjects, found alveolar / velar contrasts, that were not perceived auditorily, existed as subphonemic contrasts, indicated by tongue placement. She suggests that the presence of a subphonemic contrast may indicate that the child is in a stage of active phonemic development, and that

this may have both theraputic and prognostic implications.

In practice, EPG is highly motivating to the client. This is of great importance since the majority of users have had long term, unsuccessful therapy. Therapists, using the system, have noted the challenge to their own suppositions about phonetic placement, both in normal speech and in that of their clients. Even in cases where EPG has not been successful as a method of treatment, the insight into the clients disorder gained by the therapist has been considered of significant value in planning ongoing intervention. Some experience with computers is helpful when using the system, although not essential as the system instruction booklet is clearly written. It is essential, however, that the therapist spends time learning the system prior to using it with a client to avoid delays during sessions.

The initial outlay, particularly for centres requiring both computer hardware and the EPG program, is high, and might be hard to justify in areas of low potential EPG caseloads. Therapists using the system have generally found the cost of the palate small in comparison to the rapid progress achieved by most clients. The presentation, on screen, is adult orientated, and in this aspect the program is less "child friendly" than, e.g. the Speech Viewer.

In summary, the EPG system is felt to be of great importance in both the areas of research and remediation of speech disorders, whilst also extending our knowledge of normal production. It provides more than a ray of hope to clients and therapists who face the challenge of remediating disordered Speech.& Language Therapists who have spent long, and sometimes demoralising periods working with some of the notoriously "difficult" disorders, will welcome EPG.

References.

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