

Listen, Hear!

by Geoff Plant

Speech Tracking

Introduction

I first read about Speech Tracking (De Filippo & Scott, 1978¹) in the Journal of the Acoustical Society of America, and was quite surprised to find such a clinically useful tool in such an "academic" journal. The moment I read about the procedure, I wanted to try it out with some of my clients. When I got the chance to do so, I was pleased to find that it was a wonderful technique for use with deaf and hard-of-hearing adults, and it has been an important part of my training approach ever since. In retrospect, I believe Speech Tracking to be the single most valuable contribution made to communication training in the latter part of the twentieth century.

Speech Tracking

In Speech Tracking, there is one talker (usually the therapist) and one receiver (usually the person with hearing loss). The talker reads from a text, segment by segment, and the receiver has to repeat each segment without error. If an error occurs, the therapist has to re-present the segment until it is repeated verbatim. In order to reduce the level of difficulty, the therapist can give clues, reword, rephrase, etc., to help the receiver correctly identify the original segment. The procedure continues for a specified time period; I strongly recommend five minutes. At the end of this period, the talker counts up the total number of words presented and correctly repeated. This figure is then divided by the time elapsed to calculate the receiver's Tracking Rate in words-per-minute (wpm). For example, if a receiver was able to repeat 250 words in 5 minutes, her/his Tracking Rate would be 50 wpm.

Criticisms of Speech Tracking

Speech Tracking became a very widely used procedure in the decade after its introduction, but, in 1988, a paper by Tye-Murray & Tyler² cast doubt on its use as an assessment tool. They pointed out a number of extraneous variables, which they believed made it very difficult to control for testing purposes. These included talker variables such as speaking style, articulatory patterns, selection of segments for presentation, etc., receiver variables including degree of language proficiency, assertiveness, etc., and text selection. As a result of these factors, they recommended that Speech Tracking should be used for training rather than evaluation, unless certain stringent controls were implemented. These included an insistence on a verbatim response, the use of only one talker, and the training of talker/receiver pairs prior to testing.

The KTH Tracking Procedure

In 1992, a group at the Royal Institute of Technology (KTH) in Stockholm, Sweden, attempted to develop an approach that would enable Speech Tracking to be used as an effective test instrument. The KTH Tracking Procedure³ is a computer-controlled approach that uses live-voice presentation, but with predetermined segment length, and the use of only one repair strategy - repetition. If a word has to be repeated more than twice, the receiver is shown the written form of the word, and the computer automatically records the identity of this word. At the end of each Speech Tracking session the program automatically calculates a

¹ De Filippo, C.L. & Scott, B.L. 1978. A method for training the reception of ongoing speech. *Journal of the Acoustical Society of America*, 63, 1186-1192

² Tye-Murray, N., & Tyler, R.S. 1988. A critique of continuous discourse tracking as a test procedure. *Journal of Speech & Hearing Disorders*, 53, 226-231

³ Gnosspeilius, J. & Spens, K-E. 1992. A computer-based speech tracking procedure. *STL-QPSR* (1992/1), 131-137
Spens, K-E. 1992. Numerical aspects of the speech tracking procedure. *STL-QPSR* (1992/1), 115-130

number of measures including Tracking Rate, Ceiling Rate (time taken when all words in a segment are correctly repeated after one presentation), and the Proportion of Blocked Words (the total number of words that had to be repeated divided by the total number of words in the session). Although this method has many advantages it has not been widely accepted, but, this is due in part, to it not being compatible with Microsoft Windows. I hope, however, that this situation will be remedied soon. MED-EL is currently co-operating with a group from "The Rehabilitation Engineering Research Center on Hearing Enhancement" at Gallaudet University to develop a Windows-based version of the KTH procedure, which will then be available for distribution to clinicians.

Using Speech Tracking for Training: A Case Study

I routinely use Speech Tracking as part of my communication training approach, and find that almost all clients benefit from it. One client with whom I used it extensively was DJ, who came in for regular training sessions over a period of about one year. DJ was born severely hard-of-hearing, but acquired excellent speech and language skills. In part, this was achieved by the use of hearing aids, but it was mainly due to the efforts of his mother who ensured that all three of her hard-of-hearing children achieved similar high levels of performance. I once commented to DJ that his mother was obviously a wonderful teacher, and he replied, "No, she's not a teacher!" My response was "You want a bet?" and I think he got the point!

When he was in his late-20s, DJ started to search for a better alternative to hearing aids to assist in communication. He investigated the use of American Sign

Language, but in the end, decided that he wanted to continue to be able to communicate using speech and listening. He eventually decided to have a cochlear implant, and finally decided that the MED-EL COMBI 40+ was the best system for him. I met him soon after he received his implant, and we met on a regularly basis for a number of months. From the start, I used the KTH Tracking procedure as part of the training approach. Most of the sessions were presented auditory only; that is, with my face covered, so that DJ had to listen to what was being presented without the aid of lipreading. This approach can be quite stressful and tiring, however, so we also included some auditory-visual Speech Tracking sessions where he was able to use lipreading and listening at the same time.

In Figure 1, I've presented DJ's Tracking Rates and Ceiling Rates for the auditory only and auditory-visual presentations. Note that each point shown is his average performance over five 5-minute Speech Tracking sessions. DJ's auditory only starting level was around 40 wpm, but with training this rapidly improved to over 60 wpm, which represents an improvement of around 50%. I'm sure it could be even higher, but after a time he settled into an easy pattern of responding and enjoyed the story rather than strived for higher and higher performance levels. I think this is quite a valid response, and would never "push" a client in an attempt to gain small improvements in Tracking Rate. I'd much rather see her/him enjoy listening and come to see it as a pleasurable experience. Of course, some clients are far more "competitive" and want to see their Tracking Rates rise higher and higher. One man once commented that he saw his Tracking Rate in the same way as he did his golf handicap! The only difference was that he wanted his Tracking Rate to get higher, and his golf handicap lower!

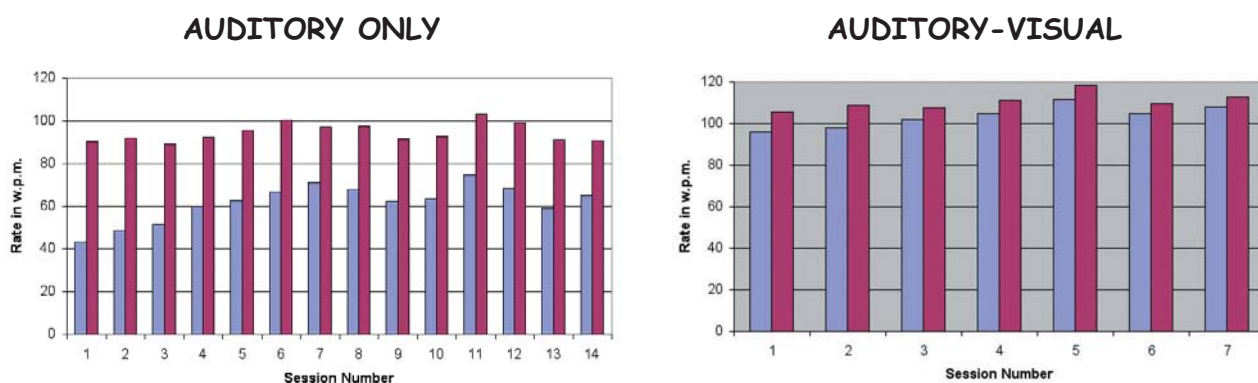


Figure 1:

DJ's Tracking Rates (blue columns) and Ceiling Rates (red columns) in words-per-minute for Speech Tracking materials presented auditory only and auditory-visually. Each datum point is the mean for five 5-minute Speech Tracking sessions.

In the auditory-visual condition Tracking Rates are much higher, and are consistently around 100wpm. This represents virtually flawless performance, and provides an insight into DJ's great skill in understanding face-to-face speech. When I'm talking to DJ face-to-face it is usually so effortless that I have to remind myself that he has a hearing loss.

One of the great advantages of the KTH Tracking Procedure is that it also records the individual client's Ceiling Rate. This is the rate the client achieves when s/he repeats all words in a segment correctly, after only one presentation. I believe that it is a very important measure, as it provides insights into her/his response patterns. For example, some clients like to "mull over" their response before they give it. I suppose that, in part, they are trying to make sure they've "got it right" before they commit themselves by responding. Others are quite slow and deliberate in their response, weighing each word carefully as they repeat back what was said.

When people with normal hearing perform Speech Tracking, they usually end up with Tracking Rates in the range 100-110 wpm, and

this is sometimes presented as the "normal" Tracking Rate against which the performance of people with hearing loss can be compared. I don't like this "measure," as it fails to take into account these different response patterns. I would much rather see an individual client's Tracking Rate expressed as a percentage of her/his Ceiling Rate, rather than compare it to a rather nebulous measure such as "normal" performance level. Figure 2 presents DJ's Tracking Rate as a percentage of his Ceiling Rate (TR/CR) in the two presentation conditions. In the auditory only condition, his TR/CR rises rather quickly from around 45% to approximately 70%, and then settles "comfortably" at around 65-70%. In the auditory-visual condition, there's little, if any, room for improvement across the duration of training, as DJ's performance level is so high (around 91%) from the very start. In the latter sessions, his TR/CR settled around 95%, which again is indicative of virtually flawless performance.

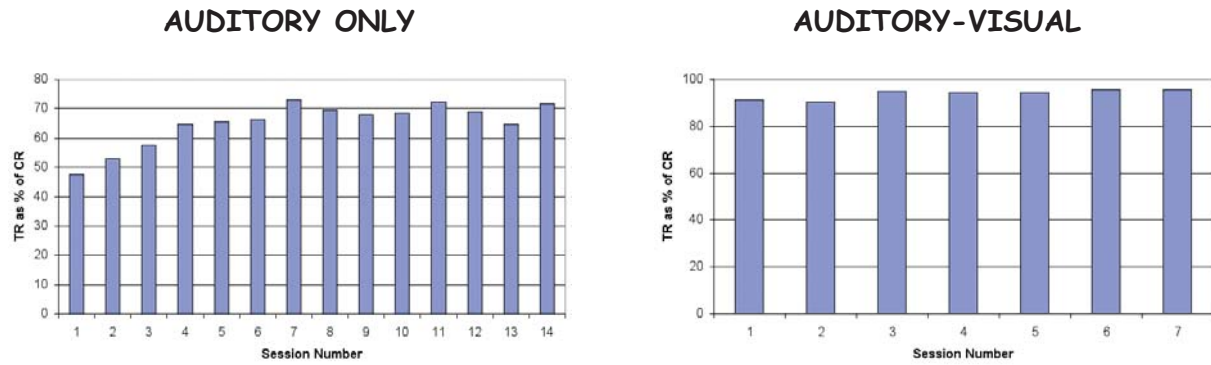


Figure 2: DJ's Tracking Rate expressed as a percentage of his Ceiling Rate for Tracking materials presented auditory only and auditory-visually. Each datum point is the mean performance for five 5-minute Tracking sessions.

Choice of Text

The text that I used in all of this testing was Astrid Lindgren's novel "The Brothers Lionheart."

The target audience for this book is older children, but I've used it with many adults without any negative reactions. I like to use books aimed at this age group, because the writing style is usually quite close to conversational speech. Books for adults tend to be far more "literary," and they often create special difficulties because the language form differs quite markedly from that used in everyday conversation. The effect of different literary styles on Tracking Rates can be profound. For example, a study conducted by Hochberg, Rosen and Ball (1989) found that the Tracking Rates obtained by the same talker/receiver pairs varied from 62.9 wpm for "easy" materials (controlled vocabulary readers designed for English-as-a-second-language learners) to 29.5 wpm for difficult materials. The "difficult" materials consisted of stories written by Agatha Christie: adult materials certainly, but really not all that complex.

On a few occasions, I've used some of the Sherlock Holmes stories written by Sir Arthur Conan Doyle, and these have resulted in a fairly dramatic drop in Tracking Rate. Over time, however, subjects have found that they are able to cope with the more difficult material, and their scores have gradually climbed back to the level found with simpler materials. I suppose the "trick" here is deciding who is suitable for this higher-level material. Introduce it too early, and the client might be discouraged and feel that her/his performance is much poorer than it really is. Introduce it at the right time, and the client will accept it as a challenge worth attempting.

Conclusion

Speech Tracking is a very useful training technique for many clients fitted with cochlear implants. It provides practice in the perception of connected material, and clients find it both challenging and worthwhile. However, there are some clients for whom it is unsuitable, and I'll deal with this problem in the next issue of "Listen, Hear!"

If you have any comments, feedback, or suggestions to this newsletter, please contact me at:

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I look forward to hearing from you.