DYALOG: A Computer-Based Measure of Conversational Performance

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Dyalog is computer software developed for measurement of functional communicative performance. During live or videotaped conversation between a client and partner, the clinician simply pushes a button during breakdown and repair. The computer displays a line graph of fluent and non-fluent conversation, and also displays numerical data: duration/proportion of conversation time occupied by breakdown and repair; number of breakdown and repair events; and average time per event. As an outcome measure, Dyalog can be used to demonstrate the benefits of situational change (e.g., reducing noise) or the benefits of longer-term communication therapy. Clinical applications are discussed.

Speech-language-hearing clinicians help people with communication disorders in many ways. In the course of therapy, the clinician may: train the client in self-help procedures, train frequent communication partners in proactive strategies, advise the client on the optimal use of assistive devices, or show the client how to modify the social or physical environment for best communication (Erber, 1996).

Typically, clinicians want to measure outcomes of the therapy that they provide. There are at least three reasons: (a) to validate or justify a therapeutic strategy, (b) to demonstrate progress to the client and to the client's family by comparing performance before and after treatment, and (c) to obtain reimbursement for therapy from an insurance company or a government agency.

Different types of outcome measures are available. Subjective data are quickly obtained by means of a report or assessment by the client, the clinician, or another person. Examples of subjective data include: (a) the client's reported use of a

communication aid or device (Mulrow, Tuley, & Aguilar, 1992); (b) assessment (rating) of handicap by the client or another person, reflected in perceived ease of everyday social or communicative behavior (Demorest & Erdman, 1987; Katz & Lyerly, 1963; Newman & Weinstein, 1986); (c) assessment (rating) of anxiety or stress that is experienced during everyday interaction by the client or another person (Bloodstein, 1987; Craig, 1990; McCroskey, 1984); and (d) satisfaction with communication (Oates, Lochert, & McMahon, 1990).

Other outcome measures are more objective, but data collection may involve special procedures and equipment, or may require a considerable amount of time. Examples of objective data include: (a) per cent words or sentences identified by the client (Mendel & Danhauer, 1997), (b) the client's speech intelligibility (Bridges, 1991; Kent, 1992), (c) narrative tracking rate (DeFilippo, 1988; Tye-Murray & Tyler, 1988), (d) efficiency of information exchange (Davis & Wilcox, 1985; Yorkston, Beukelman, & Flowers, 1980), and (e) the variety and number of strategies applied by the client when misunderstandings occur (Blaylock, Scudder, & Wynne, 1995; Erber, 1995; Tye-Murray, 1991).

CONVERSATIONAL PERFORMANCE

Clinicians have recognized for many years that improvement in a client's *conversational* performance is an important rehabilitative goal. A variety of conversation-based therapies have been developed for this purpose (Davis & Wilcox, 1985; Erber, 1996). Conversation-based therapies are attractive to both clients and clinicians because they reflect the communicative activities of daily living.

To monitor changes in clients' conversational normalcy or fluency, clinicians have successfully employed *rating scales* (Erber, 1996). Rating scales, however, are subjective, require training of raters, and may be difficult to apply if fluency fluctuates within a conversation. Clinicians also have engaged in detailed analysis of conversational behavior to specify client needs (Caissie & Rockwell, 1993; Tye-Murray & Witt, 1996). This type of measurement, however, can be tedious and typically requires far more time for analysis than the original conversational sample. It is apparent that clinicians need a simple, quick, and objective method to routinely assess the conversational benefits of therapy.

GENERAL INFORMATION ABOUT DYALOG

Dyalog is a computer-based method that has been developed for routine measurement of a client's functional conversational performance. The result is a line graph or "cumulative record" (Skinner, 1972) which depicts the amount of time that two people participate in fluent and non-fluent conversation.

HOW DYALOG IS USED

Dyalog is extremely easy to apply in practice. To use Dyalog, the clinician

first chooses the behavior to be examined (e.g., breakdown/repair). Then the clinician selects the amount of conversation to be evaluated (e.g., 2 min).

Conversational topics may be randomly selected from a deck of cards (e.g., shoes, camping, chocolate, furniture). Conversational conditions may be compared: with/without an assistive communication device, at a near/far distance, in a quiet/noisy room, with/without visual cues, with an experienced/inexperienced communication partner, or before/during/after communication therapy.

The clinician carefully observes a sample of conversation either live or recorded on videotape. While the conversation flows smoothly, the clinician does nothing. Whenever the conversation breaks down and repair is required, the clinician depresses and holds down the space bar on the computer keyboard. When the participants have restored fluent conversation, the clinician releases the space bar. These simple rules are applied throughout each sample of conversation that is assessed (see Table 1).

Table 1

Some Simple Rules for Using Dyalog

Instruction	Condition
Do not press the space bar:	whenever fluent conversation is in progress
Press the space bar and hold it down:	whenever conversation breaks down and repair is required
Release the space bar:	when fluent conversation has been restored

At the end of the sample of conversation, the computer automatically displays a line graph that summarizes the clinician's analysis (see Figures 2 and 3). Time periods of normal conversation are shown as flat line segments; time periods of disordered conversation are shown as downward sloping line segments. The point where the line graph intersects the right vertical scale indicates the total amount of time occupied by breakdown and repair.

The Dyalog program also automatically computes and displays four *numerical* scores that clinicians can use to describe conversational performance (see Table 2):

- the total amount of conversation time, in seconds, that contained breakdown and repair;
- the proportion of total conversation time that contained breakdown and repair;
- the number of breakdown and repair events; and
- the average time, in seconds, per breakdown and repair event.

In general, all these numerical scores decrease as conversational performance improves. Thus they can be used to demonstrate the positive results of commu-

Table 2

Data Obtained During Conversations With a Client (E.M., Female, Age 84) Who Listened
With and Without a Portable Amplifier. Numerical Data (Conversation Time = 120 s)

Breakdown/repair	With amplification	Without amplification
Time in seconds	8	64
Proportion of total conversation time	.07	.53
Number of events	2	6
Average time in seconds per event	4.0	10.7

nication therapy. A printed copy of the line graph and the numerical data are available for clinical records, and/or each client's results may be stored in the computer for later examination.

COMPARISON OF DYALOG
WITH RATINGS OF CONVERSATIONAL FLUENCY

Clinicians often use subjective ratings to assess conversational fluency (Erber, 1994, 1996). These ratings correspond to the proportion of conversation time that flows smoothly without breakdown and repair (Erber, 1996). Preliminary
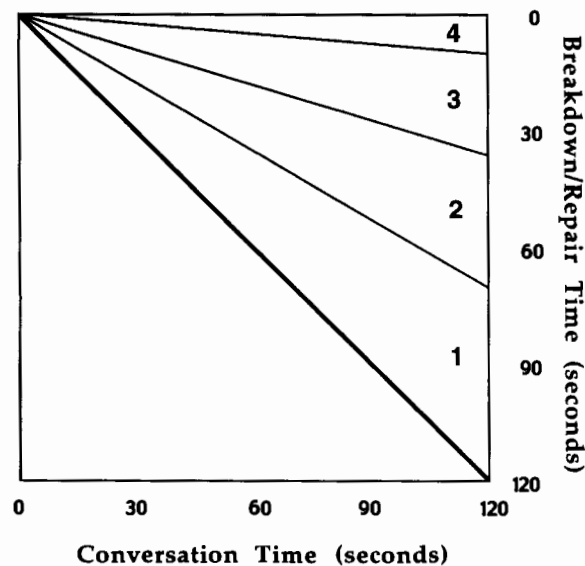
Figure 1. Approximate regions of the Dyalog plot that correspond to subjective conversational fluency ratings of 1, 2, 3, and 4.
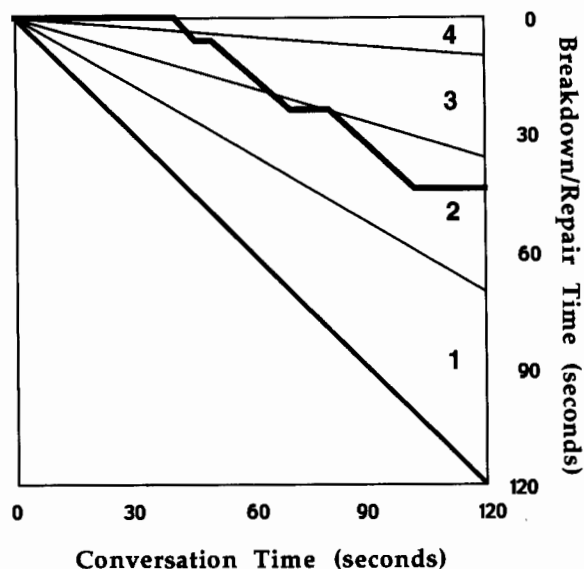
Figure 2. Example of a curved line graph that passes through three conversational fluency regions of the Dyalog plot.

observations suggest that Dyalog results are related to student clinicians' subjective ratings of conversational fluency on a 4-point scale. That is, videotaped conversations which they rate reliably as 1, 2, 3, or 4 tend to yield line graphs within the general regions of the Dyalog plot shown in Figure 1.

We have observed that some conversations, however, are not easily assessed with a subjective rating scale. Occurrences of breakdown and repair may be concentrated at the beginning of the conversation when the client is orienting to the topic, or at the end of the conversation when the client is fatigued. The amount of time required for resolution of breakdowns may vary throughout the conversation. The result may be a Dyalog line graph that bends or curves (see Figure 2). Conversations of this type (where the line graph appears to pass through two or more regions within the borders of the Dyalog plot) typically yield unreliable ratings. Different raters may not agree on the number to assign, for example, because each rater may attend to or remember a different factor or a different part of the conversation. In such cases, where subjective ratings of conversational fluency are unreliable, the clinician can use the printed Dyalog line graph to describe the progress of the conversation unambiguously.

CLINICAL EXAMPLE

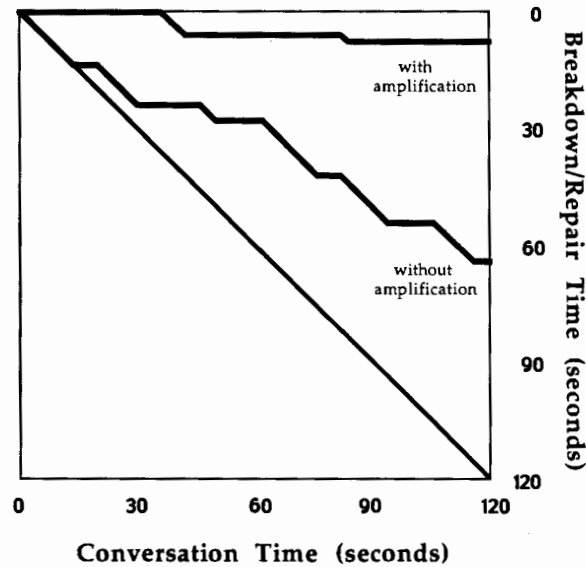"Instant therapy" (Erber, 1996) is the systematic application of situational

Figure 3. Dyalog line graph obtained during conversations with a client (E.M., female, age 84) who listened with and without a portable amplifier.

change whose effects are evident without extensive training of the client or the communication partner. E.M. (female, age 84 years), a nursing home resident with a moderate age-related hearing loss (better-ear 3-frequency pure tone average = 53.3 dB HTL), received instant therapy in the form of amplification through a portable amplifier (Tandy Stereo Amplified Listener 33-1093A) connected to lightweight stereo earphones (Nova-42). The amplifier was set at ½ volume and high-frequency emphasis, as preferred by E.M. The communication partner, a student clinician (female, age 23 years), held the amplifier case beneath her chin so as not to obscure the mouth and spoke across the microphone grille at a distance of about 50 mm (Erber, 1994). She sat 1 m from the client and faced the windows to maximize visible cues.

As the partner engaged in face-to-face social conversation about grandchildren with E.M., another student clinician (female, age 25 years) pressed the space bar on a small laptop computer whenever E.M. requested clarification and held the space bar down during participants' attempts to restore fluent conversation. She released the space bar whenever conversation was restored.

Figure 3 and Table 2 show typical Dyalog results obtained during two different 2-min conversations with E.M. – with and without the portable amplifier. The considerable improvement in conversational fluency that occurred when E.M. listened to sound amplified through the assistive listening device is evident in the difference between the two line graphs and also between the two sets of numeri-

cal summary data. For example, without amplification, breakdown and repair occupied 64 out of 120 s, but with amplification, breakdown and repair occupied only 8 out of 120 s. This information can be used to support a clinician's recommendations that care staff regularly use a portable amplifier and earphones when conversing with E.M.

IMPLICATIONS FOR THE CLINICIAN

Clinicians report that Dyalog software is easy to use in practice, especially after one has acquired a basic theoretical understanding of the particular behavior selected for observation. The line graph permits one to appraise overall conversational performance at a glance. The numerical data permit conversational performance to be quantified. The printed results provide a clear, concise summary of a client's conversational behavior under different conditions or at different times. As a functional outcome measure, Dyalog can be used to demonstrate the benefits of situational change and/or the benefits of longer-term communication therapy.

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REFERENCES

Blaylock, R.L., Scudder, R.R., & Wynne, M.K. (1995). Repair behaviors used by children with hearing loss. *Language, Speech, and Hearing Services in Schools, 26*, 278-285.

Bloodstein, O. (1987). *A handbook on stuttering* (4th ed.). Chicago: National Easter Seal Society.

Bridges, A. (1991). Acceptability ratings and intelligibility scores of alaryngeal speakers by three listener groups. *British Journal of Disorders of Communication, 26*, 325-335.

Caissie, R., & Rockwell, E. (1993). A videotape analysis procedure for assessing conversational fluency in hearing-impaired adults. *Ear and Hearing, 14*, 202-209.

Craig, A. (1990). An investigation into the relationship between anxiety and stuttering. *Journal of Speech and Hearing Disorders, 55*, 290-294.

Davis, G.A., & Wilcox, M.J. (1985). *Adult aphasia rehabilitation. Applied pragmatics.* San Diego, CA: College-Hill Press.

DeFilippo, C.L. (1988). Tracking for speechreading training. In C.L. DeFilippo & D.G. Sims (Eds.), *New reflections on speechreading* [Monograph]. *The Volta Review, 90*, 215-239.

Demorest, M., & Erdman, S.A. (1987). Development of the Communication Profile for the Hearing Impaired. *Journal of Speech and Hearing Disorders, 52*, 129-143.

Erber, N.P. (1994). Communicating with elders: Effects of amplification. *Journal of Gerontological Nursing, 20*, 6-10.

Erber, N.P. (1995). Applications of hearing-loss simulation in education of student clinicians. *Journal of the Academy of Rehabilitative Audiology, 28*, 37-50.

Erber, N.P. (1996). *Communication therapy for adults with sensory loss* (2nd ed.). Clifton Hill, Australia: Clavis Publishing.

Katz, M.M., & Lyerly, S.B. (1963). Methods for measuring adjustment and social behavior in the community: I. Rationale, description, discriminative validity and scale development. *Psychological Reports, 13* (Monograph Suppl. 4-V13), 503-535.

Kent, R.D. (Ed.). (1992). *Intelligibility in speech disorders.* Philadelphia: John Benjamins Publishing.

McCroskey, J.C. (1984). Self-report measurement. In J.A. Daly & J.C. McCroskey (Eds.), *Avoiding communication* (pp. 81-94). Beverly Hills, CA: Sage Publications.

Mendel, L.L., & Danhauer, J.L. (1997). *Speech perception assessment.* San Diego, CA: Singular Publishing Group.

Mulrow, C.D., Tuley, M.R., & Aguilar, C. (1992). Correlates of successful hearing aid use in older adults. *Ear and Hearing, 13,* 108-113.

Newman, C.W., & Weinstein, B.E. (1986). Judgements of perceived hearing handicap by hearing-impaired elderly men and their spouses. *Journal of the Academy of Rehabilitative Audiology, 19,* 109-115.

Oates, J., Lochert, S., & McMahon, J. (1990). Change in communicative satisfaction experienced by laryngectomees and their spouses post laryngectomy. *Australian Journal of Human Communication Disorders, 18,* 5-18.

Skinner, B.F. (1972). *Cumulative record* (3rd ed.). New York: Appleton-Century-Crofts.

Tye-Murray, N. (1991). Repair strategy usage by hearing-impaired adults and changes following communication therapy. *Journal of Speech and Hearing Research, 34,* 921-928.

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

Tye-Murray, N., & Witt, S.A. (1996). Conversational moves and conversational styles of adult cochlear-implant users. *Journal of the Academy of Rehabilitative Audiology, 24,* 11-25.

Yorkston, K., Beukelman, D., & Flowers, C. (1980). Efficiency of information exchange between aphasic speakers and their communication partners. In R. Brookshire (Ed.), *Clinical Aphasiology Conference proceedings* (pp. 95-105). Minneapolis, MN: BRK Publishers.