Fluency Research: Questions, Parameters, and Designs

Purpose

This handout summarizes some of the key information about fluency and provides a few references, published and unpublished. It was a VERY quickly put together, not by any means *complete*. I hope it's helpful in giving you a few ideas or links into the murky world of fluency research!

Presenters

Carl Binder	email - Dr Fluency@aol.com
Ogden Lindsley	mail - 366 N. 1600 Road, Lawrence, KS 66049
Kent Johnson	email - Morningsid@aol.com
Joe Parsons	email - Learning@uvvm.uvic.ca
John Eshleman	email - 73767.1446@compuserve.com
Hank Pennypacker	email - 73423.3503@compuserve.com

Historical notes

Some of the early precursors and contributions to fluency research included:

- **Standard Celeration Chart:** Ogden Lindsley gave us the Standard Celeration Chart, a powerful and sensitive tool for distinguishing between, quantifying and analyzing performance (rate of response) and learning (rate of change in performance, or celeration). His commitment to human behavior frequencies led to Precision Teaching. The standard chart is the fundamental research tool for fluency research, just as the cumulative recorder was the basic tool for analyzing schedules of reinforcement.

  Pennypacker, H.S., Keonig, C.H., and Lindsley, O.R. *Handbook of the Standard Behavior Chart.* Kansas City, KS: Precision Media, 1972.

- **Projection on the Standard Chart:** Carl Koenig, Lindsley's doctoral student, summarized thousands of behavior change projects on the standard chart to demonstrate that straight-line projections based on 7-10 days of data allow accurate projection of 7-10 data points into the future. Also showed that the log scale on the chart normalizes variance or "bounce" around a split-middle projection line. This ability to project behavior frequencies is a key prerequisite for decision-making in Precision Teaching and fluency research.

  Koenig, C.H. *Charting the future course of behavior.* Kansas City, KS: Precision Media, 1972.

  Kazdin, A.E. Statistical analyses for single-case experimental designs. In M. Hersen & D. Barlow. *Single-case experimental designs: Strategies for studying behavior change.* New York: Pergamon Press, 1976. (A simple statistical test for assessing the probability that a celeration on the Standard Chart has changed as a result of an intervention.)

- **Brief timings**: Harold Kunzelman, Eric Haughton and their associates used brief (typically one-minute) timings to obtain samples of skilled behavior, graphed on the Standard Chart. The use of brief timings, versus the session-length timings originally used by Lindsley (based on the lab practice of "continuous measurement") represented a measurement breakthrough in measurement sensitivity and convenience, leading to a succession of important discoveries that we now cluster under the concept "fluency."

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Historical notes (continued)

- **Aims**: Eric Haughton reported what may be one of the most important educational discoveries of the century in the early 70's. He, his students and associates discovered that in order to achieve smooth progress in learning and mastering basic skills (e.g., writing answers to addition problems), students must achieve a certain minimum rate of performance on the "tool skills" or components of basic skills (e.g., writing digits, reading digits). This discovery blew open the traditional notion of learning hierarchy based on accuracy criteria, and really began the field of fluency research (although we did not adopt the term "fluency" until a few years later).

  Haughton, E.C. Aims: Growing and sharing. In J.B. Jordan & L.S. Robbins (Eds.) *Let's Try Doing Something Else Kind of Thing*. Arlington, VA: Council on Exceptional Children, 1972.

  Starlin, A. Sharing a message about curriculum with my teacher friends. In J.B. Jordan & L.S. Robbins (Eds.) *Let's Try Doing Something Else Kind of Thing*. Arlington, VA: Council on Exceptional Children, 1972.

- **Learning Screening**: Harold Kunzelman led a project in Washington State that applied what had been discovered about the relationships between performance frequencies and academic success to assess 18,000 students from three cities, conducting 1-min. timings on a range of skills for 10 days. Using ending performance frequencies and celerations (learning rates) quantified on the Standard Chart over the ten-day period, they were able to predict with high accuracy which students would be identified for special education service a year later. This was an important advance in assessment technology that has not been nearly exploited by educators in the years since.

  Child Service Demonstration Programs - Progress Report VI. Tacoma, Washington: Intermediate School District number 111, 1974.

- **Component/Composite assessments**: Extending from his analysis of basic academic skills and "tool" skills, Haughton began in the mid-70's to use a chemical analogy, discussing "elements and compounds" with respect to all curriculum areas, but especially gross and fine motor skills. Mary Kovacs and Anne Desjardins were important contributors to this ground-breaking motor skill research, working with Haughton in Canada. Binder, Barrett, Pollard, and their associates applied Haughton's approach with severely handicapped students, using the terminology "component and composite" to refer to the same type of relationships among skills. They began conducting timings to assess the relationships between fluency in smaller chunks of behavior to larger chunks; they used those assessments to identify component deficits in students' self-help, vocational, and academic skill performance. This represented a shift in curriculum design and assessment thinking from the linear sequencing of prerequisite behaviors to an approach that seeks to construct complex repertoires from smaller components or elements.

  Bourie, C., & Binder, C.V. Exit assessment: Diagnostic use of the standard celeration chart for curriculum planning. Award-winning poster, Conference of The Association for Behavior Analysis, Dearborn, Michigan, May, 1980.

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Great Falls demonstration project

Ray Beck of the Great Falls, Montana, schools spearheaded an effort to assess the effects of timed practice, charting and decision-making for one-half hour per day in both special and regular education. The results showed over several years that daily practice, chart-based decisions, and achieving high rates of performance on basic skills (via Precision Teaching) was extremely cost-effective and could raise an entire school's standard achievement test scores from below the 50th percentile to above the 90th. This was the first large-scale, public demonstration that fluency is a key to educational success.

Beck, R. Report for the Office of Education Joint Dissemination Review Panel. Great Falls, MT: Precision Teaching Project, 1979.

Integration with instructional design

By the late 1970's it was clear to a small community of researchers and practitioners that fluency, not mere accuracy, is the measure of *true mastery*. The next step was to integrate effective practice and fluency aims with more systematic instructional design. Three important developments were:

- **Learning Channel Matrix**: In 1980, Haughton designed a matrix with Inputs (Think, Touch, Taste, Sniff, See, Hear, Feel) down the left and Outputs (Aim, Do, Draw, Emote, Mark, Say, Select, Tap, etc.) across the bottom to form intersections called "channel sets" (e.g., See/Say), as a way of analyzing/designing curriculum and organizing what we know about fluency.
- **Combining PT with Direct Instruction:** Starting in the late 70's, Michael Maloney at the Quinte Learning Centre in Belleville, Ontario, combined Precision Teaching practice and aims with Direct Instruction lessons.
- **Morningside Model**: Kent Johnson followed Maloney, combining Direct Instruction with Precision Teaching, later incorporating instructional design principles from Markle and Thiemann (working with Joe Layng) to produce highly efficient, fluency-based curriculum sequences and materials.

Lack of publications

The field of Precision Teaching, in general, and fluency research in particular have suffered from a lack of publication. Most of those involved were teachers and teacher-trainers, not driven to publish in journals. Discoveries during the 70's were occurring so rapidly that publications could not keep up anyway. However, thousands of teachers around North America with a wide diversity of students continued to make and apply important instructional discoveries, using frequency aims, the Standard Chart, and word-of-mouth input from their colleagues and trainers. Other than a few Council on Exceptional Children publications, the only publications covering this work for many years were:

- *Special Education in Canada* (Eric Haughton, Editor - early 70's)
- *Data-Sharing Newsletter* (Carl Binder, Editor - from 1977-83)
- *Journal of Precision Teaching* (Pat McGreevy, Founding Editor; Claudia McDade, Editor - 1980 - present)

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Early text book

Although there had been a few limited-edition texts on Precision Teaching prior to 1976, they were not widely available. In 1976, Owen White (Haughton's student) co-authored a text book:

White, O. and Haring, N. *Exceptional Teaching*. Columbus, OH: Charles E. Merrill, Inc., 1976 (Second Edition in 1981).

While it was at least five years behind the current practice of its time in Precision Teaching, it did provide a "legitimate" resource for those interested in learning more or ordering a university text book on Precision Teaching.

Some Non-academic publications

I have published widely on fluency and fluency-based instruction, but not primarily for an academic audience. References include:

Binder, C. Precision Teaching: Measuring and attaining exemplary academic achievement. *Youth Policy*, 1988, 10(7), 12-15.

Binder, C. Closing the confidence gap. *Training*, 1990a, September, 49-56.

Binder, C. The 9th International Precision Teaching Conference: Highlights and future directions. *Future Choices*, 1991a, 2(3), 39-49.

Binder, C. Morningside Academy: a private sector laboratory for effective instruction. *Future Choices*, 1991c, 3(2), 61-63.

Binder, C. and Bloom, C. Fluent product knowledge: Application in the financial services industry. *Performance and Instruction*, 1989, February, 17-21.

Binder, C., Haughton, E. and Van Eyk, D. Precision Teaching attention span. *Teaching Exceptional Children*, 1990, 22(3), 24-27.

Binder, C. and Watkins, C.L. Precision Teaching and Direct Instruction: Measurably superior instructional technology in schools. *Performance Improvement Quarterly*, 1990, 3(4), 74-96.

More recent literature resources

In the last few years, several publications have reviewed significant portions of the relevant literature, including:

- Lindsley, O.R. (1990). Precision Teaching: discoveries and effects. *Journal of Applied Behavior Analysis*, 25, 51-57.
- Binder, C.V. (1993). Behavioral Fluency: A New Paradigm. *Educational Technology*, October, 1993, 8-14.

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High visibility publication

Probably the highest visibility publication related to fluency to date is:

Johnson, K.R. and Layng, T.V.J. (1992) Breaking the structuralist barrier: Literacy and numeracy with fluency. *American Psychologist*, 47, 1475-1490.

This article produced a turn-up in the growing interest in fluency research.

Comprehensive database

John Eshleman is the archivist of Precision Teaching. He has an online (HyperCard) and hard copy database of virtually every Precision Teaching publication, presentation, or working paper over a very long period of time. It may or may not be up to date (I haven't asked John). But even if it is not, you will find more fluency-related references in it than anywhere else. John's email is at the beginning of this hand-out.

Expected publications

Two publications that will be helpful when they become available are:

- Lindsley, O. R. (In Press). Precise Instructional Design: Guidelines from Precision Teaching. In C. Dills and A. Romiszowski (Eds). *Instructional Development: State of the Art*. Educational Technology Publications.

- Binder, C. (In preparation). Behavioral Fluency: Evolution of a new paradigm. To be submitted to *The Behavior Analyst*. (Traces a great deal of unpublished or obscurely published background conceptual and methodlogical development, research and application, including work from other non-behavioral fields.)

Ceilings: A framework for research and development

During the 1970's, I and Bea Barrett pursued an informal program of research and development organized around what we then called "ceilings on the development of proficiency." We identified four types of ceilings:

- **Measurement-defined ceilings**: Until one incorporates the time dimension into the assessment of skills, it is impossible to distinguish between hesitant but accurate performance and masterful (fluent, non-hesitant) performance. Failure to measure rate of performance or to use time-based mastery criteria is the single greatest obstacle to effective instruction, in my view. Precision Teaching and the Standard Chart enabled us to see these important differences. There is a good deal of research that could flow simply from applying time-based measures to a range of different component and composite skills, across multiple populations, in different curriculum areas. Sample publications with relevant data include:

  Barrett, B.H. Communitization and the measured message of normal behavior. In R. York & E. Edgar (Eds), *Teaching the Severely Handicapped (Vol 4)* Columbus OH: Special Press, 1979.

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Ceilings: A framework for research and development (continued)

- **Measurement-defined ceilings** (continued)

Wood, S., Burke, L., Kunzelman, H., and Koenig, C. Functional criteria in basic math proficiency. *Journal of Special Education Technology*, 1978, 2, 29-36.

Pennypacker, H.S. and Binder, C. Triage for American education. *Administrative Radiology*, 1992, January, 18-25. (A proposal for a nation-wide, curriculum-based fluency standards.)

- **Procedure-imposed ceilings**: Once we removed the measurement-defined ceilings, we saw that *most* instructional procedures and materials (including most so-called "behavioral" ones) severely limit the ability of learners to ever achieve or demonstrate fluency. In Bea Barrett's lab, we spent years figuring out clever ways to shift controlled operant "trials procedures" into free operant or at least self-paced operant procedures with very high maximum rates. Most so-called "behavioral" education methods constrain the rate at which the learner can move, and/or they do not support or encourage the learner to move *faster*. Early work removing these ceilings (with mostly handicapped students) included:

Binder, C.V. The effects of response rate-building on acquisition, transfer, and retention of skills. Meeting of the Behavioral Intervention Project, Arlington, Massachusetts, May, 1976.

Binder, C. Four kinds of ceilings. *Data-Sharing Newsletter*. Belmont, MA: W.E. Fernald State School, Behavior Prosthesis Lab, 1978.

Binder, C.V. Response rate measurement in a mediated transfer paradigm: teaching severely retarded students to read. Paper presented at a meeting of the Association for Behavior Analysis, Dearborn, Michigan, June, 1979. (We eliminated ceilings from a 12 per minute trials procedure by changing materials and allowing continuous See/Say responding, and got an IMMEDIATE multiplication x3 or more to around 40 per minute, followed by rate-building procedures that accelerated performance.)

Within the relatively narrow scope of academic skills and the usual Precision Teaching curriculum areas, there are a number of fairly standard procedures and materials (see/write practice sheets, free dictation spelling, free/say details about a story just read, free/abbreviate questions or ideas, etc.) which effectively remove procedure-imposed ceilings. However, in *other* curriculum areas and with other populations (e.g., many adult learning or corporate training programs), there is still a rich opportunity to discover procedures and design materials that *free the learner* to practice and perform at his or her own pace, and to accelerate performance as rapidly as possible. Included in such procedures is use of aggressive celeration aims on the Standard Celeration Chart, a practice encouraged by Lindsley and practiced by Kent Johnson and his associates.

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Ceilings: A framework for research and development ***(continued)***

- **Deficit-imposed ceilings**: Once you time performance and design procedures and materials that allow the learner to move at his or her own pace, and to encourage more rapid performance, component behavior deficits become obvious. This is the core of fluency-based curriculum design research and development over the last 15 years. Research topics and questions concern the identification of appropriate fluency aims for each composite and component behavior in a given curriculum area; measuring the effects of component skill fluency on composite acquisition and final performance; and identifying restrictive deficits with fluency-based assessment procedures. Johnson and Layng, Elizabeth Haughton, Binder, and others are working in this area.

- **Handicap-defined ceilings**: Some individuals seem to have deficits that resist our best efforts, sometimes due to biological constraints. In our early days working with multiply handicapped students, we were able to achieve remarkable results by building component skill rates in isolation before combining them into larger units. Unpublished work with multiply handicapped students in Canada (led by Eric Haughton) and in Massachusetts (led by Binder, Barrett, Pollard, McManus, et al) enabled students to achieve self-care, vocational, and social objectives previously thought impossible. Current practitioners at Morningside Academy, Haughton Learning Center, and Malcolm X College are working to understand, through focused assessments and practice procedures, what component skill deficits need to be eliminated for so-called "learning disabled" and "ADD" students. We found in the 70's that there were, indeed, seemingly permanent component deficits in many handicapped students. The strategy in such cases was to provide behavior prosthesis and/or to identify alternative behaviors, capable of achieving fluency and producing the same or desired consequences for the individual. This is a major area for further work on fluency in special education, occupational, physical, and language therapy – identifying the components. Some of the references from our group include:

  Binder, C.V. Precision Teaching for occupational therapists. Invited paper presented at the Winter Precision Teaching Conference, Orlando, Florida, February, 1981.

  Binder, C.V. Precision language therapy. Invited paper presented at the annual meeting of the Massachusetts Speech and Hearing Professionals, Natick, Massachusetts, May, 1981.

  Binder, C.V. & Pollard, J.E. Diagnostic assessment in a transdisciplinary framework. Invited presentation at the Winter Precision Teaching Conference, Orlando, Florida, March, 1982.

  Binder, C.V. & Haughton, E.C. Attempts to develop fluency in behavioral elements. Invited presentation at the Winter Precision Teaching Conference, Orlando, Florida, March, 1982.

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Ceilings: A framework for research and development (continued)

- **Handicap-defined ceilings** (continued):

  Pollard, J. & Binder, C.V. Diagnostic assessment for interdisciplinary programming. Presented at the Winter Precision Teaching Conference, Orlando, Florida, March, 1983.

  Imbriglio, S. (physical therapist working with Jim Pollard). Huntington's disease at mid-stage. *Clinical Management,* 1993 (not sure of month/vol.)

REAPS: Another useful framework

In the mid-1970's, Eric Haughton summarized what we then knew about fluency with the acronym R/APS = Retention/Application Performance Standards. With use of this mnemonic, he was emphasizing the need to *empirically* identify performance standards (aims) that would *ensure* retention and application of specific skills. Slightly later, when we began to recognize that fluency is also related to "endurance" or resistance to fatigue and distractibility, he expanded the acronym to REAPS = Retention-Endurance-Application Performance Standards. With this acronym, he challenged himself and his colleagues to identify *ranges* of performance frequencies that would ensure maximum effects with respect to those key outcomes. REAPS suggests a program of research for identifying levels of performance that support::

- **Retention**: Fluency seems to increase retention - the ability to perform after an extended period of not having done so. A related, but probably different effect, is that fluent performance is more likely to make contact with natural consequences so that it is maintained. A few old verbal learning studies showed that "overlearning" or practice beyond 100% accuracy, which is associated with improved retention, also produces shorter latencies in traditional paired-associate trials procedures. One of the few studies in the Precision Teaching tradition was:

  Orgel, R. (1984). Improved learning and motivation in university calculus classes. *The BehaviorTech Learning System: A training tool for modern times*. Lawrence, KS: BehaviorTech, Inc. This unpublished study conducted at Kansas University, showed that when students practiced with cards (SAFMEDS) until they could recall basic calculus facts and formulas rapidly they were able to recall nearly twice as much on a retention test scheduled six weeks later than on material where they did *not* practice for speed.

  Clearly, there is a significant opportunity to conduct research on the relationship between performance frequency, retention and/or maintenance.

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REAPS: Another useful framework (continued)

- **Endurance**: There is a relationship between endurance, or the ability to maintain a given level of performance over an extended period of continuous responding, and the beginning rate of that performance. This is one way to understand the classic problem of "attention span," and offers a way of explaining why students may have a hard time maintaining "time on task" for more than a very brief period when they are not fluent. With handicapped students in Barrett's lab classroom during the 1970's, we repeatedly saw that by shortening timed fluency practice durations, we could accelerate performanceand eliminate errors and "problem behaviors" without any additional interventions. There are quite a few unpublished studies and observations on this issue, including a portion of my doctoral dissertation. Two relevant references are:

  Binder, C., Haughton, E. and Van Eyk, D. Precision Teaching attention span. Teaching Exceptional Children, 1990, 22(3), 24-27.

  Binder, C. Endurance: What happers when it's not one minute. Presentation at the 8th International Precision Teaching Conference. San Diego, March, 1982.

  Binder, C. (1985). The effects of explicit timing and performance duration on academic performance in elementary school children. Doctoral dissertation available from the author at the address on this hand-out.

  Note: See later pages in this hand-out and the accompanying transparencies on research paradigms for free classroom-based and free operant experimental paradigms related to endurance and distractibility.

- **Application**: Haughton's inital discovery leading to frequency aims concerned application (aka transfer of training). He found that practice until component skills achieved high-rate performance allowed learners to progress smoothly toward fluencly with more complex skills . It became clear by the end of the 70's that learners could "improvise" and generate increasingly novel and flexible behavior to the extent key component skills were fluent. Haughton captured this insight in an hypothetical variable, the Og – a word-play on Lindsley's name obscurely analagous to the Erg, a unit of physical force in the metric system. Haughton reasoned that Ogs = number of different behaviors x frequencies of those behaviors. This insight corresponded to what has more recently been described as "generativity" in the selectionist jargon, a term related to the fact that when clusters of behaviors achieve high frequencies (or probabilities of response), there is a greater likelihood that they will combine in novel ways to form behaviors that will then be selected by reinforcement in the environment. We know this is true of improvisational jazz musicians, for example. Investigators including Kent Johnson, Joe Layng, Paul Andronis, and Robert Epstein have studied various aspects of this and related phenomena. Some references:

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REAPS: Another useful framework (continued)

- **Application** (continued):

Binder, C.V. The effects of response rate building on acquisition, transfer, and retention of skills. Presented at a meeting of the Behavioral Intervention Project, Arlington, Massachusetts, May, 1976. (Early work with self-help and vocational skills demonstrated that practice to build fluency on components of complex chains of behavior enabled handicapped students to acquire skills that they had previously been unable to acquire via traditional accuracy-based backward chaining procedures alone.)

Binder, C.V. Response rate measurement in a mediated transfer paradigm: teaching severely retarded students to read. Paper presented at a meeting of the Association for Behavior Analysis, Dearborn, Michigan, June, 1979. (In this study, we found that by building rates of the components of a mediated transfer paradigm, we could increase the rates of the emergent behaviors without any direct rate-building.)

Van Houten, R. Description of a study demonstrating the effects of building rate of writing answers to simple multiplication facts on the performance of long multiplication. In R. Van Houten. *Learning Through Feedback: A systematic approach for improving academic performance*. New York: Human Sciences Press, 1980, pp. 24-25. (This is one of the few published data sets, after Haughton's "Aims" article, demonstrating component/composite fluency relationships.)

Binder, C. and Bloom, C. Fluent product knowledge: Application in the financial services industry. *Performance and Instruction*, 1989, February, 17-21. (An example of where fluency in components of "knowledge" - facts about products and services learned on SAFMEDS, supported a generative repertoire for sales professionals analyzing case study business situations and applying their fluent knowledge to devise product "solutions.")

Johnson, K.R. and Layng, T.V.J. Breaking the structuralist barrier: Literacy and numeracy with fluency. *American Psychologist*, 47, 1475-1490. (In addition to what is reported in this article, Layng, Johnson and their associates have built fluency on components of study skills, problem-solving skills, and other domains which are, by ideal definition, "generative." They have emphasized that when components are fluent, each step up the hierarchy becomes easier rather than more difficult (unlike accuracy-based skill development, which becomes harder.)

Note: See citations listed on previous pages under *Aims*, as well.

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Performance Standards

Aims, performance standards, fluency standards - these terms all refer to the frequency ranges that define mastery, and support *Retention-Endurance-Application* for specific skills. This is a rich area for research, since frequency measures allow us to *precisely* quantify mastery, or competence, with objective, standard units of measurement (like grams, centimeters, liters, etc.) rather than with the traditional "dimensionless quantity" of percentage correct, which has no physical correlate in nature. The search for fluency aims or performance standards is similar to a botanical or astrophysical search, not like "social science." Competent adults can write answers to simple arithmetic problems between around 70 per minute and 110 per minute. This is a "fact of nature" that can be discovered and studied. The scope of human behavior provides a rich domain for research leading to fluency-based performance standards.

Many unpublished surveys have identified fluency standards in a variety of curriculum areas. For example, Johnson's basic skills curriculum materials contain lists of performance standards, and Elizabeth Haughton (Haughton Learning Center, Napa, CA) has created many lists of aims.

Among the *published* determinations of performance standards are:

Evans, S.S., and Evans, W.H. (1985). Frequencies that ensure skill competency. Journal of Precision Teaching, 6(2), 25-30.

In addition, a series of articles (that I have been unable to find) appeared in successive issues of the *Journal of Precision Teaching* and listed published aims for a large number of different skills/behaviors. Does anyone know which volumes they're in?

SAFMEDS

An important "preparation" for the study of fluency is timed flashcards, called "SAFMEDS" by Lindsley and his associates to help users recall how to use them (Say-All-Fast-Minute-Each-Day-Shuffled). Lindsley, Steve Graf, John Eshleman, and many others have used SAFMEDS in university classes and as research materials. One recent reference is:

McDade, C.E., Olander, C.P. SAFMEDS Design: (1990) A comparison of three protocols. Journal of Precision Teaching, 6(2), 69-73.

Graf, Lindsley, Pollard, and many others have also used SAFMEDS with various learning populations in a variety of curriculum areas. Ask them for references and ideas.

Binder has used SAFMEDS with the brand name Fluency Cards™ in corporate training programs, leveraging the relationship between fluency with the cards and fluent conversational speech, question-asking, logical operations, etc.

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Computerized fluency

The computer is an obvious medium for efficient practice, if programmers know enough to remove ceilings. A number of Precision Teaching people have created fluency-based computerized learning software over the years, including:

- **Exemplar**: Produced by a Company called BehaviorTech, started by Robert Orgel, a student of Lindsley. Incorporated a simple "artificial intelligence" component that adjusted item difficulty and speed of presentation, based on the learner's accuracy and rate of responding. No longer available. Used multiple-choice and fill-in items.

- **Precision Learning Systems**: Originally developed by Jim Cowardin and John Eshleman, later bought out by Aubrey Daniels Associates.. Automates see/type and see/select tasks, aimed mainly at corporate learners.

- **ThinkFast™**: Developed by Joe Parsons at the University of Victoria, this nifty program automates see/say SAFMEDS in a clever way, as well as more traditional fill-in-the-blank and multiple choice. Used by a number of university-based researchers.

- **Center for Individualized Instruction**: Claudia McDade, Chuck Olander, and other past or current personnel at Jacksonville State University's Center, have produced and reported on a number of different computer-assisted fluency programs.

Note: There are both pros and cons with computerized fluency programs. They are relatively easy to manage and automatically measure behavior. For that reason, they can be convenient research platforms. On the other hand, typical modes that are available (see/type, see/select) are not similar to the "real world" behavior for which they are used to prepare people. As I often say to my clients in the sales and marketing field, "sales people don't generally *type* to their customers, they *talk* with them." As voice recognition and virtual reality technology evolve, computers will become increasingly exciting platforms for building fluency and conducting research.

Combination with structured writing

One of my companies, Product Knowledge Systems, Inc., combines various types of fluency exercises with structured documentation. The idea is to support structured access to information that one need not "memorize," and fluent recall and application of that sub-set of verbal behavior one must have instantly in one's repertoire. This makes for some interesting combinations of instructional and information ergonomics considerations, and offers a context for research as well.

TO BE CONTINUED..... Ran out of time. See the overheads for more about research paradigms, and sample data.

Proposal

I think we could easily spend days sharing methods, tools, designs, data, etc. How about a full-day fluency research symposium next year before ABA?

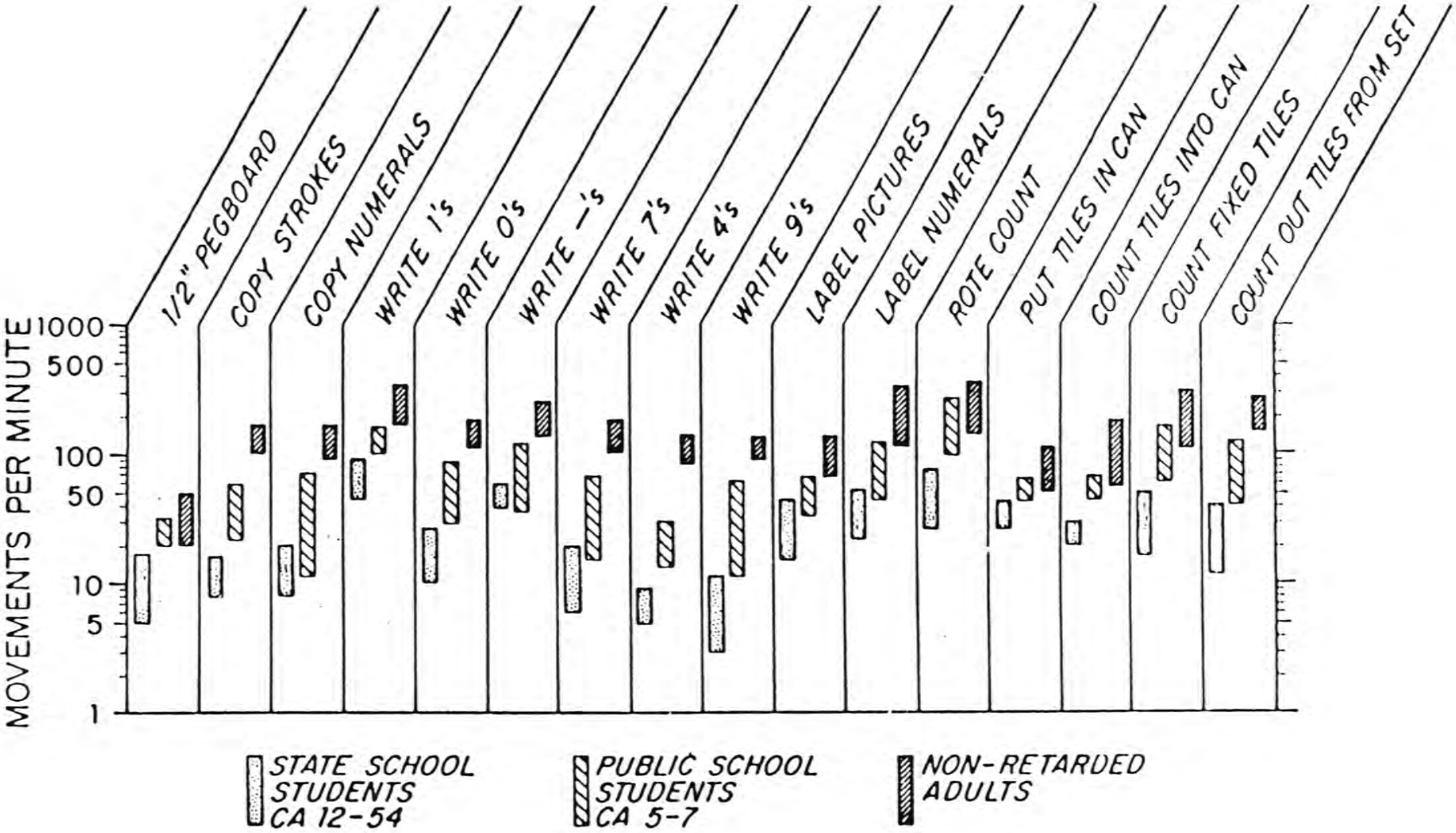
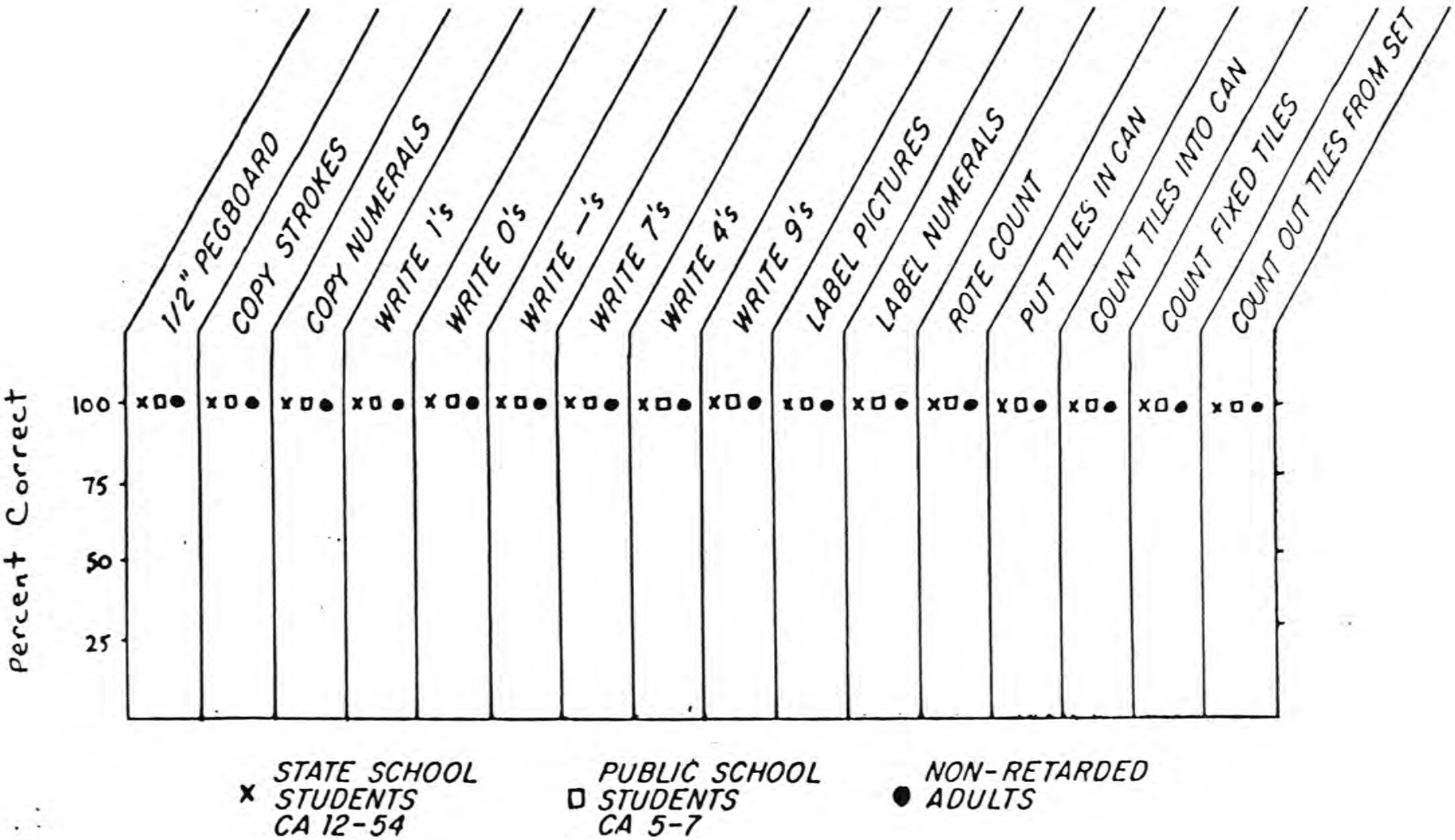


Figure 1. Frequency comparisons on some components and prerequisites of elementary skills. (Based on an unpublished pilot study conducted by Frances George and Deborah Pease)

Measurement-defined Ceiling



Accuracy comparisons on some components and prerequisites of elementary skills.
(Based on an unpublished pilot study conducted by Frances George and Deborah Pease)

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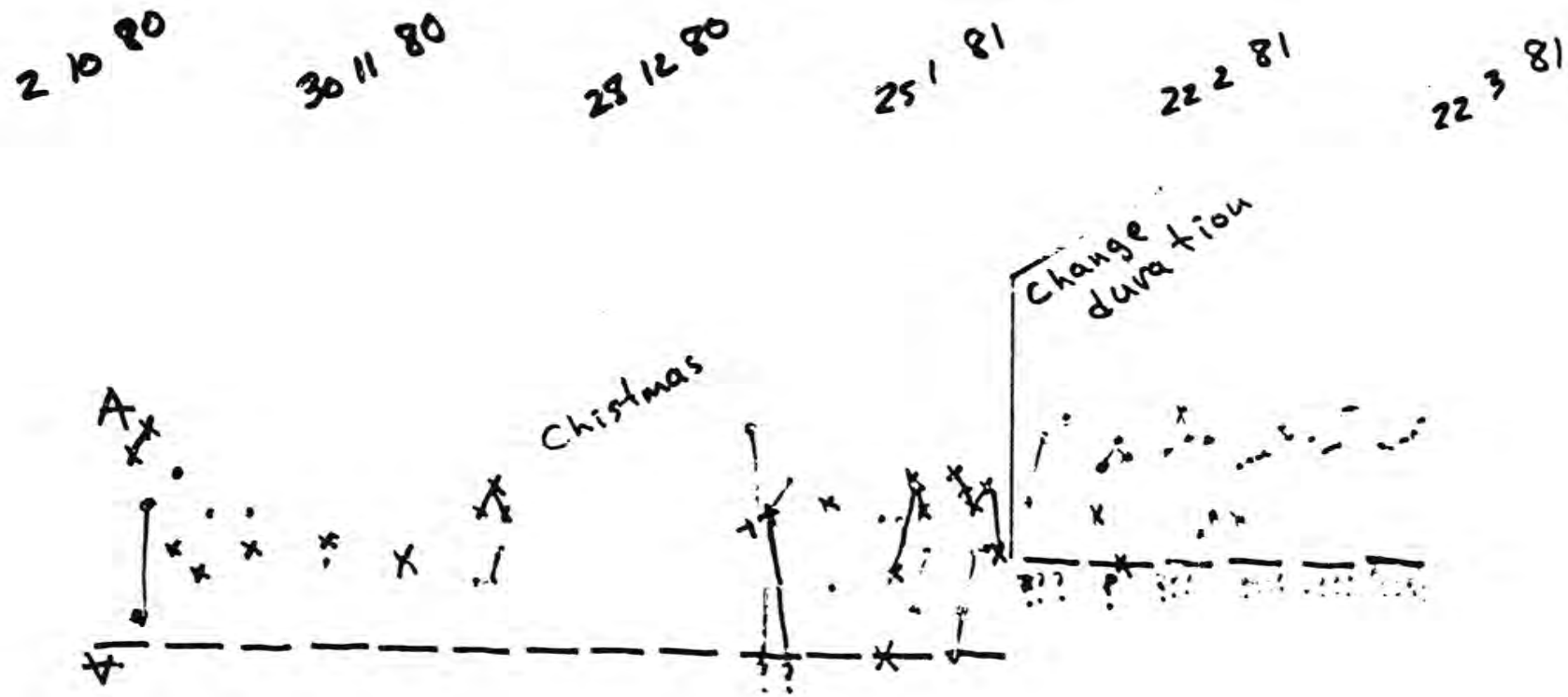
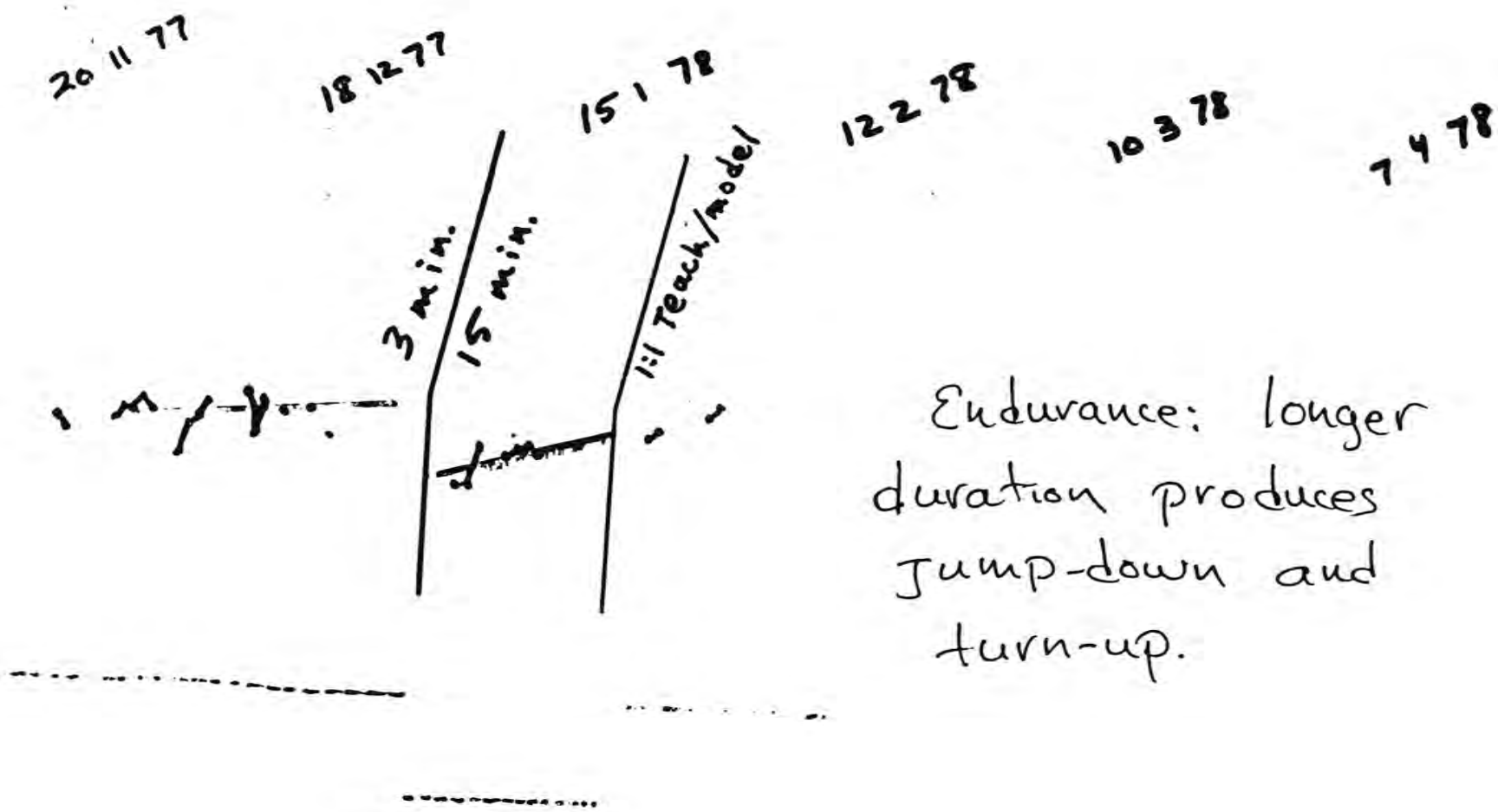
ORAL/TONGUE PERFORMANCE STANDARDS

PINPOINT	N	FLOOR	RANGE	R/E/ADS
ORAL				
THINK/OPEN·CLOSE LIPS	3	.5"	x1.8	294-166
THINK/BILATERAL SMILE·RETRACT	10	.5"	x1.7	130-78
THINK/PUCKER LIPS	9	.5"	x1.5	136-90
THINK/OPEN·CLOSE MOUTH	9	.5"	x1.9	142-74
TONGUE				
THINK/TOUCH ALVEOLAR RIDGE WITH TONGUE TIP	6	.5"	x1.8	208-116
THINK/STICK OUT TONGUE	7	.5"	x1.5	160-100
THINK/LATERALIZE TONGUE LEFT AND RIGHT	8	.5"	x1.95	176-90
THINK/SWEEP TONGUE	8	.5"	x1.86	108-58



Endurance: shorter duration reduces bounce and increases celeration.

VanDeusen	Michelle staff			Neil	9	S.H.Nudge/ Put pieces in puzzle
	Kennedy Center	staff	staff	Vacarri		



Endurance: longer duration produces jump-down and turn-up.

(2)

Barrett Binder Golante/Bourie
Behavior Dept

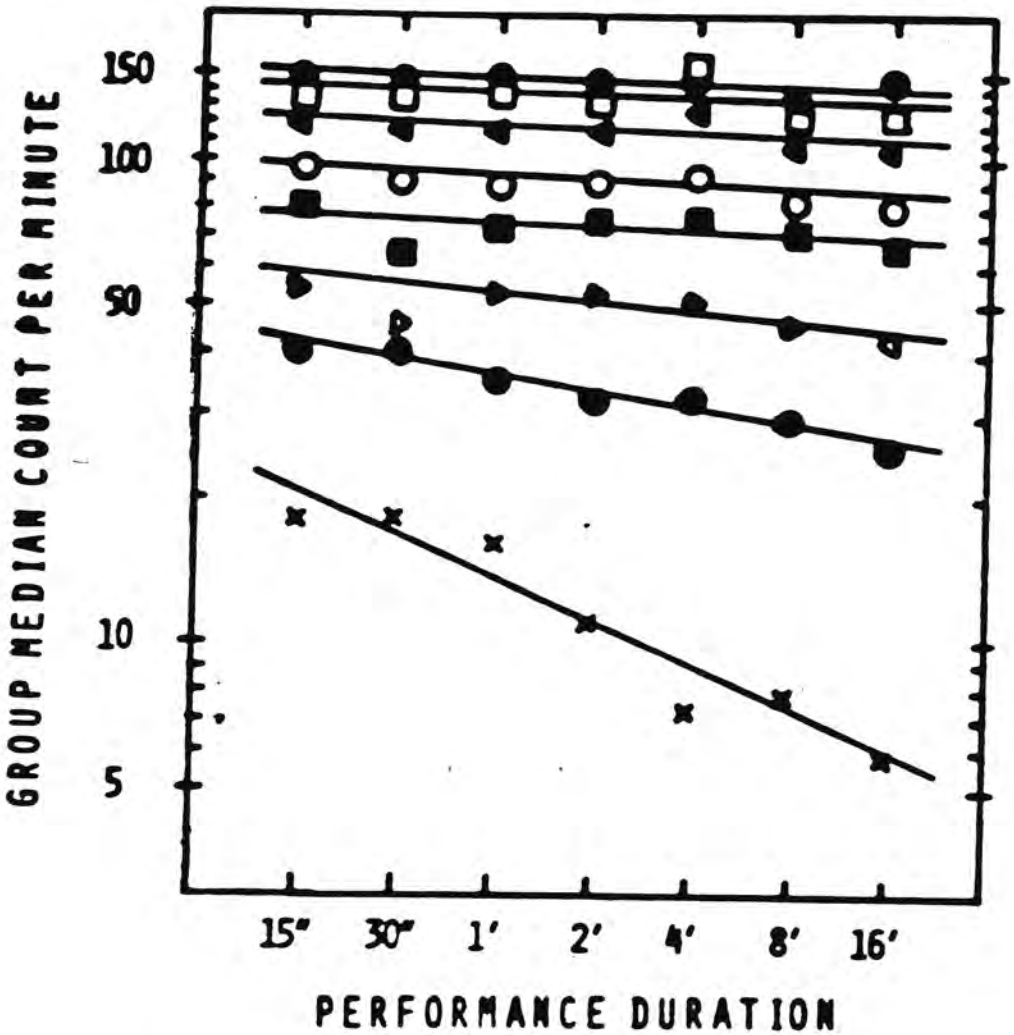
LG/CB

Paul A. 22
CB/LG

Counts beans to numeral

writing digits.

lower starting rate
= less endurance



× 0 – 20 per min., n=4
● 21 – 40 per min., n=8
▷ 41 – 60 per min., n=10
■ 61 – 80 per min., n=11
○ 81 – 100 per min., n=11
◀ 101 – 120 per min., n=14
□ 121 – 140 per min., n=10
● 141 – 180 per min., n=7

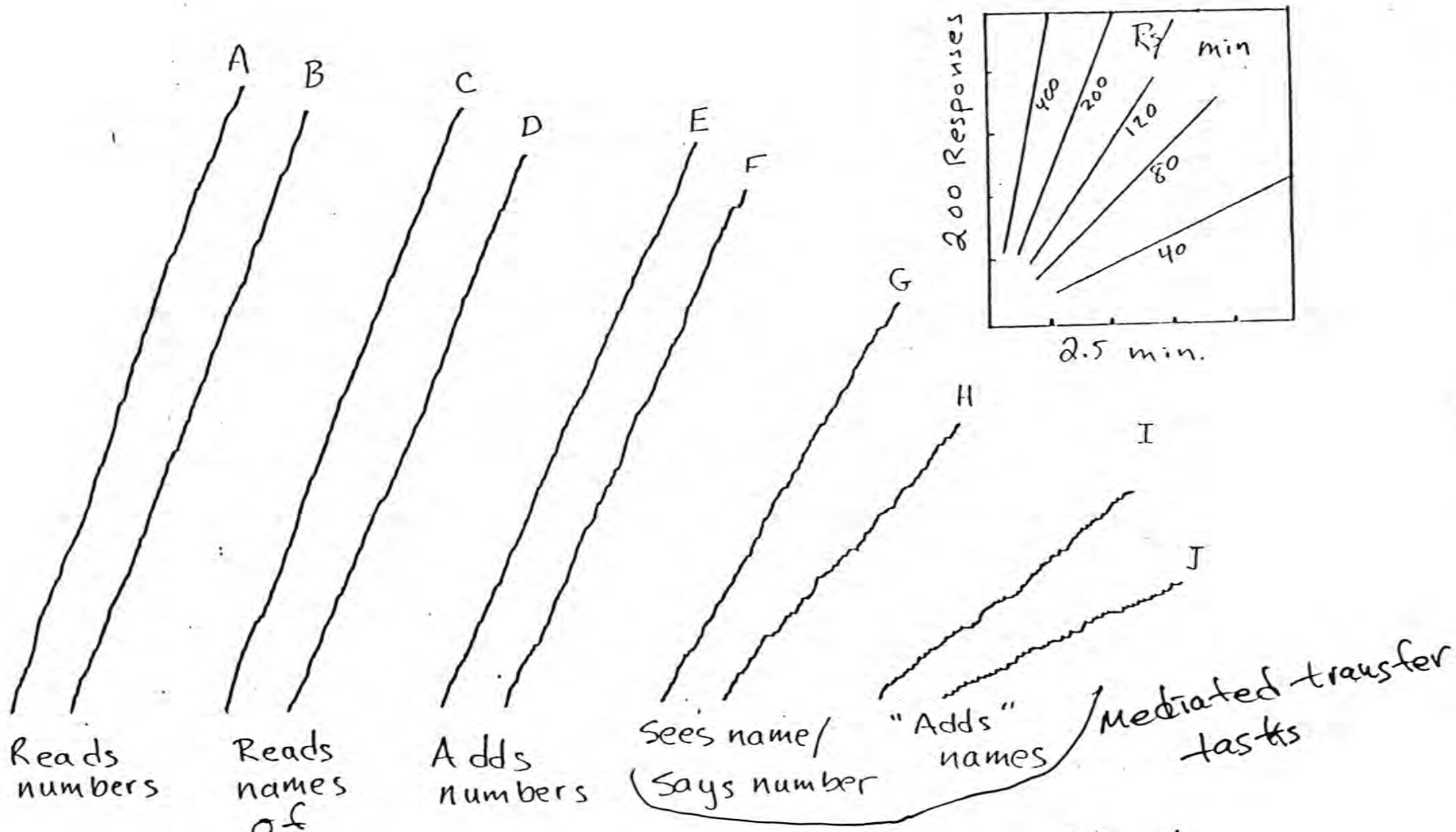

A
B
C
D
E
F
G
H
I
J
Reads numbers
Reads names of Hebrew letters
Adds numbers
Sees name/ Says number
"Adds" names
Mediated transfer tasks
Baseline without distracting audio
200 Responses
2.5 min.
min
400
200
120
80
40

Fig 1.

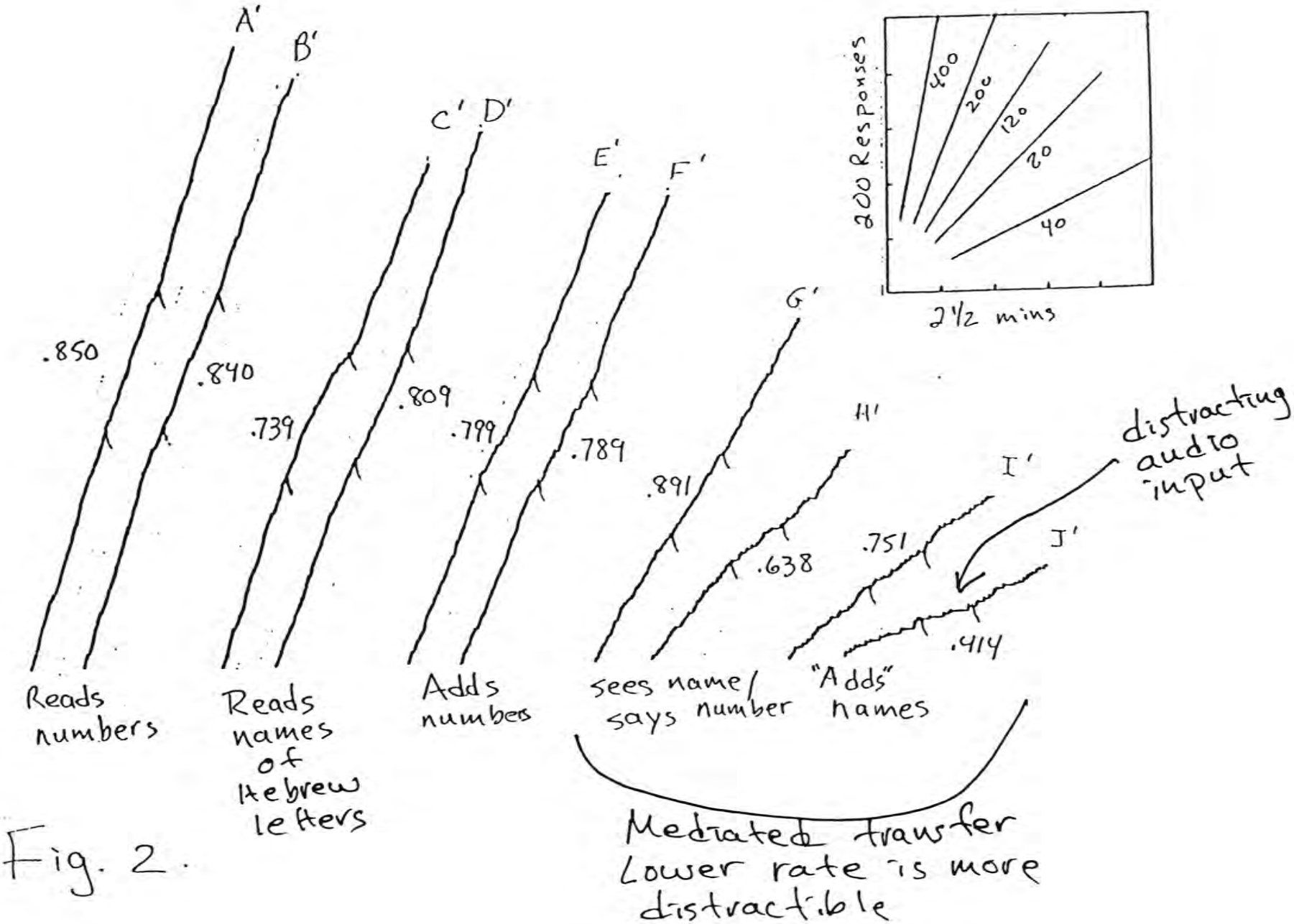

A'
B'
C'
D'
E'
F'
G'
H'
I'
J'
.850
.840
.739
.809
.799
.789
.891
.638
.751
.414
200 Responses
400
200
120
80
40
2½ mins
distracting audio input
Reads numbers
Reads names of Hebrew letters
Adds numbers
sees name/ says number
"Adds" names
Mediated transfer
Lower rate is more distractible

Fig. 2.