COMPUTER ASSISTED AUDITORY TRAINING

PRESENTED BY:

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LISTENING FOR LEARNING, LC

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Evidence exists that auditory training results in perceptual enhancements as well as neuronal changes:

Song, J., Skoe, E. Banai, K., Kraus, N., Training to improve hearing speech in noise: biological mechanisms, Cerebral Cortex 2012; 22 (5) 1180-1190.

Tremblay, K., Kraus, N., McGee, T., Ponton, C., Otis, B., Central auditory plasticity: changes in the N1-N2 complex after speech sound training, Ear & Hearing 2001; 22, 77-90.

Tremblay, K., Shahin, AJ, Picton, T,. Ross, B., Auditory training alters the physiologic detection of stimulus specific cues in humans, Clinical Neurophysiology 2009, 120: 128-135.

Krishnamurti, S., Forrester, J., Rutledge, C., Holmes, G., A case study of the changes in the speech-evoked auditory brainstem response associated with auditory training in children with auditory processing disorders, International Journal of Pediatric Otolaryngology, April 2013, v77 (4) 594-604.

Mersenich, M., Jenkins, W., Johnson, P., Schreiner, C., Miller, S., Tallal, P., Temporal processing deficits of language learning impaired children ameliorated by training, Science, 1996, Jan. 5; 271 (81-94).

Mersenich, M., Jenkins, W., Johnson, P., Schreiner, C., Miller, S., Tallal, P., Language comprehension in language-learning impaired children improved with acoustically modified speech, Science, 1996, Jan. 5; 271 (77-81).

Mersenich, M., Neural deficits in children with dyslexia ameliorated by behavioral remediation: Evidence from functional MRI, Proceedings of the National Academies of Science, March 2003, v100, #5.

Stevens, C., Fanning, J., Coch, D., Sanders, L., Nerille, H., Neural mechanisms of selective auditory attention are enhanced by computer training: Electrophysiologic evidence from language impaired and typically developing children, Brain Research V 1205 (2008) 55-99.

Gottselig, J. Brandeis, D., Hofer-Tingaly, G., Borbely, A., Achermannm P., Human central auditory plasticity associated with tone sequence learning, Journal of Learning & Memory, March 2004, 11 (2), 162-171.

Fast ForWord/Literacy programs

Scientific Learning Principles

www.scilearn.com

CAPDOTS: Central Auditory Processing Dichotic Offset Training programs

The Learning Academy

www.capdots.com

- Both programs can be done at times and locations that are convenient for students/patients
- Protocols are standardized
- Have progressive levels of difficulty
- Have reward incentives built in
- Can be monitored remotely
- Require completion of on-line training to become a provider
- Utilize padded fully aural stereo digital earphones (monitors may use earbuds or other with Y-splitter)

Fast ForWord Products

Language / Literacy Series
Elementary:
Language v2
Language to Reading v2
Secondary:
Literacy
Literacy Advanced

| Reading Series |
| --- |
| Reading Readiness |
| Reading Level 1 |
| Reading Level 2 |
| Reading Level 3 |
| Reading Level 4 |
| Reading Level 5 |

Voice onset time (VOT) requires CANS to process timing in milliseconds and to distinguish sounds based on their harmonics.

Children who are poor readers have deficiencies in the representation of consonant portions of the syllables.
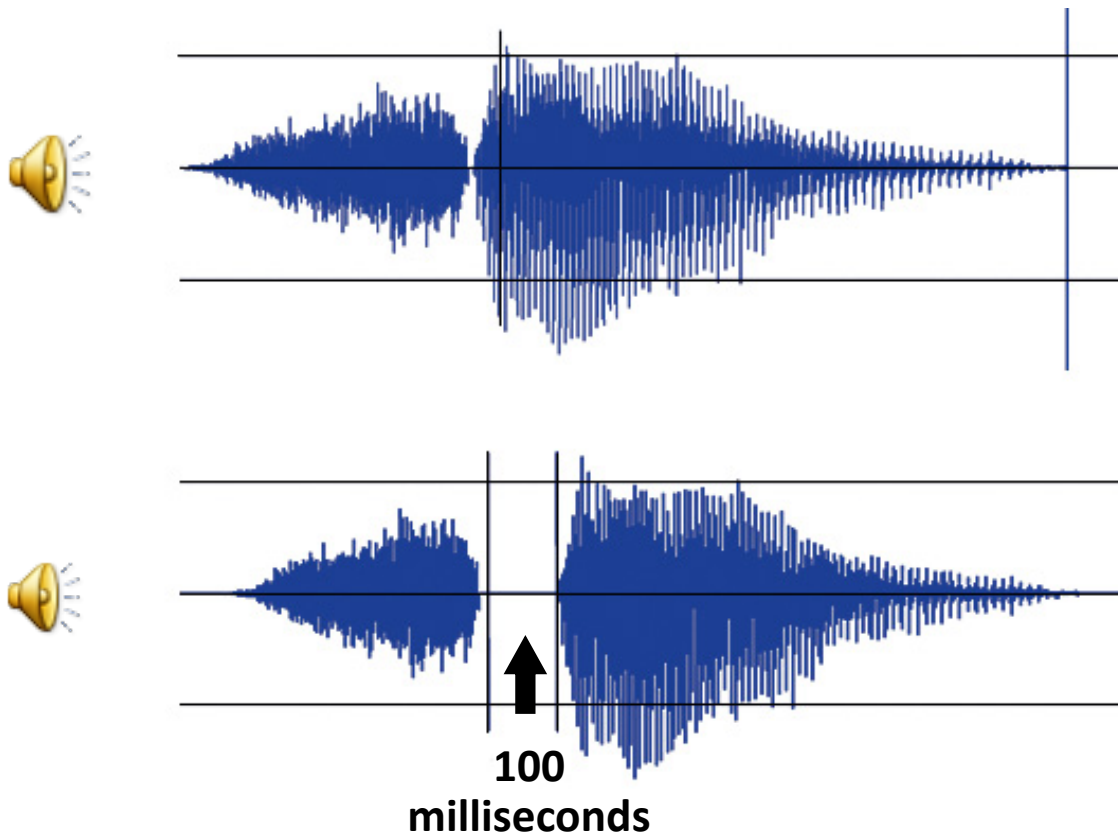
Poor readers are inconsistent in the way their nervous systems represent sound from trial to trial. (Hornickel & Kraus, Journal of Neuroscience, 2013).

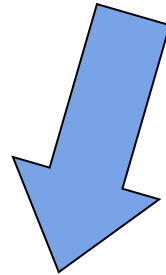# Processing Sound is a Challenge for the Brain
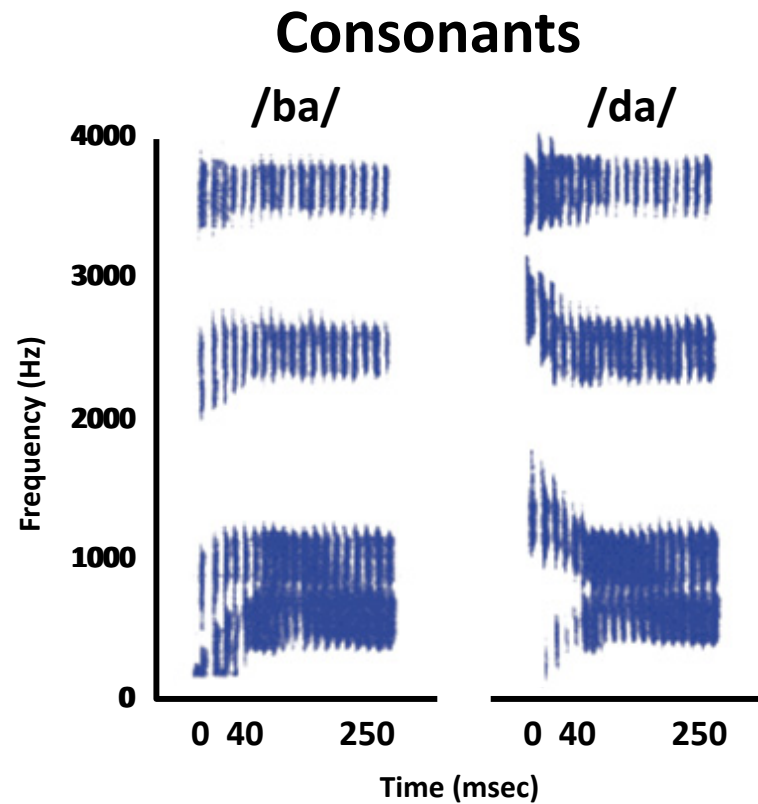
Consonants

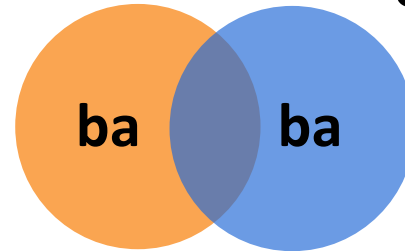# Small changes in timing…
Big changes in meaning

100
milliseconds

Acoustically Modifying a Sound Creates a "Pure" Signal

Natural sounds "overlap"

ba **ba**

ba **ba**

Fast ForWord processes sounds so that they are distinct

ba **ba**
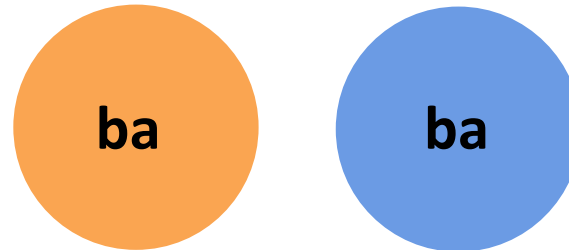
How New Technology Helps

Consonants

/ba/ /da/

Frequency (Hz)

4000
3000
2000
1000
0

0 80   250   0 80   250

Time (msec)
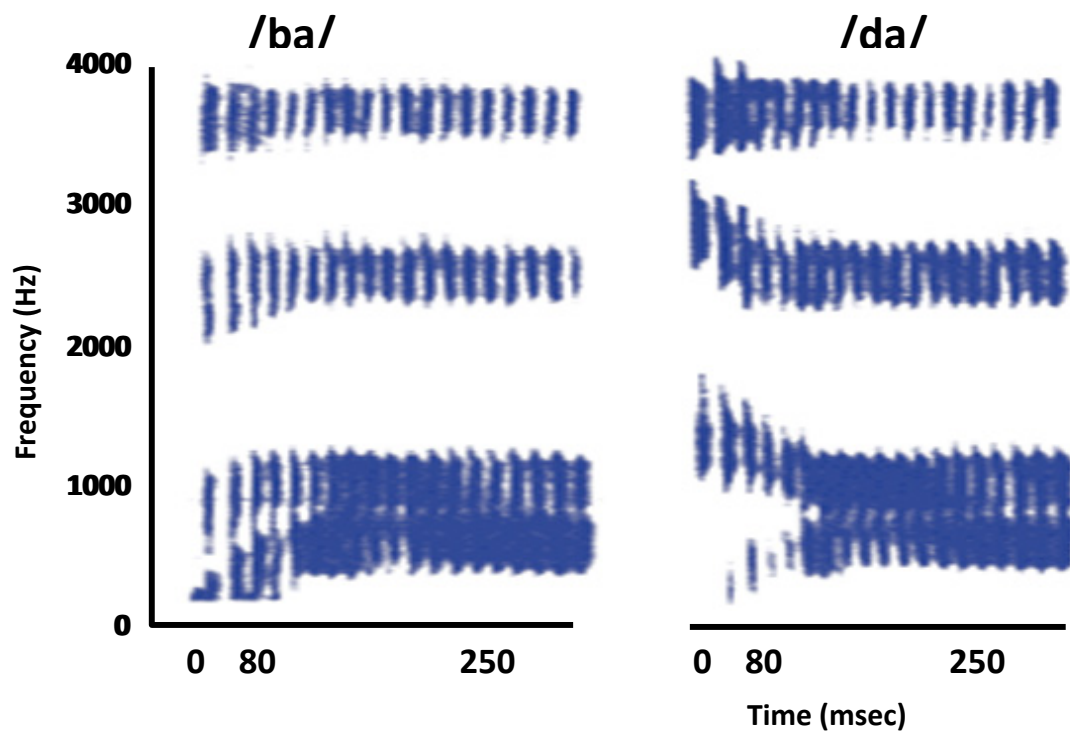
Progress Towards Natural Speech

Fast ForWord clients begin with the most acoustically modified language sounds

and progress toward more natural language
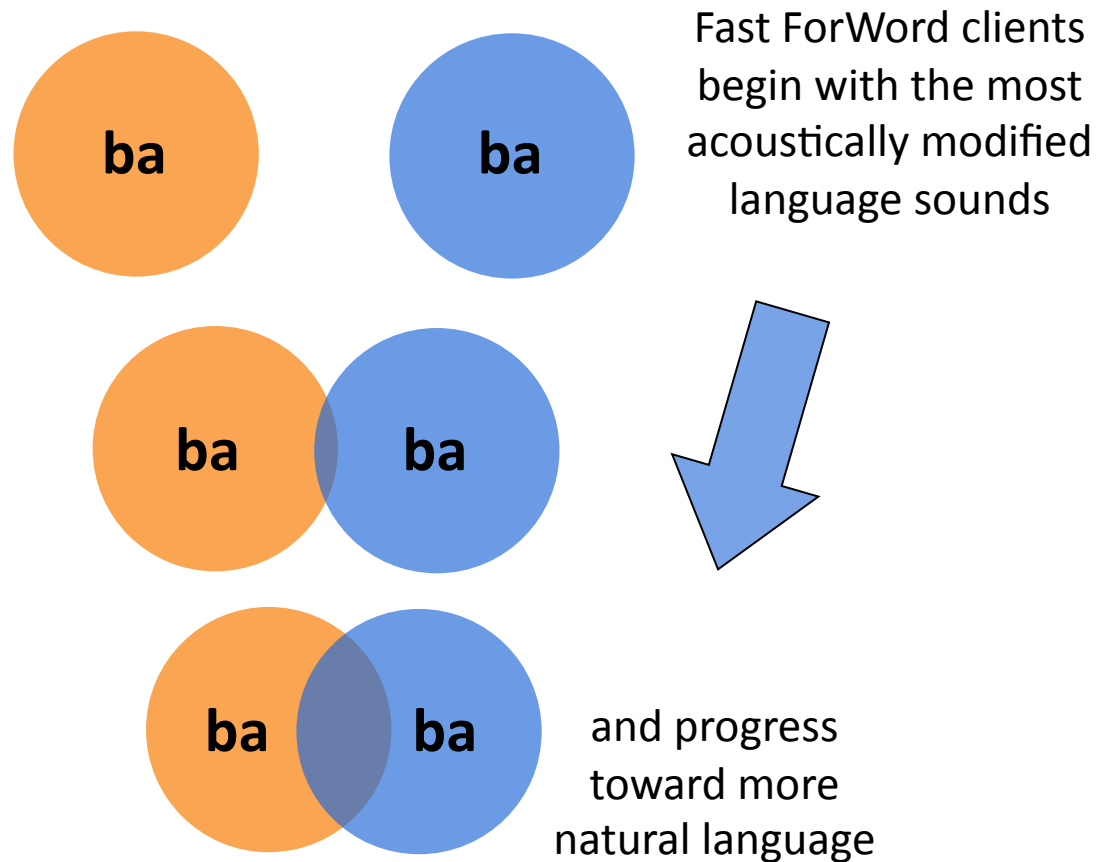
Fun Engaging Characters

Fast ForWord Language v2

Develops the following foundational learning skills:

- Listening Accuracy
- Auditory Sequencing
- Phonological Accuracy
- Phonological Fluency
- Auditory Word Recognition
- Listening Comprehension

Fast ForWord Language to Reading v2

Focuses on helping participants make the link between spoken words and reading

- Advanced Listening Accuracy
- Advanced Auditory Sequencing
- Word Analysis
- Listening Comprehension
- English Language Conventions
- Following Directions

Fast ForWord LITERACY

The LITERACY Series products build foundational reading and language skills to help clients become successful learners in the classroom.

The Fast ForWord LITERACY series is appropriate for middle and junior high school aged participants and adults.

Fast ForWord LITERACY

- **LITERACY** - moves middle and high school aged participants toward grade level reading skills, with a focus on listening accuracy, phonological awareness, and language structures

- **LITERACY Advanced** - designed to appeal to older participants while strengthening their processing efficiency so they can establish a foundation for learning

- Scientific Learning products can be performed on PC, MACs, and I-pads.
- Data is uploaded automatically when the student completes the daily exercises
- Data can be downloaded on a daily basis to monitor progress
- Generate weekly (or daily) reports to share with parents, teachers, other clinicians

Fast ForWord Language v2 software moves elementary students toward grade level reading skills, with a focus on listening accuracy, phonological awareness, and language structures.

Completely redesigned, our new LANGUAGE v2 series includes fun, engaging characters ready to motivate your students to achieve their personal best.

In addition, new built-in supportive tools help struggling students achieve success more quickly. As they build confidence, they will experience faster progress and even better results.

Our Research and Development Teams utilized outcomes from over 50,000 students to ensure these new versions would be even more effective at helping Elementary Special Education students and English Language Learners become better readers and succeed in the classroom.

And with new content and design features, the LANGUAGE v2 series **supports a Response to Intervention (RtI) approach**.

To accelerate reading progress, Fast ForWord Language v2 exercises develop critical brain processing efficiency in four key areas:

- Improves memory by having the student hold a statement or question in working memory while retrieving picture-concept associations from long-term memory.
- Improves attention by developing the ability to focus on multiple tasks and ignore distractions.
- Strengthens auditory and linguistic processing rates so that students can distinguish sounds quickly enough to discriminate individual phonemes and understand words and sentences.
- Develops sequencing skills through exercises that require the use of a logical word order to comprehend simple and complex instructions and organize a response that follows the specified sequence of actions.

7 y/o , high average IQ, VC significantly weaker than PR, poor WM, trouble with reading and phonological skills, completed FFW Language v2 (28 days) and Language to Reading (22 days). Initial testing 6/2013; post-test 2/2014;; re-eval 1/2015.

SSW: Condition: RNC RC   LC   LNC   Total # errors:

	RNC	RC	LC	LNC		
# Errors:	7	9	16	8	40	*Significant ear and order effects L/H
Norms:	2	7	12	2	22	
Post tx:	0	1	14	3	18	
1-1/2 yrs post tx:	2	1	8	5	16	*Significant L/H order effect
Norms:	2	5	7	3	16	

Phonemic Synthesis: Qualitative   Quantitative

	Qualitative	Quantitative	
Pre tx:	16	11	1 delay, 1 long delay, 1 quick,
Norm:	17	15	3 non-fused
Post:	22	22	

RGDT: normal/did not post-test   FREQUENCY PATTERNS: 2 yrs post   97% each ear

SCAN-3C:	Subtest	Standard score & %ile Pre-tx		Post tx/%		1-1/2yrs post tx	
	FW	7	(16)	10	(50)	14	(91)
	AFG+8	10	(50)	14	(91)	14	(91)
	CW-DE	9	(37)	11	(63)	9	(37)
	CS	7	(16)	9	(37)	12	(75)
	TCS	3	(1)	7	(16)	10	(50)
	COMPOSITE	92	(30)	107	(68)	117	(87)

TAPS-3:		Standard Score/%ile		Post			1-1/2 yrs post	
Word Discrimination		9	(37)				13	(84)
Phonological Segmentation		9	(37)				12	(75)
Phonological Blending		9	(37)				13	(84)
Number Memory Forward		2	(<1)	2	(<1)		7	(16)
Number Memory Reversed		9	(37)				10	(37)
Word Memory	6	(9)		6	(9)	9	(37)	
Sentence Memory		7	(16)	7	(16)		7	(16)
Auditory Comprehension		12	(75)				11	(63)
Auditory Reasoning		13	(84)				16	(98)
Composite		95	(37)				114	(83)

CAPDOTS™

- The first deficit-specific, web application specifically designed for CAPD.
- Dichotic Listening Training for binaural integration and binaural separation deficits.
- Real-world improvements in listening comprehension, attention, conversational pragmatics, academic performance, and self-confidence.

www.capdots.com

CAPDOTS™ is a product of The Listening Academy, Inc.

DICHOTIC LISTENING TRAINING

Central Auditory Processing Disorder (CAPD) is complex and presents with a variety of symptoms. Binaural integration deficits and binaural separation deficits are two of the most common CAPD diagnoses. Individuals with these deficits will benefit significantly from dichotic listening training, which has been used regularly since 1998 in clinics specializing in CAPD treatment.

CAPDOTS i

INTEGRATED

DICHOTIC <u>INTEGRATION</u> LISTENING TRAINING
for Binaural Integration or Auditory Divided Attention Deficits
using interaural time lead-lag differences.

CAPDOTS
SELECTED

DICHOTIC SELECTION LISTENING TRAINING
for Binaural Separation or Auditory Divided Selective Deficits
using interaural time lead-lag differences

CAPDOTS

CAPDOTS™

CAPDOTS™ is an online therapy system for CAPD that allows the audiologist or speech-language pathologist to select the most appropriate dichotic listening training module for their clients.

2 MODULES TO CHOOSE FROM:

CAPDOTS i™ INTEGRATED

- Used to treat binaural integration deficits identified by failure of tests such as Dichotic Digits, Competing Words, and Staggered Spondiac Word Test.

- Employs a staggered approach by presenting dichotic stimuli at the same intensity level but with staggered timing onsets.

- Progressive training stages reduce the time lead/lag differences until the dichotic stimuli are presented simultaneously at the most advanced levels.

CAPDOTS s™ SELECTED

- Used to treat binaural separation deficits identified by failure of tests such as Competing Sentences.

- Dichotic sentences are presented simultaneously with focus on a prescribed target ear.

- Progressive training stages increase the challenge by adjusting timing and contrast levels.

- Lessons contain stories that are interesting and engaging, using appropriate language and vocabulary.

AGE APPROPRIATE TRAINING

CAPDOTS-INTEGRATED™ and CAPDOTS-SELECTED™ are available in three age ranges:

- Junior (5 – 8 years)
- Adolescent (9 – 13 years)
- Adult (14 years and older)

Animated progress trackers help motivate CAPDOTS™ clients through the program.

HEARING-IMPAIRED AND HEARING AID USERS

CAPDOTS™ is uniquely able to train those with a hearing loss, hearing aids users, and older adults. To use CAPDOTS™ with these clients, set the Program to comfortable loudness levels or access their hearing aid amplification settings using Bluetooth technology.
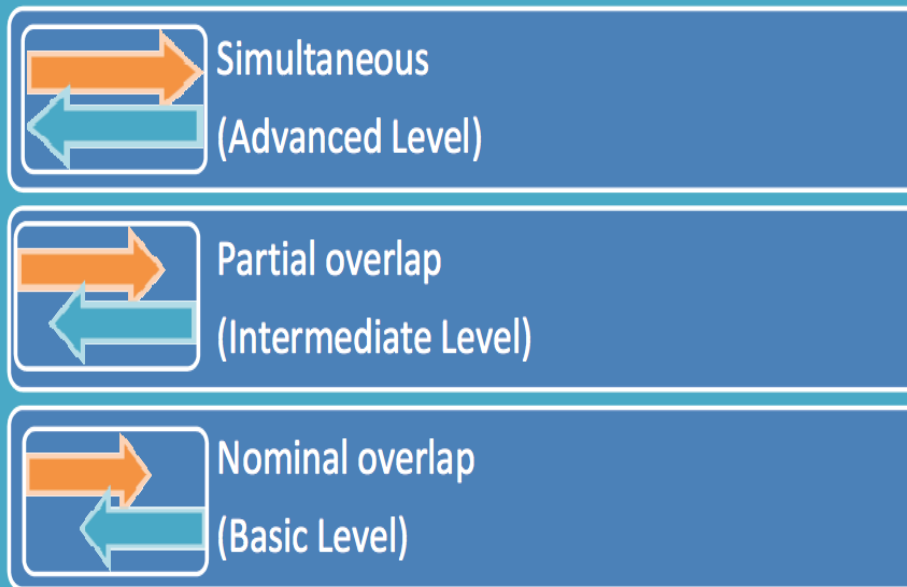
Schematic of increasing levels of difficulty by decreasing time lead-lag differences of dichotic stimuli in CAPDOTS-I.

Identifying Suitable Candidates
AUDIOLOGICAL CRITERIA
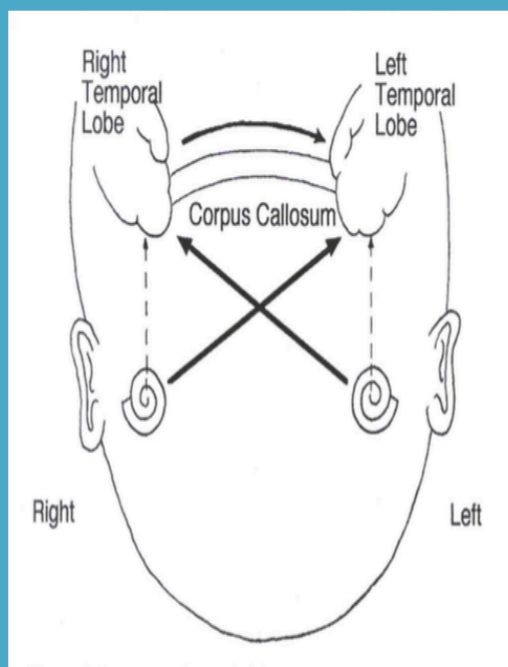
- Inter-aural asymmetry on dichotic tasks
- Linguistic labeling difficulty on temporal patterning
- SSW Type-A/Integration (Left-Competing)
- Hemisphere or Ear Effects asymmetrical on AMLR

CAPDOTS

CAPDOTS FEATURES

Web-based program, available only SLP/Auds

On or off-site work with assistant/parent

5 days per week, 20 min per day = 12 weeks

Rigorous, standardized protocol

Motivation and incentives

Remote participation and performance monitoring

Can be used on both LE and RE deficits.

Independent of loudness, usable with hearing loss

COMPUTER-BASED AUDITORY TRAINING:

allows for frequent (daily) training

is convenient for patient and clinician

increases likelihood of completion

is efficient by limiting time, effort and financial investment

is effective due to neuro-plasticity changes resulting from frequent training

is accessible from home or school

CAPDOTS

CAPDOTS HAS BEEN SUCCESSFULLY USED ON:

Learning Disabilities

Dyslexia

Autism

Gifted Twice-Exceptional

Language-Delay

Cognitive Impairment

Head Injuries

Hearing Loss

CAPDOTS

AUDITORY TRAINING USING CAPDOTS™

- Lau, C., April 2012, First Global Conference on CAPD, AAA Audiology Now, Boston, MA

- 45 normal hearing subjects, 17 females and 28 males

- Average age = 9.11 years, age range = 6.9 yrs to 18.3 yrs.

- Diagnosed CAPD with binaural integration deficits

- Completed CAPDOTS-Integrated (ranging 12 – 16 weeks)

- Results show very significant improvement ($p<0.001$) for dichotic words, dichotic digits, compressed speech perception.

- Also significant improvement ($p < 0.05$) for auditory figure-ground perception.

CAPDOTS™

"My family and friends have noticed a **huge improvement** in J. He had an **excellent school report** last year and I find that he is **relating more**, makes surprising **connections**, able to **multitask**. He is more **social**, **engages** and interacts with other children. He is also **working quicker** and with more **independence**. There are no (more) problems with **attention or focus**." *(Mother, JD, male, 10.1yrs)*

CAPDOTS™

3 subjects, each with head injury, tinnitus, and auditory processing complaints. Completed TRT with hearing aid/masker before completing CAPDOTS 30 minutes daily, 5 days per week, for 10 weeks. All reported self-perceived improvements on a post therapy questionnaire.

38 y/o male; construction worker – injured on job; TBI; slight to moderate high frequency loss:

	4/2014	12/2014	
SCAN-3 AFG	8	10	
SCAN-3 CW-FR	5	12	
Filtered NU-6			
Right	80%	92%	
Left	64%	78%	(norm=90%>)

63 y/o female; slight to moderate 4k-8k Hz loss and hearing aids; concussion; moderate sound intolerance.

DICHOTIC DIGITS	7/2011	10/2012	
Right	45%	92.5%	
Left	70%	97.5%	(norm=90%>)

60 y/o female; MVA; slight presbycusic sloping to moderate loss and hearing aids.

	4/2013	1/2014	
SCAN-3/FW	1	11	
SCAN-3/AFG	1	6	
SCAN-3/CW	1	12	
SCAN-3/CS	4	9	
Dichotic Digits			
Right	67.5%	100%	
Left	62.5%	100%	(norm=90%>)

CAPDOTS i
INTEGRATED

Suite 304 – 650 West 41st Ave
Oakridge Centre, South Tower
Vancouver, BC Canada V5Z 2M9

Email: info@capdots.com
Phone: 778-891-0037

LISTEN · PROCESS · UNDERSTAND

- CAPDOTS can be used on a PC or Mac
- Data is uploaded daily after completion of exercise
- Data can be downloaded daily for review
- Uses a variety of stimuli including digits, words, syllables, and rhymes
- Generates progress reports

HearBuilder programs (www.hearbuilder.com)

4 programs: phonemic awareness
              sequencing
              following directions
              memory

For pre-kindergarten thru 8th grade

LACE (Listening and Communication Enhancement) (www.neurotone.com)

Designed as aural rehab for adult hearing aid users

20 training sessions, 30 minutes each, 5 days/week

    Dichotic listening exercises
    Speech in noise activities
    Speed of processing/time-compressed speech
    Missing word and target word exercises

EAROBICS (www.earobics.com)

Foundations: Pre-K to 1st; Connections: 2nd, 3rd, and struggling readers

Phonemic awareness, phonics, vocabulary (blending, rhyming, segmenting, phoneme
    identification, phoneme manipulation), auditory memory, and listening skills

BRAIN FITNESS (www.brainhq.com)

Developed by originators of Fast ForWord for older adults

Auditory memory, phoneme identification, rhythm, speed of processing

Thank you for listening