

Clark-Katz Auditory Training

Multimedia Computer-Assisted Auditory-Phonemic Assessment and Training for Cochlear Implant Users: C-KATZ (Clark-Katz Auditory Training Series)

Abstract

Cochlear implant and hearing aid users may benefit from phonemic-level discrimination practice but past training methods have been problematic. A CD-ROM program has been developed at NTID which assesses and then adaptively drills persons with hearing loss on errors in speech feature perception. Exercises include Katz phonetic synthesis and decoding techniques.

C-KATZ rationale

- Other analytic AT methods may not engage higher level, auditory-memory processes used for word recognition. Katz training uses auditory memory to assemble phonemes and syllables into words.
- May result in more fluent word-recognition.

Some questions to be answered

1. What phonetic features are available to the individual CI / Hearing Aid user?
2. Can phoneme listening training:
 - a) increase the number of discriminable features,
 - b) improve % correct performance, and/or
 - c) result in self-perceived gain for receptive communication?
3. What are the relationships between speech feature reception, phonetic synthesis, and word recognition?

Computer assistance enables auditory training by:

- Providing practical and motivating means for the necessary, intensive drill and practice,
- Providing controlled listening conditions for research,
- Providing practical means for multiple talkers and presentations to enhance generality of training results.

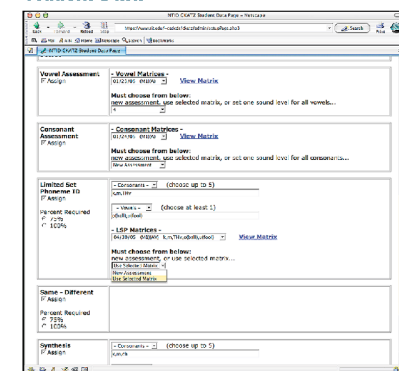
Program Features

Web-based registration and data storage

The instructor has the following registration options:

- Training Condition (headphones, CI, HA)
- Modality (auditory, audio/visual, visual)
- Warm Up
- Consonant and Vowel Assessment
- Lessons
- Passing criterion

Student Data



Each assignment is tailored to the students' needs.

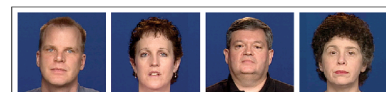


CI user listens and identifies speech sounds presented by male speaker.

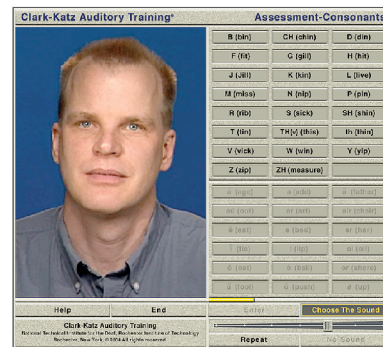
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Assessment

- Vowel - Consonant Discrimination
- Warm Up - Familiarization Activity
- Pronunciation Guides
- Multiple-Choice Format (all phonemes are clickable options)
- Can set individual item preferred listening levels
- Results are plotted as confusion matrix with category performance % correct
- Can select one of two male/female talkers



Auditory and visual training stimuli are produced by experienced speech and hearing models.



Consonant Confusion Matrix

Responses	p	t	k	b	d	g	f	h	s	z	ʃ	ʒ	θ	ð	h	r	m	n	
p	1																		
t		1																	
k			1																
b				1															
d					1														
g						1													
f							1												
h								1											
s									1										
z										1									
ʃ											1								
ʒ												1							
θ													1						
ð														1					
h															1				
r																1			
m																	1		
n																		1	

Vowel Confusion Matrix

Responses	ā	ē	ī	ō	u	ā	ē	ī	ō	u	ā	ē	ī	ō	u					
ā	1																			
ē		1																		
ī			1																	
ō				1																
u					1															
ā						1														
ē							1													
ī								1												
ō									1											
u										1										
ā											1									
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ī													1							
ō														1						
u															1					
ā																1				
ē																	1			
ī																		1		
ō																			1	
u																				1

Consonant Category Score

Manner	Category	Score
glide	w, y	87.5%
semivowel	l, r	20.0%
nasal	m, n	14.3%
stop	p, b, t, d, k, g	21.1%
fricative	f, v, th, th(v), s, z, sh, ʃ(ʒ)	14.8%
affricate	h, ch	40.0%
voiced	w, y, l, r, m, n, b, d, g, v, th(v), z, g	31.0%
voiceless	p, t, k, f, th, s, h	4.3%
Place		
labial	w, m, p, b	46.2%
labiodental	f, v	0.0%
dental	th, th(v)	0.0%
alveolar	l, n, t, d, s, z	9.5%
palatal	sh, y, r	70.0%
velar	k, g	16.7%
glottal	h	0.0%

Impressions of Assessment

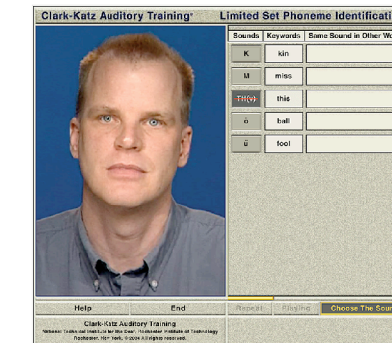
- Confusion Matrix and Category Scales provide a diagnostic analysis of the students' perception of consonant and vowel features.
- Confusions among speech sounds and areas of training are identified.
- 2 repetitions of each phoneme is practical, and efficient use of time.
- Clients enjoy the testing experience as two, one-hour sessions.

Lessons

Limited Set Phoneme Identification

Purpose

Confirm and expand phoneme recognition by practice. The instructor selects items based on the assessment results. Up to 6 sounds can be evaluated. Typically, a combination of vowels and consonants are utilized. These speech sounds will be used later in the Phonemic Synthesis Lesson.



If passing criteria is not met for two or more of sounds, the Same/Different Lesson is activated.

If passing criteria for Same/Different is met, student returns to Limited Set Phoneme Identification Lesson. If not, sound is eliminated from lessons 3 and 4.

Impressions of Limited Set Phoneme Identification Lesson

- Multiple choice response format can be easy or difficult depending on phonetic similarity of response choices.
- Response choices in a given training set should be a mix of confused items with one phonetic feature difference with those that have several differences.
- Success and challenging items keep it interesting.
- If client does not meet critical, then goes to Same/Different.

Synthesis

Purpose

Builds auditory memory for word recognition and use of pronunciation symbols. Consonants and vowels from the Limited Set Lesson are presented sequentially. The student then identifies the correct sequence of phonemes and creates the target English word.



Impressions of Phonemic Synthesis Lesson

- More word response alternatives are needed
- Selection of phonemes greatly influences the number of words available
- May need to train with nonsense syllables.

Same/Different

Purpose

Differentiate speech sounds confused in the Limited Set Phoneme Identification Lesson. Two phonemes are paired, and student responds *same* or *different*.



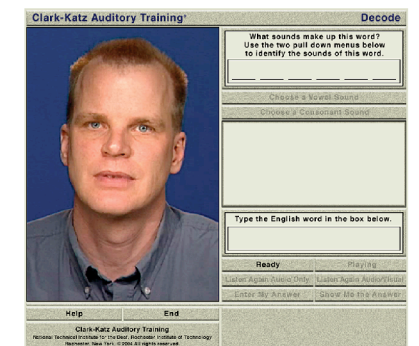
Impressions of Same/Different Lesson

- Need for same/different training depends on difficulty of Limited Set response alternatives.
- Watch for highly individualized, unexpected responses.

Decode

Purpose

Builds word recognition, auditory memory, and phonetic transcription skills. Listen to an English word, and identify the consonants and vowels that make up the word. The lesson is under development.



C-Katz Summary

C-Katz, a new auditory training program, is designed to not only improve feature discrimination, but to improve word recognition fluency by improvement of sequential memory processing for phonemes. Preliminary data indicates that the program has the potential to provide a computerized listening program for deaf and hard of hearing individuals.