Computerized Administration and Scoring of the Dichotic Nonsense Syllable Test

Conrad Lundeen, PhD
West Virginia University
Dichotic Listening Tasks

- Present verbal stimuli simultaneously (or nearly so) to the two ears
- Listeners identify the signals presented to both ears
Use

• Evaluating CANS function in:
  – central nervous system pathology (Kimura, 1961; and others)
  – auditory processing deficits (ASHA, 2005)
Problems: Administration

• Listeners often demonstrate difficulty maintaining attention and providing appropriate responses in a timely fashion.

• Administrator must:
  – stop the recording
  – re-instruct
  – back-up recording
  – repeat presentation
  – etc.
Problems: Manual Scoring

- Listeners either mark their responses on an answer sheet or make verbal responses which are recorded manually by the audiologist administering the test.
- Scoring = tabulate # correct using a key
  - time consuming
  - ERRORS!
Computer Assistance to Reduce Problems

1) administer test in a user-controlled, self-paced sequence
2) easy-to-use response interface
3) verify appropriate responses
4) score responses automatically
5) information stored in format = easy to analyze and archive
Dichotic Nonsense Syllable Test (DNST)

- Berlin, Lowe-Bell, Cullen, Thompson, & Loovis, 1973
- Sensitive to temporal lobe lesions (e.g., Olsen, 1983)
- Cumbersome administration and scoring has limited clinical application
Computer Program Development

• Visual Basic.Net (Microsoft, 2005)
• Compatible with any reasonably current Windows© operating system
  – Windows 2005
  – Windows XP
  – Windows Vista (?)
• Should run on most pc computers equipped with a sound card
Computer Program Development

- C:Program Files\WVU\Dichotic Test
- C:Program Files\WVU\Dichotic Test\Patient Files = patient data
- “Dichotic Test” shortcut in Programs
Main Form
Main Form

- 1000 Hz calibration tone playback
  - loops continuously until interrupted
Main Form

- Practice test
  - 4 stimulus pairs
  - Instructions guiding listener to make appropriate responses
  - Results are not saved
You will hear two of the sounds listed below at the same time, one in one ear and one in the other. Make your best guess of what you hear. You MUST select two sounds.

Responses:
Pa  Ta  Ka  Ba  Da  Ga

Play First Sound
Many Listeners find it hard to hear both or even one sound. That's OK. If you guess you will probably guess right.

Select Two
Good! Try again. Remember, if you guess you will probably guess right.

Select Two
• Select dichotic test
  - loads stimuli into sound buffers
  - opens response form for the listener
  - Prompt: enter file name for storing results
Stimuli

• *Tonal and Speech Materials for Auditory Perceptual Assessment, Disc 1.0*
  – (Noffsinger, Wilson, & Musiek, 1994)

• 30 WAV files for all stimulus pairs
  – Richard Wilson, PhD
  – precise timing of stimulus presentation
<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Type</th>
<th>Date Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>EoDa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>DoSa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>DoKa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>BaPa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>FaTa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>DaBa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>DoKa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>DoTa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>GoBa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>GoKa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>GoPa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>GoTa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>KoBa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>KoKa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>KoPa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>KoTa</td>
<td>64 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>PoBa</td>
<td>60 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>PoKa</td>
<td>60 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>PoPa</td>
<td>60 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>PoTa</td>
<td>60 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>FaTa</td>
<td>68 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>TaBa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>TaSa</td>
<td>66 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>TaKa</td>
<td>64 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>TaPa</td>
<td>64 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>TaTa</td>
<td>64 KB</td>
<td>WAVE Audio File</td>
<td>10/17/2006 1:50 PM</td>
</tr>
<tr>
<td>track01 Cal tone</td>
<td>5,463 KB</td>
<td>WAVE Audio File</td>
<td>8/7/2003 1:55 PM</td>
</tr>
<tr>
<td>Track:01</td>
<td>2,927 KB</td>
<td>WAVE Audio File</td>
<td>8/12/2004 12:17 PM</td>
</tr>
</tbody>
</table>
Response Form

• Check boxes for all response alternatives
• “Start” button to initiate the test
• Instructions after dichotic presentation:
  – check 2 response boxes corresponding to the stimuli heard
• Prompts:
  – 2 & ONLY 2 response boxes are checked
Response Form

• Once appropriate responses are selected, the user clicks:

Play Next Sound
– records responses
– initiates presentation of next stimulus pair
Select Two
Select One More
Too Many Selected
Responses

Pa  Ta  Ka  Ba  Da  Ga

Play Next Sound
End Form

- Scores results
- Stores in a text file named by the user
  - Column delimited
  - Easy to import to (Excel) spreadsheet
- Administrator prompt:
  - end testing, or
  - continue with additional testing
### Results: Column Delimited Text

<table>
<thead>
<tr>
<th>Key Ch 1</th>
<th>Key Ch 2</th>
<th>Resp 1</th>
<th>Resp 2</th>
<th>Score Ch 1</th>
<th>Score Ch 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ka</td>
<td>Ta</td>
<td>Ka</td>
<td>Ba</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Pa</td>
<td>Ba</td>
<td>Pa</td>
<td>Ta</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ba</td>
<td>Pa</td>
<td>Pa</td>
<td>Ka</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ba</td>
<td>Ga</td>
<td>Da</td>
<td>Ga</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ga</td>
<td>Ba</td>
<td>Ta</td>
<td>Ka</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ta</td>
<td>Da</td>
<td>Ka</td>
<td>Da</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pa</td>
<td>Ga</td>
<td>Ta</td>
<td>Da</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ta</td>
<td>Pa</td>
<td>Ka</td>
<td>Ta</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ga</td>
<td>Pa</td>
<td>Ka</td>
<td>Ga</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ka</td>
<td>Ga</td>
<td>Ta</td>
<td>Da</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Da</td>
<td>Pa</td>
<td>Ta</td>
<td>Da</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Da</td>
<td>Ga</td>
<td>Ta</td>
<td>Da</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ga</td>
<td>Pa</td>
<td>Ka</td>
<td>Ta</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ta</td>
<td>Ga</td>
<td>Ta</td>
<td>Da</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ta</td>
<td>Ba</td>
<td>Pa</td>
<td>Ga</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pa</td>
<td>Ba</td>
<td>Ta</td>
<td>Ka</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ba</td>
<td>Da</td>
<td>Da</td>
<td>Ga</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ta</td>
<td>Ga</td>
<td>Pa</td>
<td>Ka</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ta</td>
<td>Pa</td>
<td>Ka</td>
<td>Da</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Totals:** 17 19

**Averages:** 56.7% 63.3%
Easy to Open in Excel

![Microsoft Excel Spreadsheet](image-url)
Preliminary Results = Ballpark

![Bar graph showing right ear and left ear results with the right ear having a higher value than the left ear.](image-url)
Conclusion

• The author will be pleased to share the Beta version of this software with interested ASHA Convention attendees, and employ there experiences in further refinement of the software.
Typical Hardware Setup

• Administrator’s (laptop) computer
• Connected to an external monitor and mouse used by the listener
• Computer sound output routed through audiometer
Typical Hardware Setup

Patient

Audiolologist

Audiometer
References


