The Beginner’s Intelligibility Test (BIT)

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Introduction
The Beginner’s Intelligibility Test (Osberger et al., 1994) is a research instrument developed at Indiana University School of Medicine to assess the speech intelligibility of young children with cochlear implants using a transcription (write-down) procedure. Although transcription procedures are considered to have higher face validity than rating procedures for the assessment of speech intelligibility (Metz et al., 1980) and are considered relatively insensitive to contamination by degraded vocal quality, these write-down procedures are also more time-consuming and labor-intensive than rating procedures. Moreover, as designed and administered at Indiana University School of Medicine, the BIT requires three naïve listeners as auditors. Thus, the Beginner’s Intelligibility Test may be more appropriate for use in research than for individual assessment. The standard reference citation for the Beginner’s Intelligibility Test is Osberger et al. (1994), listed below in the References. Questions regarding the Beginner’s Intelligibility Test may be directed to the DeVault Otologic Research Laboratory (devinfo@iupui.edu).

Materials
Each administration of the BIT involves one 10-sentence list, and there are four separate lists. Sentences contain words familiar to children and are syntactically simple; all words are 1 or 2 syllables long. Each sentence contains between 2 and 6 words (mean = 3.8 words) and between 3 and 7 syllables (mean = 4.5 syllables). Lists contain from 37 to 40 words (mean = 38.3 words) as follows: List 1: 38 words, List 2: 40 words, List 3: 38 words, List 4: 37 words.

Procedures
As administered at Indiana University School of Medicine, the BIT involves four major components: (1) production elicitation and recording, (2) digitization and editing, (3) playback for listener judges, and (4) scoring.

Production Elicitation and Recording: The BIT uses pictures and objects to convey the target sentence, but the task is primarily imitation repetition in response to an examiner’s live-voice model. The entire elicitation session is audio-recorded. At Indiana University School of Medicine, a Marantz PMD430 cassette recorder was used in the past, with subsequent digitization and editing. Currently, recording is accomplished with a Marantz PMD670 solid-state recorder, which directly digitizes to a compact flash card.

Digitization and Editing: Recordings of production sessions must be edited to remove the examiner’s models and any extraneous signals. If productions have been captured using analog equipment, sessions must first be digitized; if productions have been captured using digital equipment, analog-to-digital conversion can be skipped.

Session signals are edited digitally to save only the child’s productions of the 10 sentences. Files of the 10 sentences are then interspersed with stimulus cues to create stimulus files for auditing by listener judges. At Indiana University School of
Medicine, each sentence is played twice for listener judges, according to the following schema:

“Number X, ready”
[Sentence X]
“Number X again, ready”
[Sentence X]

The ISI from the end of Sentence X to the following cue is 4 seconds.

*Playback for Listeners:* The speech production of each child is audited by 3 listener judges. In current studies at Indiana University School of Medicine, inclusion criteria for listener judges are: (1) age between 18 and 40 years, (2) normal hearing and normal speech, (3) English as a native language, (4) no experience or minimal experience with the speech of persons with hearing impairment. Listener judges are given answer sheets with printed numbering from 1 through 10. Judges are informed that they will be listening to well-formed sentences in English produced by children who are deaf but have cochlear implants. They are instructed to listen careful to each sentence and to write down what they hear, guessing if necessary.

*Scoring:* The BIT score for each child is the percent target words correctly transcribed, averaged across the three listener judges. All target words are scored, and all target words are weighted equally. In general, because the BIT is a measure of productive speech intelligibility, the onus for conveying the linguistic message is placed on the talker, rather than the listener, in scoring. Several principles address specific points:

1. Scoring is based solely on the degree of match between the target sentence and the listener judges’ responses. That is, what the child actually says (or what the examiner thinks the child says) is irrelevant with respect to scoring. For example, if the target sentence is *She is cooking dinner,* and the child says “She is cook dinner,” clearly omitting the progressive suffix *-ing,* a transcribed response of *She is cook dinner* will score as 3 of 4, whereas a transcribed response of *She is cooking dinner* will score as 4 of 4.

2. The relationship between the target sentence and the transcribed response is nevertheless asymmetrical. For a transcribed response to be completely correct, all words in the target sentence must have correspondences in the transcribed response, but it is not necessary for all words in the transcribed response to have correspondences in the target sentence. That is, for scoring purposes, extra words are ignored. For example, if the target sentence is *Daddy runs,* a response of *Daddy* will score as 1 of 2, whereas a response of *My Daddy runs* will score as 2 of 2.

3. If a transcription provides alternative words as responses, the word is deemed unintelligible and scored as incorrect. For example, if the target sentence is *My car is blue,* a response of *My car’s blue (or blue)* will score as 3 of 4.

4. Scoring is based solely on the full orthographic word; there is no “partial credit” based on parts of words. For example, if the target sentence is *Daddy runs,* a transcribed response of *Daddy run* will score as 1 of 2, and a transcribed response of *Daddies run* will score as 0 of 2. If the target sentence is *My car is blue,* a response of *My car’s blue* will score as 2 of 4, because target *car* and target *is* are not present in the response transcription. If the target sentence is *The boy walked to the table,* the response *The boy walked into the table* scores as 5 of 6.
Scoring is nevertheless not based entirely on matching orthography, but rather also on matching phonology. For example, if the target sentence is My car is blue, a response of My car blew will score as 3 of 4.

Scoring tolerates some degree of dialectal and spelling variation. For example, for the target sentence Grandma falls, both Grandmaw falls and Grama falls score as 2 of 2. For the target sentence He is brushing his teeth, the response He is brushin’ his teeth scores as 5 of 5.

The order of transcribed words is taken into account for scoring, although it is difficult to prescribe strict guidelines. For the target sentence Daddy runs, a response of Runs Daddy is scored as 1 of 2; arguably one of the response words is in the correct position (although it is not clear which), and the other is in the incorrect position. For the target sentence He is brushing his teeth, a response of His birthday ? ? will score as 0 of 5; although his is a target word, its sentence-initial position in the response and the appearance of response birthday corresponding to target brushing argue for a correspondence in this case to target He is.

Strike-throughs and erasures by listener judges are not considered in scoring. For example, for the target sentence That is a black hat, a response of A black hat-I buy a hat scores as 2 of 5.

Studies Using the Beginner’s Intelligibility Test
Studies from the DeVault Otologic Research Laboratory illustrating use of the Beginner’s Intelligibility Test include the following:


References


List 1
1. The baby falls.
2. Mommy walks.
3. The duck swims.
4. The boy sits.
5. Grandma sleeps.
6. That is a little bed.
7. The boy walked to the table.
8. My car is blue.
9. He is brushing his teeth.
10. She is taking a bath.

List 2
1. Daddy runs.
2. The baby cries.
3. The dog eats.
4. The girl drinks.
5. The clown falls.
6. That is a big bed.
7. The boy walked to the chair.
8. My van is green.
9. They are playing the drums.
10. She is talking on the phone.

List 3
1. Daddy walks.
2. The bunny drinks.
3. The dog sleeps.
4. The girl jumps.
5. Mommy reads.
6. That is a brown chair.
7. The boy is on the table.
8. My airplane is big.
9. He is tying his shoe.
10. She is brushing her hair.

List 4
1. The bear sleeps.
2. Mommy sits.
3. The rabbit hops.
4. The cowboy jumps.
5. Grandma falls.
6. That is a black hat.
7. The boy is under the table.
8. My airplane is small.
9. He is painting the chair.
10. She is cooking dinner.