



A Lipreading Test that Assesses use of Context: Implications for Aural Rehabilitation

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September 10, 2012

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SCHOOL OF MEDICINE



Introduction

- **Conversation is the background of all human relationships and can be used to:**
 - Share ideas
 - Express need
 - Instruct
 - Build understanding
- **A degraded auditory signal can lead to communication breakdowns**
 - Increased cognitive and physical effort to remain active in the conversation



Introduction

- **To avoid or repair communication breakdowns, individuals may apply communication strategies which restore context to the conversation.**
 - **Repeat Repair**
 - “Could you say that again?”
 - **Request for Information**
 - “Who is giving you a ride?”
 - **Elaborate Repair**
 - “Tell me more, I didn’t catch that?”
 - **Key Word Repair**
 - “What are you talking about?”



Introduction

■ Context

□ Grammatical

- *The three boy came over for dinner v. The three boys came over for dinner.*

□ Topical

- CUNY Sentences: One topic, 12 sentences
- *Food: What shall we have for dinner when our neighbors come over?*

□ Lexical

- SPIN Sentences: High Predictability and Low Predictability
- *Cut the bacon into strips.*
- *Bob heard Tom called about the strips.*

□ Situational

- Environment



Introduction

■ Situational Context



The family ate dinner at the table.



Introduction

■ Benefits to speech perception with added context.

□ Auditory Only

- Younger and older adults benefit from the addition of lexical context while listening (Pichora-Fuller, 2008; Sommers & Danielson, 1999; Dubno, Ahlstrom, & Horwitz, 1999)
 - SPIN Sentences—lexical context
 - CUNY Sentences—topical context

□ Visual Only

- Adults with normal and impaired hearing benefit from situational context while lipreading (Pelson & Prather, 1974; Garstecki & O'Neill, 1980)
 - Contextual picture
 - Contextual scenery/Auditory stimuli
- Young adults with normal hearing benefit from topical context when lipreading (Smith & Kitchen, 1972)
 - Topics



Introduction

■ Lipreading Assessment

- There are assessments that can evaluate the use of context in an auditory modality
 - CUNY and SPIN sentences
 - Previously developed tests of auditory context are often confounded by floor effects for lipreading (Tye-Murray et al., submitted)
 - SPIN Sentences–Gangé et al., 1987
 - CUNY Sentences–Altieri et al., 2011
- Can we develop a test of lipreading ability that can quantify the benefit derived from context?



Introduction

■ Current Study

- ❑ Can we develop a test that assesses lipreading ability and use of context while lipreading?
- ❑ Can we distinguish if poorer or better lipreaders improve the most from situational context?
- ❑ Does an individual's ability to use context in the visual channel correlate with the ability to use context in the auditory channel?



Methods

■ Participants

- 20 young adults (12 female, 8 male)
 - Age 18-32 (M=23 years, SD=3.9 years)
- Screened for normal hearing and normal/corrected normal vision
- Compensated \$10/hour for time and travel
- *This study was approved by Washington University School of Medicine Human Research Protection Office*



Methods

■ Materials

□ Listening Assessment

■ SPIN Test

- Lexical context provided within the sentence

□ Lipreading Assessment

■ Modified Illustrated Sentence Test (IST) (Tye-Murray et al., submitted)

- Situational context provided by pictures



Methods

■ Materials

- SPIN Test

- Digital audio samples of recorded sentences (High and Low Predictability) were leveled for amplitude and embedded in 4-talker babble



Methods

■ Procedure

□ SPIN Sentences

- Presented in High Predictability and Low Predictability conditions
 - Signal and babble presented at +/- 45 degrees azimuth
- Participants were instructed to orally repeat the entire sentence, but only the last word was scored
- An adaptive staircase method varied SBR to achieve 50% correct performance. The ratio was calculated three times and averaged.



Methods

■ Materials

□ Development of the Illustrated Sentence Test

- Open set lipreading test using contextual pictures provided before sentences to be lipread
- 3 lists of 40 sentences
 - Vocabulary from BKB sentences (Bench et al., 1979)
- An artist created illustrations depicting each sentence and pilot testing was performed to match sentences with proper illustrations
- An actress was video recorded saying each sentence



Methods

■ Materials

□ Modified Illustrated Sentence Test

- **Context:** Before each sentence to be lipread, participants saw the picture corresponding to that sentence
- **No-Context:** Participants saw only the sentence to be lipread with no other contextual cues



Methods

■ Procedure

□ IST Sentences

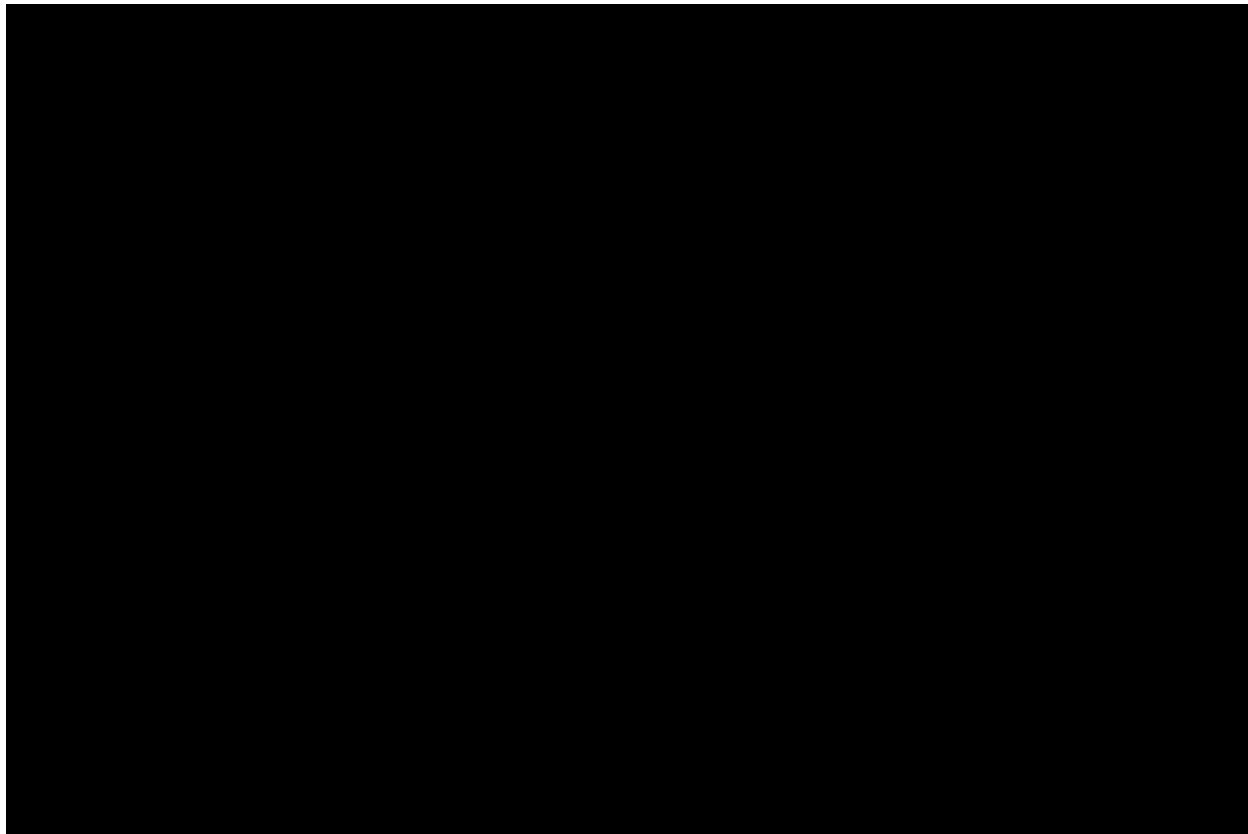
- Presented in context and no-context conditions
 - Context: participants saw a contextual illustration for 1.5 seconds before each target sentence
 - No-context: only the video-recorded sentence was presented
- 4-talker babble presented at approximately 55 dB SPL from loudspeakers +/- 45 degrees azimuth during both visual only presentations
- Scoring: Participants orally repeated the sentence.
 - Percent correct key words (excluding articles)



Methods

- **Materials**

- Modified IST stimuli demonstration**





Results/Discussion

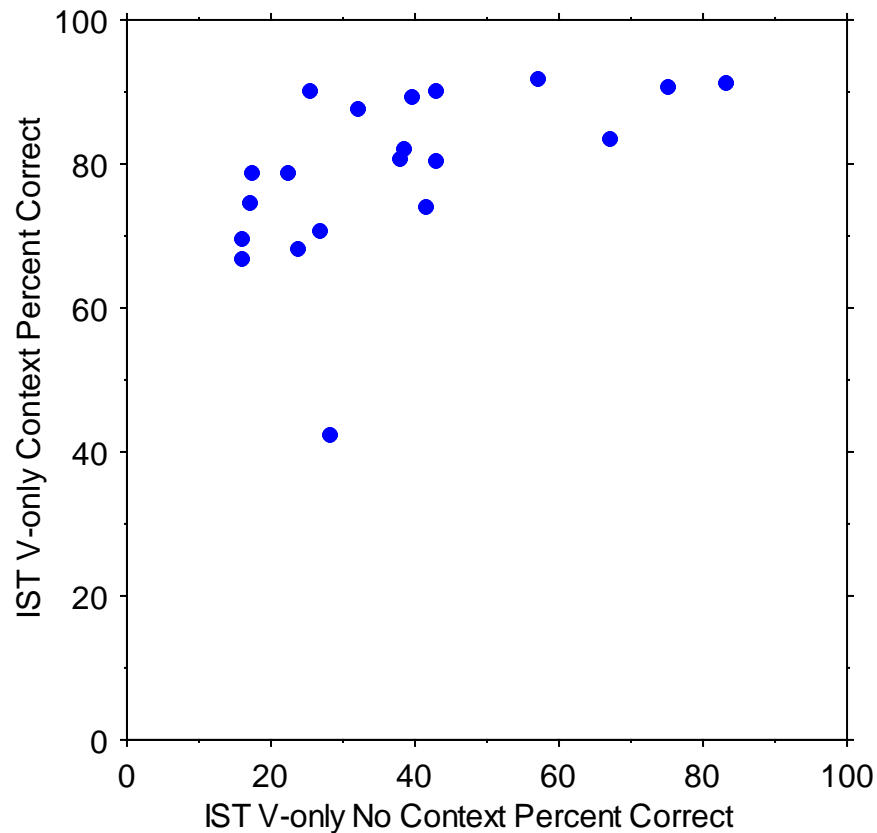
Can we develop a test that assesses lipreading ability and use of context while lipreading?

Can we distinguish if poorer or better lipreaders improve the most from situational context?

Does an individual's ability to use context in the visual channel correlate with the ability to use context in the auditory channel?



Results/Discussion



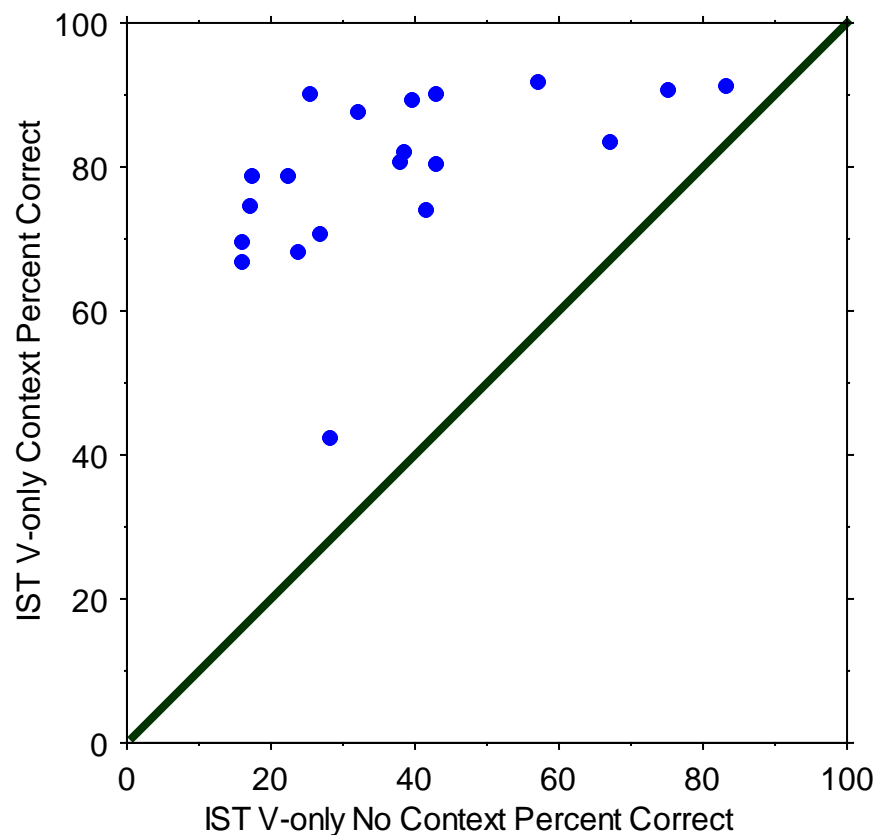
- Can we develop a test that assesses lipreading ability and use of context while lipreading?

Percent correct performance in the Context versus No Context conditions ($r=.537$, $p < .05$).

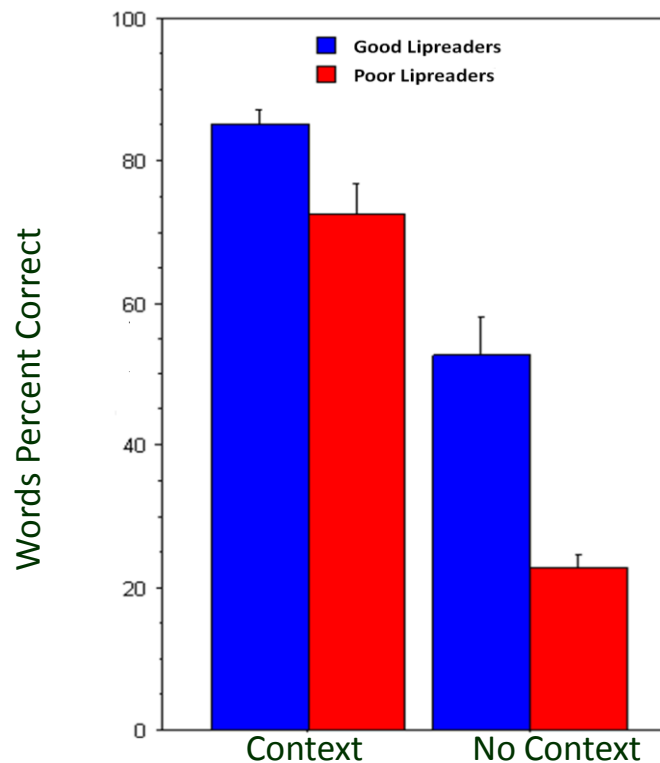


Results/Discussion

- Can we distinguish if poorer or better lipreaders improve the most from situational context?



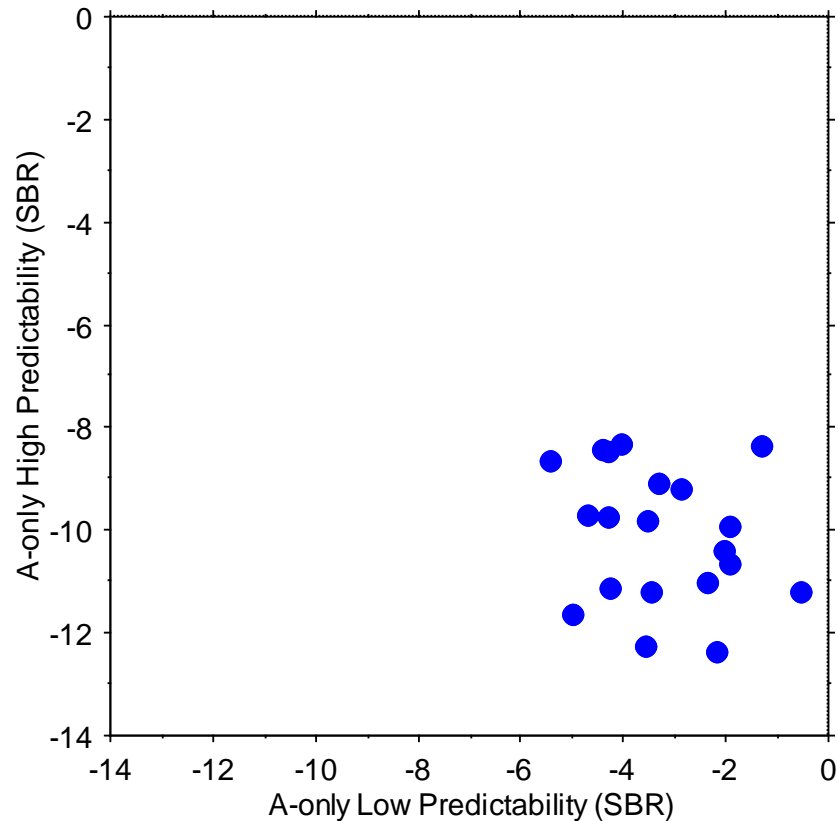
Percent correct performance in the Context versus No Context conditions ($r=.537$, $p < .05$).



Percent correct performance for lipreading in Context and No Context conditions for good (top 50%) and poor (bottom 50%) lipreaders ($F(1, 18)=7.2$, $p < .05$).



Results/Discussion



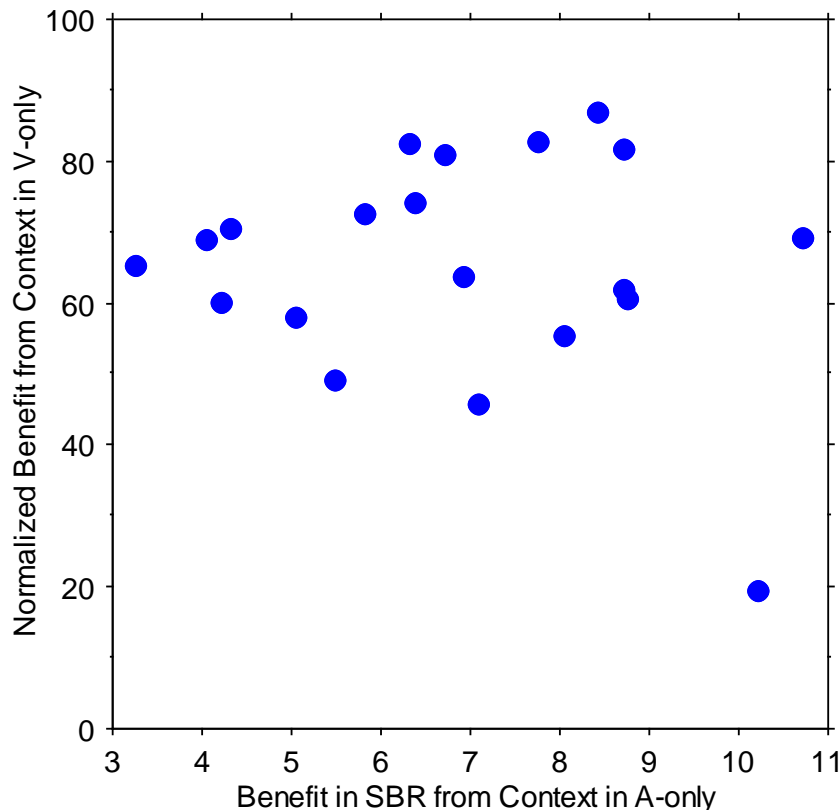
- Auditory only SPIN Sentences
 - Context versus No Context SBR at 50% accuracy for final words.

Fifty percent SBR performance in the High Predictability versus Low Predictability Conditions ($r = -.241$).



Results/Discussion

- Does an individual's ability to use context in the visual channel correlate with the ability to use context in the auditory channel?



Benefit from context in lipreading versus benefit from context in listening ($r = -.022$, $p > .05$).

Normalized Benefit =

$$\frac{IST_{\text{Context}} - IST_{\text{No Context}}}{1 - IST_{\text{No Context}}}$$



Discussion

- The IST can be used to assess lipreading ability and benefit from context
- Poorer lipreaders received more benefit from the addition of context than better lipreaders
- Potential Clinical relevance
 - Patient specific repair strategies



Discussion

- **Ability to use context while lipreading did not correlate with the ability to use context while listening**
 - ❑ **Is this lack of correlation due to differences in the type of context?**
 - ❑ **OR, does use of context in the auditory and visual channels require completely different skill sets?**



Looking Forward

■ Current Study

	Situational Context	Lexical Context
Visual	Illustrated Sentence Test	
Auditory		SPIN Test



Looking Forward

- *If type of context were held constant, would use of context while lipreading correlate with context use when listening?*

	Situational Context	Lexical Context
Visual	Illustrated Sentence Test	
Auditory	↓	↑ SPIN Test



Looking Forward

- Can we make the Illustrated Sentence Test more difficult for adults?
- Does use of context in the visual channel change across the lifespan? (Pichora-Fuller, 2008; Sommers & Danielson, 1999; Dubno, Ahlstrom, & Horwitz, 1999)
 - Does the correlation between auditory/visual use of context change with age?



Conclusions

- **The IST allows for the assessment of lipreading ability and benefit derived from situational context**
- **Poorer lipreaders benefit more from situational context than better lipreaders**
 - Implications for rehabilitation
- **There was no correlation between use of context while lipreading and listening**
 - Type of context or skill set?



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Thank You!

- **Oyer Award Selection Committee**
 - **Nancy Tye-Murrray, Ph.D.**
 - **Brent Spehar, Ph.D.**
 - **Elizabeth Mauzé, M.S.**
 - **Cathy Schroy, M.S.**