

# Informational Masking Effects in Adults With English as a Second Language

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# Purpose

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The purpose of this study is to investigate informational masking differences between native English speakers and non-native English speakers.

# English as a Second Language

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- English- the most common 2<sup>nd</sup> language in the world spoken by billions of people
- Nearly 1-in-5 U.S. residents 5 and older reported speaking a language other than English for the 2000 Census
- The majority of people who reported speaking another language reported speaking English very well

# Two Types of Masking Defined

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- 2 main types of masking noise
  - **Energetic**
    - The masker and signal frequencies overlap making signal inaudible
  - **Informational**
    - The result of confusion between masker and the signal due to perceptual similarities between the masker and the signal
  - **Many maskers produce both energetic and informational masking**
  - **The present study investigates informational masking effects using speech masker, which have both energetic and informational properties**

# Background: effects of masking on nonnative listeners

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- Studies show poorer accuracy in nonnative listeners in masking noise<sup>1,3,4</sup>
- Studies show that between group differences larger in more difficult listening situations<sup>1,3,4</sup>
- These studies used sentence material & syllable identification<sup>1,2,3,4</sup>

(Crandall & Smaldino 1996<sup>1</sup>; Cutler, Weber, Smits & Cooper, 2004<sup>2</sup>; Lecumberri, & Cooke, 2004<sup>3</sup>, Takata & Nabelek, 1990<sup>4</sup>)

# Theories to explain poorer nonnative performance in noise

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- Lecumberri and Cooke (2004)
  - Attributed poorer ability to use syntactic, semantic and/or lexical rules when fewer acoustic cues are available
- Cutler, et al (2004)
  - Attributed differences to slower, less accurate processing at all levels
  - And subconscious comparisons to native language cause greater confusion for second language listeners

# Hypotheses

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1. Performance of second language listeners will be poorer in all conditions.
2. Second language listeners will have additional informational masking (poorer performance in the male masking condition than female masking condition.)
3. Shorter exposure to English and less self perceived competence in English will correlate with greater masking effects in all conditions.

# Subjects

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- 7 native English speakers
  - Grew up in primarily English speaking households
  - Attended schools k-12 with primarily English instruction
- 7 nonnative English speakers
  - Grew up in primarily non-English speaking households
  - Attended schools k-5 with primary instruction not in English

# Speech Testing Selection of the Coordinated Response Measure

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- The CRM was developed by Bolia to enhance informational masking effects in a speech
- The CRM was used because it is
  - relatively context free
  - it uses a closed set of responses
  - it is of easy lexical complexity
  - syntax (word order) is kept constant
- This may avoid advantage that native English listeners are expected to have in using contextual cues and in familiarity with larger English vocabulary.

# Speech Testing: the Coordinated Response Measure

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Ready [call sign] go to [color] [number] now

Target- “Ready Baron, go to blue five now

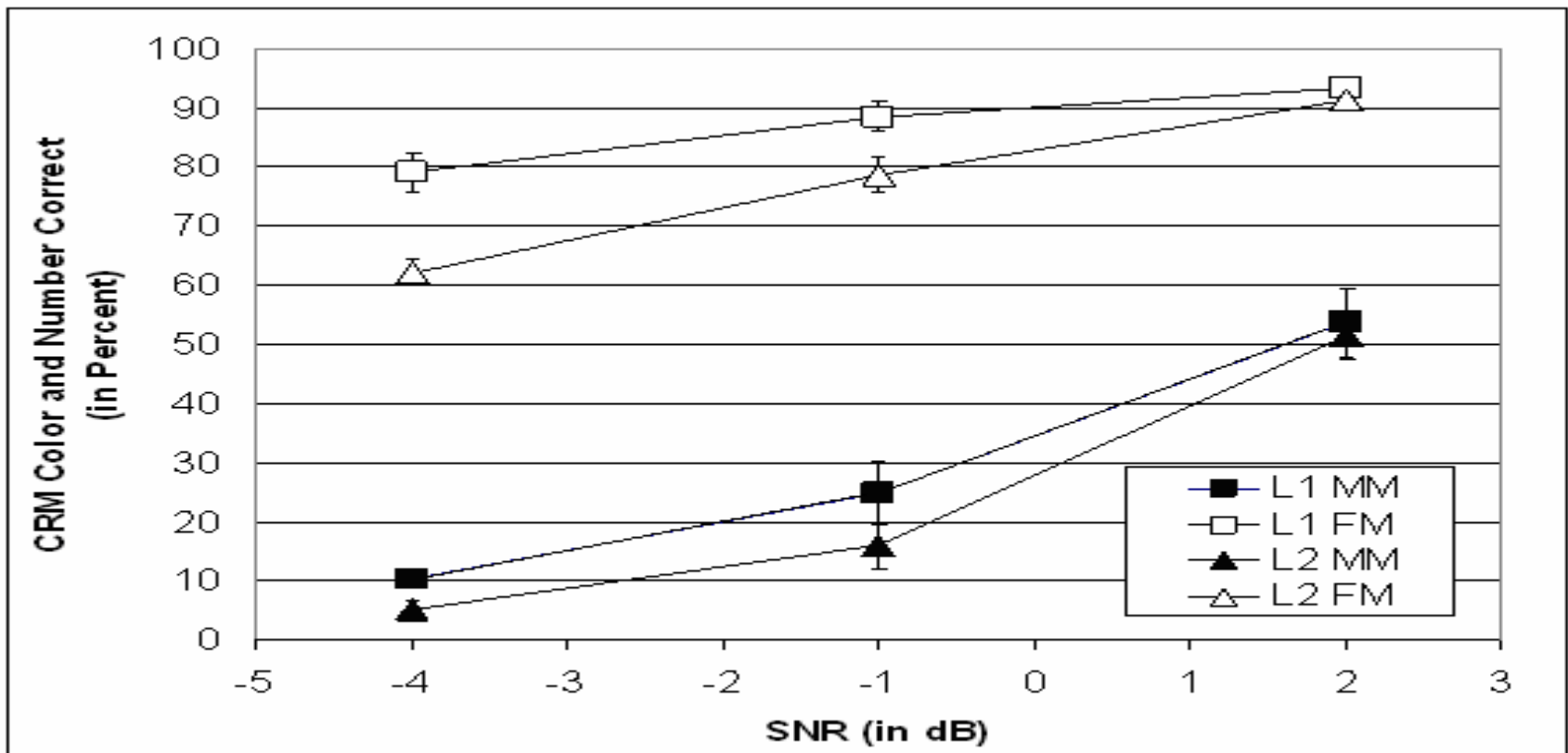
Masker 1- “Ready Charlie, go to green two now”

Masker 2- “Ready Ringo, go to red one now”

- 4 colors and 8 numbers
- Target always male
- masker female or male
- Target held constant at 70 dB
- Masker level varied to produce +2, -1 and -4 Signal to Noise Ratios

# Average Percent Correct

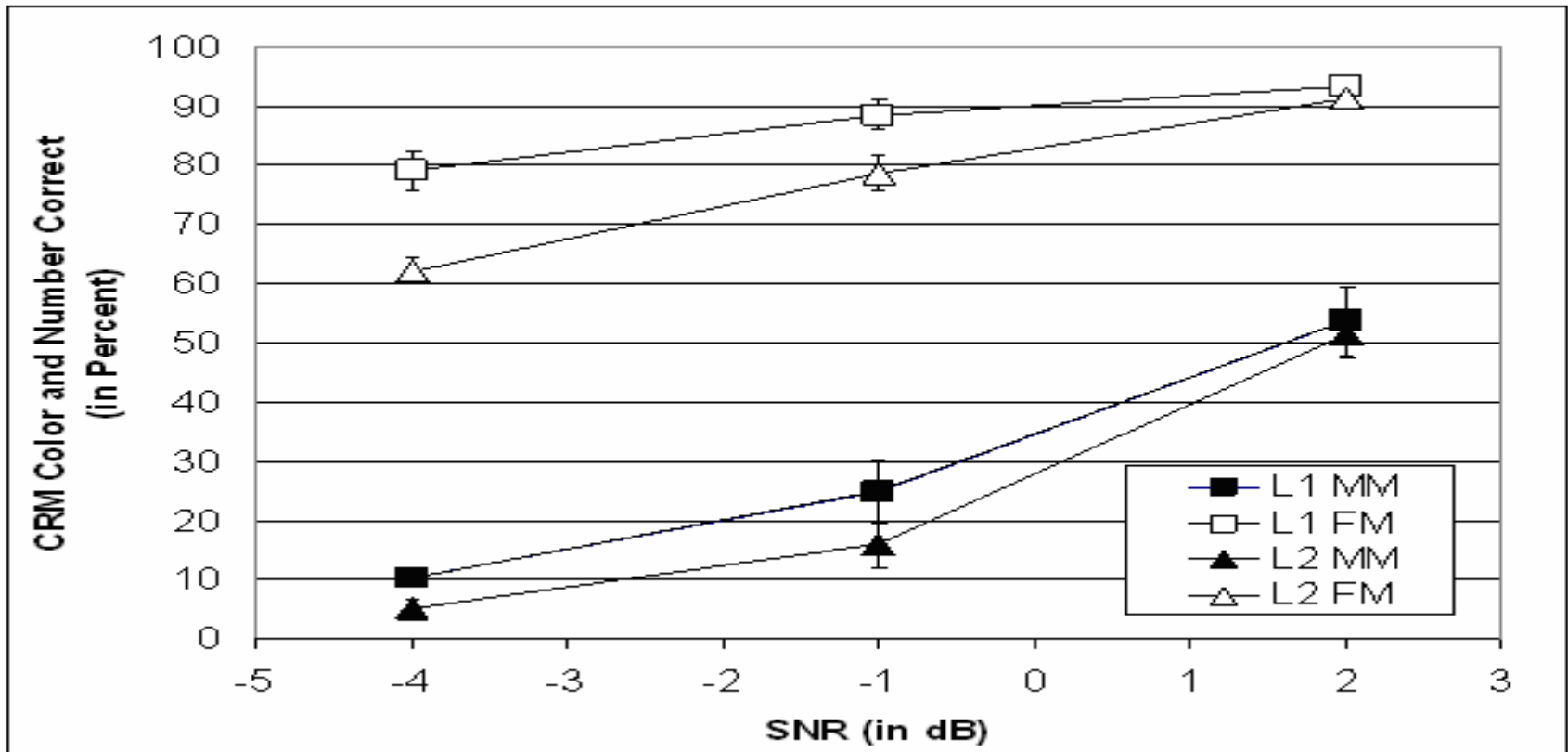
Second language listeners have poorer accuracy particularly at the most difficult Signal to Noise Ratio condition.



Key: L1-Native English; L2-Nonnative; MM-Male Masking; FM- Female Masking

# Average Percent Correct

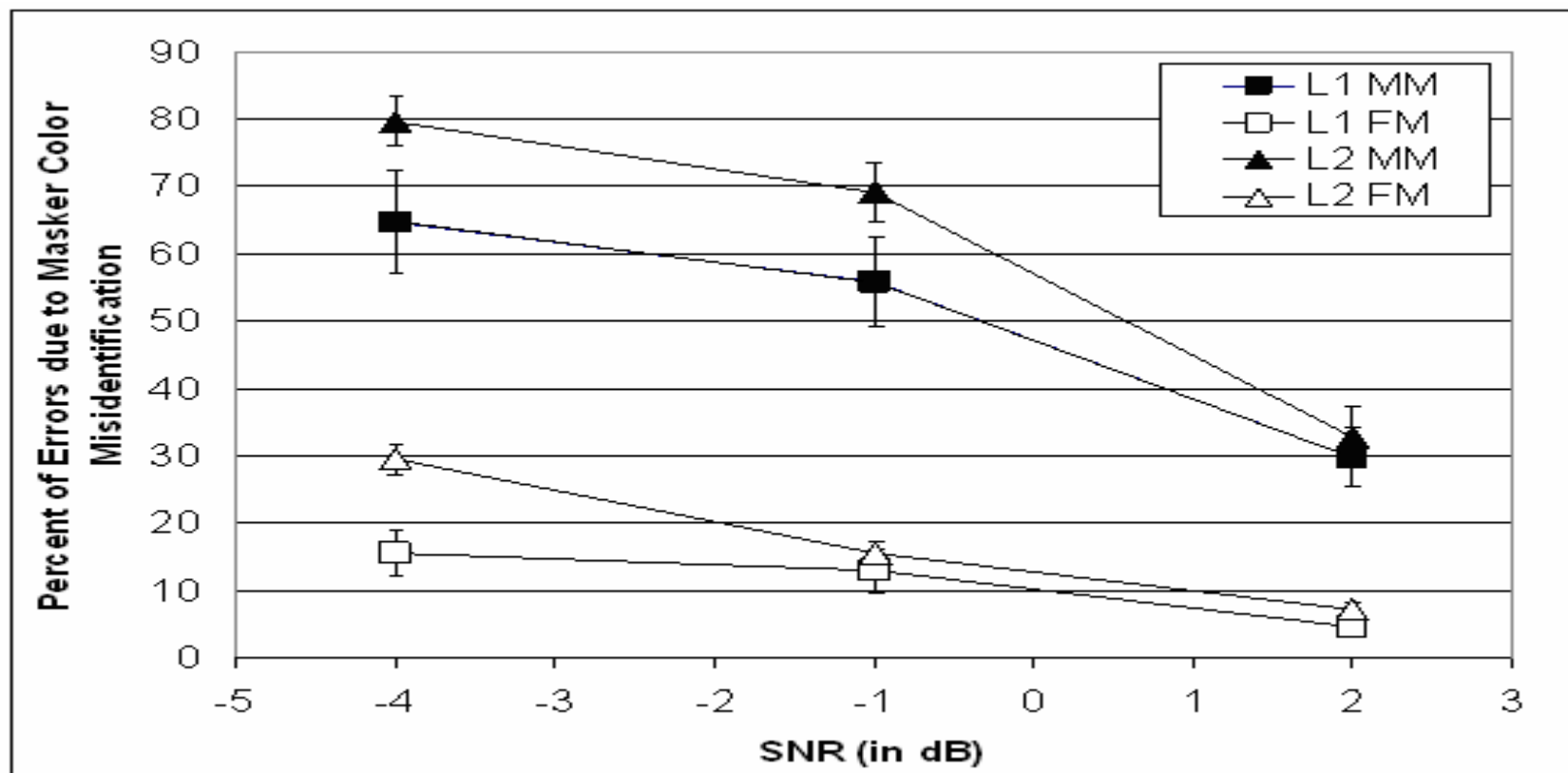
No group differences in release from informational masking., i.e. gender of masker affected both groups the same amount.



Key: L1-Native English; L2-Nonnative; MM-Male Masking; FM- Female Masking

# Average Color Confusions

Nonnative listeners more susceptible to interference of masking talker.



Y axis shows percent of incorrect responses resulting from of masker target confusions.

Key: L1-Native English; L2-Nonnative; MM-Male Masking; FM- Female Masking

# Survey Results of Nonnative English Speakers

Survey Questions	Range	Mean
Age of 1 <sup>st</sup> English Instruction	4-20	9
Years living in English speaking country	2-24	9.6
Hours per day communicating in English	1-14	8.2
Hours per day communicating in language other than English	2-12	4.3
Average Difficulty Understanding English (10 great difficulty- 1 minimal difficulty.)	1-3	1.6

# Overview of Survey Results

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- Longer exposure to English, did not correlate with greater accuracy on the CRM
- Self perceived difficulty understanding English and performance on CRM were not correlated
  - This may be because small range (1-3 out of 10) in self perceived difficulty in understanding English

# Conclusions

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- Hypothesis 1: was supported
  - Performance of second language listeners was poorer in all conditions.
- Hypothesis 2 was not supported
  - No group differences in the effects masking type:
    - Second language listeners did not have poorer performance in the male masking condition, the condition believed to produce greatest informational masking
  - Results for greater informational masking in second language listeners were inconclusive
  - Second language listeners had a higher percent of confusions with masking talkers. Indicates greater susceptibility to informational masking
- Hypothesis 3 was not supported:
  - Shorter exposure to English and less self perceived competence in English did not correlate with greater masking
    - All second language subjects were very competent English speakers