

Testing the influence of autonomous system input on human perceptual categorization of speech

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Overview

1. The importance of Situation Awareness (SA)
2. SA with large-scale autonomous systems
3. The question of uncertainty
4. Pilot study: Testing the influence of uncertain info.
5. Future directions

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The importance of Situation Awareness

What is Situation Awareness?

- Endsley's framework (e.g., Endsley, 1995):
Level 1 - Perception of elements in environment
Level 2 - Comprehension of current situation
Level 3 - Projection of future status

Importance of Level 1 is not to be underestimated

The New York Times SEPT. 13, 2015

Egypt Security Forces Accidentally Kill Mexican Tourists

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SA with large-scale autonomous systems

Let's consider a light-hearted scenario...



Note: This film is being used for illustrative purposes and its use should not be construed as an endorsement!

SA with large-scale autonomous systems

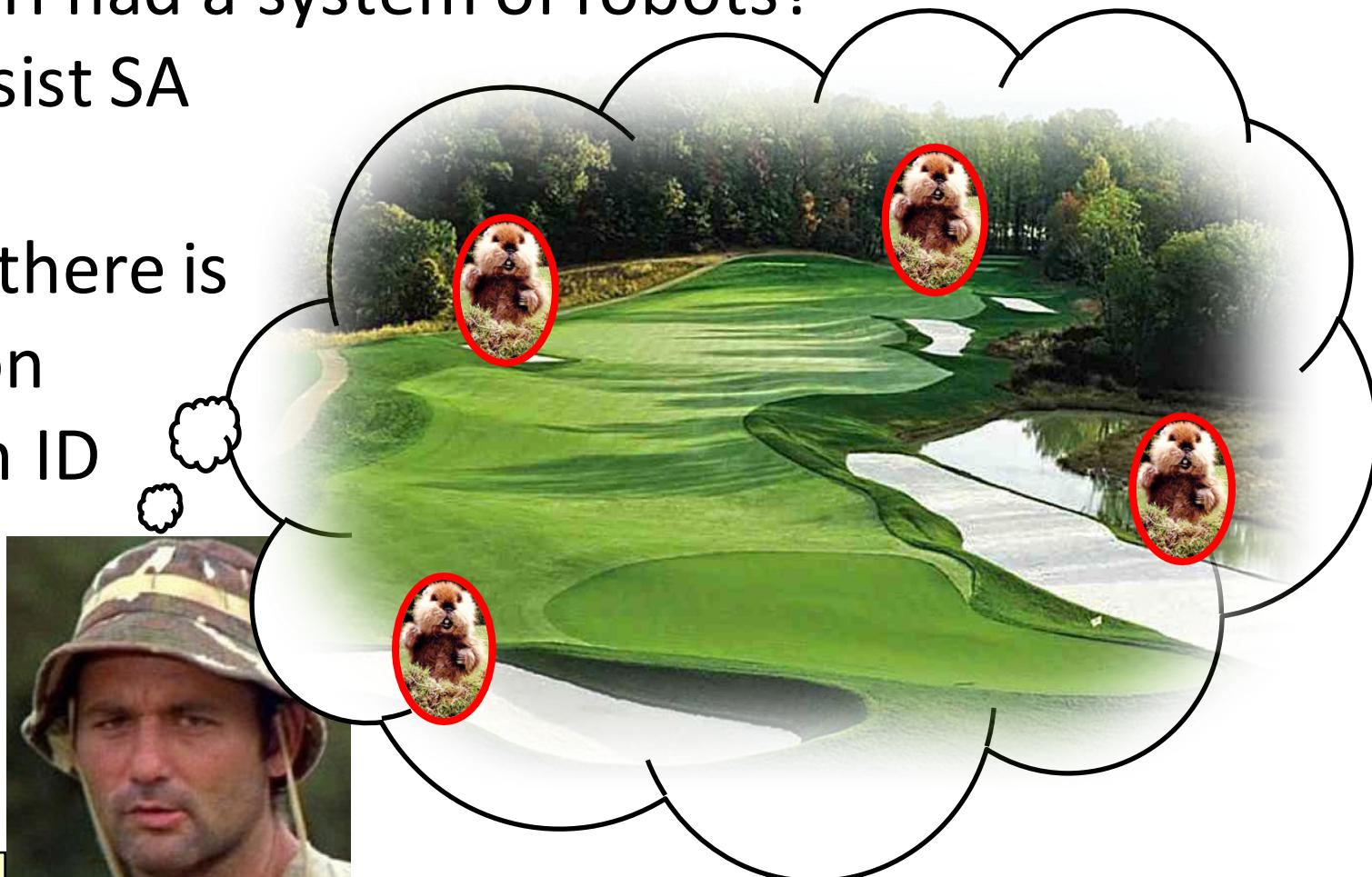
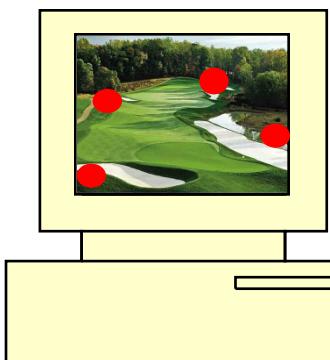
Carl Spackler wants to know where the gophers are
... but it's a big golf course



SA with large-scale autonomous systems

What if Carl had a system of robots?
...could assist SA

Note that there is
automation
involved in ID

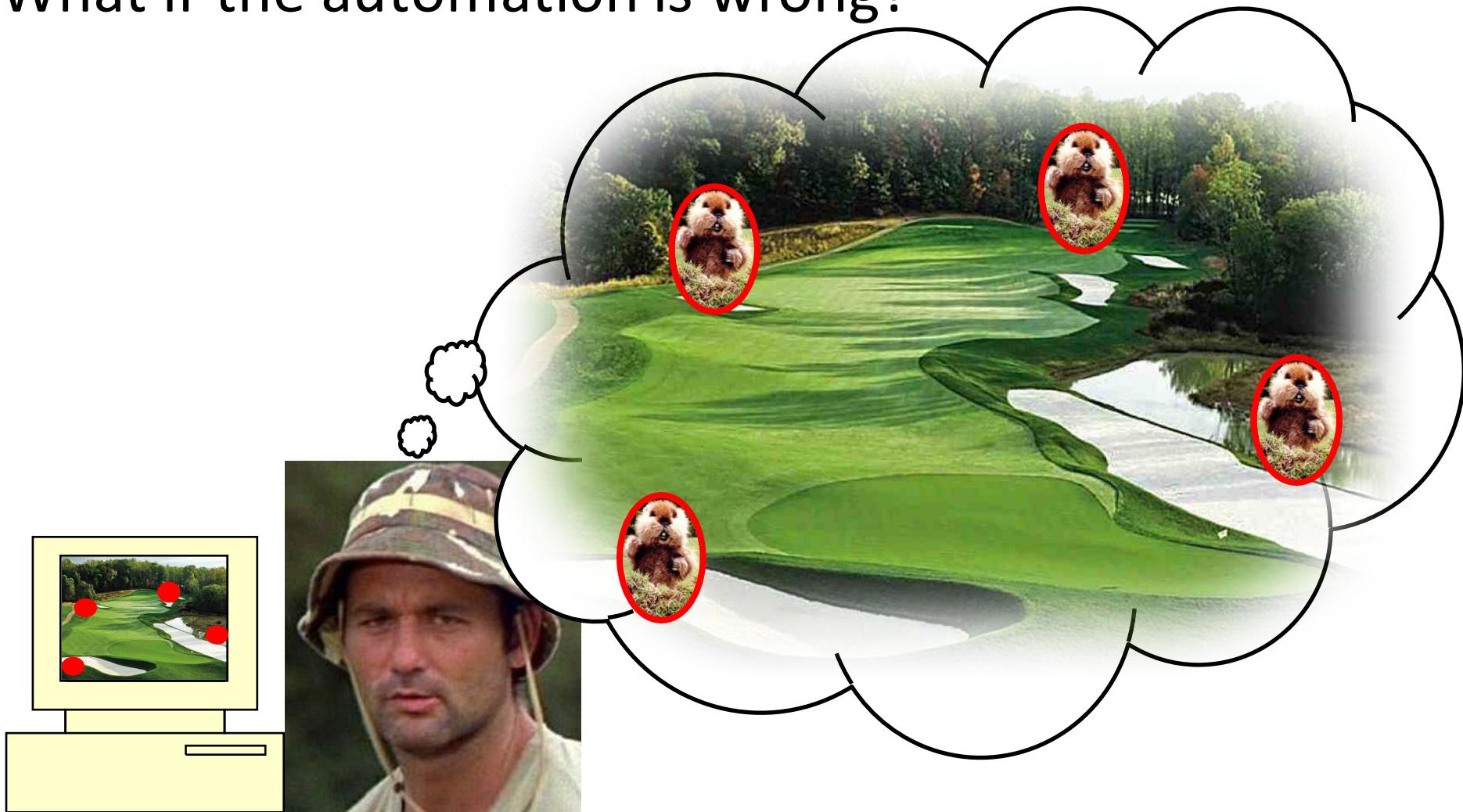


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The question of uncertainty

What if the automation is wrong?



The question of uncertainty

What if the automation is wrong?

False Alarm:

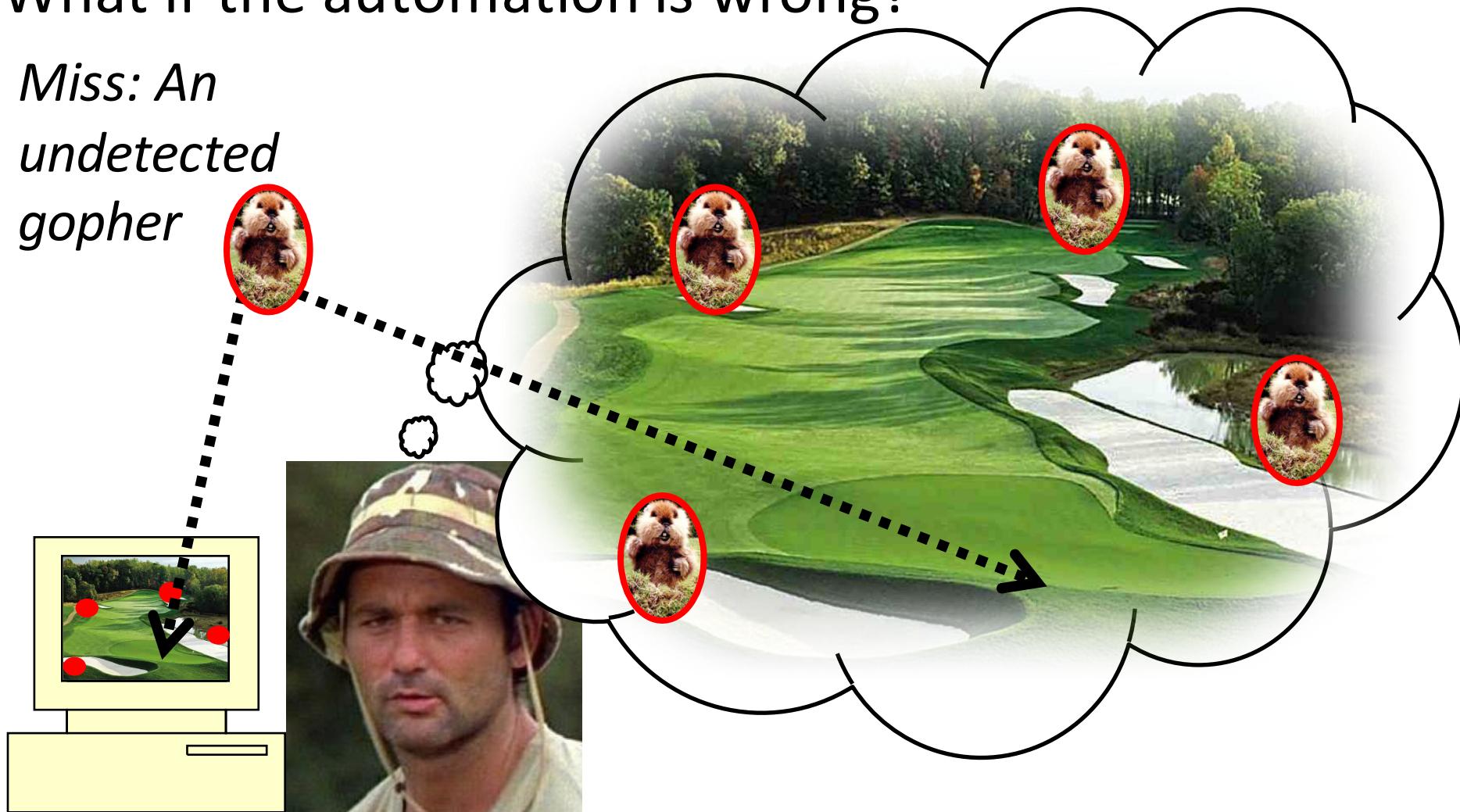
*Not actually
a gopher*



The question of uncertainty

What if the automation is wrong?

*Miss: An
undetected
gopher*



The question of uncertainty

Errors (i.e. false alarms, misses) can potentially negate the benefits of automation (Wickens & Dixon, 2007)

However, potential for errors cannot be eliminated

- In dynamic environment, always some uncertainty

Current research question: How can human operators interpret information about the uncertainty?

- Goal: maximize accuracy in Level 1 SA

The question of uncertainty

How does Carl's SA change
if the system tells him
about its own
uncertainty?



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Pilot Study

As a first step, we are adding uncertain information to a basic categorization task:

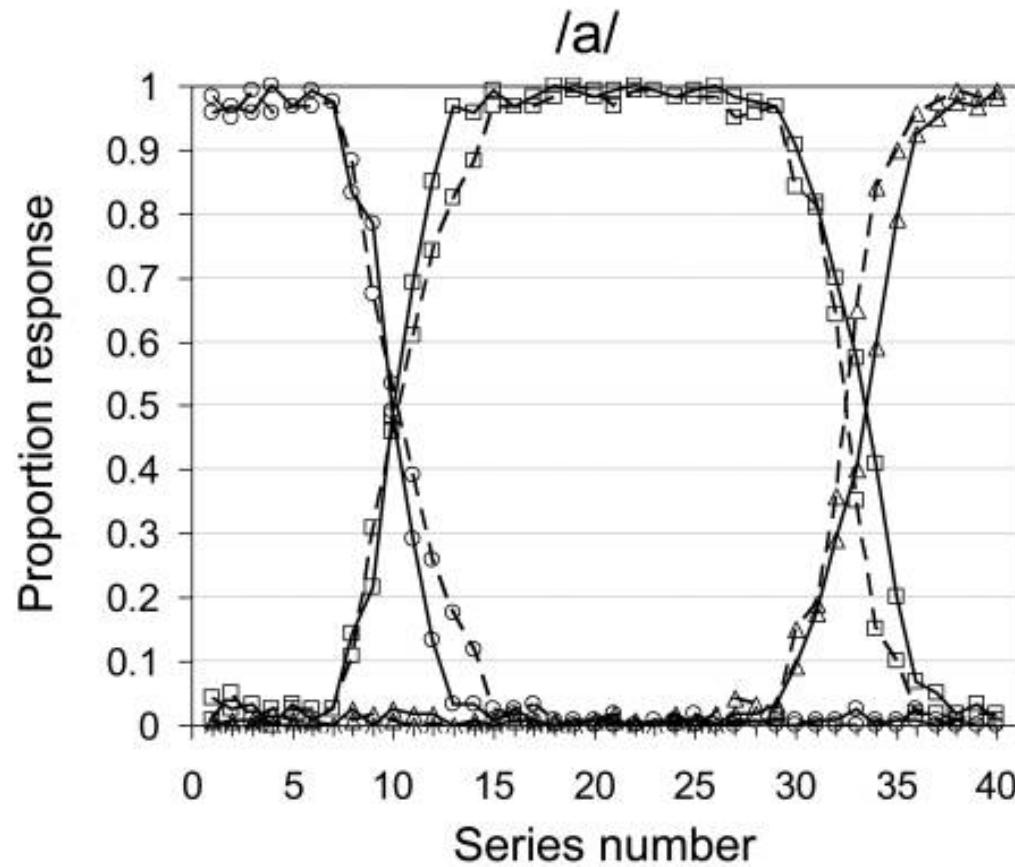
Consonant identification

- “Indicate whether you heard ABA or ADA”
- Can be influenced by visual information from the face of a speaker (e.g., McGurk & MacDonald, 1976)
- Can also be influenced by artificial visual cues (Stephens & Holt, 2010)

What if a computer provides information about the probability of each consonant?

Pilot Study

Stimuli: Five utterances along a series ranging from /aba/ to /ada/ (From the set created by Stephens & Holt, 2011)



Pilot Study

Uncertain information presented on screen

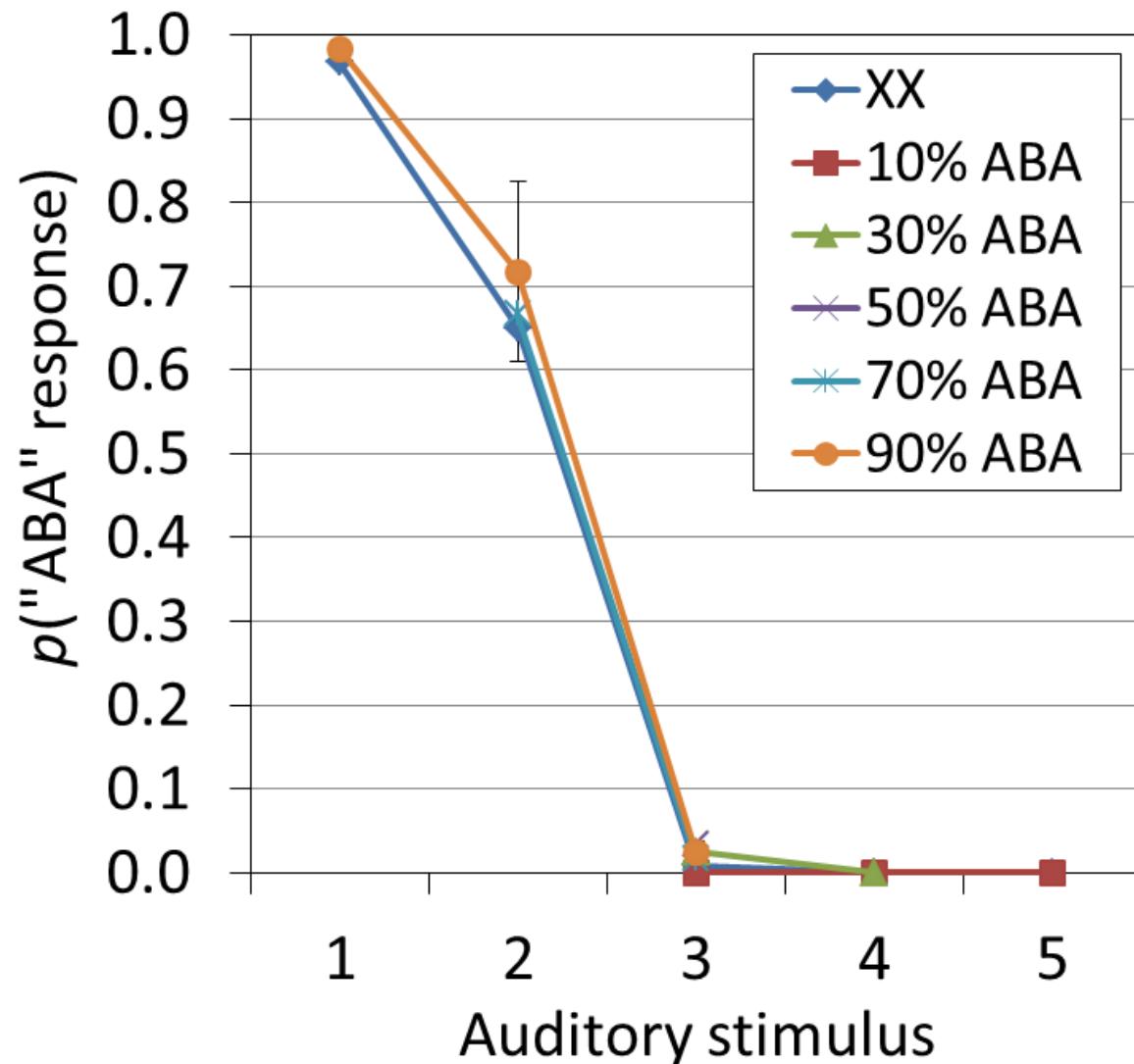
- “The automated system estimates...”
- 10% ABA; 90% ADA
- 30% ABA; 70% ADA
- 50% ABA; 50% ADA
- 70% ABA; 30% ADA
- 90% ABA; 10% ADA
- XX% ABA; XX% ADA (no information condition)

Intermediate sounds were paired with multiple percentages; each combination occurred 15 times

Pilot Study

Preliminary
results from n=8
participants

No influence of
on-screen
percentages



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Future directions

Speech categories are extremely familiar

- Little need to rely on automated system
- Next experiments will use less familiar categories

Explicitly labeled percentages may be ineffective as cues for perception

- Further experiments will represent uncertain information using other types of visualizations for uncertainty

Eventual goal: more realistic SA tasks

Acknowledgments

Christopher Moody

TECHLAV

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