

Measuring Listening Effort

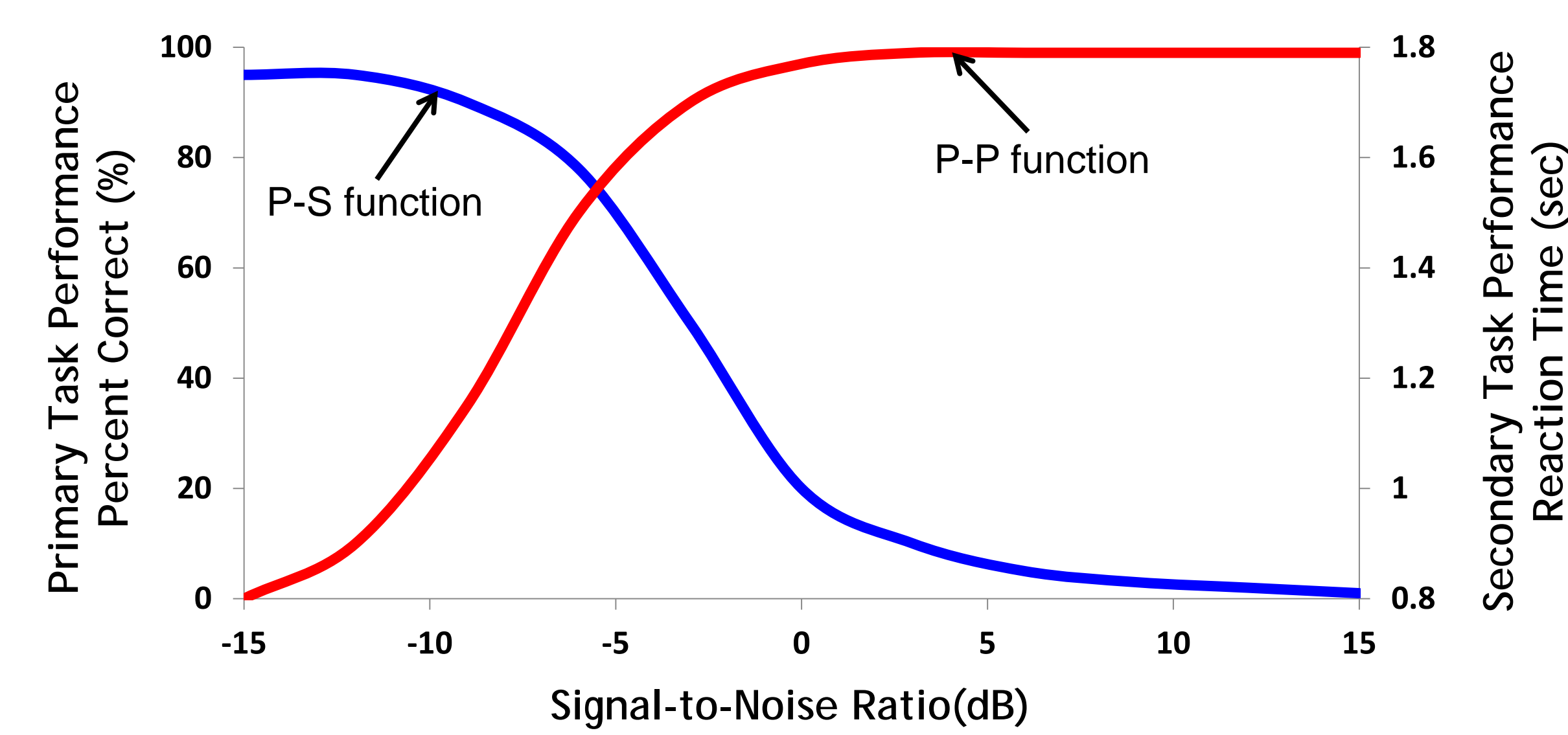
Adaptive testing procedure for a dual-task paradigm

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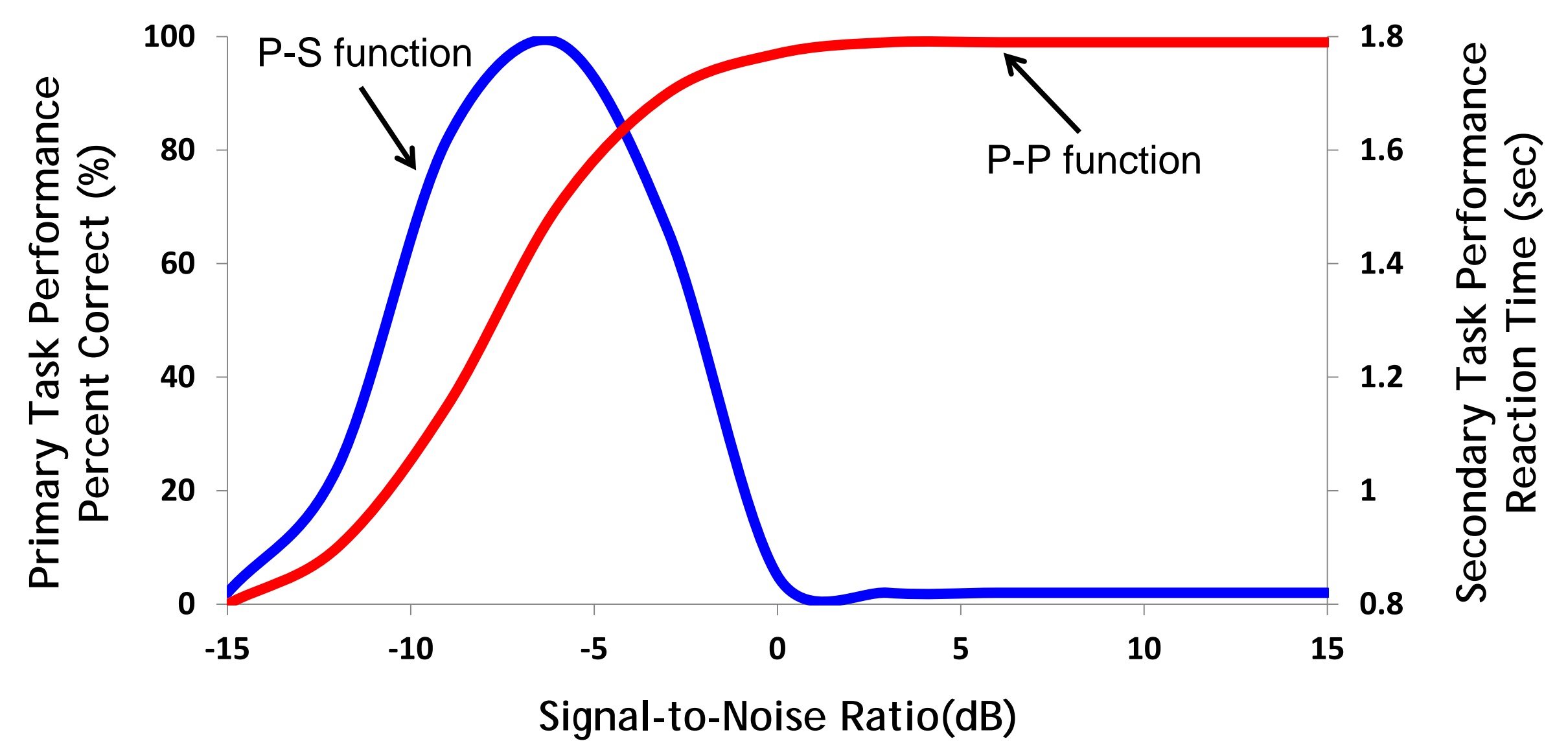
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INTRODUCTION

- Listening effort is the cognitive resources allocated for understanding speech
- A dual-task paradigm is used to quantify the listening effort, wherein the listener performs a **primary speech recognition task** and a **secondary task** simultaneously
- Results of our previous study (graph 2) indicate that the selection of test Signal-to-Noise Ratio (SNR) would greatly influence the results of the dual-task paradigm
- Purpose: to develop an adaptive dual-task methodology that is unaffected by the test SNR
- The adaptive method seeks to find the peak of the psychometric function of the **secondary task**



Graph 1. Originally hypothesized P-S function as a simple reverse-sigmoid shape that mirrors P-P function.



Graph 2. Results from the previous study revealed a peak-shaped P-S function.

METHODS

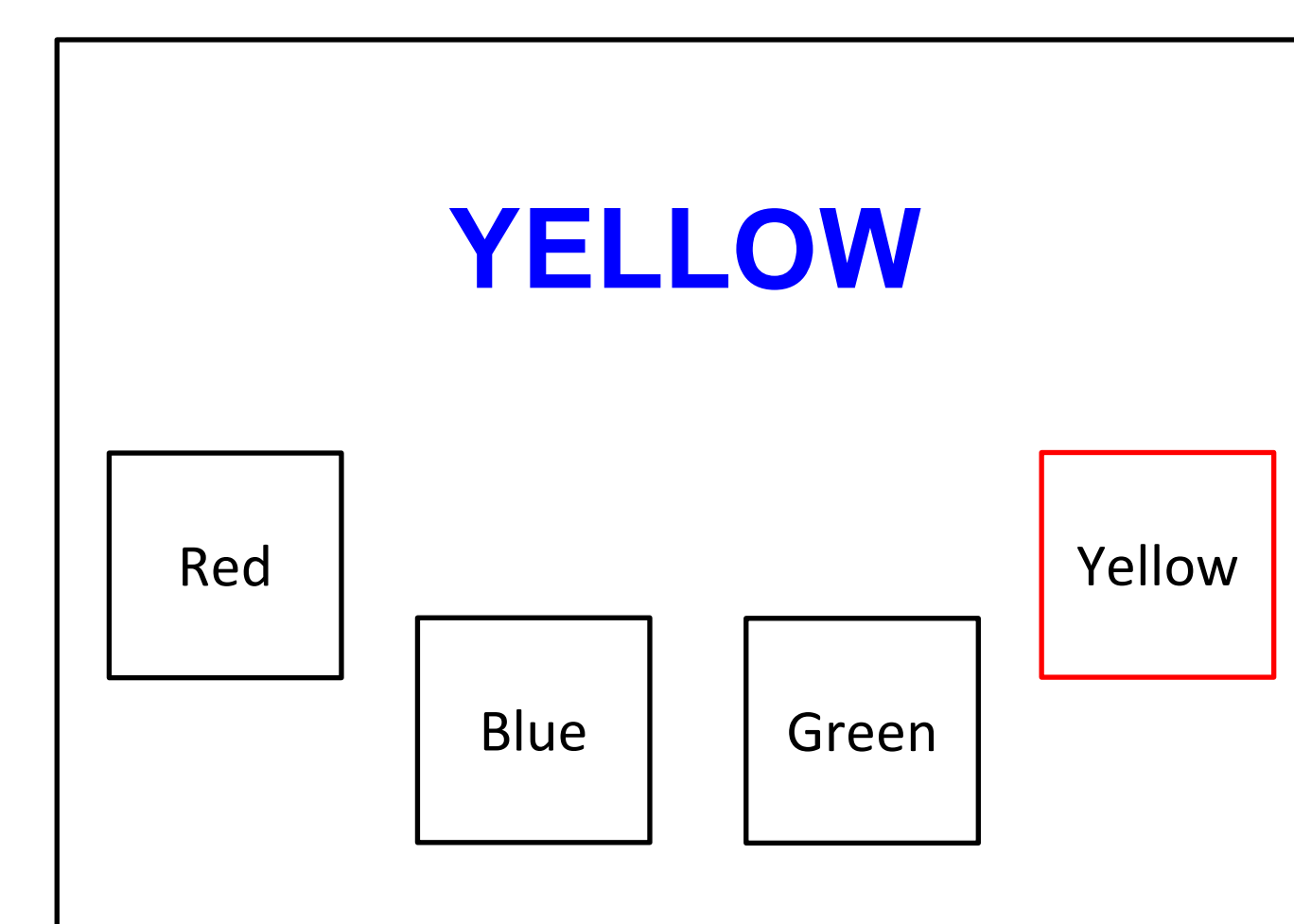
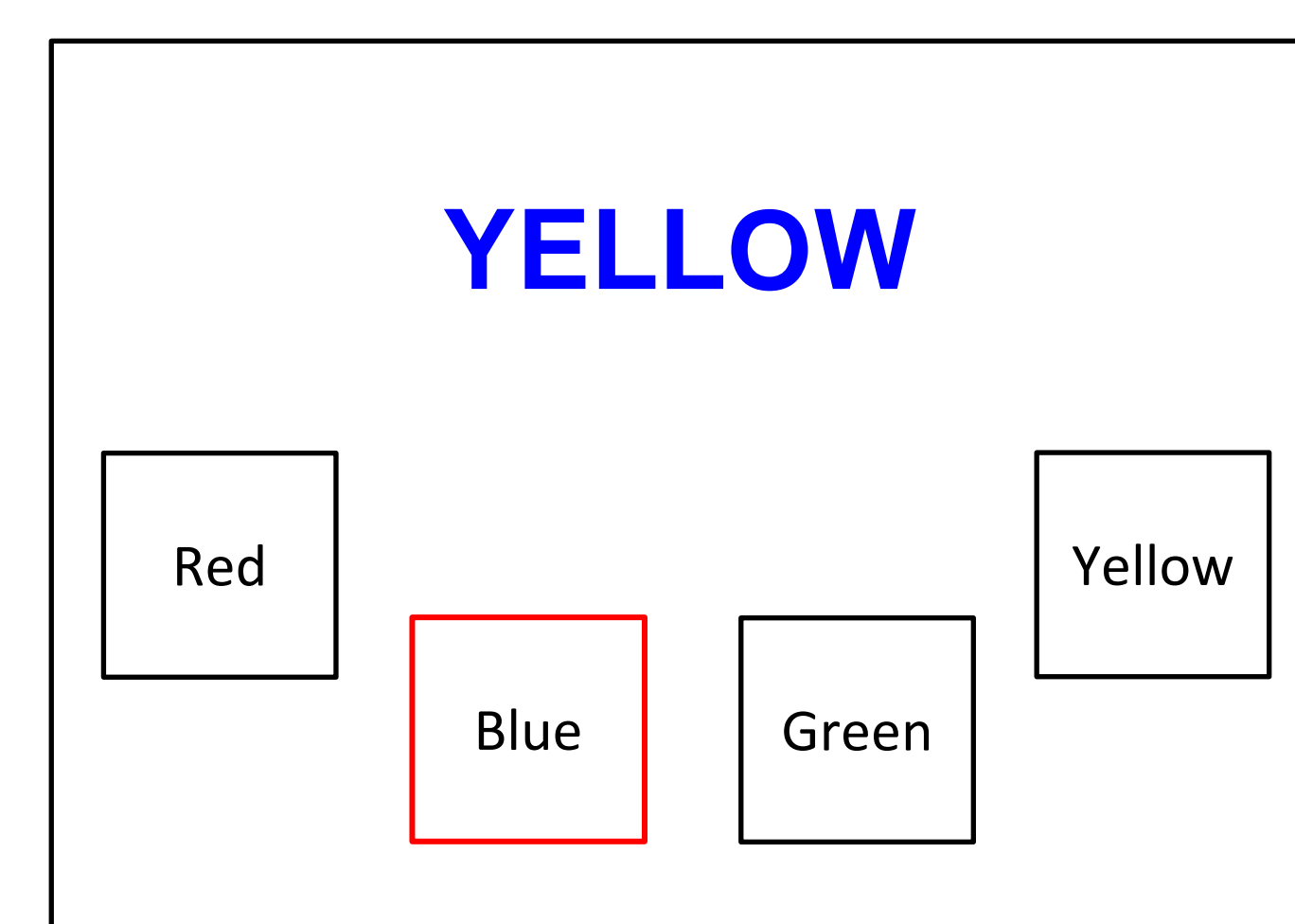
Participants

- 20 adult, native English speakers with normal hearing and normal color vision

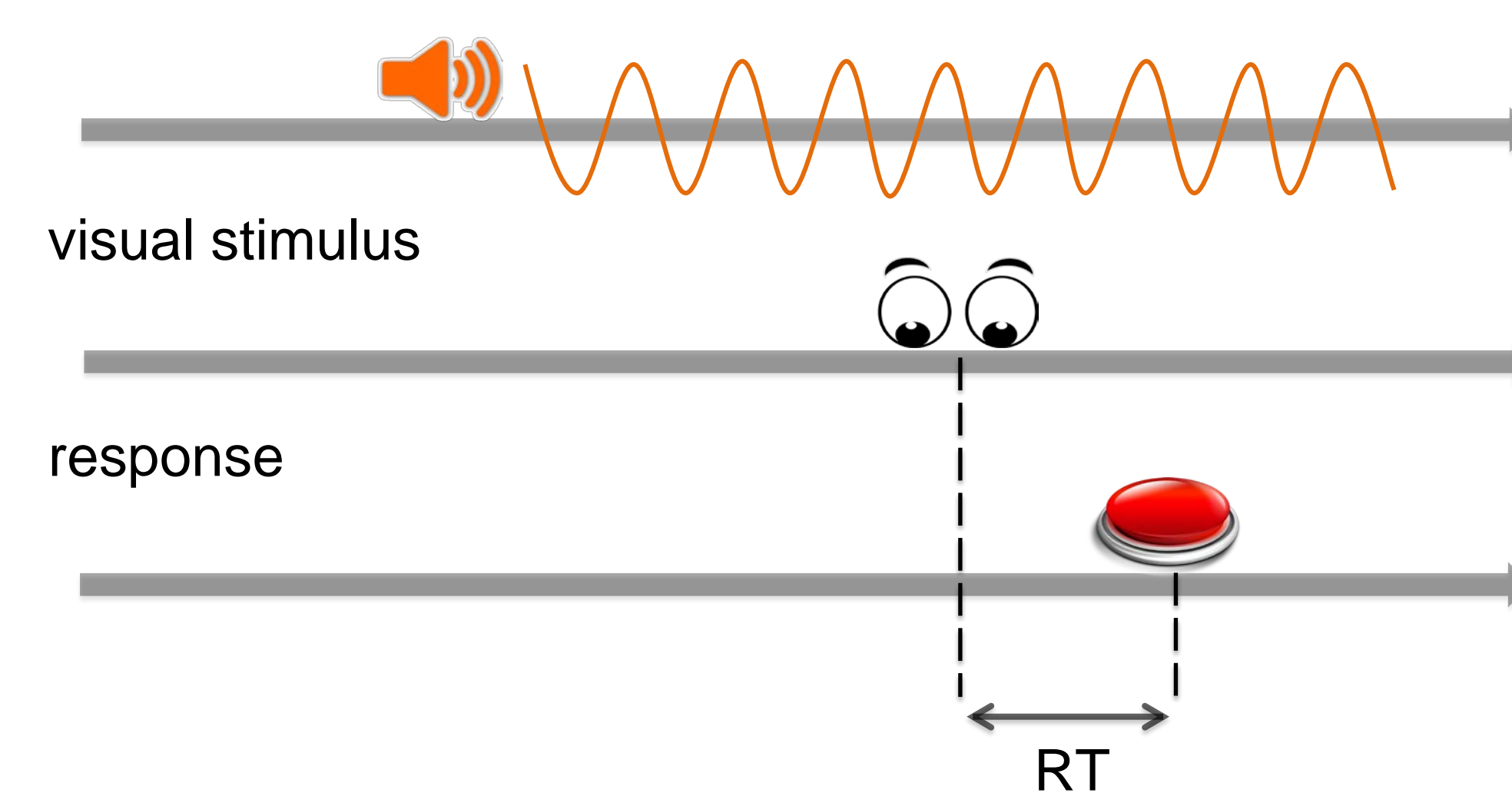
Equipment

- Speech stimulus presented in a sound treated booth through earphones
- Visual stimulus presented on a computer screen
- Participants responded via keyboard

Procedure



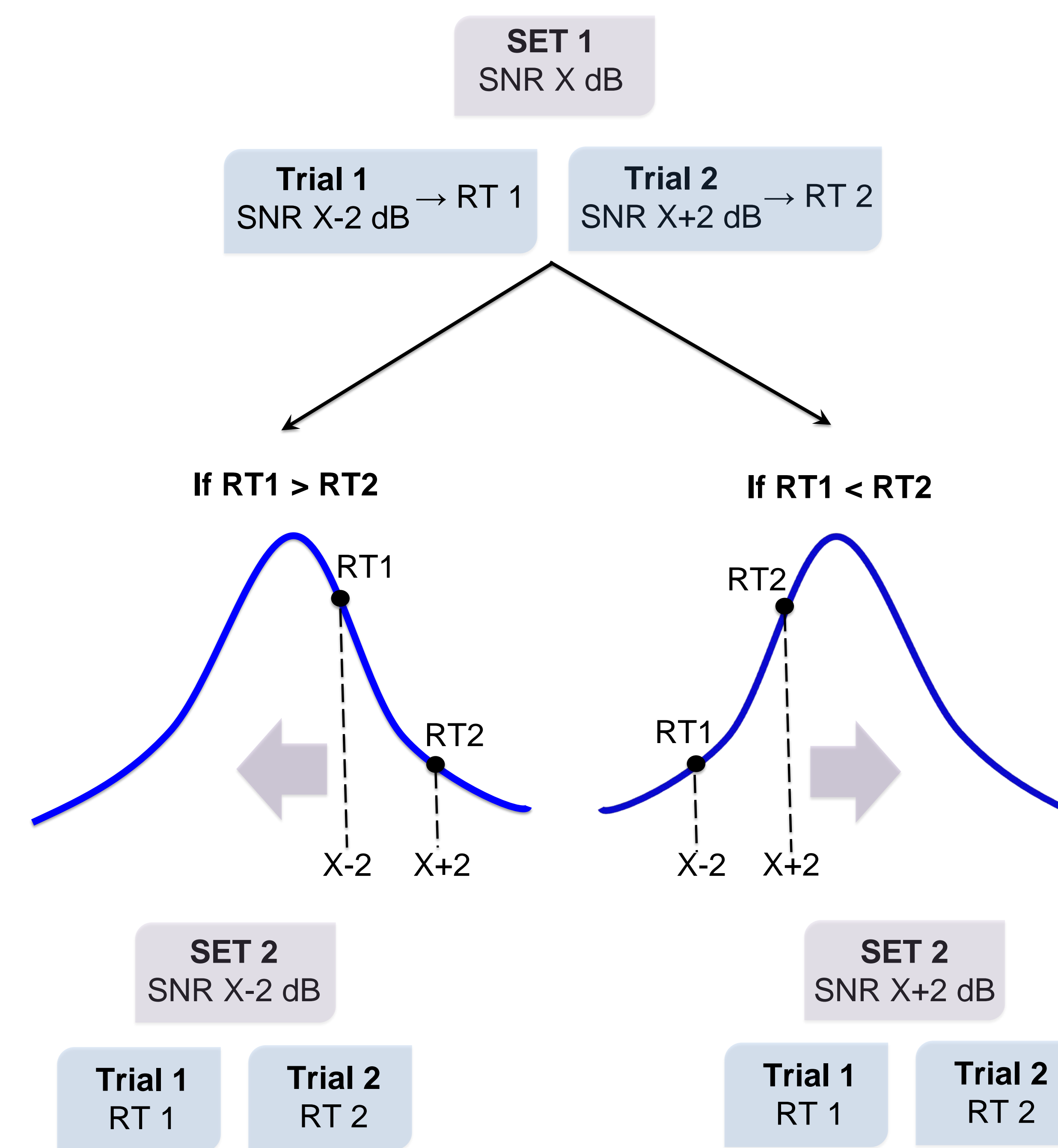
speech stimulus



- Primary task: speech recognition in noise
- Secondary task: Stroop test, with two conditions
 - Easy:** respond to stimulus by pressing the space bar
 - Hard:** respond to stimulus by pressing the button corresponding to the color in which the word is written
- Reaction time to the visual stimulus is measured
- Each condition was repeated twice
- Each condition contained 30 sets of test SNRs
30 sets X 2 trials = 60 trials

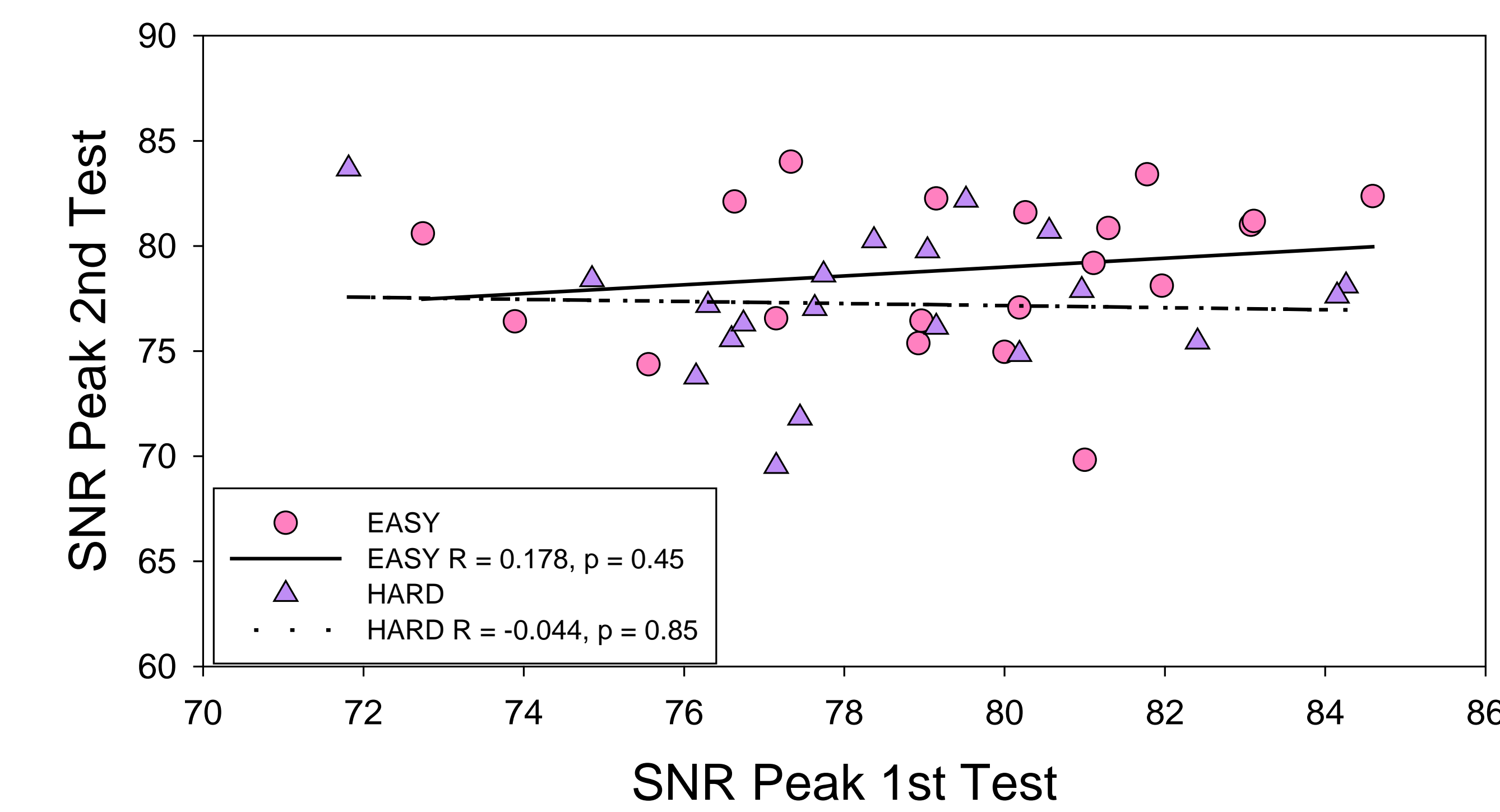
METHODS

Adaptive Method

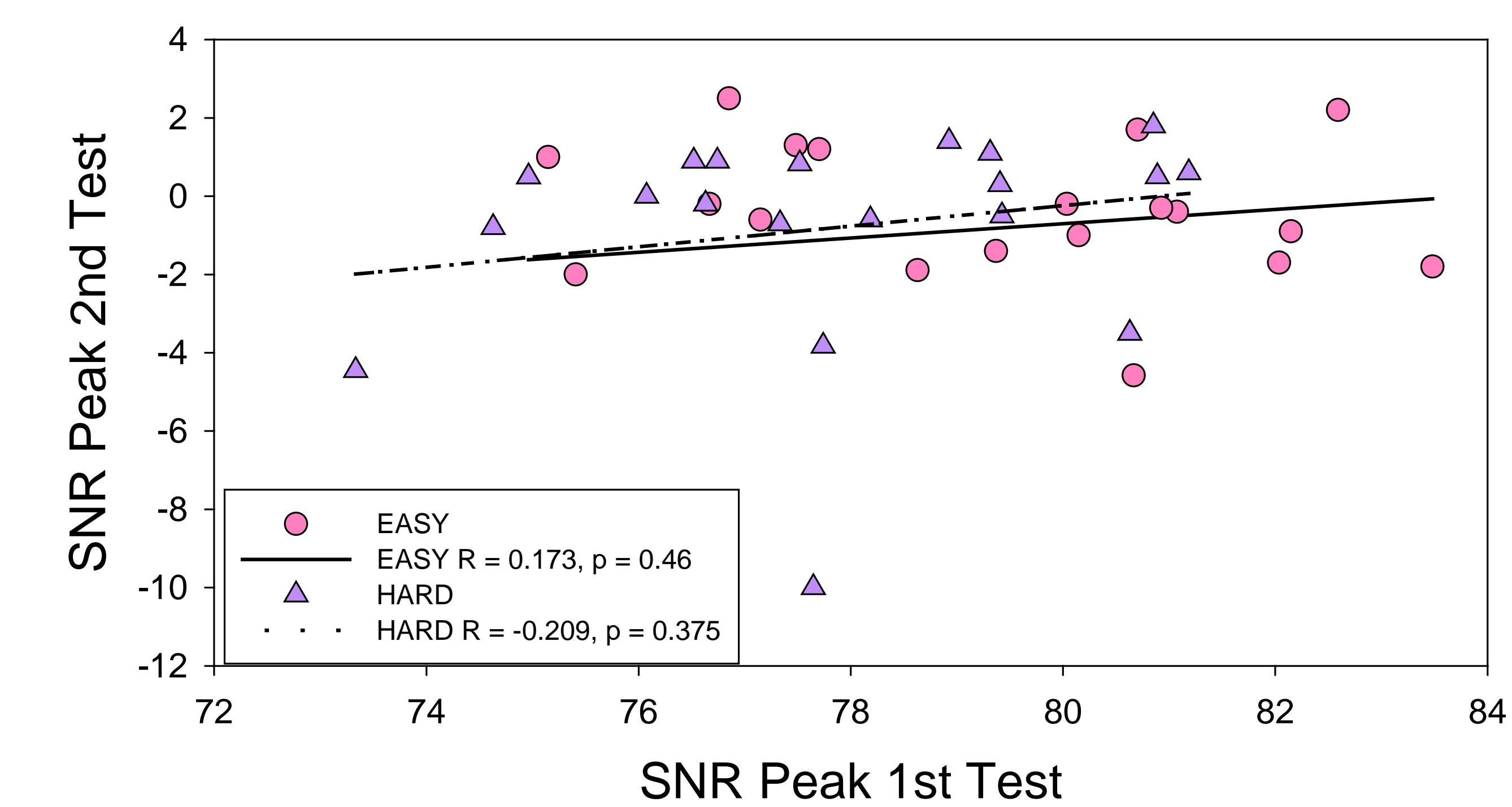


- Goal: to find the SNR-peak where the secondary task performance is the poorest
- The two RTs of the secondary task performance are measured and used to derive the slope of the P-S function
 - If the slope is negative, the performance is likely to be on the right side of the SNR-peak
 - If the slope is positive, the performance is likely to be on the left side of the SNR-peak
- The assumption is that the mean SNR across all trials will estimate the SNR-peak

RESULTS



Graph 3. Correlation between mean SNR-peak from the 1st test and 2nd test.



Graph 4. Correlation between mean SNR-50 from previous study and mean SNR-peak

DISCUSSION/CONCLUSION

- The correlation between mean SNR-peak from the 1st test and 2nd test is not significant
- The correlation between mean SNR-50 from the previous study and mean SNR-peak is not significant
- Possible Explanations**
 - During the experiment, participants were observed to be staying within the lower end of the SNR range
 - In the previous study, participants tended to quit listening for the speech signal during low SNR trials. If test SNRs were presented randomly, the peak location might be different.
 - Decreasing the range of SNR by changing to 1-dB step would be a suggestion for a future study

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