

Real-Time Feedback Amplifies the Interactive Effect Between Conflict Expectation and Stimulus Incongruity on a Speech-to-Text Stroop Application

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Highlight

- Feedback is crucial for keeping people engaged in cognitively demanding behavioral tasks.
- Real-time feedback could enhance behavioral performance in tasks involving working memory.
- We developed a speech-Stroop application that provided real-time feedback to users from three age groups: young adults (18-40 years), middle-aged adults (41-60 years), and older adults (61-80 years).
- Three types of feedback including feedback after each question, feedback after each section and feedback after all sections.
- We integrates speech-to-text software in the application to detect participants' responses.
- There was a significant difference among three types of feedback in response time, but not in accuracy levels.
- Feedback after each question resulted in longer response times, suggesting that the feedback made participants more cautious.

Introduction

- Feedback is one of the most powerful factors in learning and achievement.
- Previous studies have investigated the effect of feedback on working memory performance (Appelgren, et al., 2014).
- However, there has been no study focusing on the Stroop task and real-time feedback.
- The Stroop task has been widely used in psychological research to explore selective attention, cognitive flexibility, processing speed, and the functioning of the brain's executive control mechanisms.
- This study aimed to investigate how feedback affected conflict expectation and stimulus incongruity in Stroop task.
- To achieve this, we developed the speech-to-text Stroop application to provide real-time feedback on users' performance.
- We adopted the speech-to-text library in Flutter for recognizing responses in Thai (https://pub.dev/packages/speech_to_text/example).

Affiliation

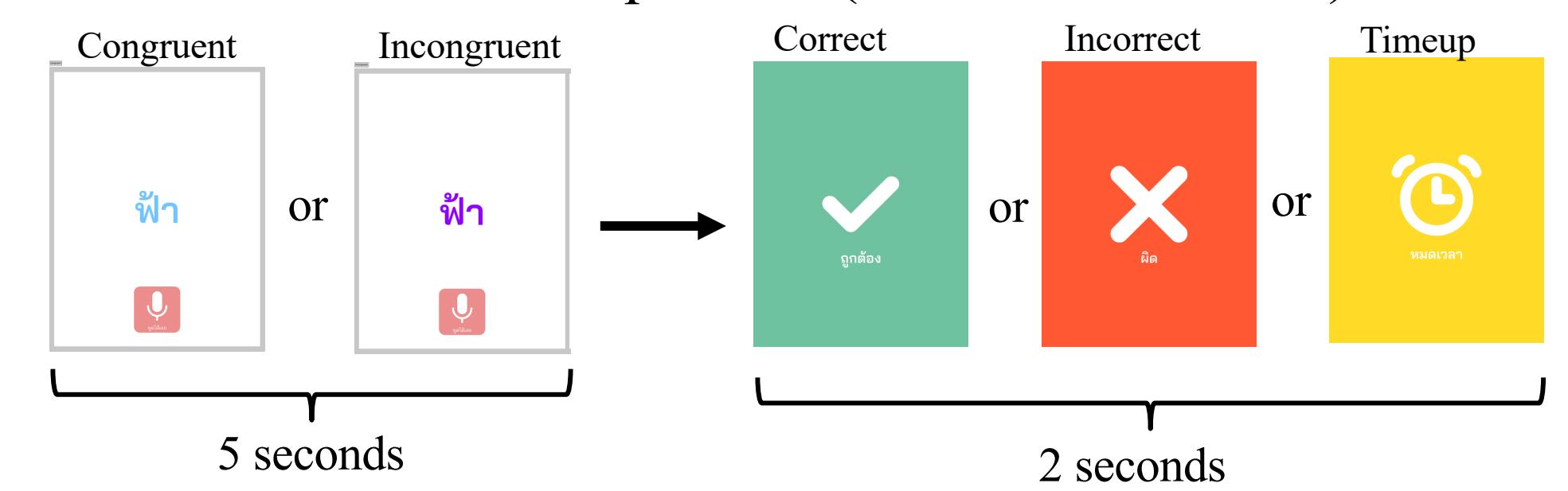
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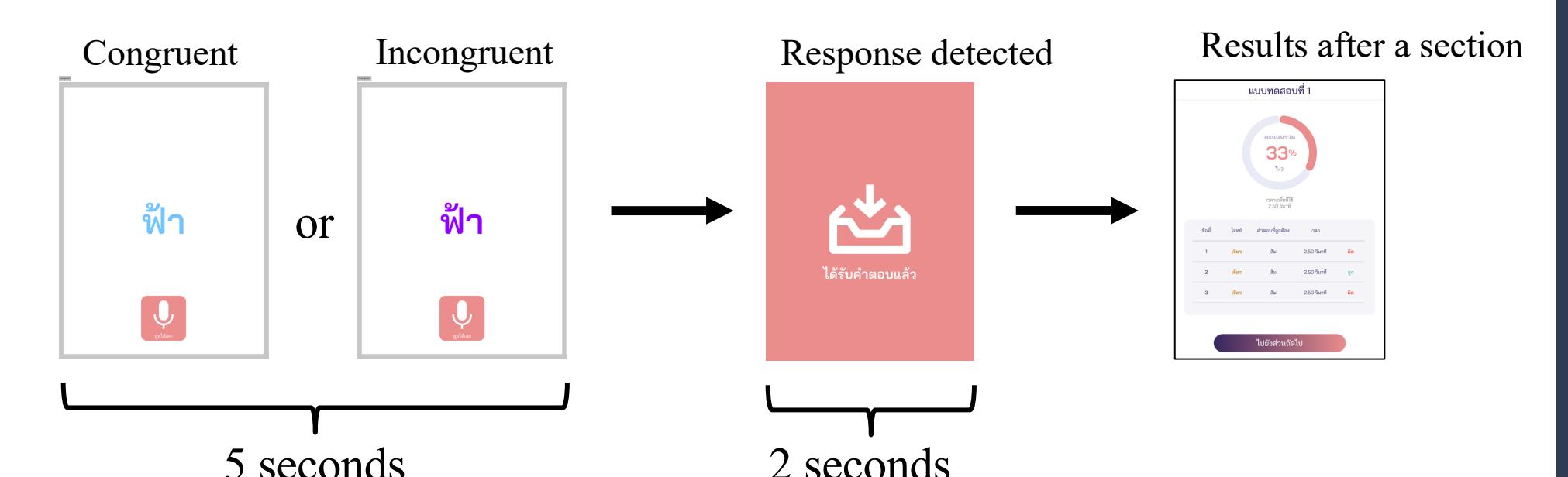
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Methodology

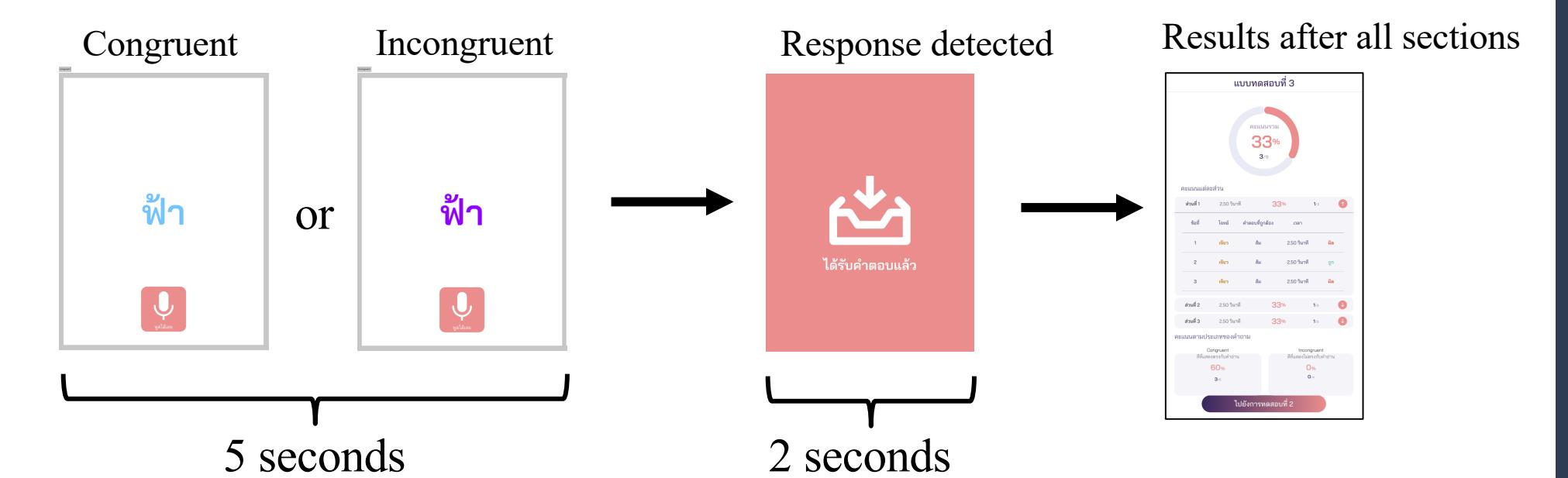
- We designed and developed the speech-to-text Stroop application using Flutter framework.
- There were 3 feedback types: feedback after each question, feedback after each section and feedback after all sections.
- Feedback after each question (real-time feedback):



- Feedback after each section



- Feedback after all sections



- We recruited 3 age-groups of participants: young adults (18-40 years), middle-aged adults (41-60 years), and older adults (61-80 years).
- First, participants had to complete a demographic survey.
- Then, a sequence of feedback types was assigned to participants randomly.
- For each feedback type, participants were required to complete 3 sections of Stroop task, with the number of congruent and incongruent trials of each section was in ratios of 3:7, 5:5 and 7:3.
- Each section contained 60 Stroop trials.
- The accuracy of speech recognition is 90% during the pilot study.
- Since the speech recognition software could detect words other than the intended color words, there were instances of false negatives during the test. For example, the Thai word for black, 'Dam,' is pronounced similarly to 'Da,' leading to potential misrecognition.

Results

- Participants:

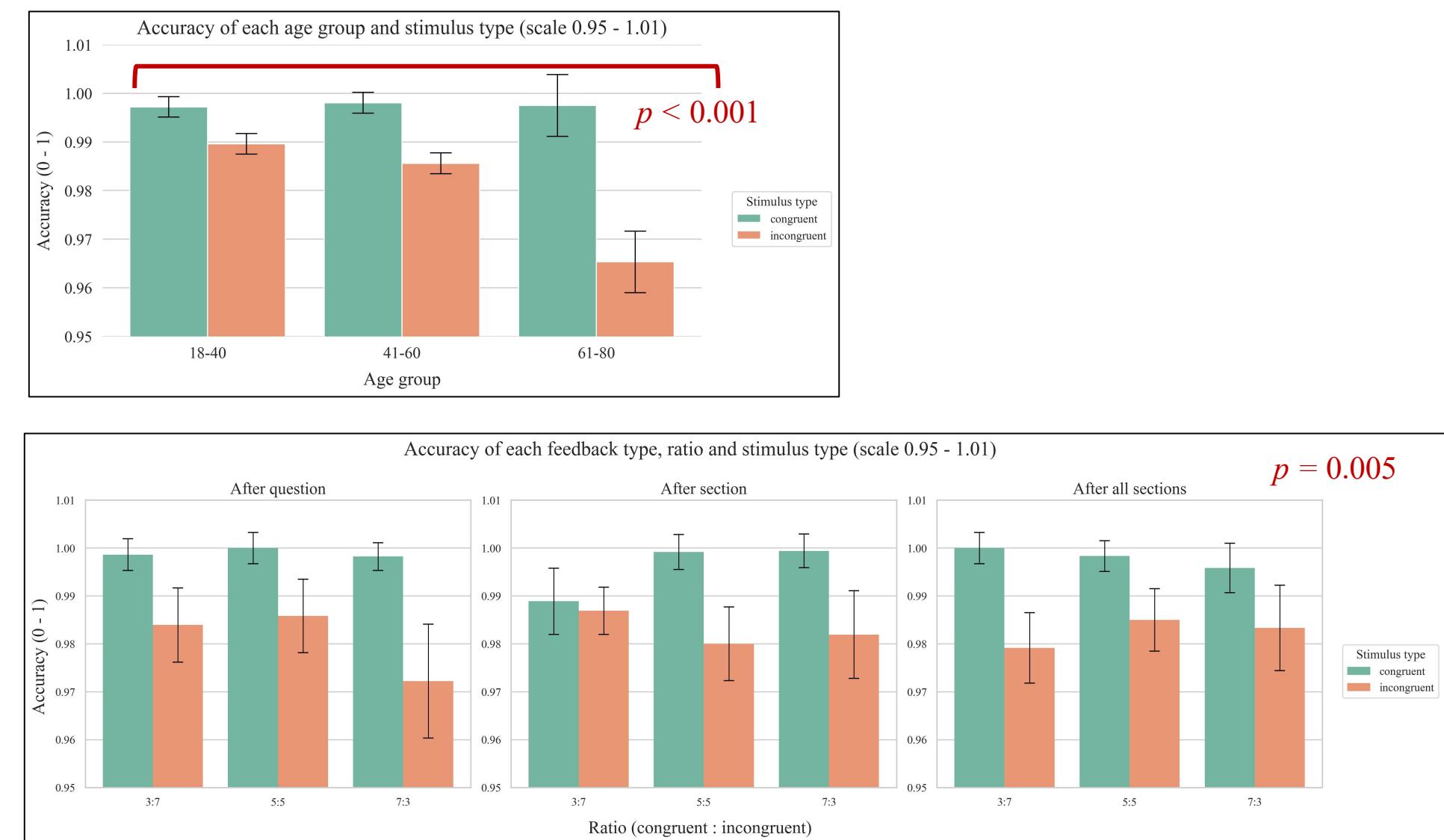
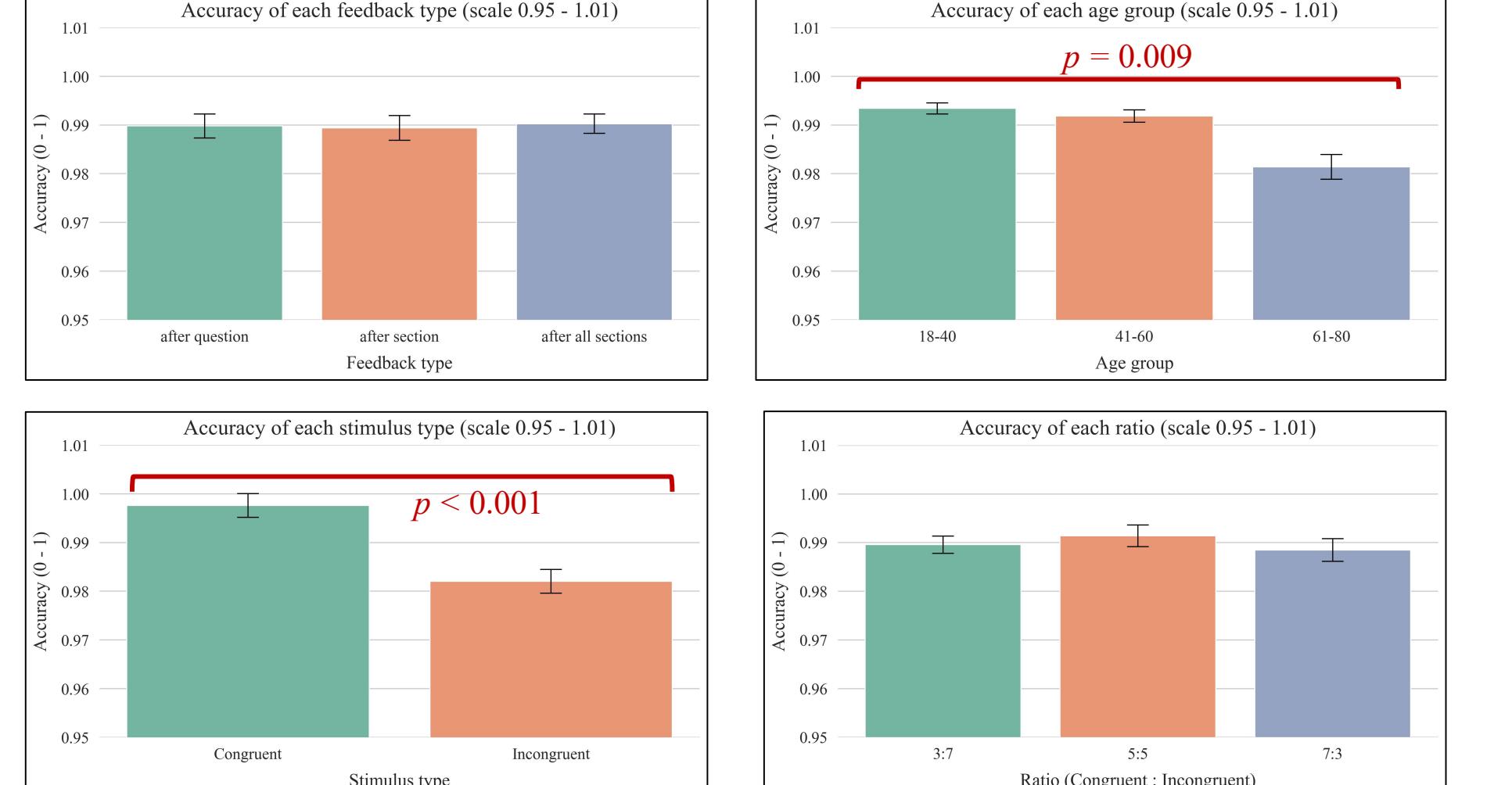
| Age group | #Participant |
|-------------|--------------|
| 18-40 years | 15 |
| 41-60 years | 15 |
| 61-80 years | 10 |

| Gender | #Participant |
|--------|--------------|
| Male | 14 |
| Female | 16 |

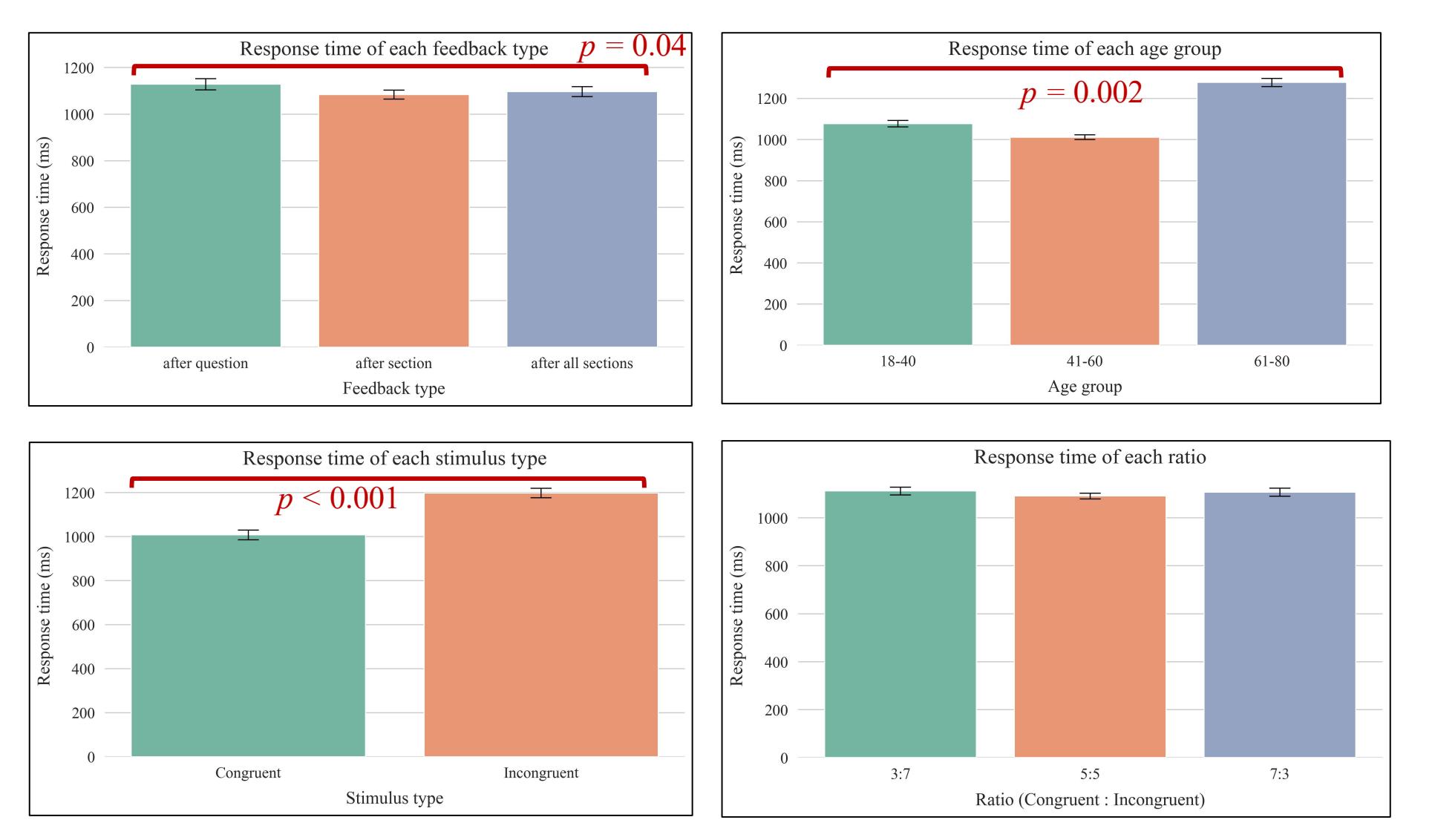
- We conducted a mixed model ANOVA to analyze factorial effects on accuracy and response time of the task.

- The factors: feedback type, age group, stimulus type and ratio.

Accuracy of Stroop task

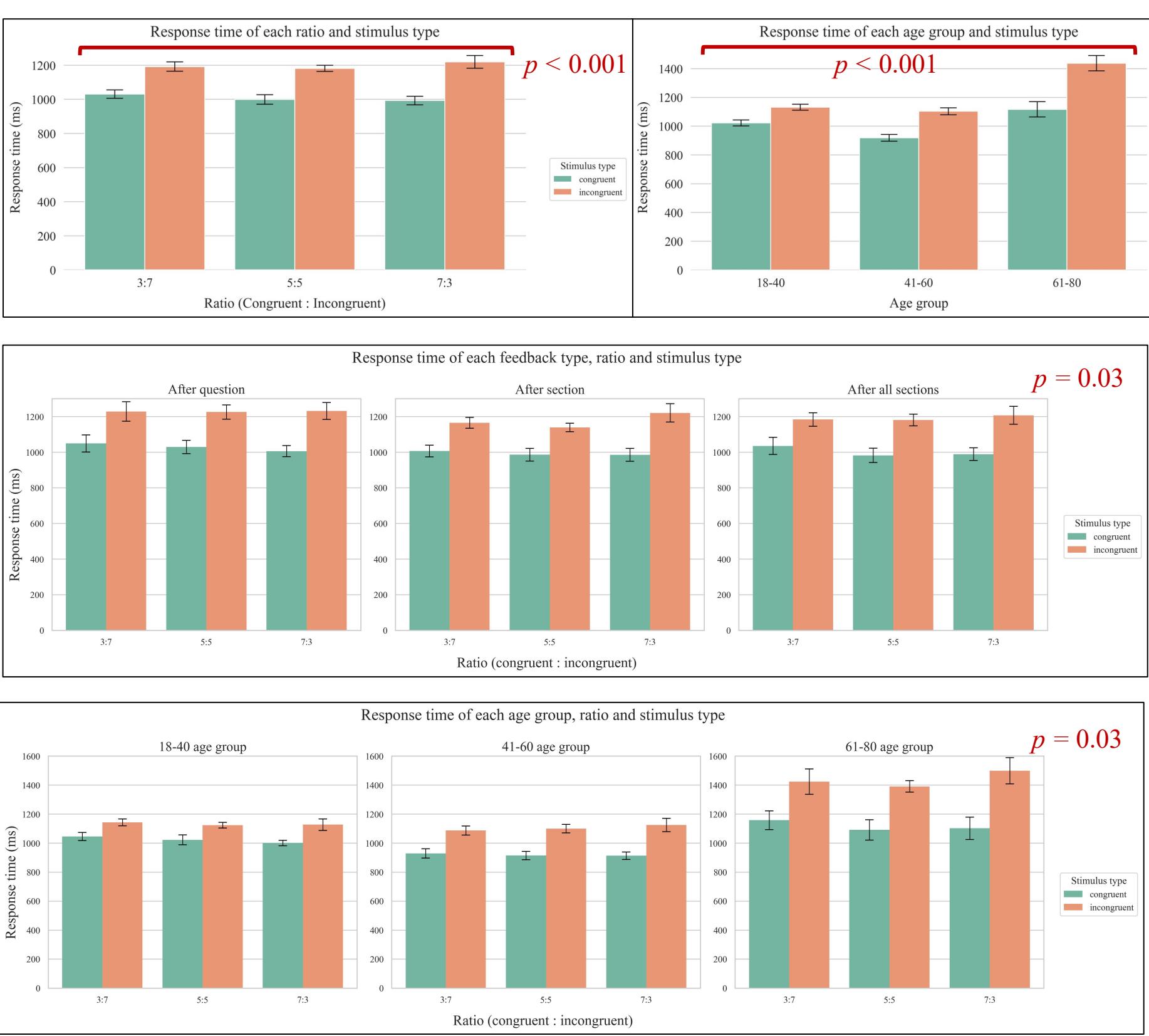


Response time of Stroop task



Results (cont.)

- Response time of Stroop task (cont.)



Conclusion

- Our study provides valuable insights into the influence of real-time feedback on cognitive control processes.
- The findings can guide the development of user-friendly and engaging cognitive monitoring and training applications suitable for all age groups.

Acknowledgements

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References:

- Appelgren, A., Penny, W., & Bengtsson, S. L. (2014). Impact of feedback on three phases of performance monitoring. *Experimental psychology*, 61(3), 224–233. <https://doi.org/10.1027/1618-3169/a000242>

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