

The following document suggests a methodology for performing an interview of the style described in “Thinking Aloud About Confusing Code: A Qualitative Investigation of Program Comprehension and Atoms of Confusion” by Gopstein et al. It suggests both high-level considerations as well as literal responses for specific common scenarios. Complete adherence to this guide is impractical, however as much as is feasible the spirit of these examples should be followed.

Outline of study

When conducting this study, each participant is run through 3 major phases

- (a) Evaluation - The subject is asked to hand-evaluate code snippets while thinking aloud. The participant is given a black pen for this section
- (b) Clarification - After each code snippet is completed the subject is asked how confident they were. Any ambiguous comments made by the participant are clarified.
- (c) Interview - After all snippets are evaluated, the participant is taken back through each snippet and allowed to ask questions, as well as misunderstandings are probed. The participant is given a red pen for this section

General rules:

- Any time a construct is misinterpreted, ask the subject (during the interview phase (c)), have you ever seen code like this before?
- Avoid yes/no questions, instead use phrases like "how" and "why", and if a factual answer is required, "what"
- Never contradict or correct the subject while they're still talking on a subject, or at all during phases (a) and (b)

- Whether or not a subject's answers are correct, keep encouraging them to talk as they keep saying new things
- Any surprising responses should be investigated further. It is ok to stop following a tangential line of investigation once the participant starts repeating themselves, or has deviated such that their responses are no longer pertinent to the research questions.
- A rule of thumb for interviews is 90% should be you listening.
- Use a black pen for the primary portion of the study where participants evaluate code (a/b) , and a red pen for the final portion when asking them for their thoughts (c)
- Begin section (b) with “Can you explain why you have this level of confidence for your answer to this question?”
- Begin section (c) with “Do you have any questions about this piece of code?”

Context-specific responses:

- Subject appears to be thinking and not speaking
 - What are you thinking?
- Subject asks interviewer a direct question
 - If the question is procedural, the interviewer may answer the question directly
 - If the question is about the intent of the study
 - I can talk to you more about this question after you've finished, but until then I can only read directly from my prompt
 - If the question is about the code they're evaluating
 - The purpose of this study is to learn about your thought process while reading code, and so I can't answer this question without changing the way you work through the code. After you are

finished, we will come back to the question and you and I will have a full discussion over how it all works.

- Subject says something inaudible
 - Can you please repeat what you just said?
- Subject says something ambiguous
 - Can you please describe what you just said in a different way?
- Subject explains the behavior of a construct wrongly (during interview, not during think-aloud)
 - How do you know {construct} behaves that way?
- There is reference to (or implications of) another programming language
 - How has knowing more than one language impacted your knowledge of programming?
 - If they mention a language explicitly:
 - You mentioned {language}, what is your experience with {language}?
 - How has knowing more than one language impacted your knowledge of programming?
 - If they explain a construct that appears to be from another language
 - How do you know {construct} behaves that way?
 - What is your experience with {list of languages with that feature, that they may have answered during the previous question}?
 - How has knowing more than one language impacted your knowledge of programming?
- Subject states a convention as if it were a rule
 - What happens if you do not {use convention}?
- Subject suggests an error occurs during the execution of the code
 - What would this error say?
 - How could you resolve this error?

- Subject mentions an aspect of their (formal/informal) learning:
 - (Choose all that are relevant)
 - How old were you when that happened?
 - Were you working alone? With a teacher? Another student?
 - Do you remember the context of learning this fact? Was it in a class? While working on a project? From reading a textbook?