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Use of Eye Tracking in Cognitive Pretests

GESIS Survey Guidelines

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These slides are based on the GESIS Survey Guidelines paper about eye tracking in cognitive pretests:

Neuert, C. and Lenzner, T. (2019). Use of Eye Tracking in Cognitive Pretests. GESIS Survey Guidelines. Mannheim, Germany: GESIS – Leibniz Institute for the Social Sciences. doi: 10.15465/gesis-sg_en_025

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A complete list of all references used on these slides can be found in the above mentioned Survey Guideline paper.

Overview

1. The methods of cognitive interviewing and eye tracking & the rationale behind supplementing cognitive interviewing with eye tracking
2. Practical implementation of eye tracking into cognitive interviewing
3. Analysis of eye-tracking data in the context of pretesting

1. Introduction

- Cognitive pretesting methods aim to uncover difficulties respondents have while answering survey questions
- A broad set of pretesting methods are available
- Each method has its own strengths and weaknesses
- Researchers often use a combination of methods to pretest survey questions

(Groves et al., 2004; Conrad & Blair, 2009; Presser et al., 2004)

1.1 Cognitive Interviewing (CI)

- Semi-structured, in-depth interviews
- Focus on respondents‘ cognitive processes during the answering of survey questions
- Enhances the comprehensibility of survey questions
- Conducted with small samples of 10 to 30 people
- Commonly used techniques:
  - „think aloud“: Verbalize all thought processes
  - „verbal probing“: Follow-up questions (probes)
- Use of pre-scripted probes and conditional (spontaneous) probing

(Forsyth & Lessler, 1991; Willis & Miller, 2011)

1.2 Eye Tracking

- Eye tracking is a technique that records people's eye movements while they process visual stimuli, e.g. answer a questionnaire on the computer
- Provides information on *where* respondents look at any given time, for *how long* they look at something, and in *which order*
- Respondents' eye movements provide information about their reading behavior and can be used to indicate question difficulties and to observe respondents' behavior
- Indicators of question problems:
  - Long and repeated fixations on words or phrases
  - Re-readings of the whole question or question parts
  - Several gaze switches between the question text and the answer categories

(Galesic & Yan, 2011; Lenzner et al., 2011; Neuert & Lenzner, 2016a; Romano Bergstrom & Schall, 2014)

1.2 Eye Tracking

Eye tracking is useful to answer the following questions:

- Do respondents read survey questions completely or do they skip (parts of) survey questions?
- Do respondents read all relevant parts of a survey question sufficiently careful, or do they just quickly scan them?
- Do respondents read survey questions in the intended order?
- Do some aspects of a survey question attract particular attention on the part of respondents?

1.3 Supplementing CI with Eye Tracking

Using a single cognitive pretesting methods has some weaknesses

Limitations of cognitive interviews:

- Qualitative data analysis is subjective
- Some respondents find it difficult to express themselves verbally
- Focus on individual questions, not on the questionnaire as a whole
- Interview situation might influence respondents‘ answers to the question

(Beatty & Willis, 2007; Conrad & Blair, 2009; Willis, 2005)

1.3 Supplementing CI with Eye Tracking

Limitations of cognitive interviews can be overcome by supplementing it with eye tracking

Advantages of eye tracking:

- rather unobtrusive and basically non-reactive
- provides important insights that can be used to assess specific questions
- is independent of respondents‘ verbal abilities, problem awareness, and willingness to report them to the interviewer
- provides quantitative and qualitative data

(Galesic & Yan, 2011; Neuert & Lenzner, 2016a; Romano Bergstorm & Schall, 2014)

1.3 Supplementing CI with Eye Tracking

Limitations of eye tracking:

- Eye tracking cannot identify the *causes* for question problems
- Eye-tracking data might be ambiguous
- Not everyone‘s eye movements can be recorded accurately (e.g., wearer of glasses)

The rationale behind the combination:

- Offers additional insights into the respondents’ cognitive processes
- Combining both methods is more productive in identifying both questionnaire problems and problematic questions
- Eye tracking helps in assessing the user friendliness and visual design of the questionnaire

(Galesic & Yan, 2011; Neuert & Lenzner, 2016a)

2.1 Eye-tracking equipment and set-up

Two common types of eye-tracking devices:

- Head-mounted eye trackers
  - allow more freedom of movement, but are comparatively invasive
- Remote eye trackers (see Figure 1)
  - less obtrusive, more comfortable, and allow a more natural experience for the user

(Duchowski, 2003)

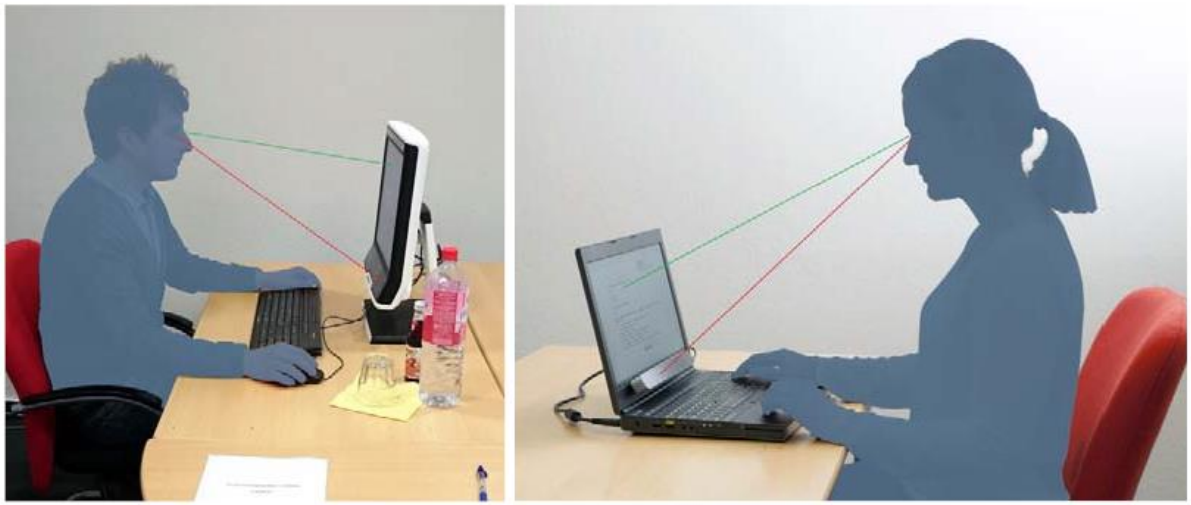

Figure 1. Eye tracker implemented in the frame of a 17" TFT monitor of a desktop computer (left); eye tracker mounted on the bottom frame of a laptop monitor (right).

2.2 Procedure

When supplementing cognitive interviewing with eye tracking, the testing session is divided in two sequential parts:

(1) Respondents fill in the questionnaire on a device with eye-tracking technology, conspicuous reading patterns or behaviors are observed and coded simultaneously by an interviewer

(2) Conduction of a cognitive interview in which previously defined cognitive techniques are administered and the peculiar reading patterns identified during eye tracking are probed

Figure 3. The picture illustrates the set-up of a cognitive interview session with eye tracking. Respondents first answer a questionnaire while their eye movements are tracked. Afterwards, a cognitive interview is conducted at the table.

2.2 Procedure

For noting peculiarities in a question it is helpful to use a coding scheme where interviewers have to check a box if they observe one of the behaviors listed.

	Observations Question 1
☑	Long and repeated fixations on words or phrases: R fixated long and repeatedly on the term "somatic"
☑	Re-readings of specific words or text passages: R read the question stem 3 times
☑	Regressions from answers to question text: Several times, back and forth
☑	Correction of the chosen response category: R changed answer from agree to neither/nor
❑	Skipping question
☑	Other: R did not read the instruction

Figure 2. Coding checklist with examples in handwritten font.

2.3 Interview protocol and interviewer instructions

Interview protocol should

- be semi-structured
  - Pre-defined probes as it is not possible to test every question
  - Use of pre-scripted probes ensures the comparability of results for later analysis across several pretest respondents
- include information on testing aims and measurement objectives
- allow to ask conditional probes, if conspicuous respondent behaviors or other peculiarities in the eye movements were observed during the eye-tracking session
- be administered retrospectively
  - give respondents a hard copy of the questionnaire to remind them of their thought processes, or
  - use a gaze video cue, that is, respondents are shown a replay of their eye movements during the cognitive interview

(Collins, 2015; Neuert & Lenzner, 2016a)

3. Analysis of eye-tracking data

The main measurements which are typically analyzed are fixations and saccades

- Fixations: moments in which the eyes remain relatively motionless
- Saccades: rapid eye movements between fixations

Eye-tracking data can be analyzed by defining areas of interest (AOI), sub-regions of the stimuli displayed are selected and metrics can be extracted specifically for each of these regions.

- Question stem and response categories are defined as two separate AOIs
- Aggregated metrics (fixation times or number of fixations) can be counted within each of the AOIs

3. Analysis of eye-tracking data

Heat maps and gaze plots can be used to visualize eye-tracking data:

- Heat maps can be used to visualize certain areas that attracted a lot of attention
- Gaze plots show the order and sequence of respondents' eye movements as they move across the screen.

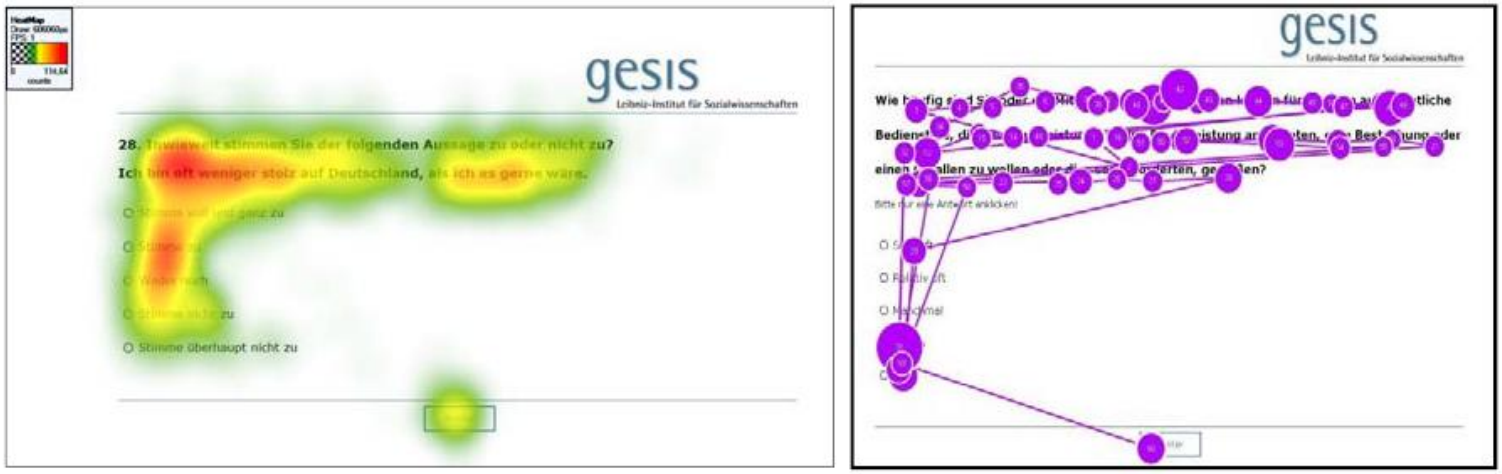

Figure 6. Illustration of two types of eye-tracking visualizations: a heat map (left) and a gaze plot (right).

3. Analysis of eye-tracking data

- Enhance data quality through comparing eye-movement data, and verbal data collected from cognitive interviews.
- The verbal data from the cognitive interviews is analyzed analogously to traditional cognitive interviews (see Lenzner et al., 2016).
- By observing respondents' eye movements, the interviewer is able to ask more targeted probing questions and to gain more information, which helps to detect problems that are not consciously apparent to the respondents.
- The eye-movement data can be compared with the verbal data gathered from the cognitive interviews to cross-validate and confirm the conclusions drawn.

We refer readers interested in the application of this hybrid method to our GESIS pretest database, in which pretest projects using this method are documented, for instance, Lenzner et al. (2015).

For more information about the Pretestlab please visit:

https://www.gesis.org/en/services/planning-studies-and-collecting-data/cognitive-pretesting

Thank you for your attention.

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