SCOTTISH GOVERNMENT SOCIAL RESEARCH GROUP
SOCIAL SCIENCE METHODS SERIES

Guide 7: Cognitive Testing in Survey Questionnaire Design

What is cognitive testing[1]?

The term cognitive testing is used in survey design to describe a range of methods which aim to capture people's thought processes and understanding in responding to questions. It brings together the disciplines of cognitive psychology and survey methodology. It can help to uncover some of the problems people have when answering and also when asking questions as part of a survey which might be missed in traditional piloting. Use of these methods alongside field pilots and other techniques can help survey designers improve questionnaire items to ensure they meet their intended objectives and those of the survey overall. Data from cognitive testing can also help analysts to understand and interpret survey data more accurately. They can enhance the reliability and validity of questions and surveys and contribute to improving data quality.

Cognitive testing techniques have been developed to explore the question response process based on a four stage cognitive model put forward by Tourangeau and other methodologists involved in the Cognitive Aspects of Survey Methodology (CASM) movement which gained ground in the early 1980s. The most common problems people have with questions are related to comprehension. Following from that are problems about how easy they find it to retrieve the relevant information they need to answer questions from memory, and their ability and willingness to provide the information in the required format. The following table summarises and defines the four stages and gives examples of the types of errors and question problems associated with each.

Cognitive Model of Question Response

Cognitive Stage	Definition	Response Errors/Question Problems
Comprehension	Understanding and interpretation of questions	Unknown terms, Ambiguous concepts, Long and overly complex questions.
Retrieval/Recall	Respondent searches memory for relevant information to answer questions	Recall difficulty, No prior knowledge/ experience, perceived irrelevance of topic.
Judgement	Respondent evaluates question and/or estimates response in deciding on an answer	Question biased or sensitive, Estimation difficult, Impact of social desirability on judgement.
Response	Respondent provides information in response to the question	Incomplete response options, Response options don't fit with understanding or judgement of question, Response influenced by social desirability, Unwilling to answer.

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[1] The use of the term cognitive testing in the context of survey design is quite distinct from its use to assess cognitive functioning of children and adults.

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Cognitive testing is essentially qualitative and the most common method used is **cognitive interviewing**[2] which involves semi-structured, depth interviews, usually with a purposive sample designed to reflect the range and diversity of views and experiences in the target population relevant to the question or survey. The interviews are conducted as (**concurrently**) or after (**retrospectively**) participants complete particular questions or survey questionnaires. There are two main cognitive interviewing techniques which each have their strengths and weaknesses and can be used separately or combined depending on the focus of cognitive testing:

- Verbal probing
- Think aloud

Verbal probing is particularly useful in helping to uncover participants' understanding of questions and to identify poorly worded or ambiguous questions. However it can also be used to examine retrieval, judgement and response. Although it is important to ensure that probing is clear, unbiased and used consistently in interviews, flexibility is an important feature of cognitive interviewing so that unanticipated problems can be identified and explored (emergent probing). Spontaneous probes are often used in response to participants' comments or behaviour. The following probes are used as standard:

Comprehension probe:	'what does the term x mean to you?'
Paraphrasing:	'can you repeat the question in your own words?'
General probes:	'how did you arrive at that answer?'
	'was that hard or easy to answer?'

It is possible to probe individual questions or a questionnaire retrospectively however there are problems with both approaches. Retrospective probing once a participant has completed a questionnaire may result in recall problems. On the other hand, probing after each question may make participants more aware of their answers which may influence their responses to following questions.

Think aloud interviewing can provide insight into the kinds of information and experience respondents draw on and the decision making process in responding to questions and is particularly useful in testing self-completion questionnaires. This technique requires respondents to put their thoughts into words as they work through an instrument. Interviewers may have to 'teach' respondents how to think aloud. The interviewer may also use probes to follow up on points raised in thinking aloud.

Cognitive testing can include the use of **card sorts** and **vignettes** to help participants visualise and talk about concepts. These techniques may also form part of the questionnaire which is being cognitively tested. **Focus groups** are also used in cognitive testing however they tend to be more useful in identifying overall themes and issues for a survey rather than specific question problems. Sometimes problems are identified in focus groups that are a product of the group dynamic and may be unlikely to arise when questionnaires are completed on an individual basis. **Observation** and **behaviour coding** are also used in cognitive testing to identify problems in answering questions including delay, uncertainty, reading errors etc, particularly at the field pilot stage.

The way in which cognitive testing is carried out should also reflect the type of survey being tested, for example; telephone, self administered, face to face, computer assisted. That said, it may be most effective to use face to face techniques in the earlier stages of survey design and follow up with cognitive interviewing relevant to the mode of administration of the survey. Willis gives an example of cognitive testing of a telephone survey which includes video monitoring of the participant as the cognitive interview is conducted over the 'phone, followed up by face to face retrospective debriefing.

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[2] The term cognitive interviewing is also used in a police context to describe a method for enhancing the accuracy and reliability of information retrieval by witnesses to and victims of crimes under interrogation. The method and literature on cognitive interviewing in this context is quite distinct from that on cognitive interviewing in survey design.

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The techniques used in cognitive testing are very similar to those used in usability testing for computer applications however the focus is on how survey respondents understand and respond to questions. Usability testing focuses primarily on the technological aspects of computer based applications. Willis (2005) makes a case for coordinating cognitive and usability testing more closely as e-mail and web-based survey methods develop.

Cognitive interviews are usually audio or video recorded, transcribed and analysed using qualitative analysis techniques or packages. The analysis of each item is reviewed and recommendations are made on whether items should be retained, deleted or modified and what modifications are required. Questions may undergo a number of rounds of testing and revision until no further problems are revealed. For instance, verbal probing is often used initially in cognitive testing to assess people's understanding of questions and followed up with think aloud techniques to explore process factors at a stage when issues about the meaning of terms have been addressed.

When should cognitive testing be used?

Cognitive testing is just one aspect of question and survey design and in general, it is most usefully carried out after the initial design of a questionnaire and before a field pilot. It can also be used iteratively throughout the process of survey development to refine questions in a questionnaire and minimise response errors. In this way, underlying problems with understanding and recall can be effectively tackled before the draft instrument is piloted so that piloting can focus on operational aspects of the survey. Cognitive testing is not an alternative to piloting but can be an important additional element in designing valid and reliable surveys.

In some cases, cognitive testing is used retrospectively to explore problems with an existing questionnaire, to help with interpretation of survey findings or to test out amended or new questions in an existing survey. This can be useful in long standing surveys where questions have been retained in the interests of consistency and maintaining a time series but where people's experience or understanding may have changed over time. It can also be helpful where an existing survey or measure is being used with a new or different target population to the one for which the survey was originally designed. Comparative analysis of cognitive interviews can help identify patterns of error and interpretation in questions across groups of people and may be particularly useful in comparing measures **between** groups eg different nationalities or socio-economic groups.

Cognitive interviewing can be particularly effective in testing questions which are complex, sensitive or intrusive. It also plays a valuable role in testing questions with specific groups who may have particular difficulties in completing questionnaires (Drennan, 2003). Consequently, it has been used extensively in health research.

The evaluation of cognitive testing in instrument design suggests that it is not necessarily better than any other method of question or survey evaluation as different methods produce different results. Issues have been raised about subjectivity in cognitive interviewing and the lack of standardisation in approaches to developing probes, analysis and interpretation of cognitive testing data. Sampling is also an issue with no clear guidance about the optimal number or spread of interviews to ensure most relevant problems are reliably picked up. Evaluations of cognitive testing have shown that while it is effective in picking up and describing problems with questions and surveys, there is a lack of consistency in the nature and volume of problems identified.

It is best used together with other questionnaire design and evaluation methods including expert review, focus groups, behaviour coding, response latency, vignette analysis, card sorts, field pilots, formal debriefing of interviewers and/or respondents, experiments and statistical modelling. The methods selected should be appropriate to the nature of the questions, the survey topic, the administration mode and the target population. In many cases, a small number of questions are cognitively tested rather than an entire questionnaire which makes the process more manageable in terms of time and cost for commissioners and for participants. Different versions of the questions will be tested with subsamples to identify which version is most effective.

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Although the focus of this methods briefing is on survey design, cognitive testing can also be used to good effect with a wide range of communication materials to ensure they are understood as intended, for example public information leaflets and adverts, guidance and instructions.

What are the advantages and disadvantages of cognitive testing?

Advantages:

- Reduces response errors in surveys and improves data quality
- Helps ensure that questions/surveys meet their objectives
- Improves validity and reliability of surveys
- Can pick up covert problems with questions which may be missed by field pilots and other survey evaluation methods
- Provides a flexible range of techniques which allow for differences in survey topics, respondents and administration mode
- Enhances analysis, interpretation and understanding of survey results
- Can be used at different stages of the questionnaire development process
- Can be used iteratively to ensure problems are addressed
- Increases the effectiveness of field piloting
- Relatively low cost in terms of potential to make surveys more robust - cheaper than field pilot and cost effective where outcome of cognitive testing informs pilot instrument

Disadvantages:

- Lack of shared concept of good practice and terminology in cognitive testing
- Potential to miss full range of problems if number of people interviewed is small or excludes particular groups of respondents
- Cost of cognitive testing in addition to piloting may seem relatively high due to intensive nature of work, need for trained, experienced cognitive interviewers and indeterminate number of iterations
- Requires researchers with strong survey design skills as the development of probes is an art in itself which needs to follow the rules of good question design – there could be a case for cognitively testing cognitive interview probes!
- Requires field capacity which generally precludes SG from undertaking this type of work in house
- No clear guidance on the optimal sample size to ensure that all problems relevant to all potential groups have been identified. Purposive sampling may result in too few interviews while open-ended nature of theoretical sampling can make it difficult to keep within resource constraints.
- Qualitative research so sampling not statistically representative and issues about how far findings can be generalised to population as a whole
- Some respondents may find think aloud techniques particularly difficult and require support and training to do this effectively
- Cognitive testing methods and interviewers can shape the data they produce and may 'create' problems that would not arise in the field
- Cognitive testing may not always provide solutions to the problems thrown up but simply highlight the need for further work
- Think aloud technique can make some respondents think more about their answers than they would have had they completed the questionnaire on their own
- There are few guidelines available on the analysis and interpretation of cognitive interviews and the subjectivity of cognitive testing analysis has been criticised

Cognitive testing is widely used by governments and research agencies including a number of permanent cognitive testing laboratories (eg National Centre for Health Statistics, the US Census Bureau etc), national statistics agencies including Statistics Canada, Statistics New Zealand and the Questionnaire Development and Testing Hub at the National Centre for Social Research in London (http://www.natcen.ac.uk/natcen/pages/hw_surveymethods.htm) . The Office for National Statistics does not routinely conduct cognitive testing but offers cognitive testing services (http://www.ons.gov.uk/about/who-we-are/) .

Development and Testing of the 2008/09 Scottish GP Access Survey Questionnaire
http://www.scotland.gov.uk/Publications/2009/05/18142136/16

Policy Context: The General Medical Services contract introduced to tackle problems of General Practitioners' (GPs) recruitment, pay and working hours, is linked to a Quality and Outcomes Framework (QOF) on which GPs' pay is based which was revised in 2008 to include two new patient experience indicators. These explored the percentage of patients who were able to: obtain a consultation with an appropriate health care professional within two working days; and to book an appointment with a GP more than 2 days ahead. The Scottish Government commissioned Ipsos MORI to design and cognitively test a questionnaire and covering letter for a postal survey of the general public to assess these indicators. The survey objectives included to ensure the survey provided robust data, was written in plain English, and was accessible to respondents for whom English is a second language or who have poor literacy skills.

Cognitive Testing Approach: Once the initial design of the cover letter and questionnaire were agreed by stakeholders, they were cognitively tested to explore how respondents understood, interpreted and answered the letter and questions; ensure the questionnaire was understood by a wide range of respondents; inform recommendations on revisions and improvements to the questions and letter; and to test this using iterative cognitive testing.

Overall, 40 cognitive interviews were conducted with a broad range of respondents, including those with English as a second language and with lower literacy levels. The sample was designed to include people that might have trouble working out the meaning or intention of the questions, have difficulty selecting the accurate response option or object to the inclusion or the phrasing of the questions/response options. Most of the sample was recruited on-street from the general public and a variety of approaches including snowballing were used to recruit people who were harder to reach.

Respondents were presented with the questionnaire and cover letter and asked to do exactly as they would if they were at home. A combination of interviewer observation (eg noting when the respondent looked puzzled, hesitated, took care or skimmed instructions or response categories) and retrospective verbal probing was used. All interviews were conducted in English in respondents' homes with interviews lasting around 45 minutes. The discussions were digitally recorded and transcribed. Respondents were given £20 in cash to cover any expenses and their time.

Outcome: Changes were made to the format and content of the letter and questions to encourage respondents to read as much of the information and instructions contained in them as possible. Amendments were also made to the routing instructions, terminology ('other healthcare professional' changed to 'doctor or nurse'), and wording for the response options was simplified. Respondents found the questions about booking appointments "in advance" particularly difficult to understand, mainly because this was not something they had done. The wording was changed to improve comprehension and the final version of the question was understood by most respondents. The overall layout of the questionnaire did not alter much throughout testing. The final version of the questionnaire and covering letter were recommended for use in the GP Access Survey.

Scottish Environmental Attitudes and Behaviours Survey 2008 (SEABS '08)
http://www.scotland.gov.uk/Resource/Doc/263223/0078735.pdf (Full Report)
Page 4 and the methodology chapter provide information on cognitive testing.

Social Science Methods Series: Cognitive Testing in Survey Questionnaire Design

http://www.scotland.gov.uk/Resource/Doc/265441/0079493.pdf (Technical Report)
Pages 10 and 11 provide information on cognitive testing.

Policy Context: The Scottish Government commissioned the Scottish Environmental Attitudes and Behaviours Survey (SEABS '08) to produce dedicated, robust and up to date social survey data to address the lack of information on people's attitudes and behaviours on climate change, sustainable development and wellbeing. The survey findings informed the Climate Change (Scotland) Bill and the development and delivery of environmental and other policy. The questionnaire was developed taking account of DEFRA's (2007) '*Survey of Attitudes, Knowledge and Behaviour in relation to the Environment'*, other relevant research and in conjunction with a number of internal and external expert bodies.

Cognitive Testing Approach: The questionnaire was cognitively tested by the survey contractor to ensure that all questions and response options were understood in the way intended. A sample of 20 people was drawn from the Scottish Household Survey (SHS) respondent database to include a cross-section of the public in terms of age, sex, household type and size, car ownership and location. A combination of interviewer observation and retrospective probing techniques were used to identify potential problems with the questionnaire and 'think aloud' techniques were used to test attitudinal items. All interviews were carried out face to face by a core member of the Ipsos MORI project team.

Outcome: The main findings together with recommendations for changes to the questionnaire were submitted in a report to the Scottish Government. Most of the changes were minimal and took the form of slight alterations to question wording and precodes to make sure that the survey was understood as intended. All of the recommendations were accepted by the Scottish Government.

Key references/links

Key texts:
'Cognitive Interviewing – A Tool for improving Questionnaire Design', Gordon B Willis, Sage, 2005 (copy available from OCR)

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'Cognitive science and survey methods: a cognitive perspective', R Tourangeau in T Jabine, M Straf, J Tanur, and R Tourangeau (Eds), Cognitive Aspects of Survey Design: Building a Bridge Between Disciplines, National Academy Press, Washington DC, 1984

The Magenta Book: Guidance Notes for Policy Evaluation and Analysis, Chapter 6: How are data collected?, GSRU, HM Treasury, March 2004
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'Cognitive interviewing: verbal data in the design and pretesting of questionnaires', J Drennan, Journal of Advanced Nursing, Vol 42, No 1, pp57-63, April 2003

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Cognitive Testing in Government:
'Development and Testing of the Scottish GP Access Survey Questionnaire', A Homes, K Sewel, S Treanor, L Murray, Scottish Government, 2009
http://www.scotland.gov.uk/Publications/2009/05/18142136/16

Social Science Methods Series: Cognitive Testing in Survey Questionnaire Design

'Cognitive Question Testing Scotland's Census Ethnicity Classification', A Homes, L Murray, Scottish Government, 2008
http://www.scotland.gov.uk/Resource/Doc/215811/0057719.pdf

Cognitive Testing of Scottish Health Survey 2008
http://www.scotland.gov.uk/Topics/Statistics/Browse/Health/scottish-health-survey/Consultation2008

'Cognitive testing: British Social Attitudes child poverty questions', Margaret Blake, Elizabeth Clery, Joanna d'Ardenne and Robin Legard, Department of Work and Pensions, Research Report No 574, 2009 http://research.dwp.gov.uk/asd/asd5/rports2009-2010/rrep574.pdf

Other Resources:
National Centre for Social Research, Survey Methods Newsletter on theme of Question Design, Vol 25, Spring 2007
http://www.natcen.ac.uk/natcen/pages/news_and_media_docs/newsletters/smu/smunews_25.pdf

Social Research Association has run training events on cognitive methods for testing survey questions
http://www.the-sra.org.uk/

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