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# Workshop synthesis: Measuring attitudes and perceptions in large scale (quantitative) surveys

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## Abstract

This paper presents the main outcomes of the workshop A5 Measuring attitudes and perceptions in large scale (quantitative) surveys. There is a big need in the community to include more questions about psychological factors in surveys, because the travel behavior is getting more divers. The workshop discussion revealed that while there are different survey methods to capture information about the participants' psychology, Likert scales are mainly used because they are easy to implement and to fill in. However, the reliability of the results must be assessed in light of the survey method and type of analysis. Further research is needed to combine quantitative surveys with methods to collect psychological information.

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## 1. Introduction

Attitudes and perceptions are becoming more and more important in explaining travel behavior, because the offered modes and the travel behavior, e.g. intermodal trips and multimodal behavior are getting more diverse. The demand for collecting data on the psychology of travelers has strongly increased in the recent years (Carrasco and Lucas, 2015; Clifton and Carrasco, 2018). Attitudes and perceptions are often collected in the social sciences using qualitative survey methods. In travel behavior research, transportation planning and modeling, travel decisions, e.g., on destination or mode choice, are often described with discrete variables such as travel times, costs, etc. Attitudes and perceptions are often not adequately considered. However, quantitative surveys ask for a lot of data, from which attitudes and perceptions can possibly be derived. A direct way to capture psychological aspects is to include questions

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or exercises in a questionnaire that reveal the participants' psychology. There are different survey methods that allow for collecting attitudes and perceptions, also in large scale quantitative surveys. These methods differ in terms of effort, prior knowledge, significance, and robustness of the collected information.

In the workshop, we collected various methods, e.g. questionnaires and/or questions with Likert scales (Likert, 1932), stated preference or choice, and others which could be implemented in large scale travel surveys. We discussed the methods and the advantages and disadvantages of each method in terms of their suitability for measuring attitudes and perceptions as well as the comprehensibility of the questionnaires and the response quality.

To get an overview of the topic we asked the participants of the workshop in a pre-survey several questions on their experiences with capturing attitudes and perceptions. The following list shows a selection of the answers and can be seen as some kind of state of the art of surveying attitudes and perceptions.

Survey methods that can be used to capture attitudes and perceptions in large scale surveys:

- Likert scales (4-point/5-point or agree/disagree) or other similar closed scales such as item lists (e.g., which of the following would encourage you to cycle more)
- Ranking exercises
- Open-ended questions
- Stated preference questions
- Quantitative surveys mainly using psychometric scales

Methods to assess the response quality in questionnaires on attitudes and perceptions:

- Analyses on reliability (Cronbach Alpha) or exploratory and confirmatory factor analysis
- Completion time and answering in patterns
- Assessing the share that did not provide an answer. For open questions, checking if people's answers correspond with the actual question.

Need to get information on psychological factors (case studies):

- Under what circumstances would people be more willing to use certain transport modes, namely active and public modes
- Analyzing factors that influence behavior or intention to use transport modes, psychological barriers, adoption of new modes, etc.
- How safe do people feel when travelling in the light of the pandemic
- Input for choice models with latent variables or factor analysis
- Survey on environmental and climate behavior. Understanding how and why people make choices and changes is key to supporting the green transition
- Intention to use services

Based on this input we worked in the workshop mainly on the topics Likert scale, open-ended questions, stated preference surveys and including new technologies as an outlook. The discussion revolved around assessing response quality, data quality and data fusion with traditional survey methods/data. Furthermore, we tried to find good methods to capture and analyze data with very limited biases and to select item sets and scales.

## **2. Surveys on perceptions and attitudes – what are the challenges**

The workshop aims at sharing experiences with collecting data on attitudes and perceptions in large quantitative surveys. Beside others, it deals with the requirements of the participants and their effort to fill in the survey as well as the quality of the survey and of the data. We had presentations on the above-mentioned topics and shared experience in already conducted surveys. These state-of-the-art surveys provide an overview on different survey methods for collecting data on psychological factors in large scale quantitative surveys. The following aspects summarize and highlight different approaches and their characteristics to identify the challenges in surveying perceptions and attitudes:

A comparison of a survey with Likert scale only and a combined survey with open-ended questions and Likert scale shows that there are significant differences in the answers, while there are no significant differences in the sociodemographic of the participants. Further, using the data from the combination of open-ended questions and Likert scale items the estimated models perform better. In the combined survey method, the answers in the Likert scale are more extreme and less in the middle (Baburajan et al., 2022).

A study of unintentionally repeated questions on two ecological topics with Likert scale in one questionnaire shows inconsistency per each question and calculated a total inconsistency score per each person. Analyses show the higher the education and income of the participants the lower is the inconsistency in the answers. Furthermore, the more ambiguous the questions the lower is the consistency (Wang et al., 2022).

Different communication methods (in this case study: face-to-face vs. online) influence the responses. In a survey on well-being while travelling with Likert scale the answers differed strongly due to the communication form. It was found, that in the online survey, the share of invalid responses was much higher than for face-to-face interviews (Arroyo et al., 2022).

In a stated preference (SP) survey on time use of people in an automated vehicle the answers were more realistic if questions were connected to a specific trip of the participants. The public transit users stated their future activities while traveling more realistic compared to nowadays car users. That means that in SP surveys the situation of the experiment should be described precisely and should be understood well by the participants (Kagerbauer et al., 2022).

If a survey with existing item sets is transferred to other countries or other cultural habits the understanding and the answers may differ significantly. If a survey works very well in one country it must not work well in other countries, naturally. In a case study in China an algorithm was developed to check strategic response patterns in an item set. Identifying response patterns that are likely to be response bias can be helpful in ensuring high data quality (Magdolen et al., 2022).

A survey on physical distancing behaviour included both subjective (perceptions) and objective (proximity measuring) data. The study reveals that the subjective data complements the objective behaviour data. The combination of different survey methods provides a more comprehensive picture of compliance behaviour (van Schaik et al., 2022).

These examples show that there are several aspects that should be considered when capturing perceptions and attitudes in (large scale) travel surveys.

### 3. Characteristics of surveys on attitudes and perceptions

Based on the pre-survey of the workshop and the presented contributions, a discussion on the survey of attitudes and perceptions followed. Four different survey methods were identified, namely Likert scales, open-ended questions, ranking exercises and new technologies. The latter include new methods such as measuring heart rates or eye tracking. All four survey methods were discussed regarding their advantages and disadvantages, the easiness to understand and to complete for the participants, the response quality, the easiness to analyze for the researcher and the results quality. It became clear, that Likert scale items are the state-of-the-art in surveying attitudes and perceptions and most studies use this instrument. The easiness to understand and to fill in Likert-style item sets for the participants was mentioned as one main advantage. Further, answers in Likert scale items can be easily transferred into numerical numbers and thus can be easily used in models.

When including Likert scales in a survey, different aspects should be considered. The response quality can be influenced both from the items and the survey itself and also from external settings. In the following a list of different aspects are given.

‘Internal’ aspects with influence on the response quality:

- Order of the items
- Inclusion of the option ‘No answer’
- Number of response categories, e.g., 4-,5- or 6-point Likert scales
- Position of item set in the survey (beginning, mid, end)
- Combination with other types of question, e.g., open-ended questions
- Duration of the total survey or interview

- Number of items
- Formulation of items (general, specific)
- ...

‘External’ aspects with influence on the response quality:

- Recruiting method, e.g., public opinion panels
- Interviewer effect (motivation, social pressure, ...)
- Incentives for participation
- ...

In the literature, several studies shed light on these mentioned aspects, e.g. Matell and Jacoby (1971) and Chang (1994) who present studies on the optimal number of alternatives for Likert scale items. Other exemplary studies are Dawis (1987) who discusses aspects on the scale construction to capture psychology or Loosveldt and Beullens (2017) who present a study on the interviewer effects on the response quality.

When discussing the quality of survey data, it is necessary to think of methods to assess the quality. Regarding Likert-style items, it is comparatively easy for participants to run through the items without careful reading and evaluating the item responses. Thus, data from item sets may not reveal the participant’s attitudes, but the outcome of a satisficing strategy. Researchers then have to evaluate the responses and to identify which responses should be examined more in-depth or even have to be excluded. Several ways to identify bad responses exist. Completion time and the share of selected ‘no answers’ can indicate bad responses. Further, standard deviation, longest sequence of the same response category and other indicators that identify specific response patterns in the item set can be additional hints. However, it still remains a challenge for the researcher to define a cut-off between responses that are likely to reveal the participant’s attitudes and responses that are likely to be biased.

Overall, it should be remembered when surveying attitudes and perceptions with Likert scales that the survey is usually intended to capture psychological constructs. Most studies make use of existing item sets, which were mostly developed by psychologists. By using standardized item sets, the underlying constructs are likely to be captured. Nevertheless, it should be checked whether the results reflect the expected constructs for example with factor analyses (confirmatory, exploratory) and with reliability tests (e.g. Cronbach’s alpha) (Gliem and Gliem, 2003).

Besides Likert-style item sets, open-ended questions can be used to survey attitudes and perceptions. Participants can freely decide in which way they answer and how much information they provide. However, the answers from open-ended questions need much more post-processing compared to answers given in Likert scale items. They are often processed with text analysis tools and the answers are grouped together in topics. The inclusion of information given in open-ended questions in models is difficult, because the conversion into numerical values is challenging.

Ranking exercises are another possible survey method which allows to collect information on attitudes and perceptions. For participants ranking exercises might be easy to fill in, as they only need to assess the answers in a relative way (not absolute). However, depending on the study, the collected information from ranking exercises might be only useful for a specific research question, but difficult to be used in other contexts because they only contain the relative assessment.

Information collected with new technologies such as tracking of the eye movement or heart rates can also help to collect information on the psychology of participants. A possible use case could be the measuring of heart rates when showing different pictures of the impact of the transport system on the environment. The collected data might help to distinct different types of people and their emotions when seeing the pictures. Overall, the application of new technologies is a large and new research field and future research is necessary to identify the potentials and limitations of these survey methods.

Fig. 1 shows an overview on the collected and discussed ideas during the workshop.

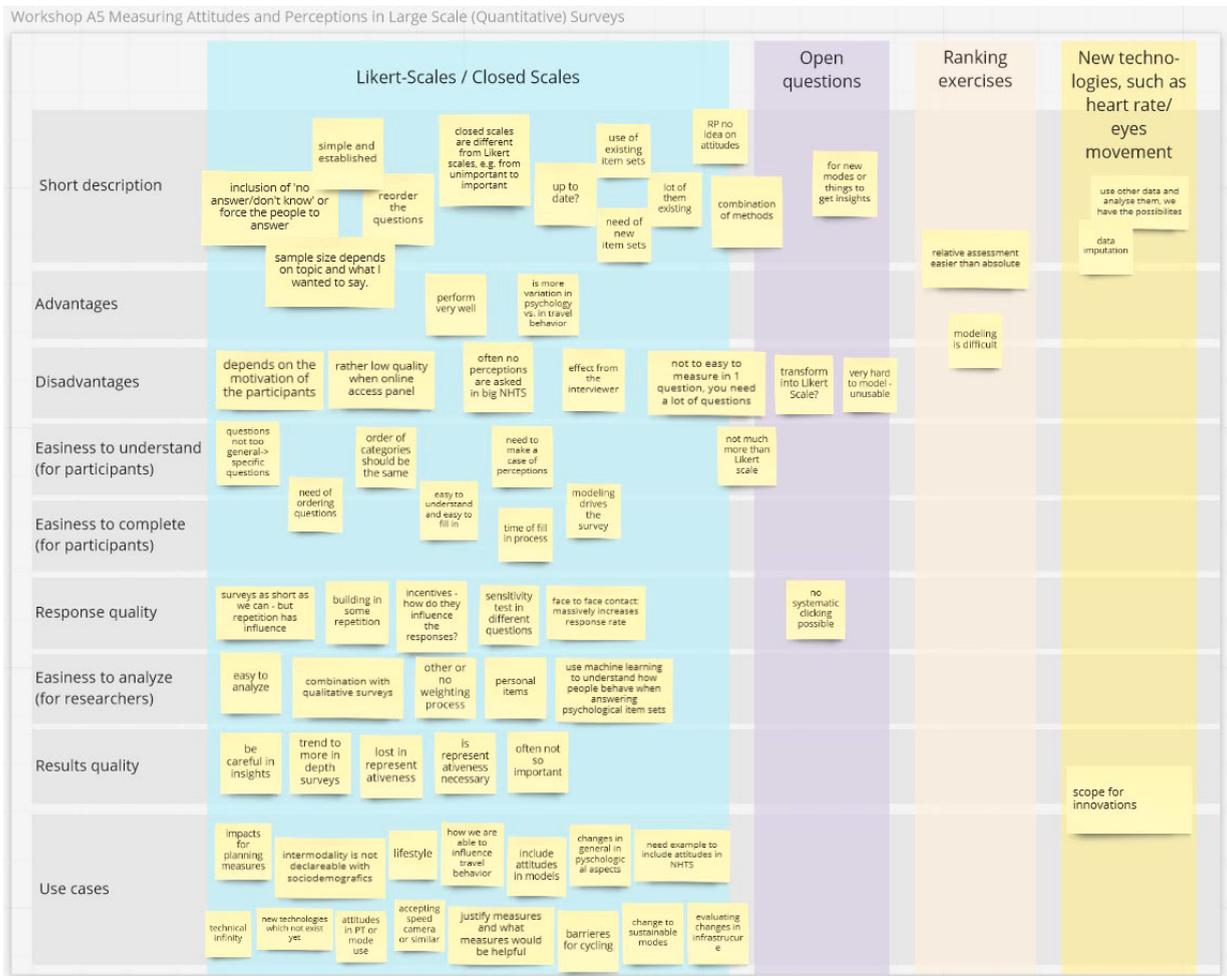


Fig. 1. Characteristics of each survey method discussed during the workshop

The discussion revealed that psychological item sets are still comparatively seldom included in travel surveys although studies that considered attitudes and perceptions proved to increase the understanding of mobility. Especially household travel surveys often have no module on capturing psychology. Reasons for this may be the lack of experiences with such psychological information and the communication of the results. Researchers should develop use cases to highlight the need of collecting psychological information.

When designing a survey that captures attitudes and perceptions, the representativeness should be considered. Up to now, surveys mainly aim at being representative regarding the distributions of sociodemographic characteristics, e.g. age, gender, household size, and spatial distributions, e.g. place of residence. For researchers the determination of the representativeness of the psychology of the participants is difficult. Thus, researchers rely on the fact, that the above-mentioned variables (age, gender, place of residence) serve as proxy of different lifestyles and psychology. However, it still remains a difficult task to control for representativeness and the decision who to ask in a survey on perceptions and attitudes should be carefully done. The participants of the workshop agreed that this issue needs to be investigated in future research.

#### 4. Conclusion and Research Needs

The workshop was about the measurement of attitudes and perceptions in large scale travel surveys. To design a survey that captures psychological characteristics is challenging, because usually psychologists use qualitative research methods. The inclusion of psychological questions in a questionnaire should be carefully considered as it opens a completely new dimension and it often results in a high respondent burden for participants. Even if Likert scales are used, which are rather easy to fill in, it is not enough to just include one or two items (Gliem and Gliem, 2003). Only well-tested item sets, with several items measuring one psychological construct, should be used. Although many different item sets collecting data on various psychological constructs exist, it can be a challenge for the researchers to find a specific well-tested item set that suits the aim of the specific study. Further, many item sets exist already for a long time and may not be suitable to collect data on rather new phenomena. Thus, new item sets need to be continuously developed. However, this should happen together with psychologists, who bring the necessary background and understanding, which are essential to capture the aimed psychological constructs.

During the workshop, several aspects that should be addressed in future research were identified:

The idea was discussed to use machine learning methods while people fill in a psychological item set. This can help to understand how people behave when answering the items and maybe allows to identify people with bad reports. Further, new technologies are promising to support the collection of psychology, for example if the eyes movement is tracked during the survey.

Another main aspect that should be considered and emphasized in research in the future, is the representativeness. Research should focus on how the representativeness of psychology, and thus the variance in psychology among different people, can be achieved.

Summing up: usually attitudes and perceptions are not included in nowadays travel surveys adequately, however there is a big need to include attitudes and perceptions due to the changing travel behavior and the more individualized habits. Future travel surveys should consider these aspects to get more precise data and insights in individuals travel decision making. However, there is more detailed research needed to analyze effects of the integration of psychological and technological aspects in household travel surveys.

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