Research and Innovation Action

Social Sciences & Humanities Open Cloud

Project Number: 823782 Start Date of Project: 01/01/2019 Duration: 40 months

Deliverable 4.13 Audio Transcript Data

Audio transcripts based on audio files collected in survey interviews

Dissemination Level	CO (Only report can be public)
Due Date of Deliverable	31/12/2021 (M36)
Actual Submission Date	03/12/2021
Work Package	WP 4 - Innovations in Data Production
Task	T4.4 Voice recorded interviews and audio analysis
Type	Other
Approval Status	Waiting EC approval
Version	V0.3
Number of Pages	p.1 – p.17

Abstract:

This report details the data collection process of audio data in an online survey and the subsequent preparation of speech-to-text transcripts. In addition, it assesses the data quality and usability of the collected data. This report is accompanied by the audio transcript data in excel (xlsx) format.

SSHOC, "Social Sciences and Humanities Open Cloud", has received funding from the EU Horizon 2020 Research and Innovation Programme (2014-2020); H2020-INFRAEOSC-04-2018, under the agreement No. 823782

History

Version	Date	Reason	Revised by
V0.1	28/10/2021	Update outcome analyses	Henk van den Heuvel, Martijn Bentum, Simone Wills
V0.2	19/11/2021	Peer Review	Ruud Luijkx
V0.2	19/11/2021	Peer Review	Joris Mulder
V0.2	20/11/2021	Submission to WP Lead	Judith C. Koops
V0.3	22/11/2021	Comments from WP4 leader	Diana Zavala-Rojas
V1.0	20/11/2021	Submission to WP Lead	Judith C. Koops

Author List

Organisation	Name	Contact Information
KNAW-NIDI	Judith C. Koops	Koops@nidi.nl
CLARIN-RUN	Henk van den Heuvel	H.vandenHeuvel@let.ru.nl
UVT-EVS	Ruud Luijkx	R.Luijkx@uvt.nl

Executive Summary

Task 4.4. Voice recorded interviews and audio analysis in the Social Sciences and Humanities Open Cloud project aims to integrate the collection of audio recordings into an existing social sciences survey infrastructure. A proof of concept was prepared by the Generations and Gender Programme, the Common Language Resources and Technology Infrastructure and the European Value Survey in the form of an experiment in which an Audio Module was integrated in the Dutch Longitudinal Internet studies for the Social Sciences. The quality of the audio data was assessed by the Centre for Language and Speech Technology. This report can be used as a guideline for the collection and processing of digital language data and as a template for future synthesis of infrastructures in the Social Sciences and Humanities cluster.

The Audio Module was collected in April 2021 among men and women aged 20-49. For the purpose of the experiment, the software Questfox was integrated into the existing survey infrastructure. The response rate to the Audio Module was 63%. A total of 100 people used voice recordings to respond and 386 typed their answer in a text box. The audio recordings were of average to good quality and 90% were suitable for further linguistic and computational analyses.

The experiment shows that collaboration across social sciences and humanities infrastructures can generate high quality digital linguistic data, both in terms of audio and text. This data can add substantive content to the information already captured in the surveys, also through further analysis by linguistic and computational tools. In addition, the data can be used to improve these tools and to improve language coverage. In order to reduce selectivity due to very low response, we advise future projects to allow respondents to type instead of orally respond to questions if respondents wish to do so. To reduce the need for the use of audio files to a minimum, the project team recommends making speech-to-text transcripts available for research.

Abbreviations and Acronyms

ASR	Automatic Speech Recognition
CARI	Computer Assisted Recorded Interviews
CLARIN	Common Language Resources and Technology Infrastructure
CLST	Centre for Language and Speech Technology, Radboud University, Nijmegen
ERIC	European Research Infrastructure Consortium
ESS	European Social Survey
EVS	European Values Study
GGP	Generations & Gender Programme
KNAW	Royal Netherlands Academy of Arts and Sciences
LISS	Longitudinal Internet studies for the Social Sciences
NIDI	Netherlands Interdisciplinary Demographic Institute
NLP	Natural Language Processing
SFTP	Secure Shell File Transfer Protocol
SHARE	Survey of Health Ageing and Retirement in Europe
SSHOC	Social Science & Humanities Open Cloud
UVT	Tilburg University
WER	World Error Rate

Table of Contents

1.Introduction

Survey Infrastructures like the Generations and Gender Programme (GGP), European Values Study (EVS), European Social Survey (ESS), and Survey of Health, Ageing and Retirement in Europe (SHARE) systematically interview tens of thousands of individuals across Europe each year. People, randomly selected from the population, are asked about a wide range of information that is valuable to researchers and policy makers. Yet, a large proportion of the information conveyed in an interview is lost. The respondents' tone, their clarity, their fluidity, the depth of the vocabulary can all be used to provide insights into various concepts of interest to social scientists such as cognitive function and verbal reasoning skills. To make use of this lost data it is necessary to integrate the tools of linguistic infrastructures into the analytical pipeline of survey infrastructures.

Task 4.4. Voice recorded interviews and audio analysis in the Social Sciences and Humanities Open Cloud project (SSHOC) aims to integrate the collection of Computer Assisted Recorded Interviews (CARI) into an existing social sciences survey infrastructure. The collection of audio data and the subsequent processing of this data is organized by the Royal Netherlands Academy of Arts and Sciences (KNAW-NIDI), Common Language Resources and Technology Infrastructure (CLARIN ERIC), and Tilburg University (UVT-EVS).

Data collection guidelines, including the questionnaire and technical specifications, were provided in the first deliverable associated with Task 4.4: *Deliverable 4.12 Guidelines for the integration of Audio Capture data in Survey Interviews*[1]. This report follows it and provides information about the archiving strategy of the generated audio files and auto-transcribed text files in Chapter 3 *"Data Storage"* and assesses the data quality and usability in Chapter 4 *"Data Quality"*. Deliverable 4.12 included data collection guidelines. However, due to the COVID-19 pandemic, several changes to the data collection approach had to be implemented. Chapter 2 *"Changes to Data Collection Approach"* describes these changes in detail. The conclusion and recommendations are provided in Chapter 5. As per suggestion of the Reviewers of D4.12, Chapter 5 also reflects on how multilingual aspects at the level of language processing tools can be tackled in the future.

[1] Tom Emery, Ruud Luijkx, Giovanni Borghesan, & Henk van den Heuvel. (2019). SSHOC D4.12 Guidelines for the integration of Audio Capture data in Survey Interviews (v1.0). Zenodo. https://doi.org/10.5281/zenodo.4558280

2. Changes to Data Collection Approach

The data collection of audio recordings was planned to commence in the first half of 2021. In preparation of the data collection, deliverable D4.12 *Guidelines for the integration of Audio Capture data in Survey Interviews* was prepared in December 2019. The authors recommended implementing the collection of audio data in the Dutch Generations and Gender Survey. The reasons for this were threefold. Firstly, given the location of the partners involved in this task, the Netherlands was identified as an optimal candidate for testing the initial implementation of CARI in an ongoing social survey data collection. Secondly, the high-quality automatic speech recognition (ASR) tools of CLARIN, which are used to prepare the speech-to-text transcripts, are available for the Dutch language. And lastly, the data collection of the Dutch Generations and Gender Survey was envisioned in the first half of 2021, which fitted well with the timeline of Task 4.4.

In the summer of 2020 it became clear that, as a result of the COVID-19 pandemic, the data collection of the Dutch Generations and Gender Survey had to be postponed. Because of the uncertainty about the actual start of data collection in combination with the deliverable due at the end of 2021, other options were explored. It was decided to embed the collection of voice recordings in the Longitudinal Internet studies for the Social Sciences (LISS).[2] LISS is an online panel survey. While many surveys relying completely or partially on face-to-face interviewing had to be postponed because of the COVID-19 pandemic, the LISS panel was one of the few social science infrastructures which could continue to operate during the COVID-19 pandemic. This in combination with the fact that the LISS panel operates in the Netherlands and collects information among Dutch language speakers (important for the use of the ASR software of CLARIN) made the LISS panel a good alternative.

The LISS panel consists of 5,000 Dutch households, comprising approximately 7,500 individuals aged 16 years and older. The panel is based on a true probability sample of households drawn from the population register by Statistics Netherlands and is refreshed annually. Every month, panel members complete online questionnaires of about 30 minutes in total. Panellists receive a monetary incentive of an equivalent of €2,50 for 10-minute survey time. Part of the interview time available in the LISS panel is reserved for the LISS Core Study. The LISS Core Study is repeated yearly and is designed to follow changes in the life course and living conditions of the panel members. In addition to the LISS Core Study there is ample room to collect data for other scientific, policy or socially relevant research. The LISS panel also

[2] LISS Panel: https://www.lissdata.nl/ (accessed Nov 2021)

facilitates innovative research projects. In fact, before the start of the current project, LISS already had experience with collecting a CARI module.

The Audio Module was collected via the LISS panel in April 2021. 771 LISS panellists aged 20-49[3] were asked to participate. The Audio Module took about 10 minutes interviewing time.

2.1 Implementation of Audio Module

The Audio Module started with questions about the respondent's device, internet browser and availability of a microphone. Based on the answers to these questions it was assessed if respondents were able to record their voice. If respondents were able to record, they were routed to the Audio Module and were asked for permission to record their microphone for the duration of the Audio Module. Before the module started, the microphone was tested once to assess the quality. Respondents whose device could not make a voice recording or who did not give permission to use the microphone, were asked to either close the questionnaire and fill it in at a later moment or to continue with a text version of the Audio Module. Respondents who opted for the latter were asked the exact same questions but were asked to write down their answer in a text box. More information about the development of this questionnaire is provided in Deliverable D4.12 *"Guidelines for the integration of Audio Capture data in Survey Interviews"*.

The LISS panel uses software Quest. In 2020, this software did not have an integrated CARI functionality. However, several software solutions were available that could accommodate the collection of audio information. For the purpose of this experiment, Questfox[4] was selected because it is secure and easy to integrate into the LISS panel software. Questfox supports over 120 languages, is device agnostic - i.e., it is compatible across the most common device systems - and produces good quality audio files which is pivotal for the preparation of speech-to-text transcripts and further analyses of audio and text files.

2.2 Privacy and security

Data security and privacy is of utmost importance when collecting information of individuals. Several measures were taken to ensure data security (see Figure 1).

[3] It was deemed important to keep the data collection strategy as close as possible to the description provided in Deliverable 4.12. Although the LISS panel allows to collect information of younger and older respondents, it was decided to collect only information among those aged 20-49, the age-range envisioned to be collected with the Dutch Generations and Gender Survey.

[4] Questfox website: https://www.questfox.com/en/ (accessed Nov 2021)

Before the Audio Module started, respondents were informed about the purpose of the experiment and use of their data and were asked for their consent. Only respondents who provided consent accessed the Audio Module prepared in the Questfox software via a secure connection. Once it was assessed that respondents were able to record their voice with their device, they were asked to give permission to record via the microphone for the duration of the Module.

For data security reasons, information collected in the Audio Module was not saved at the Questfox server, instead, it was immediately sent to a Secure Shell File Transfer Protocol (SFTP) server of LISS. This way the information collected in the Audio Module was automatically separated from other information collected during the LISS survey and could not be accessed by Questfox. After respondents finalized the Audio Module they were sent back, via a secure connection, to their personal LISS page.

Once the data was collected, all voice recordings were manually checked by the LISS team to make sure that all identifiable information like names and addresses were deleted from the audio files. Concretely this meant that the LISS team listened to all audio files and deleted personal information manually. The Questfox software also provided speech-to-text transcripts of the audio files. The LISS team ensured that identifiable information was also deleted from these transcripts.

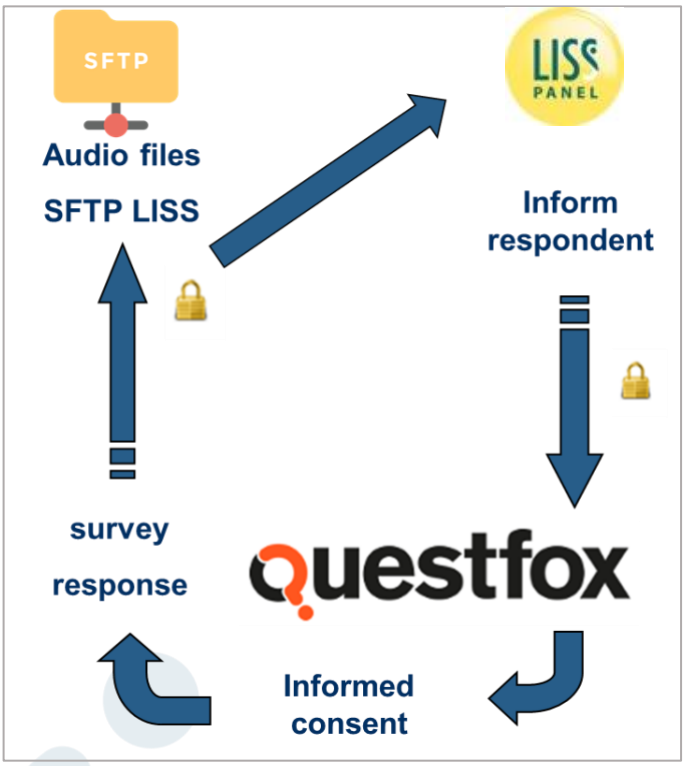

Figure 1. Graphical representation of the implementation of the Audio Module in the LISS panel using Questfox software.

2.3 Preparation of audio transcripts

One of the objectives of Task 4.4 was to test the open source ASR tools from CLARIN which are used to prepare speech-to-text transcripts. A detailed description of this process is provided in Deliverable D4.12 *"Guidelines for the integration of Audio Capture data in Survey Interviews"*. The integration of the Audio Module in the LISS panel survey lead to two minor changes to the envisioned preparation of speech-to-text transcripts. Firstly, the speech-to-text transcripts are not based on the original audio recordings, but instead on the cleaned audio recordings devoid of identifiable information which were prepared by the LISS team. Secondly, the preparation of transcripts often involves an additional step in which transcripts are checked and corrected if needed (the ASR-control as part of step 2 in Figure 2). Commonly this step involves manual transcription of (a part of) the audio files and a comparison of these text files with those produced by the ASR tools. However, because the Questfox software also provides speech-to-text transcripts, these text files were used as an ASR-control check instead.

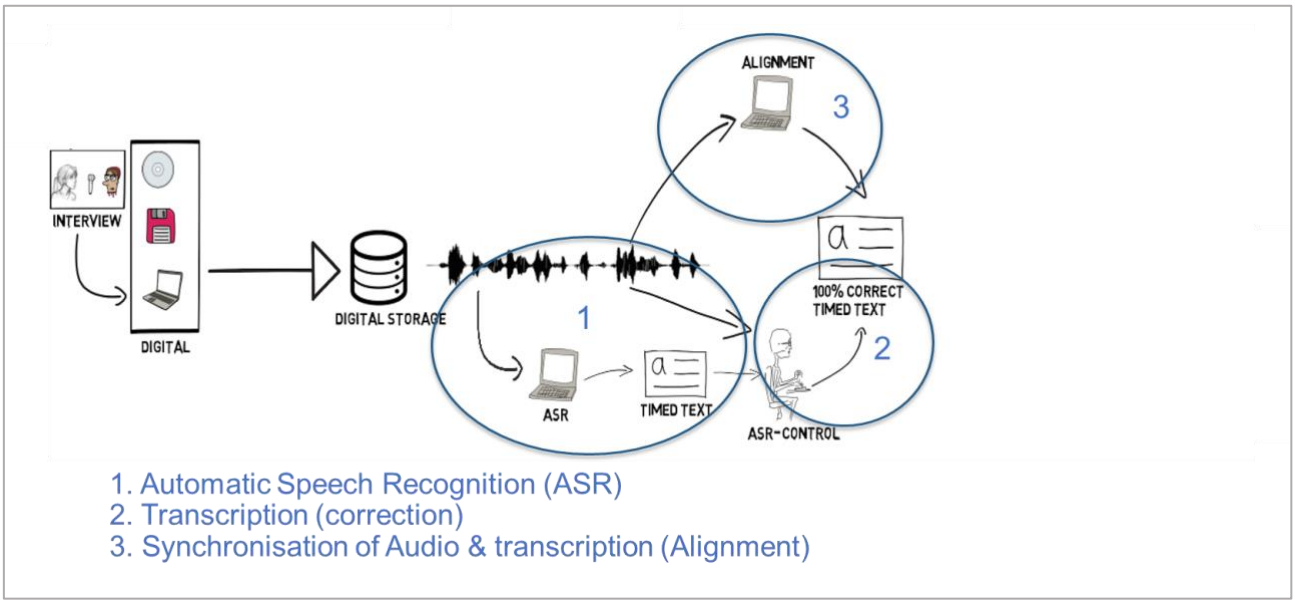

Figure 2. Graphical representation of the use of CLARIN's ASR tools to prepare speech-to-text transcripts.

3. Data Storage

The speech-to-text transcripts devoid of identifiable information, as well as the responses to the survey questions will be made available in excel format to researchers via the LISS Data Archive[5] from January 2022 onward.

The data will be published in the LISS panel data archive as an "Assembled Study" and can be found under the title "Voice recorded interviews SSHOC project".

The data will be made available to registered researchers who have signed a statement in which they agree to all rules and conditions of the use of the LISS panel data[6]. English codebooks will also be made available via the LISS Data Archive. The audio files and transcripts generated by Questfox were shared with the Task 4.4 members and with the project team members at Centre for Language and Speech Technology (CLST) for analysis. The recordings will not be distributed further.

4. Data Quality

4.1 Non-response and drop-out rates

In total 771 respondents aged 20-49, were invited to take part in the Audio Module. Of those invited, 631 (82%) started the module and 486 (63%) completed the module. Of those who completed the module 100 (21%) used voice recordings to respond, while 386 (79%) responded by typing their answers in a text box. This brings the total response rate of the audio recordings to 13% and those via written responses to 50%. For the audio recordings this resulted in 2379 audio files from 760 sessions (for some respondents there are multiple recording sessions), and a total duration of approximately 9 hours of audio.

4.2 Quality audio recordings and transcripts

As high quality audio recordings are pivotal for the use of ASR tools to prepare speech-to-text transcripts (Draxler et al., 2020), this will for a large part determine how well the collected information can be used for further exploration of the data (see CLARIN for an overview). In general, the audio quality is high because there is little speaker overlap (multiple people speaking at the same time), and because the

[5] Data https://www.dataarchive.lissdata.nl/ (accessed Nov 2021)
[6] LISS panel Data Statement https://statements.centerdata.nl/liss-panel-data-statement (accessed Nov 2021)

respondents are close to their computer to fill in the questionnaire, they are likely to talk close to the microphone and are more likely to be seated in a quiet place without much background noise.

CLST performed two analyses of the audio quality of the recordings. The first one was of a qualitative nature and performed by listening to a subset of the recordings. The selection comprised 594 audio files of all available answers to questions Q8, Q13, Q14, Q42, Q43. Most of the 150 speakers were thus included at least three times in the selection. Each recording could obtain one of the following labels: *Good, Average, Poor, Very Poor*. Comments were added if utterances were considered *Poor* or *Very Poor*. The results are show in Table 1.

About 90% of the recordings are of a good/average acoustic quality. These are well suited for ASR. The remaining recordings showed flaws in terms of loud background noise by other speakers or equipment, clipping, channel flaws, and inadequate microphone settings. ASR is also hampered if there is not enough silence at the start of a recording. In some (but fewer) cases the problematic quality is due to characteristics of the speaker, such as strong accents, fast or hesitant articulation, or a very low or loud speaking volume.

Table 1. Qualitative assessment of the audio recordings.

Label	Frequency	Percentage
Good	338	56.90%
Average	187	31.48%
Poor	53	8.92%
Very Poor	16	2.69%

The second evaluation was quantitative in nature. The project team compared the output (transcriptions) of the Questfox ASR with the output of CLST's ASR for Dutch. The assumption is that a high level of agreement between transcripts indicates good audio quality. The agreement was computed with a measure which is standard in ASR: the Word Error Rate. The Word Error Rate (WER) is computed as the difference between one transcription and another by counting the number of substitutions, deletions and insertions in relation to all words in the transcription.

The formula for this is:

Word Error Rate = 100% * (#substitutions + #deletions + #insertions) / (#total words)

Therefore, the quality is considered better if the WER is lower. In this task the transcription of Questfox are used as a reference and calculated the WER score by comparing it with the transcription of our recognizers. The Questfox transcriptions were compared with the transcriptions generated by CLST's recognizers for A. Conversational Dialogues, B. Oral History, C. Parliamentary Speeches. The observed WER-scores are displayed in Table 2. All three recognizers show about the same WER scores in the comparisons of their transcriptions with those of Questfox.

Table 2. Quantitative assessment of the audio recordings comparing the transcriptions of the Questfox ASR with the transcriptions of CLST's ASR.

CLST Recognizer	Word Error Rate	Substitutions	Deletions	Insertions
Conversational Dialogues	38.63%	18.66%	10.67%	9.30%
Oral History	40.09%	19.36%	11.67%	9.06%
Parliamentary Speeches	38.62%	18.69%	10.62%	9.31%

The project team zoomed in on the outputs of the ASR for parliamentary speech by looking at the WER scores for individual utterances. Table 3 shows an overview of utterances sorted by WER scores with an indication of the quality of the transcription match. It can be seen that this is a less positive result than the perceptual assessment of the acoustical quality above. Plausibly, the utterances with poor and very poor transcriptions matches also contain the utterances with the poor and very poor assessments for acoustic quality above but summing up to 42% their share is much higher than the 11% for the acoustic assessment. Also, the share of average transcription matches is much higher than the share of average assessments for the perception based acoustic evaluation of the recordings.

Table 3. Quantitative assessment of parliamentary speech comparing the Word Error Rate for individual utterances.

Word Error Rate range	Frequency	Percentage	Quality of match
<15%	390	21,58%	Good
16%-40%	652	36,08%	Average
41%-85%	601	33,26%	Poor
>85%	164	9,08%	Very poor

In sum, the project team concludes that the audio recordings are of average to good quality for ASR processing but that there is sufficient room for improvement of the ASR engines.

For future studies in SSHOC the project team will make manual transcriptions of the material which will serve as a better reference for performance measurements of ASR. Additionally, the audio recordings and transcripts will be further studied. An inventory of words and expressions which were not correctly recognized and need to be added to the vocabulary of the recognizer will be made. Further, a number of higher order analyses will be conducted. High quality acoustic information can for example be used for emotional analyses. Here, information on pauses, pitch and volume is used to get an indication about emotions of respondents in general or about a certain topic (Nazareth et al., 2019). Other information, such as, verbal reasoning skills, dialects, and language fluency, can also be extracted. Once proper transcripts are prepared, the text files can be used for qualitative analyses with programs such as: ATLAS, NVivo and Praat, or can be used by computational linguists for further analyses with Natural Language Processing (NLP) tools to perform topic modelling and sentiment analysis.

5. Conclusion and Recommendations

In *Task 4.4. Voice recorded interviews and audio analysis* of the SSHOC project, the collection of a CARI module was successfully integrated into LISS, a Dutch social sciences panel survey. The Audio Module, consisting of a combination of closed and open ended questions, was collected in April 2020 among respondents aged 20-49.

Audio recordings are a valuable source of information. The data can be used for quantitative analyses such as topic modelling and sentiment analysis. In addition to the factual information provided, acoustic information can be used to get supplementary information about the respondent, such as their emotional state, verbal reasoning skills, language fluency and dialect. These analyses require recordings of high quality. The LISS panel and other social surveys are potentially suitable candidates for delivering high quality audio data because respondents are already close to the device and its microphone while filling out the questionnaire and there is little to no speaker overlap. This was confirmed by the experiment. Of the audio recordings collected via the LISS panel, 90% were suitable for further analyses.

Linking information obtained via higher order linguistic and computational analyses with other content of a survey can add real value to existing social sciences infrastructures. The reverse is also true. ASR and other linguistic and computational tools are pivotal in the analyses and interpretation of large amounts of (online) digital information. However, the development and implementation of these tools is skewed and tend to work less optimally for the majority of languages. This experiment for example showed that even though 90% of the Dutch recordings were of high enough quality for ASR, the Word Error Rate between automatic transcriptions was close to 40% suggesting ample room for improvement of the ASR engines. A digital data collection in different countries using existing social sciences infrastructures could provide a similar test for other languages and could be used to make an inventory of words and expressions which were not correctly recognized in order to improve future performance. Moreover, the detailed socio-economic and demographic background information collected in the survey would allow for a thorough examination for which groups of speakers the ASR tools work optimally and for which groups it should be improved.

Collecting audio recordings via existing social sciences infrastructures is challenging. A first hurdle is technically implementing a CARI module in an existing infrastructure. Similar to LISS, some infrastructures may be working with software which lack CARI capability, while for others the quality of the data output cannot be guaranteed. Infrastructures which plan to collect audio responses on a regular basis may decide to invest in the development of the CARI functionality, or to change to a different software. Alternatively, a different (commercial) software could be implemented in the existing infrastructure to collect only the CARI module. The advantage of the latter is that it is more cost-effective than developing or changing software, at least in the short run. Moreover, it may provide access to other services, such as a customer service, active user community, or speech-to-text transcripts. Disadvantages

of using different software simultaneously are that it almost always coincides with a change in layout, and it increases the risk of technical issues, which could increase drop-off rates.

Another challenge of collecting voice recordings is the reluctance of some respondents to participate in a CARI survey or module. In the case of web interviews, respondents might find it uncomfortable to talk to a device or to record and share data that contains their voice. A lack of suitable equipment or environment, such as a lack of a microphone or being in a crowded or noisy area, may be other reasons for low participation rates. The experiment was well set up to collect a CARI module via web interviewing. LISS panellists are used to an online survey environment, and many had participated before in different online experiments. Moreover, LISS ensures that households are provided with a computer and Internet connection if needed. Nevertheless, out of the 771 respondents who had participated in the LISS survey and were eligible to participate in the Audio Module, voice recordings were collected of only 13% of those. To reduce selectivity due to very low response, we advise future projects to allow respondents to type instead of orally respond to questions if respondents wish to do so. Moreover, adding the CARI module at the end of the survey may reduce the risk of early drop-out. Participation rates may also improve with face-to-face interviewing instead of online interviewing. The presence of an interviewer could improve respondent experience because it may feel more like a conversation. Moreover, the personal relationship with an interviewer and the possibility to ask questions may improve the length and detail of responses and reduce the reluctance to share recordings. Having an interviewer present who can control the device and environment could also improve the quality of the recordings themselves. A disadvantage of having an interviewer present is that it can introduce bias to responses (interviewer bias).

European social survey infrastructures, such as GGP, EVS, ESS and SHARE have data management strategies in place to ensure data security for collecting, processing and archiving survey data. However, identification of a person is more likely with voice recordings than with other survey questions. For this reason, the project team deems it better to collect audio recordings about general topics, such as the European Union or democracy than about personal topics such as a person's health or family. In addition, we advise to check and correct all recordings and transcripts to guarantee that no personal information – names and addresses – are mentioned in the data that is archived and shared. We also advise to inform respondents about the use of their voice recordings and to explicitly ask for their consent. Other strategies to increase data security that could be considered are:

- Limit the data collection. Social sciences infrastructures often capture data of thousands of respondents. Collecting a CARI module among a smaller group of respondents can reduce the risk of identification. In addition, this strategy reduces overall respondent burden, processing burden, and server requirements for data collection and storage.

- Limit access to audio files. We advise to store the audio recordings in a linguistic archive such as The Language Archive[7] and only grant access to researchers and research projects that explicitly intend to use the audio information. The availability of speech-to-text transcripts will reduce the need for the sharing of the audio files to a minimum.
- Limit additional information that is shared. A researcher interested in the influence of age on audio quality should be provided with this information only. Sharing all other information that was collected in the survey may increase the risk of identification of an individual were the data to fall in the wrong hands.

To conclude, the overarching aim of task 4.4, to demonstrate the utilization of survey infrastructure and linguistic tools to collect, process and analyse digital language data, was achieved. The experiment shows that collaboration across social sciences and linguistic infrastructures can generate high quality digital linguistic data. This data can add substantive content to the information already captured in the surveys. In addition, it can provide linguistic infrastructures with national representative digital linguistic information which can be used for substantive analyses as well as further development of ASR and NLP tools.

[7] https://archive.mpi.nl/tla/ (accessed Nov 2021)

6. References

Draxler, C., van den Heuvel, H., van Hessen, A., Calamai, S., Corti, L., & Scagliola, S. (2020). A CLARIN transcription portal for interview data. In *LREC 2020 - 12th International Conference on Language Resources and Evaluation, Conference Proceedings*.

Emery Tom, Ruud Luijkx, Giovanni Borghesan, & Henk van den Heuvel. (2019). *SSHOC D4.12 Guidelines for the integration of Audio Capture data in Survey Interviews (v1.0).* Zenodo. https://doi.org/10.5281/zenodo.4558280

Lessler, J. (1984). Measurement error in surveys. In C. F. Turner & E. Martin (Eds.), *Surveying Subjective Phenomena* (pp. 405–440). New York: Russell Sage.

Nazareth, D. S., Tournier, E., Janse, E., Heylen, D., Westerhof, G. J., & Truong, K. P. (2019). An acoustic and lexical analysis of emotional valence in spontaneous speech: Autobiographical memory recall in older adults. *Proceedings of Interspeech*, 3287–3291.

Smith, T. W. (2018). Improving multinational, multiregional, and multicultural (3MC) comparability using the total survey error (TSE) paradigm. *Advances in Comparative Survey Methods: Multinational, Multiregional, and Multicultural Contexts (3MC)*, 13–43.

Zieliński, M. W., Powałko, P., & Kołczyńska, M. (2018). The past, present, and future of statistical weights in international survey projects: Implications for survey data harmonization. *Advances in Comparative Survey Methods: Multinational, Multiregional, and Multicultural Contexts (3MC)*, 1035–1052.