API vs. human: Comparing the performance of speech-to-text transcription using voice answers from a smartphone survey

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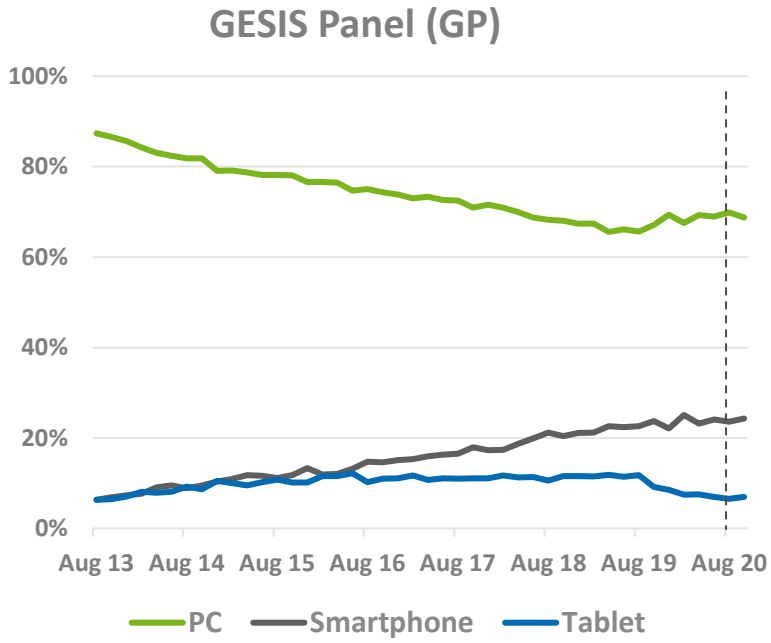
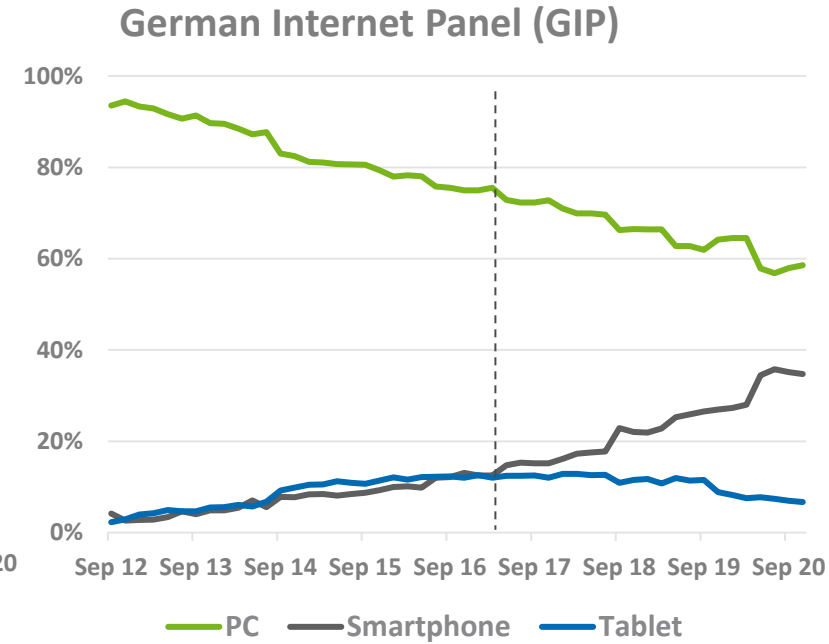
DZHW
Deutsches Zentrum für Hochschul- und Wissenschaftsforschung

Web Surveys and Digital Innovations

- Increase of web-based surveys
  - *Academia: ANES, CRONOS, EVS, GESIS Panel, GIP, HRS, LISS Panel etc.*
  - *Public/private sector: Facebook, Google, UNESCO, World Bank etc.*
- Increase of mobile device use in web-based surveys
  - *Mobile optimized layouts as default* (Revilla et al. 2016)
- Emergence of digital intersections
  - *Ex ante data linkage (e.g., sensors)* (Elevelt et al. 2021; Höhne & Schlosser 2019)
  - *Ex post data linkage (e.g., trace data)* (Pasek et al. 2020; Stier et al. 2020)

Devices in Web Surveys





Country: Germany. Prob-based online panels (GP and GIP). Six waves per year. Vertical lines indicate the introduction of mobile-optimized layouts. Calculations: Gummer et al. (2023).

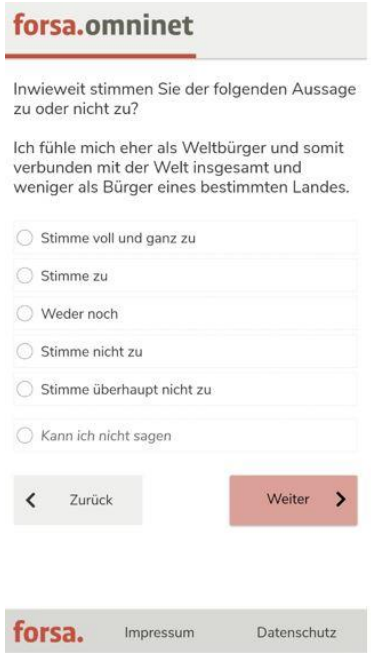
Smartphones and Voice Answers

- New communication channels because of smartphones
  - *Linking established methods with technological innovations*
- Voice answers to (open) questions
  - *Closeness to daily conversation* (Tourangeau et al. 2000)
  - *Rich information due to narrations* (Gavras & Höhne 2022; Gravras et al. 2022)
- Technological requirements of voice answers are met
  - *Even in web-based surveys with large N*
- Nonetheless, answer transcription is still required
  - *Human transcription is burdensome and time consuming*
  - *APIs may not be entirely ready*

Research Questions

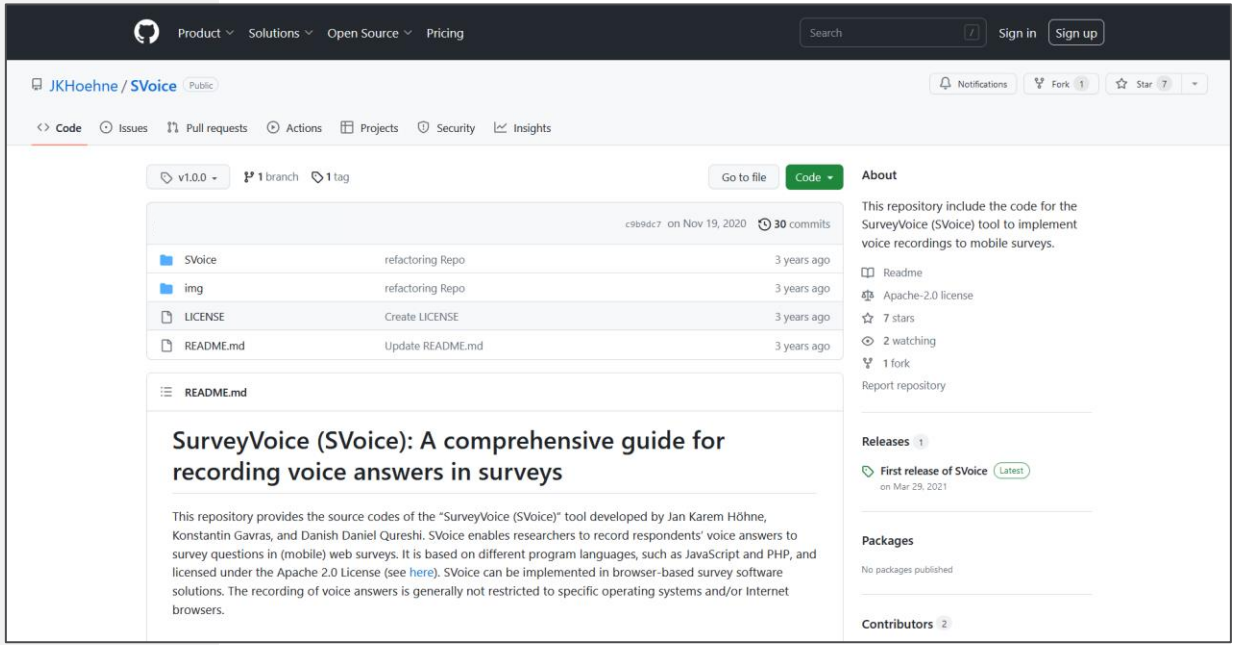
- RQ1: What is the transcription quality of APIs?
- RQ2: What types of errors occur in API transcription?
- RQ3: How long does transcription by APIs and humans take?

Method: Study Design



- Cross-quota sample
  - *Age, gender, and education*
  - *Forsa Omninet Panel (Nov 21)*
- 2 Questions + probes
  - *Relationship between citizens and state (ISSP 2013, 2014)*
- No recording time restrictions
  - *Overall, we have 609 voice answers for analysis.*
  - *These answers vary between 1 and 295 seconds.*

Method: Collecting Voice Data



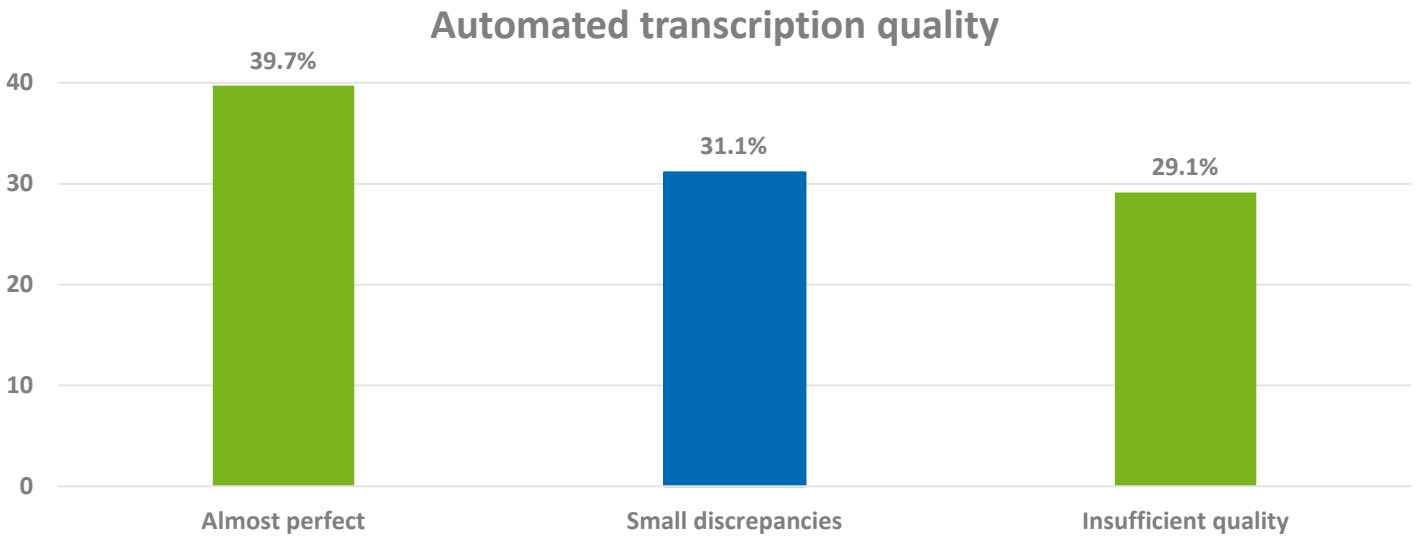
https://github.com/JKHoehne/SVoice/tree/v1.0.0

- SurveyVoice (SVoice) tool (Höhne et al. 2021)
- Open-source
  - *Apache 2.0 License*
- JavaScript, CSS, HTML, and PHP
- Implementable in browser-based smartphone surveys

Method: Analytical Strategies

- We used the Google “Cloud Speech-to-Text” API
  - *Costs: $0.024 per minute (without data logging – standard)*
- Transcription quality
  - *1 Almost perfect transcriptions, 2 small discrepancies (minor errors), and 3 insufficient quality (major errors)*
  - *Intercoder reliability: Agreement > 90% (Kappa > 0.84)*
- Transcription error types
  - *1 No mistakes, 2 misspellings, 3 word separation error, 4 word transcription error, 5 missing words, 6 incorrect grammatic, 7 words added by mistake, and 8 words replaced by numbers*
  - *Intercoder reliability: Agreement > 82% (Kappa > 0.78)*

Results: Research Question 1



We have less than 1% of poor-quality recordings that cannot be transcribed.

Results: Research Questions 1

Almost perfect

ja Weltbürger wäre dass ich mich überall zu Hause fühlen würde das oder so ähnlich

ich finde den Begriff zivile Ungehorsam doof und ich habe es auch dreimal gelesen um es einigermaßen zu verstehen aber ich will keine Beispiele nennen aber ich denke einfach dass wir anderer Meinung sind also die Menschen da anderer Meinung sind und schon deshalb einfach Ungehorsam aber der Begriff ziviler Ungehorsam der gehört hier nicht her widerstrebt mir finde ich auch nicht gut

Small discrepancies

ein Weltbürger ist quasi überall auf der Welt zu Hause vielleicht auch nirgendwo zu 100% zu Hause und ja kann man sich nicht an eine bestimmte Kultur oder Herkunft ist offen für er alle möglichen Kulturen und auch ich freue mich flexibel also möglichst viel gereist und hat auch ja einen großen Teil seines Lebens vielleicht im Ausland verbracht und dort gelebt

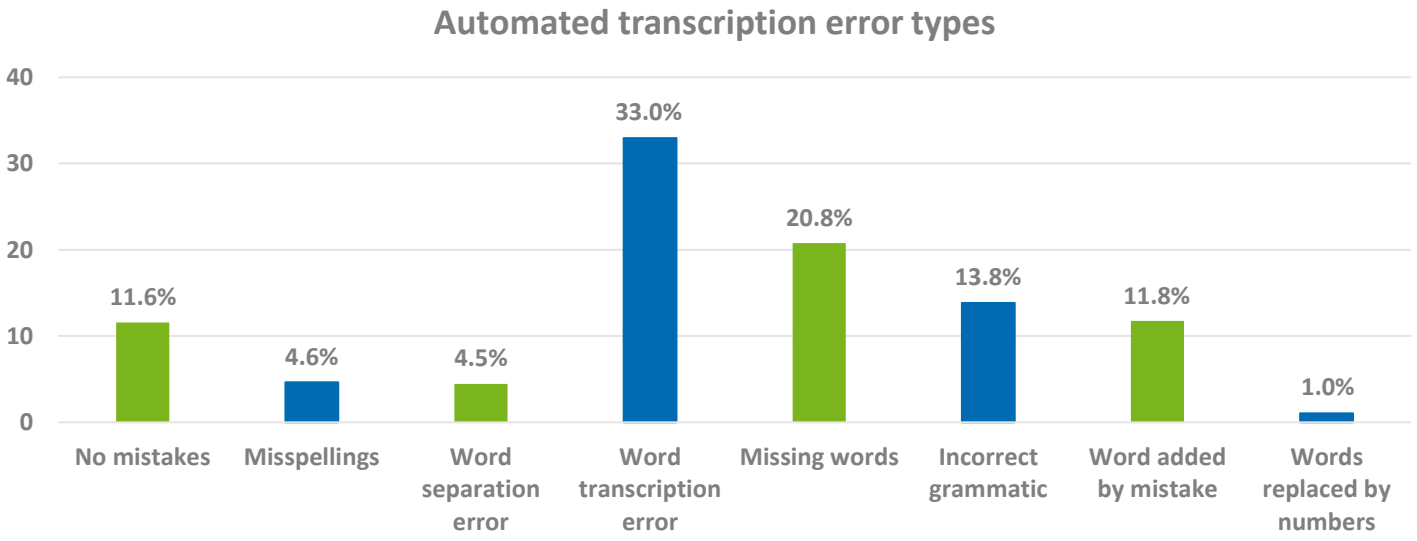
Beispiel ich bin zivil und gehorche nicht in Medien und Politik

Insufficient quality

es ist eine schöne und mein schöner Garten Schüler glaube oder sonst du für Weltbürger ist letztendlich wird die Mehrheit der Menschheit immer erst zum 80. somit auch auf ihr eigenes Land und werde snap macht der geh zu Grunde dafür gibt genügend Beispiele in der Geschichte

ja heute kleine Aufkleber wie ging das System also sich nicht an alles halten was die einem vorschreiben möchten weil es kann ja nicht sein dass das da das ist zwar die Meinungsfreiheit los heute beginnt jetzt immer Kasperl und so entscheiden 19 Zoll für dich richtig ist aber naja und das Badezimmer zwei Leute hatten da ich glaube ich würde hier die auch mal besprechen

Results: Research Question 2



Results: Research Questions 3

Questions	File number	Coder 1 time (20%)	Coder 2 time (20%)	Mean time (20%)	Estimated time (100%)
1	63	125 min	95 min	110 min	550 min
2	60	120 min	100 min	110 min	550 min

Google “Cloud Speech-to-Text” API needs about 40 seconds for transcribing 1 min voice input. In total, the API needed about 153 minutes for all voice answers.

Discussion and Conclusion

- The API makes a great job in 40% of the cases
  - *In the other cases, there are (some) quality concerns*
  - *Combination of API and humans may be most promising*
- There are various error types that need to be considered
  - *Word transcription error and missing words are most prominent*
  - *Misspellings and word separation error are only minor threats*
- API transcription is 3.6 times faster than humans
  - *Its console can be easily operated through R*
  - *Open-source solutions are developing (e.g., Whisper)*
- Take home message
  - *APIs are not entirely ready for transcribing voice answers*
  - *Transcription effort needs to be considered in studies with voice answers*

Mobile Apps and Sensors in Surveys (MASS)

Call for Papers

5th Mobile Apps and Sensors in Surveys (MASS) Workshop

https://massworkshop.org/

Organizing committee

Jan Karem Höhne (DZHW, Leibniz University Hannover), Florian Keusch (University of Mannheim), Peter Lugtig (Utrecht University), and Bella Struminskaya (Utrecht University)

Date

March 6-7, 2024

Location

Washington, DC (USA)

This time, the Mobile Apps and Sensors in Surveys (MASS) workshop takes place jointly with the Current Innovations in Probability-based Household Internet Panel Research (CIPHER; see https://dornsife.usc.edu/cesr/cipher-2024/) conference. CIPHER will be held from March 7-8, and presenters at either event are invited to attend both events.

- MASS takes place in Washington DC (US)
  - *From **March 6-7,2024***
  - *Together with CIPHER conference*
  - *Submission deadline is **December 1, 2023***

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Many thanks for your attention!

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