Transcribing and *coding* voice answers obtained in web surveys: comparing three leading automatic speech recognition tools

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Using voice answers in web surveys

web data opp

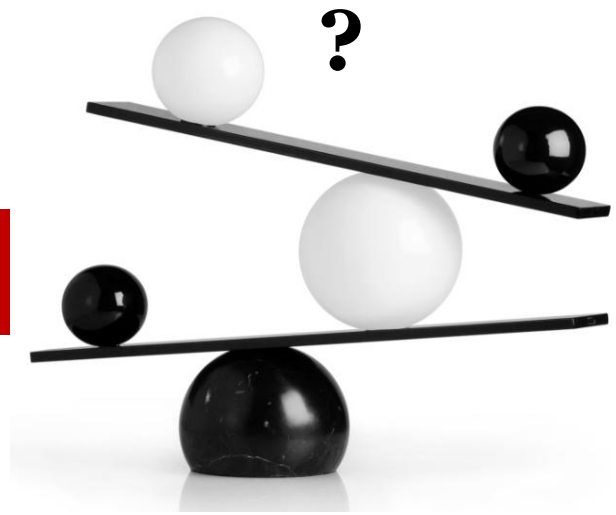
Disadvantages

Researchers

- Technical problems
- Selection bias
- Data protection & ethical issues
- Transcription & coding

Participants

- Privacy issues
- Context not conducive to speaking



Advantages

Researchers

- Longer/richer answers
- More spontaneous
- Emotions, tone of voice, etc.

Participants

- Reduced time/effort to provide information
- No need for writing skills

This study

THIS STUDY

Main goals

Transcription

RQ1: How do 3 leading automatic speech recognition (ASR) tools perform across various dimensions?

Google Cloud Speech-to-Text

Whisper OpenAI

Vosk

Coding

RQ2: How similar or different are the codes of transcribed responses generated by a human and the OpenAI GPT-4o model?

vs

GPT-4o

THIS STUDY

Data collection & sample

Data collection

Tool

Population of interest

Quotas

Sample used

Opt-in online panel, February/March 2024

THIS STUDY

Data collection & sample

Data collection	Opt-in online panel, February/March 2024
Tool	WebdataVoice (Revilla et al., 2022)
Population of interest	
Quotas	
Sample used	

THIS STUDY

Data collection & sample

Data collection	Opt-in online panel, February/March 2024
Tool	WebdataVoice (Revilla et al., 2022)
Population of interest	Adult online population living in Spain
Quotas	
Sample used	

THIS STUDY

Data collection & sample

Data collection	Opt-in online panel, February/March 2024
Tool	WebdataVoice (Revilla et al., 2022)
Population of interest	Adult online population living in Spain
Quotas	Gender & age + education
Sample used	

THIS STUDY

Data collection & sample

Data collection	Opt-in online panel, February/March 2024
Tool	WebdataVoice (Revilla et al., 2022)
Population of interest	Adult online population living in Spain
Quotas	Gender & age + education
Sample used	Those with at least one transcription = 859 panellists

THIS STUDY

Survey about perceptions of nursing homes in Spain

80+ questions

2 requests for voice

Focus on first one

WHY TRANSP

Explain why you think that nursing homes provide [*no information at all/very little/some/a lot of/a huge* ***amount of information***] about the implementation of their services.

Please give as much detail as you can. In your answer, mention if you think there is a difference among **public** and **private** nursing homes.

THIS STUDY

Analyses

Transcription

Block 1 (each ASR tool)

- Transcription provided
- Length
- Clarity
- Problems
- Valid

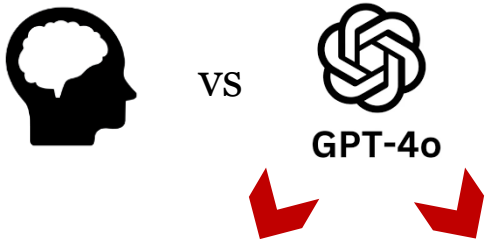
Block 2 (pairs)

- Different words
- Similar meaning

Coding

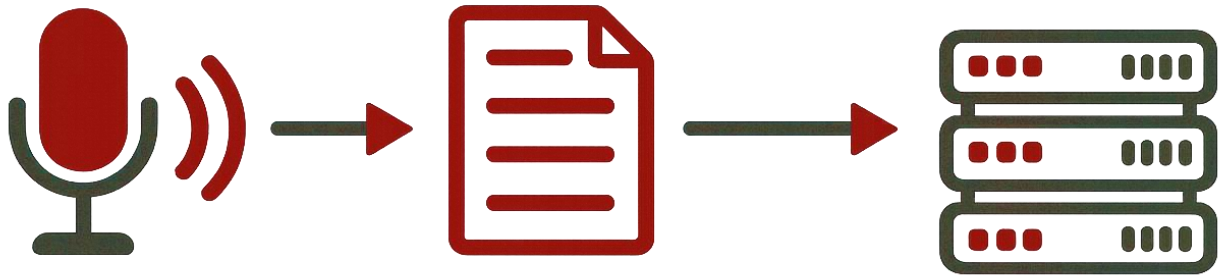
Subset of indicators of *RQ1*

Compare:



No “true value”

Main results



MAIN RESULTS

Transcription: Comparing the 3 ASR tools

Block 1	
Provided	% Provided
Length	# Characters # Words
Clarity	% Clear % Very clear
Problems	% 1+ Missing % 1+ Added % 1+ Wrong % No problem
Valid	% Valid

$N_{\text{“Provided”}}$ = 859. $N_{\text{“Other indicators”}}$ = 636 for Google, 857 for Whisper, 773 for Vosk.
Superscripts indicate a significant difference ($p < 0.05$).

MAIN RESULTS

Transcription: Comparing the 3 ASR tools

Block 1		Google (a)
Provided	% Provided	74[bc]
Length	# Characters	285[c]
	# Words	51[c]
Clarity	% Clear	5[bc]
	% Very clear	94[bc]
Problems	% 1+ Missing	9[bc]
	% 1+ Added	7[bc]
	% 1+ Wrong	10[bc]
	% No problem	77[bc]
Valid	% Valid	97[bc]

$N_{\text{"Provided"}}$ = 859. $N_{\text{"Other indicators"}}$ = 636 for Google, 857 for Whisper, 773 for Vosk.
Superscripts indicate a significant difference ($p < 0.05$).

GOOGLE

- Only 74% have a transcription
- However, when there is a transcription, it performs strongly:
  - 94% very clear
  - 77% with no detected problem

MAIN RESULTS

Transcription: Comparing the 3 ASR tools

Block 1		Google (a)	Whisper (b)
Provided	% Provided	74[bc]	**100**[ac]
Length	# Characters	285[c]	310[c]
	# Words	51[c]	55[c]
Clarity	% Clear	5[bc]	22[ac]
	% Very clear	94[bc]	73[ac]
Problems	% 1+ Missing	9[bc]	**19**[ac]
	% 1+ Added	7[bc]	**28**[ac]
	% 1+ Wrong	10[bc]	5[ac]
	% No problem	77[bc]	57[ac]
Valid	% Valid	97[bc]	**80**[ac]

$N_{\text{"Provided"}} = 859$. $N_{\text{"Other indicators"}} = 636$ for Google, 857 for Whisper, 773 for Vosk.
Superscripts indicate a significant difference ($p < 0.05$).

GOOGLE

- Only 74% have a transcription
- However, when there is a transcription, it performs strongly:
  - 94% very clear
  - 77% with no detected problem

WHISPER

- Almost all have a transcription
- But high levels of missing (19%) and added words (28%), and low rates of valid answers (80%)
  - Hallucinations?

MAIN RESULTS

Transcription: Comparing the 3 ASR tools

Block 1		Google (a)	Whisper (b)	Vosk (c)
Provided	% Provided	74^{bc}	100^{ac}	**90**^{ab}
Length	# Characters	285^{c}	310^{c}	**386**^{ab}
	# Words	51^{c}	55^{c}	69^{ab}
Clarity	% Clear	5^{bc}	22^{ac}	72^{ab}
	% Very clear	94^{bc}	73^{ac}	**11**^{ab}
Problems	% 1+ Missing	9^{bc}	19^{ac}	14^{ab}
	% 1+ Added	7^{bc}	28^{ac}	13^{ab}
	% 1+ Wrong	10^{bc}	5^{ac}	90^{ab}
	% No problem	77^{bc}	57^{ac}	8^{ab}
Valid	% Valid	97^{bc}	80^{ac}	94^{ab}

$N_{\text{"Provided"}} = 859$. $N_{\text{"Other indicators"}} = 636$ for Google, 857 for Whisper, 773 for Vosk.
Superscripts indicate a significant difference ($p < 0.05$).

GOOGLE

- Only 74% have a transcription
- However, when there is a transcription, it performs strongly:
  - 94% very clear
  - 77% with no detected problem

WHISPER

- Almos all have a transcription
- But high levels of missing (19%) and added words (28%), and low rates of valid answers (80%)
  - Hallucinations?

VOSK

- Intermediate level of transcriptions (90%) → Closer to true answer rate?
- Longest length (386 characters)
- Punctuation issues → Low clarity (11%)

MAIN RESULTS

Transcription: Comparing pairs of tools

Block 2	
Diff. words	# Perc. diff words
Similar meaning	% Partly similar
	% Very similar

Superscripts indicate a significant difference ($p < 0.05$).

MAIN RESULTS

Transcription: Comparing pairs of tools

Block 2		G-W (a)	W-V (b)	V-G (c)
Diff. words	# Perc. diff words	19^{bc}	33^{ac}	24^{bc}
Similar meaning	% Partly similar	10^{bc}	26^{a}	22^{a}
	% Very similar	77^{b}	59^{ac}	73^{b}

Superscripts indicate a significant difference ($p < 0.05$).

G - W

Google & Whisper have the **smallest** word discrepancies and the **highest** level of similarity

MAIN RESULTS

Transcription: Comparing pairs of tools

Block 2		G-W (a)	W-V (b)	V-G (c)
Diff. words	# Perc. diff words	19^{bc}	33^{ac}	24^{bc}
Similar meaning	% Partly similar	10^{bc}	26^{a}	22^{a}
	% Very similar	77^{b}	59^{ac}	73^{b}

Superscripts indicate a significant difference ($p < 0.05$).

G - W Google & Whisper have the **smallest** word discrepancies and the **highest** level of similarity

W - V Whisper & Vosk exhibit the **largest** word discrepancies, and show the **lowest** level of similarity

Whisper | Google | Vosk

MAIN RESULTS

Coding: Comparing human and GPT-4o coding

Block 1	
Clarity	% Clear
	% Very clear
Problems	% 1+ Missing
	% 1+ Added
	% 1+ Wrong
	% No problem
Valid	% Valid

Superscripts indicate a significant difference ($p < 0.05$), within ASR tool.

MAIN RESULTS

Coding: Comparing human and GPT-4o coding

Block 1		Google (b) GPTo	Google (c) GPT	Whisper (b) GPTo	Whisper (c) GPT	Vosk (b) GPTo	Vosk (c) GPT
Clarity	% Clear	31[a]	30[a]	24	22	59[a]	58[a]
	% Very clear	66[a]	66[a]	68[a]	69[a]	7[a]	7[a]
Problems	% 1+ Missing	41[a]	43[a]	28[a]	27[a]	98[a]	97[a]
	% 1+ Added	36[ac]	38[ab]	28	29	78[a]	78[a]
	% 1+ Wrong	33[a]	34[a]	11[a]	11[a]	91	91
	% No problem	44[ac]	41[ab]	56	55	2[a]	2[a]
Valid	% Valid	85[a]	84[a]	66[a]	66[a]	75[a]	74[a]

Superscripts indicate a significant difference ($p < 0.05$), within ASR tool.

GPTo-GPT

Few significant differences between GPT codings, and only for Google

→ Setting the temperature to 0 does not substantially affect the results

MAIN RESULTS

Coding: Comparing human and GPT-4o coding

Block 1		Google (a) Human	Google (b) GPTo	Google (c) GPT	Whisper (a) Human	Whisper (b) GPTo	Whisper (c) GPT	Vosk (a) Human	Vosk (b) GPTo	Vosk (c) GPT
Clarity	% Clear	5^{bc}	31^{a}	30^{a}	22	24	22	72^{bc}	59^{a}	58^{a}
	% Very clear	94^{bc}	66^{a}	66^{a}	73^{bc}	68^{a}	69^{a}	11^{bc}	7^{a}	7^{a}
Problems	% 1+ Missing	9^{bc}	41^{a}	43^{a}	19^{bc}	28^{a}	27^{a}	14^{bc}	98^{a}	97^{a}
	% 1+ Added	7^{bc}	36^{ac}	38^{ab}	28	28	29	13^{bc}	78^{a}	78^{a}
	% 1+ Wrong	10^{bc}	33^{a}	34^{a}	5^{bc}	11^{a}	11^{a}	90	91	91
	% No problem	77^{bc}	44^{ac}	41^{ab}	57	56	55	8^{bc}	2^{a}	2^{a}
Valid	% Valid	97^{bc}	85^{a}	84^{a}	80^{bc}	66^{a}	66^{a}	94^{bc}	75^{a}	74^{a}

Superscripts indicate a significant difference ($p < 0.05$), within ASR tool.

GPTo-GPT

Few significant differences between GPT codings, and only for Google

→ Setting the temperature to 0 does not substantially affect the results

H-GPT

Significant and substantial differences between human and GPT codings across all 3 ASR tools

However, they do not always alter the order of performance across ASR tools

MAIN RESULTS

Coding: Comparing human and GPT-4o coding

Block 2		Google-Whisper (a) Human	Google-Whisper (b) GPTo	Google-Whisper (c) GPT	Whisper-Vosk (a) Human	Whisper-Vosk (b) GPTo	Whisper-Vosk (c) GPT	Vosk-Google (a) Human	Vosk-Google (b) GPTo	Vosk-Google (c) GPT
Similar meanings	% Partly similar	10^{bc}	6^{a}	7^{a}	26^{bc}	9^{a}	11^{a}	22^{bc}	12^{a}	13^{a}
	% Very similar	77	75	75	59^{bc}	65^{a}	64^{a}	73	76	75

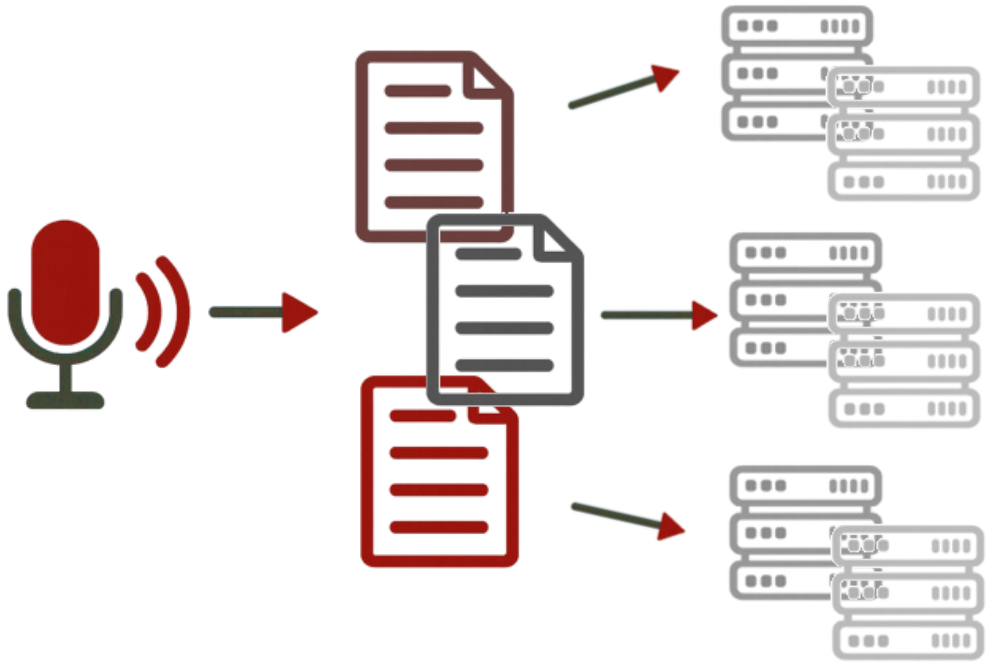
Superscripts indicate a significant difference ($p < 0.05$), within a pair of tools.

Similar patterns

Human | GPTo | GPT

In general, GPT codings suggest a lower quality of the transcriptions

Conclusions



CONCLUSIONS

Summary of results

Each of the ASR tools has **distinct** merits and limits

+

Human and LLM-based coding also **differ** significantly

=

Use **several** ASR tools & implement human + LLM-based coding

Google sometimes fails to provide transcriptions but shows high clarity

Whisper almost always provides transcriptions but has hallucinations

Vosk has the longest length but clarity issues and high rates of incorrect words

Setting the temperature to 0 does not affect much

Additional information at minimal added cost

Conclusions

Performance of ASR tools and GPT models **evolves rapidly** + **vary** with factors like …

- … language and background noise for the ASR tools
- … specific prompts or settings for GPT

Researchers should be prepared to **adjust** to these changes and potentially incorporate newly emerging tools

Key recommendations likely to remain effective across contexts and over time

1. Carefully select the ASR tools when transcribing voice responses
2. Use multiple transcriptions to mitigate each ASR tool's weaknesses
3. Test different settings for each tool
4. Document the choices made to ensure transparency and replicability

Thanks!

Questions?

Paper accepted in JSSAM:
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https://www.upf.edu/web/webdataopp