The Relationship Between Linguistic Accommodation and Speaker Attribution

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Communication Accommodation

= people adapting their behavior to the person they are interacting with

Image by DALL·E via ChatGPT

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- short-term and long-term
- converging and diverging

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➢ ***Focus:*** linguistic style accommodation*

*also called alignment, convergence, or entrainment

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Accommodation domains

- communication patterns/strategies (Giles et al., 1991; Danescu-Niculescu-Mizil et al., 2011)
- language change (Ruch & de Benito Moreno, 2023)
- power dynamics (Kacewicz et al., 2013)
- identity expression (Gasiorek, 2016; Bourhis, 1979)
- collaborative problem-solving (Fusaroli et al., 2012)
- negotiation tactics (Taylor & Thomas, 2008)
- patient-clinician relationships (Khaleghzadegan et al., 2024)
- human interactions with chatbots/AI (Bhatt & Rios, 2021; Biancardi et al., 2021)

Factors favoring converging accommodation

This can depend on the linguistic factor (phonetic, lexical, syntactic, etc.), but most follow the same pattern:

- A certain amount of convergence is automatic (cognitive priming)
- The **strength** of the convergence is modulated by social factors, including familiarity, hierarchical position, affiliation, common goals, and many others

Notably for this presentation:

- People tend to converge in telephone conversations (Giles et al., 1991)
- People tend to converge when they have a shared task to accomplish (Branigan, Pickering, McLean, & Cleland, 2007)
- More short-term accommodation among strangers (Pardo, 2006)
- Symmetric convergence among peers (Niederhoffer & Pennebaker, 2002)

Study motivations

Being able to measure accommodation across transcripts of conversations:

- Can help us infer the relationship between two communicators
- Tells us about the difficulty of the attribution task
- Reveals how to do speaker/authorship attribution more reliably

Dataset

- Fisher English Training Speech Transcripts Dataset* (Cieri et al., 2004)
  - 10 minute telephone conversations between strangers
  - Assigned a conversation topic to collaboratively discuss

**dataset made available by the Linguistic Data Consortium*

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- Reasons for picking Fisher
  - natural, open-ended conversation (less studied)
  - collaborating to discuss a topic
  - strangers (no previous accommodation)
  - previous speaker attribution work on Fisher for comparison

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Example Fisher transcript

A: hi
B: hey how's it going
A: pretty good
B: nice to meet you
A: you too
B: so we're supposed to talk about food huh
A: i guess the what was the topic um if we'd r- rather eat out or
B: right
B: uh it was would you rather eat out or in and uh
A: why
B: why i guess yeah all right
A: okay
B: um
A: there's like advantages to both [laughter]
B: yeah absolutely absolutely

Accommodation metrics

- Linguistic Style Matching/LIWC
  - Niederhoffer & Pennebaker, 2002; Taylor & Thomas, 2008; Khaleghzadegan et al., 2024
- Subtractive Conditional Probability + LIWC
  - Danescu-Niculescu-Mizil et al., 2011
- Local Linguistic Alignment
  - Fusaroli et al., 2012; Wang et al., 2014
- (Word-Based) Hierarchical Alignment Model + LIWC
  - Doyle et al., 2016; Doyle & Frank, 2016
- Embedding-based
  - Yu et al., 2021; Nasir et al., 2023; Rosen & Dale, 2024
- ALIGN
  - Duran et al., 2019; Dideriksen et al., 2023; Fusaroli et al., 2023

Challenges for accommodation metrics

- Often focus on single turns so ignores broader context
- Don’t capture directionality
- Mostly word-based or word category-based
- Don’t account for the baseline frequency of each feature
- Features’ frequencies may depend on message length
- Language specific

ALIGN (Duran et al. 2019)

Analyzing Linguistic Interactions with Generalizable TechNiques

Image by Gemini Flash 2.5

Benefits

- measures accommodation by turn and across a conversation
- captures directionality of accommodation (A>B vs. B>A)
- measures accommodation at different linguistic levels (lexical, syntactic, semantic)
- compares the accommodation measure to a "surrogate" baseline
- not necessarily restricted to English
- easy-to-use Python library

github.com/nickduran/align-linguistic-alignment

ALIGN method

- Linguistic levels
  - Lexical: token/lemma n-grams
  - Syntactic: POS tag n-grams
  - Semantic: concept words in each utterance turned into high-dimensional embeddings via word2vec (Řehůřek & Sojka, 2010)

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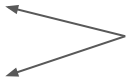
  - Semantic: concept words in each utterance turned into high-dimensional embeddings via word2vec (Řehůřek & Sojka, 2010)
- Calculate cosine similarity of each linguistic level between speakers
  - by turn and by conversation (across all turns in a conversation)

A: [do you: 1, you think: 1, think so: 1]

B: [i do: 1, do think: 1, think so: 1]



cosine similarity: 0.4 (accommodation score)

ALIGN method

Lexical | Semantic | Syntactic

Order	Direction	Token Bi-	Token Tri-	Lemma Bi-	Lemma Tri-	Conceptual	Stan token Bi-	Stan token Tri-	Stan lemma Bi-	Stan lemma Tri-
0	1 > 2	.000	.000	.000	.000	.390	.192	.000	.192	.000
1	2 > 1	.436	.289	.436	.289	.547	.000	.000	.000	.000
2	1 > 2	.267	.173	.267	.173	.631	.000	.000	.000	.000
3	2 > 1	.159	.062	.156	.062	.877	.500	.159	.537	.235
4	1 > 2	.089	.000	.105	.010	.879	.497	.142	.583	.196
5	2 > 1	.000	.000	.023	.000	.774	.259	.024	.341	.118
6	1 > 2	.000	.000	.024	.000	.806	.277	.025	.254	.050

Cosine similarity normalizes counts across utterance lengths.

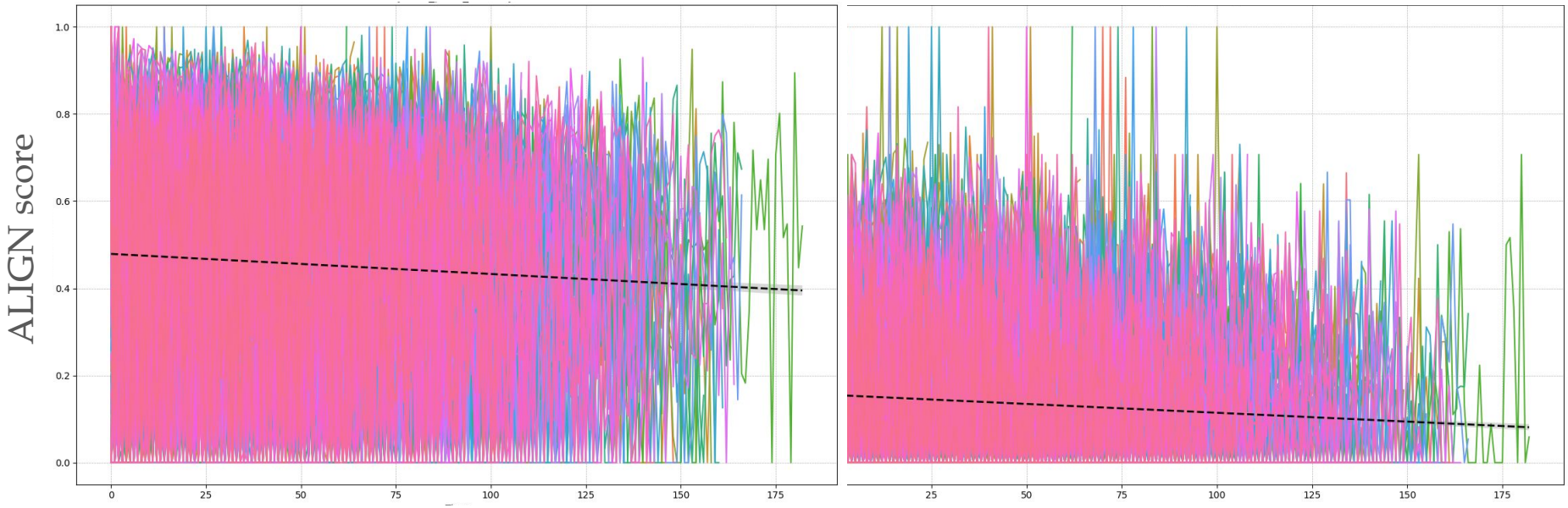
ALIGN method for Fisher

1. Take a random sample of 300 calls
2. Preprocess calls
    a. remove capitalization, punctuation, one word utterances
    b. ensure speakers alternate
3. Calculate accommodation for those 300 calls over time
4. Graph the results

ALIGN: Syntactic

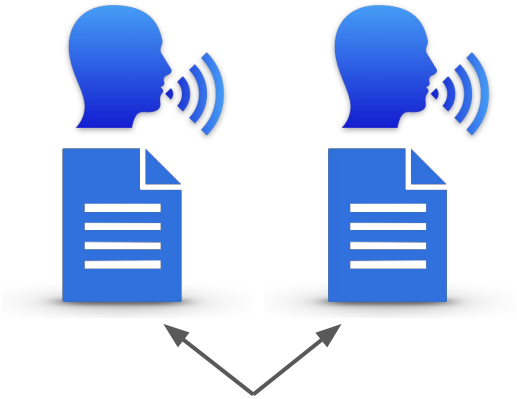
POS tag unigrams

POS tag bigrams



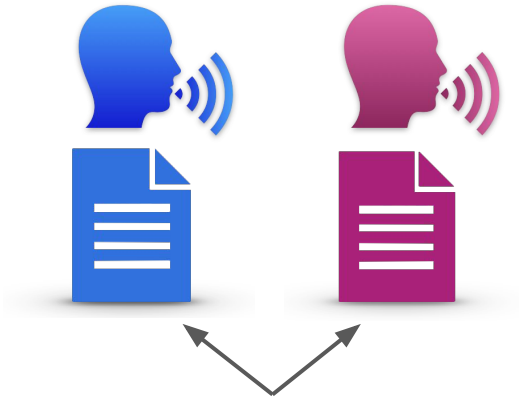
Speaker verification

same speaker trials



cosine similarity

different speaker trials



cosine similarity

➢ ~1400 tokens across an average of 100 utterances per speaker

Stylometric attribution method

Features
+
logistic
regression
classifier

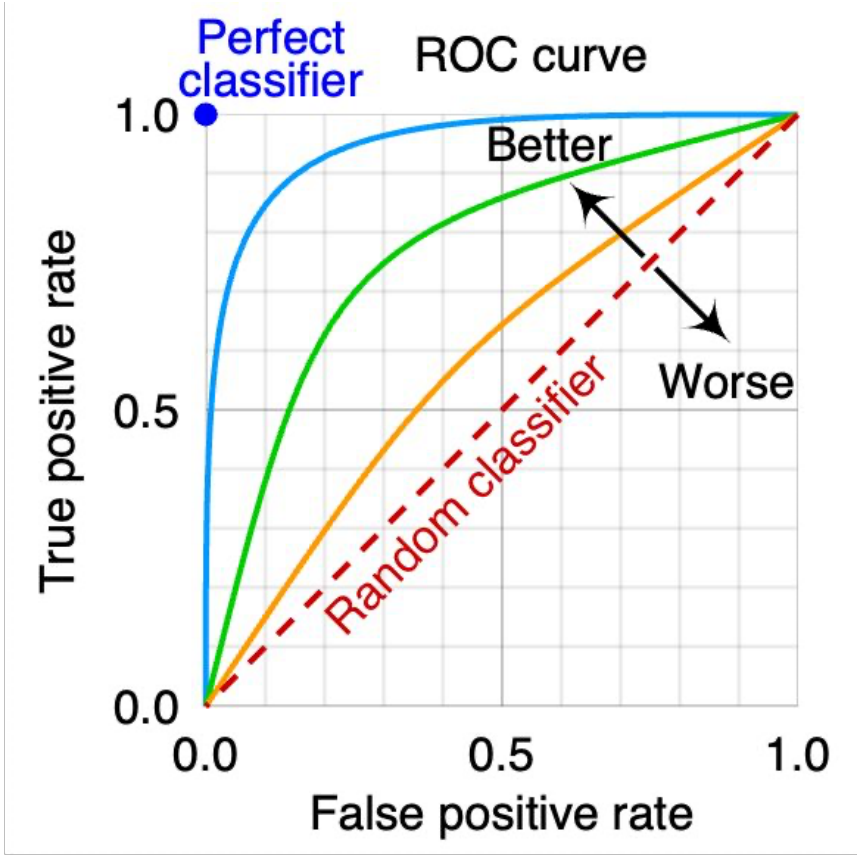
Character	punctuation mark frequencies (18 total)
	TF-IDF character n-grams (for n = 3, 4, 5, 6)
Token	number of tokens (T)
	number of unique tokens (U)
	ratio of types to tokens (U:T)
	TF-IDF token n-grams (for n = 1, 2, 3)
Word	average word length (in number of characters)
	ratio of short words (<5 chars) to total words (short:W)
	ratio of long words (≥8 chars) to total words (long:W)
	ratio of capitalized words to total words (caps:W)
Syntax	number of sentences
	average sentence length (in number of tokens)
	function word frequencies (390 words)
	function phrase frequencies (69 phrases)
	POS tag frequencies (using Stanza, UPOS tagset)
	TF-IDF POS tag n-grams (for n = 1, 2, 3)
Complexity	vocabulary richness (Yule's *I*)
	readability measures (9 total; using Python's TEXTSTAT)
	ratio of hapax legomena to total number of words
	ratio of hapax dislegomena to total number of words
Style	number of contracted terms (out of 61 total)
	number of non-contracted terms (out of 62 total)

Evaluating model performance

Area Under the ROC Curve (AUC)

ROC = Receiver Operating Characteristic

Can be understood as the success rate of the model
(so 0.7 is 70% successful)



Implemented using Python's scikit-learn library

Stylometric attribution performance

AUC ↑	**full**	**# trials**
Stylo	0.861	1913

Stylometric attribution performance

AUC ↑	full	# trials
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AUC ↑	first 50 utts	last 50 utts	# trials
Stylo	0.631	0.574	108

➢ Performance decreases on the end of the transcript compared to on the beginning.

Accommodation and speaker attribution

- Previous literature and speaker attribution results favor converging accommodation in Fisher conversations.
- But the ALIGN metric suggests that accommodation trends slightly downward throughout a conversation.

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➢ What's going on?

Future work

- Develop a new, better metric to measure if/how accommodation changes throughout a conversation
- Compare to accommodation on other datasets
    - one with likely more accommodation
    - one with likely less accommodation
- Compare to other metrics on Fisher
- Take social and identity-based information into consideration

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