

4th Focus Conference on

# Forensic Linguistics



## BOOK OF ABSTRACTS

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## **Testing authorship analysis on spoken language transcripts: Establishing a first benchmark**

Purpose statement: Create a baseline for computational content-based authorship analysis systems applied to transcribed speech.

Research question: How does non-auditory authorship analysis perform on transcripts of oral language when determining whether two ‘scripts’ were said by the same person or different people?

Research problem: In forensic linguistics, speech data are analyzed for their phonetic properties, with other linguistic information playing little role (Watt & Brown, 2020). Textual data, by contrast, are primarily assessed via lexical, syntactic, and semantic features (Stamatatos, 2009; Neal et al., 2017). Interestingly, though, these two approaches have yet to be combined systematically, analyzing speech data via phonetic and lexical/structural information. Before they can be combined, however, we need to know whether non-phonetic features are capable of identifying authors in transcribed speech in a similar way to that for written texts, for which this work is a first step. As such, there is no currently-defined state-of-the-art for this particular problem.

Methods and data: We chose a corpus of transcribed phone calls in which all calls had an assigned discussion topic and speakers often participated in multiple calls (Cieri et al., 2004). The calls lasted 10 minutes and were gender-balanced. We initially selected 900 pairs of speaker transcripts to form the basis of a speaker verification task, in which a pair of speaker transcripts is identified as being from either the same speaker or different speakers. To obtain 300 same-speaker pairs, we matched two transcripts from the same speaker, each from a different call with a different assigned topic. For 600 different-speaker pairs, we created two separate 300-pair datasets: a ‘harder’ one that matched the two call transcripts that formed a single call (discussing the same topics), and an ‘easier’ one that did not require the different speakers to be in the same call. For each speaker in the pair, we extracted a variety of character-/token-/sentence-/conversation-based features, most of which were stylometric features from previous work (e.g. Stamatatos, 2009; Neal et al., 2017) for reasons of comparability; however, as we intend this as a baseline, we hope to move toward linguistically-superior features in the future (cf. Chaski, 2001). We then trained a Naive Bayes classifier on these feature sets and assessed its ability to identify each pair as the same speaker or different speakers.

In this talk, we present our results across metrics, data subsets, and two transcript ‘encodings’ available in the corpus: one with prescriptive punctuation/capitalization and another without punctuation in all caps. We extracted the same pairs from both encodings to additionally test the impact of annotation on the results. In preliminary experiments, we have found similar accuracies for each encoding (84.2% (0.161 EER) and 82.5% (0.141 EER), respectively) with

only slightly lower results on the ‘harder’ pairs. We discuss these results in (rough) comparison to authorship analysis models based on written texts.

Impact: Combining insights from multiple branches of forensic linguistics may eventually enrich current forensic speaker recognition models and provide a more comprehensive speaker profile.

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## Voice lineups: A comparative study of current methods

A voice lineup, also known as voice parade, is the auditory version of the visual lineup. A witness, in this case an earwitness, hears a number of different speakers in order to assess, whether the perpetrator is heard in the lineup or not. Voice parades are applied in cases, where a victim of a crime heard the voice of the criminal, but was not able to see him/her. The attacker may have been masked or the victim was not in the position to see the face or only heard the voice over the phone. Voice parades have become accepted as part of the legal system in many countries. The construction of a voice parades is time-consuming and costly. As a consequence, they are only commissioned when the crime concerned is a serious offence; the construction of voice parades belongs therefore to the less frequent tasks of a phonetician, compared to tasks like speaker comparison, tape transcription and enhancement. In particular cases, however, they can be crucial – providing the additional piece of evidence necessary for the completion of a forensic investigation.

Why are guidelines for the construction of a voice parade so important? The reliability of voice parades depends on a number of factors. Wells (1978) in his overview of eyewitness-testimony research distinguished two types of variables: estimator and system variables. The first type concerns variables that affect eyewitness accuracy but are not under the control of the criminal justice system. Examples of estimator variables are severity of the crime, exposure duration, characteristics of the victim like memory retrieval skills or identification ability, or characteristics of the defendant like distinctiveness. System variables are under the direct control of the criminal justice system. Examples are retention interval, lineup structure (e.g. functional size versus nominal size), instructions to the witness, etc. It is these guidelines that may lead to optimal settings of these system variables being used, so that the witness is offered the best possible chance of being accurate and the innocent suspect the best chance of not being selected from the parade. Guidelines also provide the scientists or police officers involved with useful instructions; there are many issues to consider and in the case of an unfamiliar voice, time is an important factor (de Jong-Lendle et al., 2015). Thirdly, guidelines are crucial in the judicial process: they help to increase the number of lineups that are appropriately constructed and conducted and by doing so they may reduce the number of costly appeals.

This talk provides a general review of the different guidelines and recommendations for voice parades worldwide. The three that are most detailed, were designed from a scientific perspective, were applied in casework and have acquired official status within their associated justice departments, will be compared and discussed within a scientific framework: the guidelines used in the United Kingdom (Home Office Circular 057/2003), Germany (Gfroerer & Jessen, 2021) and the Netherlands (Van Amelsvoort, 2018).

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Ella Fletcher (University of Alicante)

## **The computational analysis of syntax for the authorship attribution of social media texts**

This investigation will propose and develop a reliable computational method for the Authorship Attribution of social media texts using syntactic analysis. Recent advances in technology have made social media a focus for criminal investigations; Forensic Linguists must adapt and be able to perform high levels of analysis on social media data. Texts from social media are generally short and not very syntactically rich. With the state-of-the-art showing a shift towards syntax, but mostly remaining with larger text samples, this investigation will provide a significant contribution to this ever-evolving professional and academic field.

Authorship Attribution is a Forensic Linguistics problem with professional applications. It involves the classification of textual features to determine an author's style (or idiolect) and using this to attribute the authorship of a questioned text (Coyotl-Morales et al. 2006), this can be facilitated with Natural Language Processing (NLP). Stamatatos (2009) provides an example of this. His work focused on evaluating computational and statistical methods for Authorship Attribution, establishing length of text as a principal factor affecting accuracy. Interestingly, however, he implied that shorter texts facilitate attribution as they do not allow for intratextual style variation. Lagutina et al. (2019) also employed computational methods for Authorship Attribution. Their focus was on the analysis of syntactic structures, which they deemed key to both stylometry and idiolect. They analysed constituency parse trees and used these to determine a probabilistic context-free grammar for each author in the problem. A final, important paper to mention is Tyo et al. (2022). They used the *VALLA* Benchmark to determine that, when the known-text sample for each author is over or around 100,000 words, the BERT<sub>A</sub> method is most effective. The Ngram<sub>A</sub> method, however, is more accurate when dealing with smaller sample sizes or *domain-shift*.

This investigation will evaluate a set of null and alternative hypotheses.

**NULL:** It is predicted that there is no relationship of dependency between the features of social media texts and the accuracy of computational syntactic analysis for Authorship Attribution.

**ALTERNATIVE:** It is predicted that there is a relationship of dependency between the features of social media texts and the accuracy of computational syntactic analysis for Authorship Attribution.

Specifically, this investigation will look at the accuracy of dependency parsing as an input for a supervised classification method using relatively short texts. The dependency parsing tool will be chosen after a process of experimentation, serving to reflect the advantages and shortcomings of each proposed tool. A social media corpus will be analysed with the chosen tool(s) and this output will form the input for a supervised classification method. This will be quantitatively evaluated to determine the effectiveness of the method.

The analysis undertaken throughout this investigation will guide the development and finetuning of a computationally based method, using dependency parsing and supervised classification, for the Authorship Attribution of social media texts. In a professional environment, this method will be a useful tool for the Forensic Linguist to boost their overall degree of certainty when employed alongside contextual and, if necessary, linguistic analysis.



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**Ella Fletcher** is currently a student on the Doctorate in Linguistics programme at the University of Alicante; her doctoral thesis focuses on computational methods using syntactic analysis for the authorship attribution of short social media texts with little syntactic richness. Her academic portfolio includes a BA in Modern Languages with First Class Honours (University of Southampton), and a Master in English and Spanish for Specific Purposes (University of Alicante). She was awarded the *Premio Extraordinario* for outstanding performance in her master's and achieved specific mentions for Medical English, Legal English and Forensic Linguistics.

Eilika Fobbe (University of Mainz)

## **On the evaluation of linguistic evidence and applying the Bayesian approach to forensic author identification**

A central, if not crucial, element of forensic linguistic expertise on questions of authorship is the linguist's assessment of whether or not a particular author wrote a text. Only with this decision can the court assess the evidential value of the text. The most common way of answering the court's question about the text's origin is to make a statement on a probability scale about how likely it is that the candidate is the author of the text in question. With this more or less traditional approach, linguists regularly overstep the boundaries of the expert role defined by the law and make themselves theoretically vulnerable to attack because they answer the court's hypothesis rather than the probative value of the evidence. For this reason, it is not only recently that there has been an ongoing debate in the forensic sciences about evaluating the evidence obtained from analysis and which theoretical framework is most appropriate.

In forensic linguistics, the Bayesian model still needs to be discussed. While other forensic sciences, such as phonetics or DNA analysis, have long established the Bayesian approach to evaluate analysis results in their disciplines, it has only recently been embraced in forensic linguistics. In most cases, researchers focus on applying Bayes' theorem to the computational analysis of linguistic data. Since the primacy of Bayes over other methods is already self-evident to these authors, more fundamental questions, such as what it means to use the Bayesian framework in linguistic authorship identification, are less relevant.

The paper, therefore, focuses on the general aspects of applying the Bayesian concept of conditional probabilities in forensic linguistics and some of the main discussion points about Bayes in the forensic sciences. After an introduction to the essential elements and the significance of the likelihood ratio for the expert witness' evaluation of evidence, examples from casework in author identification are used to show that the Bayesian logic model is well suited for the linguistic interpretation of evidence. In addition, a common reasoning error associated with this logical approach is addressed and illustrated with linguistic examples.

It is fair to assume that the adaptation of Bayes will strengthen the role of linguistics in the forensic sciences, as the concept conceives probability assessments as part of an individual's belief and considers statements based on experiential knowledge equivalent to data-based statements. The Bayesian approach thus offers an alternative to frequentist approaches, which, as a consequence, tend to underestimate the value of qualitative work and often regard experience-based assessments as subjective, if not unscientific. Most importantly, the approach is far more compatible with the role of the expert witness in court than the traditional approach.

The paper introduces the Bayesian approach and its advantages for forensic linguistic analysis from a general perspective and outlines possible ways to apply it to questions of author identification.

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Nora Giljohann (Ruhr-University Bochum)

## **Author profiling for hate speech spreaders**

The contribution deals with the special challenge of creating author profiles of hate speech spreaders. The focus is on the language used by the authors of hate speech and whether specific statements can be made about individual authors or groups of authors. A major problem of combining the two phenomena is that hate speech is characterized by short and spontaneous messages, whereas author profiling requires a lot of material to make valid statements about an author. Moreover, language is a social and not a physical phenomenon, which is why only probability statements can be made in author recognition (cf. Fobbe 2017: 283). Furthermore, reference must be made to the existing problem of defining hate speech, since the context and framework of a statement play a decisive role in determining whether it is hate speech or not (cf. Marx, 2020, p. 715).

The self-generated dataset (in German) on which the analyses are based consists of data from the messenger service Telegram. Groups were selected according to certain criteria and chat histories were downloaded. The data was manually annotated and individually evaluated according to whether it is hate speech or not. Specific criteria have been established for this purpose, but the work on the material has once again revealed the complexity in this area. After all, a certain subjectivity cannot be avoided in the assessment. In addition the messages were divided into different categories, such as racism or anti-semitism. In total, about 13,000 messages have been manually annotated. From the data, the authors who wrote the most hate speech messages were filtered out to examine the language of the individual authors in more detail. To better process the material, the program #LancsBox was used for word and n-gram analysis. #Lancsbox was also used to create graphs to illustrate which vocabulary was mainly used by the different authors (Brezina et al., 2020).

Initial findings of the research are that the annotation of the posts is very complex due to the variability of the language and the subjective assessment about hate speech. In addition, the analysis of language shows that the form of hate speech differs in some cases greatly among different groupings and authors. It will be further elaborated which individual, linguistic aspects of the authors are conspicuous and which linguistic structures are particularly interesting in relation to hate speech and filtering. How important are code words in hate speech? In relation to hate speech, the legal perspective must always be included, as freedom of expression is of great importance to our society (cf. Brings-Wiesen, 2017, p. 37).

The goal of this work is to show with mainly manual work, which group-specific structures can be observed from a linguistic perspective in relation to hate speech. The detailed analyses are intended to show which statements can be made about hate speech spreaders. From this, important insights are to be extracted in order to combine these peculiarities with an artificial intelligence and thus improve the filtering of hate speech in the German language by specifications.

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**Nora Giljohann** is a research assistant at the Ruhr-University Bochum (Germany) in the Department of German Linguistics. In her PhD, she is researching the topic of author profiling of hate speech spreaders as part of the SecHuman project. The project is designed for interdisciplinary research. In her master's thesis she already dealt in detail with the phenomenon of Hate Speech.

Victoria Guillén-Nieto (University of Alicante)

## **Irony as a pragmatic indicator of maturative closeness in aggressor-victim interaction**

Speaker identification and author identification have long been outstanding areas of expertise in Forensic Linguistics—the scientific study of language as evidence (Guillén-Nieto and Stein 2022: 1-33), to the extent that, more often than not, these areas of expertise can be wrongly taken for the whole discipline of Forensic Linguistics. However, linguistic expertise has expanded over the years to other areas far beyond identification tasks, including plagiarism detection. For example, in Spain, the present author has recently given sworn testimony in cases associated with gender-based violence, harassment and statement veracity evaluation. This paper investigates *maturative closeness* between aggressor and victim in cases related to child abuse. Lawyers for the defence strategically resort to the psychological concept of maturative closeness to spare their clients from conviction or reduce the penalty of imprisonment in a guilty verdict.

The general aim of this paper is to analyse irony as a pragmatic indicator of maturity (Pexman and Glenwright 2007: 178-196). Irony, as explained by Holmer, "requires a rich texture of living, and it does not belong to infants, to the thoughtless, nor the animals" (Holmer 1975: 1). From a pragmatic point of view, irony has argumentative power; it is a complex discursive strategy that engages the difference between an explicit, said meaning, and an implicit, unsaid meaning, and is often used for humorous or contentious purposes.

The paper sets up two hypotheses: 1) The null hypothesis predicts no relationship of dependence between a subject's maturity and their use of irony as an argumentative strategy. 2) The alternative hypothesis predicts a relationship of dependence between a subject's maturity and their use of irony as an argumentative strategy.

From a methodological point of view, the analysis combines irony theory, appraisal theory and relevance theory. The analysis will be illustrated through its application to a court case involving child abuse. The participants in the speech event are a 23-year-old boy and a 15-year-old girl. The materials analysed are the Whatsapp conversations both subjects had in 98 days. The conversations include abundant verbal and non-verbal interaction, e.g. emojis, between both subjects.

Findings from this paper demonstrate the useful insights pragmatics can provide in cases concerning maturative closeness evaluation and how linguistic expertise can complement the findings of forensic psychologists in similar cases.

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- Pexman, M. P., & Glenwright, M. (2007). How do typically developing children grasp the meaning of verbal irony? *Journal of Neurolinguistics*, 20(2), 178–196.

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## The forensic application of communicative principles

Responsible language policies derive from foundational principles of successful communication, which favor linguistic structures with features like accuracy, efficiency, and context appropriateness. Principles-based language policies apply to high-stakes formal communications, in which noncompliance could harm stakeholders and society in general. Forensic linguistic reports are high-stakes documents whose exposition is rightly expected to be exceptionally compliant with communicative principles. Appeal to those same communicative principles can sometimes constitute the basis for a report's argumentation.

Why should courts value an expert linguist's opinion on the meaning of a given sentence when individuals without linguistic training can interpret the full range of sentence structures of their native language? Linguistic opinions, however, are less valuable than conclusions properly drawn from linguistic facts. Communicative principles provide the foundation to demonstrate with certainty that certain linguistic structures in context are sufficient or deficient for a given purpose. This process has forensic value because the existence of materially deficient linguistic structures provides evidence of professional negligence and sometimes even malfeasance. Such principled identifications of sufficiency or deficiency are not mere opinions; they qualify as conclusions properly drawn from linguistic facts.

Some pertinent communicative principles for high-stakes situations have been formulated as writer guidance<sup>1</sup> in this way:

An interpretation satisfying the applicable linguistic, logical, and pragmatic rules is a valid interpretation, even if the original writer and others favor another interpretation.

All rules of logic apply, even if the writer does not understand them.

Readers have the right to take you at your literal word, in context.

Negligent violations of communicative principles sometimes resemble rhetorical flourishes. In forensic linguistic reports, however, readers can justifiably take a literal interpretation in context from each structure employed. For example, if a rebuttal writer alleges that a colleague "assumes [something] without justification," the reader expects to find no overt "justification" in the original report. In this case, the writer provided *explicit* justifications, so the rebuttal linguist committed the fallacy of suppressed evidence. One such isolated fallacy could be excusable negligence, but the relevant rebuttal promoted over 15 logical fallacies, which undermined the rebuttal's credibility.

Various enterprises have been held accountable for leading individuals to sign documents containing materially defective linguistic structures. One attestation consisted of three sentences with roughly similar meanings: two sentences with qualifying phrases and the last sentence without qualifiers. Regardless of the writers' intention, the paragraph was demonstrably indecipherable as a coherent message because the third sentence contradicted the first two. High-stakes documents with materially self-contradictory assertions qualify as defective.

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<sup>1</sup> Habick, T., & Cook, L. (2022). *AICPA test development fairness guidelines*. AICPA.



Communicative principles impose duties on consumers of high-stakes documents too, namely not to derive cynical or wishful interpretations that are precluded by the literal grammatical structures employed.

There are both direct and indirect linguistic pathways to a given meaning. Efficient linguistic structures<sup>2</sup> are favored because they lack content-irrelevant distractions from the intended meaning. Principles-compliant communications permit only meaning-convergent signals while excluding meaning-divergent ones.

This paper explores the role of communicative principles in a global environment where good-faith communications cannot be taken for granted.

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<sup>2</sup> Levshina, N. (2023). *Communicative efficiency*. Cambridge University Press.

## **Reconstructing the folk pragmatics of legal professionals in Spain regarding epistemic modality and indirect evidentiality in defamatory texts**

When dealing with a lawsuit involving a language-related crime such as defamation, it is necessary a thorough analysis of the allegedly defamatory text based not only on legal parameters, but also on linguistic criteria (Shuy 2010). Sometimes, this analysis is not particularly challenging, because the original text contains, for example, extremely derogatory expressions or because the defendant accused categorically the plaintiff of having committed a crime in which it has been demonstrated that he/she was not involved. Nonetheless, if speakers are aware of the legal risks they are running, they may prefer to produce less overt forms of defamation, which makes it more difficult to analyse.

Among the different strategies at their disposal are linguistic items that help restrict one's responsibility. Some of them are markers of epistemic modality (Nuyts & Van der Auwera 2016) encoding low or medium commitment, such as Sp. *quizá* ('maybe') o *probablemente* ('probably'). Other expressions belong to the domain of indirect evidentiality (Aikhenvald 2018): they mark that the speaker simply inferred what he/she is conveying or someone else told him/her about, as in Sp. *al parecer* ('apparently'), *supuestamente* ('supposedly') or *según dicen* ('it is said'), without necessarily assuming its truth-value.

Identifying the exact effect of these expressions in a potentially defamatory text is not an easy task, since, depending on their semantics and pragmatics, each linguistic item modulates in different ways the type of responsibility assumed. This might have a big impact in the resolution of lawsuits involving defamation. However, their role in alleged language-related crimes has been so far neglected in the field of Forensic Linguistics (Izquierdo-Alegría 2021). To make things worse, linguist experts, at least in Spain, are rarely called upon by the judges or by the lawyers of the contending parties in cases involving hate speech, incitement to terrorism or defamation (Guillén Nieto 2020: 12). This means that legal professionals normally rely on their linguistic intuitions when dealing with allegedly abusive texts. This may entail many analytical difficulties in the courtroom, especially when the texts that triggered the legal process are instances of covert defamation.

The aim of this paper is to unveil which are the (linguistic, discursive, pragmatic) criteria used by legal professionals in order to analyse defamation cases in which different expressions of indirect evidentiality and epistemic modality play a major role in the allegedly defamatory text. This paper is based on a corpus of 10 court decisions given by different Spanish courts that have been selected because the allegedly defamatory texts contain at least one of these expressions that dramatically modifies the responsibility assumed by the defendant. This study reveals that, despite their importance, there are very rare mentions to these linguistic items, and they are analysed in a very intuitive and vague way, without making relevant distinctions. In addition, contextual criteria are generally favoured, overlooking many important linguistic criteria.

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Annarita Miglietta (University of Salento)  
Eugenio Totaro (University of Perugia)

## **The information sheets of Italian banks: Between comprehensibility and clarity, linguistics and law**

### Purpose statement

The purpose of this work is to propose the simplification of the current account information sheets offered to consumers, trying to verify whether and at which levels of analysis it is possible to intervene and to what extent the simplification process is feasible without altering the structure and legal rigour.

### Research problem

The idea stems from a well-known but unsolved problem relating to the complexity and lack of clarity of information sheets which often undermine decoding by consumers, thus damaging their right to get information or to be informed.

### State of the art

In Italy, with D.Lgs. 385/1993 and, in particular, with the *“Bank of Italy’s provision on the Transparency of Financial Banking Transactions and Services - Correctness of relations between intermediaries and customers”*, pre-contractual information on bank current accounts must be aimed at *«ensuring clear and accessible information for customers»*. Bank of Italy requires *«layout criteria that ensure high levels of legibility; - structure of the documents suitable for presenting the information in a logical and priority order that satisfies the information needs of the customer and facilitates the understanding and comparison of the characteristics of the products; - syntactic simplicity and lexical clarity calibrated on the level of financial literacy of the customers for whom the product is intended, also in relation to the characteristics of the latter. The most important and recurrent technical terms, acronyms and abbreviations are explained, with precise and simple language, in a glossary or in a legend»* (§1.3.). To date, even if in the presence of a *«prototype of current account information sheet offered to consumers»* developed by the Bank of Italy, it is clear that what the Italian central bank has done still has very wide margins for improvement to achieve the results it seeks.

### Hypotheses or research questions

Therefore, we will try to verify on which levels of analysis, macro or micro-textual, the documents present critical issues and if it is possible to intervene, combining legal rigor and linguistic-textual simplification.

### Description of the methods, instruments and tools

In particular, the account information sheets offered to consumers of the 5 major Italian banks will be analysed, the Gulpease readability index will be evaluated and interventions will be made in compliance with the indications of the Bank of Italy. Rewrites of the texts will be proposed to be subjected to a stratified sample to verify their effectiveness.

Summary of the main conclusions or statement about the relevance and potential impact of the piece of research

The simplification of the traditional style of banking information could have important repercussions on the exercise, by consumers, of the right to be informed in order to avoid misunderstandings and fallacious interpretations when signing contracts.

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Elena Morandini (University of Alicante)

## **Human and computer bias in transcript analysis for computational forensic linguistics purposes**

This paper aims to assess human bias in mafioso conversations transcripts for Computational Forensic Linguistic analysis and, together with other forensic tools such as Social Network Analysis, reduce such bias improving data quality for solid evidence gathering.

Questioned since Forensic Linguistics' very beginnings because of human bias, transcripts reliability is taken too often for granted (Gilbert & Heydon, 2021). In the digital era, abundant research has been conducted into human and automation bias to minimise weaknesses in data for investigative and forensic purposes (Campana & Varese, 2012; David et al., 2020). Yet, automatic analysis based on questionable transcripts would surely lead to biased conclusions, and the weight of forensic linguist experts' testimony is as substantial as the data used when drawing such conclusions. At the same time, wiretapped conversation records are indispensable for a fuller picture of criminal organisations in their natural setting.

This paper attempts to answer two questions: a) are transcripts admitted as evidence in court a valid instrument of study for linguistic purposes? b) If treated as a document classification problem in a Computational approach, can human bias be assessed and mitigated using statistics?

A direct comparison of the original audio with its final transcript would be idyllic (Guillén Nieto, 2021) to include pragmatic elements eluded in transcripts and disregarded by algorithms as silences, emotions, and threats. Without such complete material, an experiment will be carried out using speech acts samples from the abovementioned transcripts without their corresponding audio. These samples will be analysed using linguistic quantitative and qualitative approaches at different pragmatic levels. With Corpus Linguistics, the recurrence of traits will be analysed, such as word frequencies, keyness, n-gram, and collocation network evidenced in qualitative analysis. Finally, a regression model and a classification model with Weka (Frank et al., 2005) will be applied to the results to calculate the bias percentage.

To conclude, this paper intends to deepen forensic linguist expertise in criminal proceedings, offering objective results even from texts repeatedly criticised for their lack of objectivity, such as transcripts. Moreover, human and technical biases assessment will help experts offer more solid evidence in front of a U.S. court, where the Daubert Criteria restrictions would be met.

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## **The validity of temporal information in forensic voice comparison in a likelihood ratio-based approach: A case study of limited length speech**

This study investigated the validity of analyzing temporal information when a speaker's speech is extremely short. Each speaker's speech was compared using a likelihood ratio-based approach. Two research questions were posited: 1) Can temporal information from extremely short speech be used for forensic voice comparison? 2) Do the results differ if the calculation methods use temporal features ( $\Delta C$ ,  $\Delta V$ ,  $\Delta VO$ , varcoC, varcoV, and varcoVO) compared to results based on  $\bar{x}$  of the segments? A subset of the speech corpus THAI SER was used in this study, focusing on speech sounds produced by 156 speakers (90 female). Each speaker produced the same three sentences which comprised 15, 22, and 19 syllables, respectively, and were used as background, suspect, and offend data, respectively. To avoid possible cognitive bias, all speech sounds were labeled using the Montreal Forced Aligner without manual adjustment. The duration of all segments were measured. To assess the validity of the temporal information, multivariate kernel density likelihood (Aitken & Lucy, 2004) as implemented by Morrison (2007) was calculated for each pair of speakers. In total, 4,356 pairs of male speakers and 8,100 pairs of female speakers were compared. The validity of the temporal features was first assessed.

The study adopted the interpretation of the likelihood ratio proposed by Rose (2002), such that a likelihood ratio with a value greater than 1 was deemed to indicate "same speaker" whereas a value less than 1 was deemed to indicate "different speaker". The calculations using the temporal features revealed that only 1.51% of same male speaker pairs and 96.95% of different male speakers were correct; 0% of same female speaker pairs and 99.89% of different female speaker pairs were correct. Evaluation using  $\bar{x}$  of the segments was then completed. For male speakers, 19.67% of same speaker pairs and 79.81% of different male speaker pairs were correct; 34.44% of same female speaker pairs and 74.48% of different female speaker pairs were correct.

The results reveal that using  $\bar{x}$  of the segments leads to better results than calculations based on temporal features, which suggests that temporal information, specifically the use of  $\bar{x}$  segments, can be used for forensic voice comparisons even if the individual speaker's speech length is extremely short. However, the performance is quite poor. The performance may be improved if longer speech data are used. Previous studies have shown that temporal information is not affected significantly by recording devices and channels, unlike formant frequencies (Byrne & Foulkes, 2004). Consequently, this study demonstrates the possibility of reliably using temporal information, particularly  $\bar{x}$  of segments, as an alternative acoustic feature in forensic voice comparison when other acoustic features are not available.

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**The communication intermediary and ‘putting the case’:  
Facilitating effective communication during cross-examination**

Participating in the justice process as a vulnerable person can be daunting. One source of distress is unfamiliarity with legal proceedings and technical jargon employed by justice sector professionals in court. Defendants with Autism Spectrum Disorder, also referred to as Autism, are a particularly vulnerable group who often come into contact with the criminal justice process (Maras et al, 2017). When a defendant with Autism gives evidence at trial, a particular challenge is cross-examination where the defendant is required to respond to leading and suggestive questions posed by the prosecutor in order to contradict the defendant’s evidence. Considerable research has pointed to the fact that use by lawyers of leading and suggestive questions during cross-examination is detrimental to the experience of giving evidence for a defendant with Autism, often resulting in evidence deemed unreliable (Eastwood & Patton, 2002). Cross-examination is integral to test a witness (Browne v Dunn, 1893), yet research revealed it disadvantages vulnerable people (Smith & Mahoney, 2018). Communication intermediaries were introduced in Australian criminal proceedings in 2016. The intermediary assists justice professionals with appropriate communication to obtain “best-quality evidence” from a vulnerable person that is complete, coherent and accurate (Cooper & Wurtzel, 2012). This presentation describes procedures in a novel case after the author was appointed as the intermediary for a defendant with Autism in an Australian sexual abuse trial.

The research aims in this case study are to examine whether intermediary presence enabled (1) the lawyers to ask more comprehensible and less complex questions and (2) the defendant to have better comprehension, be more confident and provide clear evidence. We highlight interactions between the intermediary, the defendant, the Crown Prosecutor and the defense barrister. We provide illustrative examples of problematic questioning (leading, tag or complex questions), the intermediary recommendations and the defendant’s responses. Excerpts of the trial transcripts were coded for different question types commonly used in cross-examination: (1) simple questions with a question word (WH); (2) leading questions (tag or statements as questions); (3) complex questions; and (6) multifaceted questions. To measure comprehension, the defendant’s responses were categorized as: (1) asking for clarification; (2) expressing uncertainty; (3) showing misunderstanding and (4) referring to the intermediary. Systematic qualitative analysis of the transcript excerpts of the defendant’s evidence disclosed that after a ground rules hearing, with intermediary input, lawyers asked more comprehensible and less complex questions. Under cross-examination, the defendant had better comprehension of the questions, asked for clarification and gave clearer, more confident evidence. The results demonstrated procedures for intermediaries to enhance meaningful participation of vulnerable defendants in an adversarial trial.

Intermediaries provide vulnerable people an opportunity to participate in a system that previously excluded them. The dearth of research into intermediary special measure uses in Australia limits the acceptance and extension of their role. The proposed research project will aim to provide valuable information to enable policy development regarding: (1) professionalisation of the role of intermediaries and (2) potential roles for intermediaries with vulnerable defendants in Australian criminal jury trials.

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## Measuring variety of meaning for authorship verification

A new approach to measuring qualities of lexical variation is proposed and evaluated. Computational approaches to authorship verification focus on features like word choice and order, with reference to frequency extremes: highly frequent lexical items of closed-class syntactic categories, punctuation marks, letters, etc., and sequences of such items; and items as infrequent as hapex legomena. Apart from hapex counts, and abstractions over lexical items like counts of “long words” that provide measurements of lexical variety, such approaches tend to ignore items from open-class categories, because the open-class items themselves reveal content more than style. Consider using hapex legomena counts as an index of lexical variety. The method proposed and evaluated here can differentiate two extreme configurations possible for the number of hapex items in a corpus of texts associated with an author.

One extreme is that all of the items mean exactly the same thing, and another extreme is that all of those items mean completely different things. Arguably, latter situation involves more lexical variety than the former, inasmuch as it requires command of a greater breadth of concepts and their lexicalizations.

The proposed method of assessing lexical variation adapts the notion of context vectors as distributional representations of word meaning. Given a corpus of interest, one may determine the frequency-based ranking of items within the corpus. Focus on word tokens as items. Given a target word, and some number of positions (say,  $j$ ) to the left and to the right of any instance of the target word, one may observe the count of each of the  $n$  most frequent items in the corpus as placed one position to the left, and up to  $j$  positions to the left, as well as up to  $j$  positions to the right of the target. These counts may be relativized to, for example, the total number of tokens in the corpus. One now has a vector of length  $2 \times j \times n$  for each target word. A vector represents the contexts of length  $2 \times j$  surrounding the target word and relative frequencies of the  $n$  most frequent items in the corresponding context position relative to the target word. Hence, such a representation is known as a context vector (Finch & Chater, 1992).

Given context-vectors, one may use a standard measure, such as cosine, of the distance between two vectors, and hence similarity of word meaning. The method used here does exactly that, examining all pairwise cosine comparisons of word context vectors between all items in three different frequency bands in a corpus: the  $p$  most frequent items, all items, the  $q$  least frequent items. Standard statistics (quartiles, mean, median, standard deviation) of those measures of differences are used as abstract features.

Using an authorship verification dataset of fan-fiction (Bischoff, Deckers, Schliebs, Thies, Hagen, Stamatatos, Stein, & Potthast, 2020), the method is evaluated using a state of the art baseline approach that considers “syntactic” features of style alone compared with the addition of context vector proximity statistics as proposed. Context vector distance statistics provide statistically significant reduction in mean absolute error.

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