Testing realistic forensic speaker identification in Japanese: a likelihood ratio-based approach using formants

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Thesis Abstract

This thesis investigates to what extent it is possible to perform forensic speaker identification under three important conditions of realism:

• with forensically realistic data, i.e. natural and non-contemporaneous speech;
• with ‘traditional’ (i.e. non-automatic) acoustic parameters of formant centre-frequency;
• with a Bayesian Likelihood Ratio approach as a discriminant measure.

Natural speech data were elicited from 13 male speakers of Standard Japanese on two occasions separated by about a fortnight. A map-task was used, which was designed to contain words with five tokens of each of the short pitch-accented vowels /i e a o u/, e.g. nemoto (‘name’), terebi (‘television’), sushiya (‘sushi shop’), jinja (‘shrine’). In addition, a set of several tokens of moshimoshi /moʃimɔʃi/ (the Japanese word for ‘hello’ over the phone) was elicited. The task was repeated twice in each recording session, giving four sets of data overall. The centre-frequencies of the vowels’ first
four formants, and the F-pattern in moshimoshi were extracted by LPC analysis using CSL, and then subjected to further statistical processing. An ANOVA was carried out to determine what segment/formant combinations were more promising as speaker identification parameters from the point of view of magnitude of F-ratio (cf. Wolf 1972). On the basis of high F-ratio, and to conform to forensic realism, three values were selected from the individual vowels, and three from the set of moshimoshi, to be used as discriminant parameters. For the vowels, these were F2 and F3 in /e/ and F2 in /i/. For moshimoshi, these were F3 in /m2/, /o1/ and /j2/.

A discriminant test was performed using an overall likelihood ratio as a discriminant function (cf. Evett, Scranage and Pinchin 1993, Meuwley and Drygajlo 2001). This was calculated by first finding the likelihood ratio for each of the six parameters, checking that they were not significantly correlated, and then taking their product to derive the overall likelihood ratio. The formula for the likelihood ratio in Aitken (1995: 181) was used. Mean and standard deviation for the reference population in the formula were estimated using a cross-validation (leave-one-out) technique. Values of the overall likelihood ratio less than unity were interpreted as indicating a different-speaker pair, and values greater than unity were interpreted as indicating a same-speaker pair. Ninety non-contemporaneous same-speaker pairs, and 180 different-speaker pairs were tested.

Results showed that 5 out of the 180 different-speaker pairs were wrongly classified as same-speaker, and 9 out of the 90 same-speaker pairs were wrongly classified as different-speaker. This gives error rates of c. 3% false alarms, and 10% missed hits. It was concluded that speakers can indeed be discriminated on the basis of their formant frequencies from non-contemporaneous natural speech with relatively few (i.e. 6) acoustic parameters. It was hypothesized that it might be possible to discriminate a greater number of speakers with more parameters.

References
Referring and repairing in Spanish covertly taped conversations

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Keywords: covertly taped conversations, referential preferences, repairs, aliases, highly contextualized reference forms, topical coherence, Coherence Rule, conversational implicature

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Thesis Abstract
This thesis examines the linguistic behaviour of 14 members of one of the most powerful Colombian Cartels, the Cali Cartel, which from 1993 to 1995 was being investigated for the importation and distribution of cocaine in the United States. According to the indictments surrounding this case, the criminal investigation looked into allegations of crimes related to drug trafficking, such as money laundering, the concealment of the source and true owners of finances used for the acquisition of cocaine, and the protection of the leaders of the organization from arrest and prosecution. The allegations of concealment, in particular, are the central focus of this analysis. In this dissertation I examine the linguistic behaviour of the speakers engaged in criminal activity. In addition, I investigate whether the speakers’ fear of being overheard affects their referential preferences and their ability to negotiate repairs in 400 pages of written transcripts, which were obtained from a wiretap placed on the telephone line of one of the leaders of the criminal organization who was operating in the United States. The transcripts include 68 conversations that occur in a time span of six days and were recorded by a law enforcement agency and obtained from a United States Federal District Court House.

The dissertation is divided into six chapters. Chapter 1, ‘Introduction’, states the goals. The chapter proposes that when speakers engage in criminal activities they:

- prefer referencing expressions that designate a unique referent by tapping into knowledge shared by the speaker and the addressee, but which do not provide general information to any overhearers;
- perform repairs by tapping into their shared knowledge of a referent and by avoiding referencing expressions that provide general information to potential overhearers;
are unable to identify any referent that is not already known to the addressee and may on occasion violate certain discourse rules in order to withhold information from overhearers.

Furthermore, I propose that the referencing and repair strategies of speakers in covertly taped conversations can be used to determine, in a court of law, whether speakers are attempting to conceal information through language, which can constitute a violation of federal racketeering laws, such as Title 18 of the United States Code (18 USC 1956A3, see Shuy 1993: 3).

Chapter 2, ‘Referential Preferences in Spanish Covertly Taped Conversations’, provides a theoretical and empirical framework for the representation of reference in the dissertation data. In this chapter we find that speakers prefer reference forms that tap into the knowledge shared with their addressees, such as aliases and descriptions. Aliases, for example, which are used predominantly in the data, take the form of proper names and general noun phrases:

<table>
<thead>
<tr>
<th>General noun phrases</th>
<th>Gloss</th>
</tr>
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<tbody>
<tr>
<td>El señor</td>
<td>The man</td>
</tr>
<tr>
<td>El sobrino</td>
<td>The nephew</td>
</tr>
<tr>
<td>El suegro</td>
<td>The father-in-law</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proper names</th>
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<tbody>
<tr>
<td>Patti</td>
<td></td>
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<tr>
<td>Yei</td>
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</tr>
</tbody>
</table>

However, unlike the traditional uses of proper names and general noun phrases, which tend to disclose generally accessible information, aliases have a discourse function that serves to conceal the true identity of a referent in the data, such as Patti who is identified in the indictments as the alias of the head of the criminal organization.

Chapter 3, ‘Referential Choices and the Need for Repairs’, explores the relationship between the speakers’ referential preferences and their ability to achieve topical coherence with their addressees. To do this, the chapter looks at the need for repairs and at the repair choices of speakers in the data. The data shows that the reference forms that do not designate a unique referent in the data, such as general noun phrases, are more prone to repairs than those that are apparently shared by the speaker and the addressee, such as aliases. Furthermore, the repair mechanisms that are used most often to perform repairs consist of reference forms that do not disclose general information, such as repeating the referent and using aliases and descriptions.
Chapter 4, ‘Negotiating Repairs in Spanish Covertly Taped Conversations’, looks more closely at the negotiation of repairs in the data. The analysis of this repair strategy shows that the need of speakers to be covertly informative results, on some occasions, in the violation of the Coherence Rule (Tsui 1991), which can give rise to conversational implicature (Grice 1975). Below is an example taken from the data:

1. Stage 1 (SP1): Hablé con este man.
   Stage 1 (SP1): I talked to this man.

2. Stage 2 (SP2): ¿Quién?
   Stage 2 (SP2): Who?

   Stage 3 (SP1): You understand.

4. Stage 4 (SP2): Ah.
   Stage 4 (SP2): Ah.

   Stage 5 (SP1): Well, I’ll talk to you later

In this example the speaker performs a repair using a strategy that relies on the addressee’s obtaining an implied meaning, you understand, which is also realized as you know or you get my drift. This type of repair strategy, unlike the other strategies seen in the data, illustrates the speakers’ willingness to exploit their shared knowledge of a referent, even at the risk of being uncooperative, in an effort to ensure that no general information about a referent is disclosed to an outsider who may be overhearing the conversation.

Chapter 5, ‘Legal Applications of the Dissertation: A Statistical Analysis’, provides a step-by-step guide for the preparation of linguistic evidence, such as covertly taped conversations, for the courtroom. This chapter proposes that by comparing the rates of concealment in the covertly taped conversations of convicted criminals (obtained from historical cases) with those of innocent parties, linguists can determine whether the use of reference forms and repairs of each group are statistically different. If these are shown to be statistically different, this analysis can be applied to conversations of suspected criminals to determine whether speakers change their use of reference forms and repairs when talking with specific parties. This will provide a statistical basis for demonstrating whether a speaker is attempting to conceal information, a demonstration that could be useful in a court of law.
Chapter 6, ‘Conclusion’, provides a final synopsis of the major findings and contributions of the dissertation to the field of linguistics and the law.

References

Legal discourse in English: analysis of the Institute Cargo Clauses

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Thesis Abstract
This thesis analyses legal discourse in English, or legalese, through a corpus consisting of a group of five marine insurance policies. The so-called Institute Cargo Clauses were issued in 1982 by the Technical and Clauses Committee, which represents both Lloyd’s Underwriters and company markets. The Clauses constitute a sample of the most traditional legal discourse in that they have been used in the London insurance market since 1912 and ultimately date back to 1450. The Clauses are, therefore, shaped by Common Law rule-making machinery. Indeed, The Clauses are the product of a very specialized professional community, Lloyd’s Insurers, but still have a surprising scope of application. In fact, despite coming from the peculiar framework of the Anglo-Saxon juridical system, they are stapled – in their different versions – to the insurance policies of any kind of international transaction and used as worldwide terms of marine cargo insurance. This standard but striking course of action submits approximately 70 per cent of the courts around the globe to the peculiarities of a legal system with a different mechanism of hermeneutics and adjudication from their own. It also ties them to the lin-
guistic – and mostly untranslatable – whims of a set of texts drafted in sheer *legalese*, a specialized kind of discourse labelled as arcane, cumbersome and obscure by both specialists and laymen.

The study uses genre analysis to explore the extent to which this group of documents constitutes an instance of legalese; it asks whether the texts contain features that characterize them as products of the communicative devices of a very specialized professional sector. Basically, a genre is a highly structured communicative event – either written (as in business letters, statutes or abstracts) or spoken (as in cross-examinations, negotiations or job interviews) – that may be studied within examinations of the theoretical and/or applied aspects of the professional and academic varieties of a language. Getting to know a genre is, thus, having access to the communicative devices of a specialized community; hence, the deeper the generic knowledge one has about a specific profession, the more initiated enlightenment one will have about the mechanisms that construct its communicative processes.

The analytical model deployed divides the research process into three different areas. The first, *formal* or *superficial*, analyses the graphetic or visual features in the text, together with other, so-called, surface traits such as lexical and syntactic ones. The second, *textual* or *discursive*, deals with lexical and grammatical cohesion devices, as well as with staging mechanisms of the sort represented by topicalization, thematization, tense and modality. Finally, *pragmatic* or *generic*, which embraces aspects that are often labelled *cognitive* and *communicative*. Most of the studies carried out to date on legal discourse in English are largely formal, with notable exceptions such as those by Bhatia (1983, 1987, 1993), Kurzon (1984, 1986) and Maley (1987, 1994). While this study began by considering the traits that other authors consider peculiar to *legalese*, the innovative aspect of this research could be seen to be its systematization into subsequent levels of textualization and contextualization. As the study unfolded, and despite the initial division between levels, the results obtained at the first level complemented those obtained at the discursive level, which, in turn, explained and were rooted in the cognitive and communicative phenomena that build up the text.

At the first level, when analysing the graphetic mechanisms, I found that the seemingly clear and accessible graphic presentation belied difficulties posed by the erratic and apparently whimsical punctuating devices used in *the Clauses*, where commas are absent in the strings of words that relate to risks and exclusions. The lexical stage reveals that the almost 9000-word corpus is mostly technical, rather than archaic. This lexical specialization derives from the use of (i) *terms of art* (ii) words baptized as *inclusive* (general words with specific meanings in the text), and (iii) a phenomenon peculiar to *the Clauses: lexical multinomials*, or strings of words linked without a comma and tied with the conjunction *or* at the end of the series,
used to specify the different risks and exclusions in the policies such as:

*capture seizure arrest restraint or detainment*

vessel or craft being *stranded grounded sunk or capsized*

In addition – also at the superficial level – a syntactic study detects long, complex, convoluted sentences. In these sentences, long, embedded sequences of right-branching structures play an important role in realizing typically inclusive and exhaustive legislative language. The corpus shows an average of 58 words per sentence (the longest with 238 words) and 690 dependent clauses, 81 per cent of which are postmodifications. To these occurrences we may add the presence of syntactic features such as passivization and nominalization (used ostensibly to disguise the identity and detach the legal authority), conditionals and other resources that reveal the status and circumstances in which the risk is covered – or not – under the policy.

At the second or discursive stage I have analysed the texts from the point of view of the basic rules of linguistic organization, asking what makes the texts work and gives them their informative role. The results of this scrutiny show that we are dealing with a hugely repetitive discourse with graphic, rather than grammatical cohesion devices. Lexical cohesion is attained, on the other hand, by means of the peculiar phenomenon of lexical multinomials, found in our previous level, and technical words in semantic clusters that refer to the worlds of insurance and freight, marine transport and contracts. Applying the traditional semantic canons of legal hermeneutics has revealed that these terms are positioned in a relationship of inclusion that tries to exhaust all the contingencies of risk and exclusion: what is not there, is not excluded. Staging devices have, furthermore, favoured the reification of discourse by means of the manipulation of tense and modality, theme and topic. The autonomy of the policy and its existence as a tangible entity, its institutionalization as a legal instrument, are evident at this level.

Finally, the fact that these policies are an instance of genre is shown by what I have labelled as its cognitive elements – its external and internal organizational schema – as well as by its communicative function and pragmatic conventions. Cognitively, on the one hand, we are aware of a text with a rigid macrostructure – its visual format and graphic cohesion – together with a great internal complexity that articulates the legal relations by means of 122 legal qualifications. These qualifications deal mainly with time, circumstance and legislative authority and restrict, delimit and complicate the world of rights and duties that the policies reflect. Communicatively speaking, on the other hand, the Clauses constitute a whole declarative illocution with the enacting strength of law or norm, capable of changing the state of affairs by virtue of the supremacy that
arises from the fact that their sender is the recognized source of authority. This overall declarative act is, moreover, peopled by a series of so-called pseudo-directive acts that are implicit, not straightforward mandates, according to which the Assured is commanded to obey and the Underwriter is empowered to follow his or her own will. Finally, the existence of a very relevant extra-textual framework has to be considered, the Marine Insurance Act of 1906. Important implicatures or extra-textual knowledge operate in the ICC corpus, virtually in the hands of its issuers, which explains their lack of – in Gricean terms – cooperativeness and, in turn, forces the would-be receivers to cooperate independently of their volition.

In conclusion, our findings illustrate that the Institute Cargo Clauses are wholly understandable only from the point of view of the communicative group that issues them, namely the Committee of Lloyd’s Underwriters. This professional group uses these Clauses for their own communicative purposes and these purposes are concealed from the layman and user. This very fact has serious implications because the Clauses are used as international business tools. The results show the potential value of the contributions made by linguistics as a discipline that may help to unravel the obscurity and complexity of the legalese that articulates these policies, which are used worldwide to rule the cosmos of marine cargo insurance.

References
Factors affecting children’s responses to nonsensical and unanswerable questions

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Thesis Abstract

When children are interviewed in the forensic context, it is important that they indicate when they do not understand a question, or when they do not know the answer to a question. Previous research has found that children try to answer nonsensical questions (e.g. Hughes and Grieve 1980). However, this research was largely based on children’s responses to closed (i.e. yes/no) questions. The way a question is phrased (question format) has been shown to affect the accuracy of children’s responses in interviews about real-life events (e.g. Peterson et al. 1999). This study aims to investigate whether question format may also affect children’s responses to nonsensical questions.

In two experiments, 145 five- to eight-year-olds were asked nonsensical and sensible questions. Each question was phrased in both a closed format, and in a more open format (Wh-questions). With the closed nonsensical questions most of the children’s responses were either ‘yes’ or ‘no’. However, with the nonsensical Wh-questions most of the children’s responses indicated uncertainty about the question. These results suggested that children are more likely to say that they do not understand a question if the question is phrased in a more open format, but may not indicate uncertainty if they are only invited to respond ‘yes’ or ‘no’. In an additional task, children were asked to judge the questions as silly or sensible. Almost all of the children judged the nonsensical questions to be silly, and the sensible questions to be sensible. Therefore, the children answered the nonsensical questions despite realizing that the questions were silly.

A further experiment investigated what children meant when they responded to nonsensical questions. In this study, 91 children were not only asked a series of nonsensical and sensible questions, but they were also asked to explain their answers. This study examined children’s explanations of answers to the nonsensical closed questions and found that
children giving the same response (e.g. ‘no’) to the same question meant different things by that response. So, when children respond to closed questions in an interview, the interviewer may not be aware of the particular meaning that the child intended to convey, unless the child is asked to elaborate on that response.

The three final experiments of the thesis explored whether question format would also affect children’s, and adults’, tendency to answer sensible questions to which they did not know the answer. In the first experiment, 151 children and adults were told two short stories, and then questioned about those stories. Half of the questions were answerable based on the information provided in the stories; the other half were not answerable. Within these categories, half of the questions were closed questions, and half were Wh-questions. The results showed that most children correctly said ‘don’t know’ to the unanswerable Wh-questions, but that the majority of children tried to answer the unanswerable closed. Although the majority of adults correctly indicated when they did not know the answer to a question, they were still more likely to do so in response to a Wh-question compared with a closed question. The last two experiments in the thesis showed that these results were replicated when participants (N = 182) were interviewed about a staged event. In addition, these experiments found that the ‘knowledgeability’ of the interviewer affected the tendency of participants to say ‘I don’t know’. If the interviewer was perceived to have knowledge about the event, participants were less likely to admit correctly when they did not know the answer than when the interviewer was perceived to be ignorant about the event.

This research suggests that when children (and adults) are interviewed, questions with a more open format should be used in preference to closed questions. Children are more likely to admit when they do not understand the question, or when they do not know the answer, when questions are phrased as Wh-questions compared to yes/no questions. Also, the perceptions about interviewer ‘knowledgeability’ may affect an interviewee’s responses. When interviewers are perceived to already have knowledge about the event, participants may be more likely to try to answer unanswerable questions, rather than correctly admitting their lack of knowledge.

These results have important implications for any situation in which a child is required to answer questions, including the forensic context, clinical and educational settings, and experimental research using child participants. Interviewers should be cautious in interpreting children’s responses to yes/no questions, and should try wherever possible to phrase questions in such a way that children have to generate their own response. In addition, interviewers need to be aware of the possibility that children’s responses will be influenced by their perception of the interviewer’s knowledge.
In our future research we will continue to explore factors that influence children’s tendency to indicate when they do not know the answer, for example, individual differences such as self-esteem, and differences in features of the interview situation such as instructions given to children prior to an interview. This research will be conducted alongside collaborative work with a local police force’s Child Support Unit, where we will be analysing investigative interviews carried out by the police with children who have allegedly suffered sexual abuse.

REFERENCES