Linguistics and the Law: An Introduction to the Forensic Applications of Phonetics and Phonology

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Overview.

The purpose of this paper is to introduce to the reader some of the ways in which one or more of the sub-fields of linguistics are used for legal purposes, such as helping to identify a viable suspect in a bombing attempt, how to determine whose voice actually made a violent threat and how to legally determine the appropriateness of a new product name. It is my hope that such an introduction will encourage readers, particularly the students among us, to see that there are many interesting applications of the principles of linguistics that extend beyond the usual areas of usage (such as for language education, speech therapy and voice training). In this paper, then, I conduct a brief survey of some of the ways in which linguistics has been used for forensic applications.

Preliminaries.

I first became interested in the forensic applications of linguistics several years ago. It began as a basic schoolboy interest in crime-solving through the artificial situations introduced to me by writers such Sir Arthur Conan Doyle and Agatha Christie. I marveled at the deductive powers of the featured sleuths that both authors manipulated behind the scenes in their novels to investigate, and solve, a variety of devious and bewildering crimes by often referring to the most rudimentary and obscurest of evidence. All the while, though, I realized that these were works of fiction, and that the real world was not as simple as they made it sound, no matter how brilliant you were.

I held this opinion until I happened across James Brussel's (1968) *Casebook of a Crime Psychiatrist*. In this relatively short paperback, I was astounded to see a real-life Sherlock Holmes, in the form of Brussel, solve seemingly impossible real world crimes using a sharp deductive mind, informed by years of first-hand study of the human condition, with a very insightful understanding of language usage. In particular, I was awestruck by his account of how he was able to develop an uncannily accurate profile of the "Con Edison Bomber," a madman that had terrorized residents of New York City for a period of 16 years, stretching from 1940 into the mid 1950s—a profile that, once released, led police rather quickly to the capture of the bomber. This account led me to consider other situations where both linguistic and psychological knowledge played an important role in

resolving criminal investigations, as well as other legal issues. Below, I review the Case of the Mad Bomber, and then go on to consider more recent applications of various fields of linguistics (particularly phonetics and phonology) to forensics.

1. The Case of the Mad Bomber[1]

The Mad Bomber made thirty bombs over a sixteen year period in the New York City area, beginning in 1940. During this period, he had also authored and sent numerous hand-written letters to the police and to local newspapers. The usual tools for investigation, such as fingerprints, were not helpful at this early stage of law enforcement, either because the bombs blew the fingerprints into a million unidentifiable pieces, or because fingerprinting as a science simply hadn't reached any stage of useful efficiency for those fingerprints that did exist —there were no exhaustive data banks, no rapidly processing computers, and so forth, by which to run a trace, or to find a match. What clues the investigators had were essentially the bombs themselves, the targets (the individuals—what did they share in common, if anything, and could they possibly suggest a link to the bomber?), a few telephone calls from the perpetrator, and the letters. After years of fruitless investigation, in late 1956, the police asked Dr. Brussel, a psychiatrist and an expert on the intricacies of the criminal mind, to look over the letters, and to make further inquiries into their evidence, in order to see if he could get any insights into whom this person might be, and how or why he was targeting various individuals or institutions for bombs in the community.

For our purposes, it is not necessary to go into too many of the actual details—who got injured or killed, what buildings were damaged or destroyed, etc., do not pertain directly to our discussion. The bomber began by planting his first bomb in front of the Consolidated Edison Company building in Manhattan in November 1940. Consolidated was a power company. The bomb didn't go off because it was poorly made, but did contain a short note, "Con Edison crooks, this is for you." (Brussels 26) The note raised immediate questions. Was it meant to be read, as a kind of warning, with full knowledge that the bomb wouldn't go off, or was it foolishly included, ignoring the fact that if the bomb had gone off, it would have been blown into dust and never read? In the following year, two more bombs, and messages, followed. Again, neither bomb exploded. As America headed into war in Europe, the third one had been delivered to a downtown Manhattan police precinct, with the following handwritten message, in block capital letters: "I WILL MAKE NO MORE BOMB UNITS FOR THE DURATION OF THE WAR—MY PATRIOTIC FEELINGS HAVE MADE ME DECIDE THIS—LATER I WILL BRING THE CON EDISON TO JUSTICE—THEY WILL PAY FOR THEIR DASTARDLY DEEDS...F.P." (Brussels 27) In the ensuing fifteen years, dozens more similar letters were sent to various individuals and newspapers in the New York area, all signed by "F.P." As the years went by, his bombs became more sophisticated, and in 1950, the first one actually exploded. A week after the explosion, "F.P." telephoned the New York *Journal-American*, asking for the

editor, but was unable to get through. The unknowing clerk registered his complaint though; "F.P." was upset that the paper hadn't been publishing any of his letters which accompanied the bombs.

By 1956, F.P. had placed bombs in or near several movie theaters, phone booths, Consolidated Edison facilities and police stations. Investigators had a difficult time making a connection between these seemingly different targets. And, by this time, his bombs were detonating more regularly, with the inevitable result of people getting injured, in some cases severely. When his sixteenth bomb blew up in a Manhattan theater, gravely injuring six people in the process, the police finally turned to Dr. Brussel for help.

Dr. Brussel first looked over all available letters carefully. He noted that they were all hand-written, in very neat, clear, printing-script, block letters. He noted the tidy appearance of the notes, with no rips, smudges, crossed out or erased letters. Everything was precise, neat, orderly and well organized. The doctor deduced that the writer was likewise a very ordered person, with such attention to detail that he was quite likely very paranoid. Based on these notes, the doctor projected that F.P. probably had been an excellent, highly competent employee, performing high quality work. (Many people suspected that F.P. was in fact a current or former employee of "Con Ed", since he began his bombing with them as a target, and he frequently referred to the power company in his letters.) Dr. Brussels further suggested that F.P. had never participated in risky, outgoing behavior such as fighting, shouting, arguing and so forth.

He also noted by the vocabulary and the syntax used in the letters that the writer likely had a good education, but did not attend college. He further thought that because of some of the awkward and sometimes formal expressions, he was likely reared by someone who had immigrated to the US, and where he spent a great deal of time at home, isolated from other children, and the outside world. He never used regional slang or American colloquialisms, and some of his sentences seemed as if they had first been written in a foreign language, then translated. Dr. Brussel noted that "dastardly deeds" was particularly odd, as was the use of "the Con Edison," where locals would use simply "Con Ed."

Dr. Brussel then considered the manner of letter-making—the writing of each grapheme, noting that the "w" was misshapen when compared to the others—a flaw that stood out uniquely amongst otherwise "correct" letters. Thinking of language as a "mirror of the mind," he eventually saw the rounded and drooping "w" of the bomber as indicative of some sexual issues (with the "w" perhaps resembling a woman's breasts), probably focused on a difficult love-hate relationship with his mother. He concluded that the mother is probably now dead, and that he lived alone or with another female relative, with no friends of any kind, and nothing that would make him stand out in any way. Based on bomb placement (they were hand-delivered), the doctor was also able to suggest what part of New York he resided in. Further, because of the timing of the placement of the bombs (during the day, on weekdays and on weekends) he likely was no

longer employed, and had probably lost his job due to some sort of illness, or perhaps an on-the-job accident.

Finally, Dr. Brussels developed one of the first bona fide real world criminal profiles in forensic history. He described the suspect in the following way;

> Single man, between 40 and 50 years old, introvert. Unsocial but not anti-social. Skilled mechanic. Cunning. Neat with tools. Egotistical of mechanical skill. Contemptuous of other people. Resentful of criticism of his work but not probably conceals resentment. Moral. Honest. Not interested in women. High school graduate. Expert in civil or military ordinance. Religious. Might flare up violently at work when criticized. Possible motive: discharge or reprimand. Feels superior to critics. Resentment keeps growing. Present or former Consolidated Edison worker. Probably case of progressive paranoia. (Brussels 58)

From this profile, it is easy to get an idea of where police went next. They looked over old Con Ed files (they of course had already looked through them, but previously had little idea of what to look for), as far back as the 1920s up to 1940 to see if any employees has been discharged for medical or other reasons that might fit this description, and who might bear a grudge against the company, even after so many years have passed—this added to the information that he is likely born of foreign parents, living in a certain identified area of New York, of a certain age, and so forth. The police were able to identify rather quickly one person

who seemed to fit the profile perfectly. Dr. Brussel told them a bit more, before they went off to question the newly identified suspect. He said that he was probably a neat dresser, but dressed in more older traditional styles of dress, suggesting that when they found him he would be wearing a buttoned-down, double-breasted suit.

The police identified their suspect as George Metesky (born George Milauskas), an unmarried man living alone (his immigrant parents were both dead and had no relatives), had worked at Con Ed in the 1920s, and had been a model employee until a boiler accident forced him into early retirement. He had put in a claim for, and had been denied, a workman's compensation retirement income. Police were able to track down his current address, and went to his home to question and arrest him. When George appeared at the door, he was wearing his pajamas. Dr. Brussel's prediction appeared to have been incorrect. However, after they asked him to get dressed, he returned with freshly combed hair, newly shined shoes, and wearing a blue pin-striped double-breasted suit, buttoned! After his arrest, when asked what "F.P." stood for, he replied, "fair play."

The point of this long narrative is to set the stage for considering other ways that we may identify individuals based on some aspect of their background or personality, as reflected through their language. While in the foregoing case, Dr. Brussel relied primarily on behavioral insights (bomb placement, style of manufacture, attention to detail), we also saw how language usage (both in style of writing, but also in vocabulary chosen, and style and

sophistication of syntax) can play an important role in both learning about the character of the individual who created the text, but also about identifying who that individual might be, based on these language samples. In most of the following cases[2], we will look at how different kinds of language styles may enable us to determine who might be an appropriate suspect (or not). In essence, we are trying to determine whether we can distinguish one individual from all others in a given community, based upon linguistic factors alone. Can we, in fact, develop a DNA-type of definitive delineating criteria for speech (or other language skills) as we have done for blood typing?

2. The Case of Lost in Translation[3]

For purposes of gathering evidence, identifying suspects, and so forth, the human voice is of course used to convey all kinds of information. However, the steps from what is actually spoken, to what is finally documented on paper in the form of official courtroom transcripts is often fraught with many obstacles. The transcriptions of spoken messages sometimes fail to transmit important nuances conveyed in the original messages. Moreover, the accuracy of the statements can often affect judgments determining useful and useless information, truth and lies, and sometimes, even guilt or innocence. Witnesses, victims and perpetuators are some of the people whose statements can play an important role in such matters. In most cases, statements are not recorded, but are simply transcribed in notebooks by investigating officers, lawyers, hospital staff, and so forth. And, even when

statements are recorded, there are still many difficulties in transcribing the original statement into a courtroom transcript. Let us look at one example, a sentence spoken by an Australian who migrated from Lebanon when he was an adult.

(1) [ɔjʌs(1.5)ω(.3)dəmaˀn(.3)wɔsdis wɔ
        sdis(.5)hisɛd(.2)dʌən
        waridʌənwaridʌənwari(.5)jənʌaə
        (.2)ɔisɛi(.2)kitstəumʌtʃʌpsɛt]
        (Gibbons, 2003, 28)

The statement in (1), is spoken in English, and transcribed phonetically, including indicators (in parentheses) of pause length durations. However, only the most accomplished phonetician would be able to understand this phonetic transcription, so Gibbons (2003) offers a simplified version based on the Chambers English Dictionary method of phonetic representation (from which I have further deleted both nasal and length diacritics), represented in (2).

(2) oiara...ur, də man..wos dis wos dis
        wos dis..hi sed..don wuri don wuri
        don wuri..yəno..oi sa kits too much
        upset
        (Gibbons, 2003, 29)

From this, a more readable version that most people could understand was derived, using colloquial wording and spelling patterns, shown in (3).

(3) I ask, er, the man, what's this,
        what's this, what's this. He said,
        don't worry, don't worry, don't worry,
        you know. I say the kids too much
        upset.

However, fearing jurors would equate the interrupted, non-fluent pattern with ignorance on the part of the witness, and ignorance with deception or at least reduced

believability, the statement was then rendered into a more common written form, shown in (4).

(4) I ask the man, "What's this." He said, "Don't worry." I say "Kids too much upset."

This last statement is still ungrammatical, and for much the same reasons as noted above for generating (4), and a final "correct" version was offered for this statement, in the form of (5).

(5) I asked the man "What's this?" He said "Don't worry." I said "The kids will be very upset."

Clearly there are a large number of differences that separate the original phonetic transcription from the final "court-sanitized" version. Lost are the repetitions of course, which may be important, given a particular context. It may be quite relevant to learn whether the speech was produced by a fluent native speaker (as is indicated by the version presented in (5), or by a person who had difficulty with certain vowels, consonants, and combinations, as we would expect of a non-native speaker of English (Version (1)). Also, is the stammering in the original transcription indicative of great emotional stress, such as where the speaker had feared for his or her life, or is it a reaction to a shocking event, or simply inadequate control over the rhythm and structure of English (due to the fact that it was spoken by a non-native speaker of English)? All of these things may bear significantly on both the manner and content of the message, but is lost without the nuances contained in (1) to be both recognized, and interpreted, for the court, by a skilled phonetician.

This example is offered to illustrate the range of problems in ascertaining useful statements, and verifying that the information recorded, either by hand, or on tape, accurately portrays all of the information intended in the source utterance. Here we have seen the problems that occur when there was actually a recorded sample of the message available to investigators. One can imagine how much greater the distance can be between utterance and the transcribed version of it is, when the utterance was simply recorded in note-form during the course of a routine interview, or even worse, when it is generated from memory when a witness is asked to recall what he or she heard, sometimes weeks, months or even years after the source utterance was spoken. This leads us to our next case, which involves voice recognition, and the attempt to distinguish between the speech of two brothers.

4. The Case of Brotherly Love[4]

In this case, two families were at odds with one another, one Jewish, one not. The Jewish family began receiving anti-Semitic threats that were attributed to the head of the other clan. The threats were made in the form of telephone calls to various members of the Jewish family, the Hatfield's[5], contained references to Nazis, and threatened possible violence. Several members of the family who had received the phone calls felt they recognized the caller's voice as the head of McCoy clan. Because of the violent threats, and the Nazi references, police were called and began an investigation into the threats.

The Hatfield phones were tapped, and newly telephoned threats were recorded on tape.

The voice used in the telephone threats indeed seemed to be the head of the McCoy clan. The head of the clan, Mr. McCoy, was thus brought to trial on various hate-crime charges. He vehemently claimed innocence, however, saying that it was not his voice on the tapes (phone traces or caller ID systems were not available at the time of these crimes). This seemed somewhat incredulous, since his speech did appear to be identical to the speech recorded on tape.

Dr. Hollien, a forensic voice expert, and linguist, was called to court to compare the voice on tape to the voice of the defendant. He began by analyzing the taped phone calls. In listening to the tapes, he noted two distinctive speech patterns that seemed to indicate an idiosyncratic pattern in the speech of the person making the telephone threats. First, he noted what he called "an odd distortion" within common consonant clusters (such as with "str-" in "strong"), and the other distinguishing feature involved a feature relevant to the timing, or rhythm of speech, essentially an unnaturally long delay between certain syllables in words in phrases. When he listened to the speech of the defendant, he heard both of these same distinctive features, and initially concluded that both the telephone caller, and the defendant, were one and the same persons.

However, after Dr. Hollien more thoroughly and closely examined speech samples from both the tapes and the defendant, he began to see that while the voices were indeed quite similar, there were in fact differences, particularly in vowel height (or pitch). He was puzzled by this

since this indicated that he clearly had two speakers that were nearly identical, but not quite.

By happenstance, while in court Dr. Hollien overheard the McCoy family members talking amongst themselves, where he was able to clearly identify the "other" voice (the voice used in the telephone calls); similar to the defendant's, but not identical. It turned out to be the defendant's brother, a recently released mental patient who was trying to "help" his family in their crusade against the Hatfields. When questioned, he happily admitted that he had made the phone calls, and was subsequently arrested on the same charges his brother had faced, while his brother, the older McCoy (the "Real McCoy"?) was released from custody.

5. The Case of the Airplane Bomb[6]

This next case also involves taped voice recordings, taken from telephoned bomb threats made to Pan American Airlines at Los Angeles International Airport, in 1984. Whether they be bomb threats, extortion threats, ransom requests, or whatever else, recorded messages can offer the investigator a great deal of information about the speaker. The phonetics, phonology, morphology and syntax can all provide useful indications as to the speaker's gender, age, ethnicity and nationality, educational background, among other indicators. Though a separate topic, even those who attempt to disguise their voices electronically or by other means rarely can cancel all the relevant indicators out (we will see one rather feeble attempt in later, in The

Case of the Secret (?) Code Language).

We begin by looking at a transcription of a portion of one of the threats (with due respect to the transcription problems noted in the previous case):

> uh, it's gonna be planted on that plane by a majority Communist group and I hope you die on it. It's gonna be a bomb, a nuclear bomb that's gonna be able to kill you and every body on that plane, and I hope you know it by now. (Gibbons, 1994, 286)

Many more messages followed, most containing similar threats, though in some cases the flight number was identified (815), the time identified (11:15) and so forth. Though thankfully no bomb was ever discovered, and flight 815 took off and landed safely, the police did work hard on identifying the caller. They were able to identify a suspect, but since there was in fact no actual bomb, there was very little evidence linking the suspect to the crime (various felony charges threatening loss of life and the destruction of an aircraft). The suspect was identified as a Mr. Prinzivalli.

The eminent phonetician, Dr. Ladefoged, was first asked by the defense team to examine the telephone transcripts and compare them to the voice of Mr. Prinzivalli. They also asked a second forensic language specialist, Dr. Gibbons, to examine the tapes independently. It is important to point out that Dr. Gibbons was not told whether Dr. Ladefoged found the voices similar or dissimilar—the defense wanted independent documentation by Dr. Gibbons, untainted by previous analyses. They chose Dr. Gibbons because of the fact that he was from the Northeast (New York), and it was thought

that the person making the threats was from the same area. Below is a sample that was used in the comparison.

(6) There's gonna be a bomb going off on the flight to L.A.
Telephone Voice:
[dɛzgenəbiəbɔᴰmgoɪnɒfɒnðə
flaꜛɪttuɛleʲ]
Defendant Voice:
[dɛ^zgɔnabiəbɒmgoɪɲoᵊfanð
flaɪttuꜛɛlɛ^ⁱ]
(based on Gibbons, 1994, 288)

Gibbons, as I am sure did Ladefoged, realized immediately that the voices came from two distinctly different speakers. However, both statements, in a general transcription, were rendered identically ("There's gonna be a bomb going off on the flight to L.A."). The question posed to Gibbons was how to show to the jury what he could easily see in the transcriptions shown in (6), above; namely, that the dialects of both speakers were measurably and quantifiably different—to the phonetician, or the phonologist. Vowel qualities were different, in particular, but there were also even differences in consonants (see how "going" is treated for both voices).

You will note small directional diacritics, essentially the tips of arrows, pointing up, down and to the side. These indicate that a vowel is produced a little higher, lower, further forward or further back than the usual sound represented by this symbol. Regional dialects show consistency in these areas, where speakers of one dialect will routinely articulate certain vowels higher than speakers of other dialect, or further forward, or lower, and so forth. By looking at distributional patterns, it is possible to

identify speakers as belonging to one speech community, or dialects, at the exclusion of others. Observe the following figures, adapted from Gibbons, on the vowels used in words such as "bomb," "off," and "on," ([ɔ,ɒ,ɑ]), by both the bomb-threat caller and the defendant Prinzivalli. Each figure includes several tokens of the same target words, such as "bomb" and "off," indicating a certain degree of intra-person variation. Despite this intra-person variation, we can clearly see a systematic difference between the two speakers. In particular, note the range of F1 values[7] for the defendant (from about 350 to 650) as opposed to the caller (from above 600 to nearly 800).

Speakers of the Eastern New England dialect of English, such as the bomb-threat caller, have a tendency to use the vowel, [ɒ], for words such as "crop," "loss", and "law,"; while speakers of the New York City dialect of English, such as Mr. Prinzivalli, tend to use [ɑ] for words such as "cot," "crop," and "stock," but [ɔ] for words such as "loss,", "frost," "off," "law,", "salt," "talk," "hawk" and so forth. Clearly the person making the telephoned bomb threats, and Mr. Prinzivalli, were two different people,

speaking two different regional dialects of English. Both Drs. Ladefoged and Gibbons testified to these findings, and Mr. Prinzivalli was released without further criminal proceedings against him. The true identity of the person who threatened Pan Am Flight 815 was never discovered. We turn now to consider a case where the identity of the caller involved was rather easily discovered, despite attempts at concealing his identity by using a secret "code" language.

6. The Case of the Secret (?) Code Language[8]

The following case involves the not-so-clever attempts by a pair of accomplices to a murder to prevent others who might be listening in from understanding their telephone conversations. They employed the rules of a child's language game, a dialect of "Oppish," which I have discussed elsewhere (see Skaer (forthcoming)) to try to disguise their language. Before discussing the rules of the code language they used, let us review and example of their speech, transcribed phonetically, in (7).

3.10	3.05	3.00	2.95	F2/F1
				350
				400
				450
				500
				550
				600
	off(ɒ)	bomb(ɒ)	on (ɒ)	650
	com-(ɒ)	bomb(ɒ)	bomb(ɒ)	700
	on(ɒ)	pos-(ɒ)		750
	off(ɒ)			800

Figure 1. /ɒ/ phoneme of bomb threat caller

3.10	3.05	3.00	2.95	F2/F1
				350
			off(ɔ)	400
				450
		off(ɔ)		500
		bomb(ɑ)	bomb(ɑ)	550
	on(ɒ)			600
pos-(ɒ)				650
				700
				750
				800

Figure 2. /ɔ,ɒ,ɑ/ phonemes of the defendant

(7) [bəpəkəposəpinəpʌkəpʌpəpωəpovm
     əpʌnθsjəpu
     kəpɪntəpeikəpaf]
     (Gibbons, 2003, 294)

The statement in (7) was spoken using English as the base language, but it was disguised by changing the message in a predictable way, using the rules of Oppish. Oppish is in fact a very simple language game, where a game "token," /ap/, or in this case, /ep/, is inserted before the first vowel of every syllable. Let us now look at what this message would look like in a normal alphabetic transcription.

(8) b(ep)ec(ep)ause (ep)in (ep)a
     c(ep)ouple (ep)of m(ep)onths y(ep)ou
     c(ep)an t(ep)ake (ep)off

Now, if we remove the game tokens, we are left with a rather simple statement.

(8) ...because in a couple of months you
     can take off...

Investigators were now able to go back to their recorded calls, and monitor future ones, with a clear understanding of what the two murder suspects were saying. They also found their task made easier since the two accomplices had frequent lapses in using the game and often interjected phrases such as "I am just so nervous," and "You know, it's, it's worth it. Anything is better than going (ep)ins(ep)ide." (pg 295)

As you can imagine, however, "inside" (in prison), is exactly where both accomplices ended up. In the next case, we look at a different aspect of the use of linguistics in a legal context. There is no crime here, rather, we consider a question of proper product labeling, where a mistake in pronunciation may make the difference between life and death.

7. The Case of Mislabeled Products[9]

The use of linguistics in dealing with product names is fairly frequent. In fact, some global enterprises maintain links to linguists either full or part time to research new possible product names, to identify any cultural nuances that may be attributed favorably or unfavorably to them, to determine appropriate, memorable spellings and pronunciations for new product names, and so forth. Sometimes, linguists also play a role in determining these issues in a courtroom as well, as this next case demonstrates.

In the Case of Mislabeled products, Wall (2004) discusses the case of two drugs being produced and sold in Australia with two very similar names, but with two very different kinds of drugs. One drug was already established in the Australian market; "Alkeran," which was designed to be used for dealing with certain neoplastic diseases, and if misused, could cause severe (life-threatening) damage to bone marrow, resulting in infection, bleeding, leukemia and death. The other drug, "Arclan," was being newly introduced as an over-the-counter remedy, developed for minor abnormal symptoms. Makers of Alkeran were strongly opposed to the introduction of Arclan, at least as long as it retained the name, "Arclan," fearing that some people may mistake one for the other, with possibly catastrophic consequences.

Clearly, though, the spellings of the two medicines *were* different, so at first glance it doesn't appear that there should be a real problem, or at least certainly not one that

the Australian legal system would have to deal with. However, the makers of Alkeran were not concerned about the spelling of the new drug's name, but its pronunciation, where they felt that both product names were so similar in phonetic structure, that in haste or in casual speech, the two might be mistaken for each other, with grave consequences. Let us look at the "formal" (careful speech) Australian pronunciations of both drug names.

(9) a. Alkeran [ælkəræn]; b. Arclan [ɑklæn]

At first glance, pronunciations, too, look dissimilar enough so as to not cause a litigious problem. "Alkeran" is three syllables, while "Arclan" is just two. However, as I and many others have noted elsewhere (see Skaer (2001) for a related discussion of casual speech rules), an unstressed middle syllable, typically just a schwa as we have here, is frequently omitted entirely in casual speech, thus producing [ælkræn], for "Alkeran.".

(10) a. Alkeran [ælklæn]; b. Arclan [ɑklæn]

Further, the ability to distinguish between the liquids, [l] and [r], already a very similar pair of sounds, articulatorily, in the second syllable of both words in (10) becomes quite difficult when spoken casually, where frequently one can be mistaken for the other, and/or is frequently lost altogether in Australian speech leads to a further reduction in distinctions. We now have the three sources of confusion listed in (11)-(13).

(11) a. Alkeran [ælklæn]; b. Arclan [ɑklæn]

(12) a. Alkeran [ælkræn]; b. Arclan [ɑkræn]

(13) a. Alkeran [ælkæn]; b. Arclan [ɑkæn]

And finally, due to the tendency in Australian English, as noted above, for a lost of liquids altogether, we could also of course have the first [l] of "Alkeran" lost as well, leaving us with nearly identical casual speech forms for both drugs, only different by the marginally different qualities of the two low vowels [æ] and [ɑ], which in Australian, according to Wall, are quite close, thus also allowing for these too to be easily confused for one another.

(14) a. Alkeran [ækæn]; b. Arclan [ɑkæn]

(15) a. Alkeran [ɑkæn]; b. Arclan [ɑkæn]

(16) a. Alkeran [ækæn]; b. Arclan [ækæn]

It is easy to see, then, that the new drug was not allowed to retain the name "Arclan" because of the many ways in which it could be spoken and perceived as possibly the drug Alkeran, and if one were mistaken for the other, possibly dire consequence could potentially result.

Conclusions.

As I stated in the beginning of this paper, my purpose here was simply to introduce some of the different ways in which the tools of linguistics (particularly phonetics and phonology) have been used to investigate, solve and resolve legal issues. What I have discussed here is just a very small drop in an ever-growing bucket of forensic cases that have been assisted in some way by means of linguistic investigatory tools. I have left out probably more than I have included (I have had little

to say about morphology, and even less about syntax, but both are certainly as important as the sub-disciplines of linguistics that I did mention). Even in the fields I did discuss, such as phonetics, and phonology, I have to admit here that I have only looked at these areas superficially, and that each deserves much more time and energy before getting a clear understanding of all that is possible in these fields.

So, can we provide a linguistic fingerprint, a voice identification metric, for each and every specific individual on the planet? Some will claim that we can, while I remain somewhat guarded, and say that in many cases we can certainly exclude all other reasonable possibilities.

The sciences of phonetics and phonology provide many of the tools that can assist us in these determinations. Already we can at least partially identify, and quantify, the fundamental frequency "signatures" of individual speakers, the idiosyncratic way in which certain vowels and consonants are produced, the differences in general voice quality that separates one speaker from another (from breathiness to monotonous to screechy), the rhythm and rate of speech as specific identifiers (fast/slow, extenuated pauses, and so forth), intonational and stress

patterns (reduced or exaggerated, native or non-native, rhythmic or chaotic, etc.), dialectic differences (including differences in vocabulary, syntax, as well as many of the oral features mentioned here), speech impediments (such as a speaker lacking teeth, or who has a sore tongue), and other unique behaviors of speech delivery that may serve to distinguish one speaker from all the rest.

While there have been attempts to group key speech indicators into a kind of identification checklist, there is to date no one acceptable scientific instrument that will clearly tell us that the speech sample under investigation could only have come from the one single person on this planet who produced it, but, likely, the time is not far off when such capabilities are within our reach. I hope the cases I have discussed here have served to stimulate your interests in one or more aspects of the speech sciences, so that perhaps you will someday seek to contribute in some small way towards the rapid development of the sciences of speech production and perception, and perhaps as a result, help contribute to the shaping of our world into a safer, and more peaceful place to live.

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1   The term "Mad Bomber," was given to the suspect by the local media at the time of the bombing. The facts in this case were drawn from Brussel (1968).

2   Though the foregoing case involved both written and spoken language samples used by the perpetrator of a crime, in the remaining cases we examine, we will somewhat arbitrarily restrict ourselves to examples that relate to spoken language. This is done primarily to limit the scope of this paper. I should acknowledge, however, that there are many fascinating avenues of pursuit involving the written language from a legal point of view, such as determining copyright infringements (is "McMotel" an infringement on MacDonald's®, for example?), and on authorship issues such as last wills (did the deceased person actually revise his own will and end up giving all his money to charity, and not his recently acquired fourth wife?) and even to suicide notes (was the note written by the deceased, or by a murderer trying to cover his tracks?), among many more. In these and other cases, morphology, syntax and other linguistic features can help to determine or undermine the authenticity of certain documents. Further, we distance ourselves somewhat from the issue of determining authorship through handwriting analysis. While certainly a viable and important tool in the investigation of certain crimes, the method of forming letters does fall outside of the usual purveys of linguistic investigation. So, in the remaining cases discussed here, we will focus primarily on cases that involve both phonetics and phonology.

3   The facts in this case were drawn from Gibbons (2003).

4   The facts in this case were drawn from Hollien (2002).

5   I have used "Hatfield's" and "McCoy's" here to represent the two families; their real names were never released to the public.

6   The facts in this case were drawn from Gibbons (1994).

7   F1 and F2 values refer to ways that acoustic speech information is measured. "F" stands for "formant," which represents a peak in an acoustic frequency spectrum. F1 represents the lowest frequency, F2 the second, and F3 the third. Usually only the first two are used to characterize human speech. For our purposes here, it is important simply to note that the two speakers represented in Figures 1 and 2 represent quantitatively significant different values, as a result of being produced by two distinctly different individuals. The figures are base on information provided in Gibbons (1994).

8   The facts in this case were drawn from Gibbons (2003).

9   The facts in this case were drawn from Wall (2004).

10 While not all of the sources cited below were used directly in this report, certainly all played

a role in the formation of the ideas discussed here, and would prove useful for anyone interested in pursuing this line of inquiry further. I particularly recommend Gibbons (2003), Hollien (2002), McMenamin (2002) and Rose (2002).