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Text messaging forensics

Txt 4n6: Idiolect free authorship analysis?

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Introduction

Danielle Jones disappeared on 18 June 2001; she has not been seen since and her body has never been found. Within hours of her disappearance two text messages were sent from her phone which, the police suspected, might have be written by her Uncle, Stuart Campbell. In the first case of its type to reach the UK courts, Malcolm Coulthard offered a linguistic analysis which showed that the messages were unlikely to have been written by Danielle. Stuart Campbell was convicted of Danielle's murder on the 19 December 2002 at least in part because of the linguistic evidence. In a parallel case, Jenny Nicholl disappeared on 30 June 2005. Once more Malcolm Coulthard was able to offer a linguistic analysis suggesting that she was unlikely to have texted the final messages sent from her phone and that her lover, David Hodgson, was one of a small group of possible authors. Hodgson was convicted of Jenny's murder on 19 February 2008.

Further evidence of the potential utility of forensic linguistics in the examination of text messages was provided in 2007 when I was given permission to carry out a survey of mobile telephone seizures by the Northamptonshire Police, a medium-sized semi-rural force, located in the East Midlands of the UK and covering about 900 square miles and a population of 640,000. The police in the UK have powers to seize mobile phones and the information they obtain ranges from the location of the phone at any particular time, to the call record and details of the SMS text messages sent and received. I was given access to all 186 phones seized during a three-month period, from which a total of some 10,000 text messages were recovered. Further analysis of the case files showed that for only twelve of these phones was there any suspicion that the owner had not sent all of the messages. Perhaps unsurprisingly in none of the cases was a forensic linguist employed to resolve these potential disputes. However, the degree of actual and potential investigative interest in the authorship of text messages appears to be growing and this raises some very real theoretical and

methodological problems, not least whether such short and fragmentary texts are amenable to any form of authorship analysis.

Coulthard makes the strong claim that

> The linguist approaches the problem of questioned authorship from the theoretical position that every native speaker has their own distinct and individual version of the language they speak and write, their own idiolect, and **...** this idiolect will manifest itself through distinctive and idiosyncratic choices in texts.
>
> (Coulthard 2004: 432)

Even if the first claim here, that every speaker has their own idiolect, can be sustained, there is no necessary implication from it that an individual's idiolect will be measurable in every text produced by that person, whatever its length. It would be perfectly rational to hold Coulthard's view and to also hold that a substantial and varied body of text would be required before manifest idiolectal features became noticeable or measurable. Coulthard's working definition of the idiolect as a 'distinct and individual version of language' only becomes useful to the authorship analyst if an idiolectal feature repeats itself, either within one text or across several texts by the same author. In the context of text messaging it may be that individual messages are considered too short to allow the possibility of idiolectal analysis, but conversely it may be possible to analyse idiolect in text messages by examining many messages written by the same individual. Further to this, although Coulthard claims his definition to be a 'theoretical position', a distinction must be made between observation and theory. On the one hand, there is the observation of features which might comprise an idiolect, that is to say idiolectal analysis requires an empirical study which produces evidence of consistency and distinctiveness. On the other hand, a linguistic theory of idiolect is required, which would provide explanation of any empirical evidence. The analysis of authorship may depend conceptually on theories of idiolect as distinctive versions of language but practically and methodologically authorship analysis depends on the facility to detect consistent patterns of language use. If consistent patterns can be detected, then the next step will be to determine how distinctive any such patterns are. Practical authorship analysis may depend less on a strong theory of idiolect than on the simple detection of consistency and the determination of distinctiveness.

The principal theoretical question this chapter addresses is whether authorship analysis can be valid as the mere detection of degrees of consistency and the determination of degrees of distinctiveness, or whether in its practical application it must rest implicitly or explicitly on a particular and strong theory of idiolect. Consistency and distinctiveness may, of themselves, be evidence that an idiolect exists, but they do not constitute an explanatory theory of idiolect. In this theoretical sense, authorship analysis based only on consistency and distinctiveness can be considered idiolect free, or at least idiolect light. Below, following a theoretical discussion of different theories of idiolect and their explanatory usefulness, a method will be demonstrated that measures consistency and distinctiveness in text messaging authorship analysis. The chapter then

concludes with a discussion of whether such an analysis in fact depends upon or requires the practitioner to subscribe to a theory of idiolect, and whether one particular theory of idiolect has advantages over any other.

Authorship analysis and theories of the linguistic individual

Current work in forensic authorship analysis has tended to polarise between those who argue that work on authorship requires a strong understanding of the cognitive mechanisms of textual production on the one hand (Chaski 2001; Howald 2009), and on the other those who believe a stylistic understanding of language production is sufficient to explain authorial consistency and distinctiveness (McMenamin 2001). This debate has proved important in the United States Court system. Howald (2009) supporting Chaski's (2001) position, argues that stylistic approaches to authorship analysis are theoretically weak and therefore should fail the legal admissibility tests applied by the American courts. Some of this debate seems to rest on alternative conceptions of the idea of the linguistic individual and indeed on different theories of idiolect.

Cognitivist theories of idiolect

A set of theories of idiolect (which I shall refer to as cognitivist theories) suggest that individual language production is largely determined by linguistic competence. Competence is conceptualised here as the cognitive capacity of an individual to produce language and as such is reflected in linguistic performance. If one holds a cognitivist view of the linguistic individual then one good approach for authorship analysis involves trying to measure their cognitive capacity. Such approaches analyse particular aspects of language which are well explained by cognitive models of language production; for example, aspects such as syntactic complexity or measures of the mental lexicon. It is possible in a general sense to measure such features and demonstrate variation between authors and groups. For example, quantitative and computational linguists can, at least with longer texts, describe mathematically, features of individuals' language production in terms of word frequency distributions (Baayen 2001; Holmes 1998; Grant 2007) syntactic structures (Chaski 2001; Spassova and Grant 2008) and other observable markers of authorship. The successful employment of these approaches in the resolution of authorship attribution problems does in fact depend upon, and thus demonstrate, degrees of consistency and distinctive-ness. However, the cognitivist theories of language production upon which these approaches rest do not of themselves explain consistency within an author's textual production, nor distinctiveness between any two authors. To have a well worked out theory of language production is different in this sense from having an explanatorily strong theory of idiolect. A theory of idiolect must provide an explanation as to why one individual's production is consistent across texts, and must also explain why that individual's language is distinctive as compared with that of other individuals. Cognitivist theories may be better at explaining consistency within an individual's textual production but it is more difficult to elaborate cognitive explanations of distinctiveness between individuals. In describing language production systems cognitivist theorists tend to assume minimal individual differences or assume that differences between individuals are relatively uninteresting.

A good example of this cognitivist reduction in interest in individual linguistic variation is Chomsky's move from his earlier interest in the dichotomy between competence and performance to his later, allied but distinct theoretical dichotomy between internal and external language; *L-I* and *L-E*, respectively (Chomsky 1985). Theories of language competence can incorporate the possibility of variation between individuals, however, the more recent dichotomy between *L-I* and *L-E* holds less explanatory power in this respect. In these theories, theoretical primacy is given to understanding individual internal language capacity, *L-I*, rather than the less essential *L-E*, where distinctions between natural languages and their variants are seen as rather uninteresting. The research focus is not on differences between different individuals' *L-I* (arguably there are none) but rather on what is common to all individuals in *L-I*. This theoretical work is one of the foundations for the development of cognitive science in the late 1980s and early 1990s and cognitive science has in turn informed the more recent biologically focused project of cognitive neuroscience. Where cognitive linguists proposed information processing models or architectures for language production the neuroscientists looked to realise these models in terms of particular brain locations and processes.

In order to understand the implications of this to forensic work, we need to trace a brief history of an area where cognitive psychologists and neuroscientists have made some progress in explaining just one small part of language production. One such area is child language acquisition and a small part of this literature focuses on the way children learn irregular past tense verbs which is sometimes said to demonstrate a U-shaped learning curve. Initially children produce these irregular forms accurately, for example, English 'went' as a past tense for 'go' and 'was' for 'is'. In the next stage of learning, however, children appear to unlearn these verb forms now creating errors such as 'goed' or 'wented'. This stage represents the 'dip' in the U-shaped learning curve. In the final stage of learning, representing a rise out of the learning curve dip, children's performance improves again and they begin to use the correct forms for irregular past tense verbs again.

Beretta *et al*. (2003) examined alternative cognitive models attempting to explain this U-shaped learning curve. Some cognitive models propose a rule-based system whereby the first language learner produces regular verbs using a *stem+ed* production model and there is also an entirely separate part of the model devoted to simply memorising the small number of irregular verbs (e.g. Pinker and Ullman 2002). This type of model is referred to as a '*rules plus memory model*' and it is argued that the developmental interaction between these two elements can explain the U-shaped learning curve. A less recent and entirely different model, based on neural networks, is provided by Rumelhart and McClelland (1986) who argue that associative learning alone can account for the U-shaped learning curve. Their model contains only a single processing network and is unified in the sense that regular and irregular forms are learnt in a single system.

These two models both appear to accurately explain the observable data but at this stage in the historical development of the field, they both faced the same reasonable criticism; this is that although each model was conceived to be consistent with experimental results, there is no strong sense in which they could have claimed to be real. That is to say, neither model could claim to be related either to the biological foundations of language production, or to the social reality of language use. Choosing between two models which are both consistent with the available experimental data is entirely

arbitrary. The solution to this problem came with the development of brain imaging techniques over the last ten years. This has made real the understanding that there are very specific brain locations through which different aspects of language are produced. In the case of learning past tense verbs, Beretta *et al*. (2003) report the discovery that the production of regular and irregular verbs actually occurs at two separate brain locations. This new evidence can provide a reason for choosing Pinker's rules plus memory model over Rumelhart and McClelland's associative model with its implication of a single structure.

Developments such as these in cognitive neuroscience have important implications for discussions of idiolect which in turn, are important for work in authorship analysis. With regard to idiolect, the main implication is that, just as we as a species share biological structures, so too we share brain structures in language production. The general focus of cognitive neuroscience is not on variation between individuals, but on shared commonalities. If I as a speaker of English have two neurological structures for the production of past tense verbs then so too will you. Adopting a cognitive view of language production tends to make the explanation of idiolectal variation more difficult rather than easier. Of course, it is not impossible to develop a cognitive neuroscience of idiolectal variation. Just as we recognise minor biological differences between individuals, so we may argue for similar individual differences in cognitive structures. To ignore cognitive neuroscience in discussions of idiolect would be reckless, but it is extremely difficult to use this body of work to explain actual individual differences between texts written by the same or different authors. By contrast stylistic theories of idiolect can and indeed do explain individual differences between authors.

Stylistic theories of idiolect

Forensic stylistics is sometimes seen as being in opposition to more cognitivist approaches to idiolect. From the cognitivist perspective, it has been suggested that those who take a more stylistic approach to authorship analysis have a weaker theory of idiolect and that the variables used are not on as solid a foundation in terms of linguistic theory (Howald 2009). Proponents of the more stylistic approaches naturally take issue with such an evaluation arguing that theories of stylistic variation are essential to understanding differences which occur between individuals (McMenamin 2002). My argument is that understanding language variation stylistically, as the interaction between habit and context, does not imply a lack of linguistic theory so much as an alternative linguistic theory. Stylistic and variationist theories of language are less focused on providing species-wide explanations of language production than on developing explanations as to how and why language varies and/or remains constant across sociolinguistic contexts. Such an approach may in fact be able to provide a better explanation of variation between individuals than cognitivist approaches. Individuals will have different linguistic experiences and these will be revealed in their language production. This is not idiolect free authorship analysis, but rather authorship analysis which has a different conception of the nature of idiolect.

Johnstone (1996, 2009) studying the language of Barbara Jordan, and Kredens (2002, 2003) studying the language of Morrissey, separately describe the consistency of individual linguistic stance across texts, contexts and indeed across a lifetime of textual production. In these detailed descriptions, it is possible to draw some individual historical and social explanations for consistent features of language use. For

example, Johnstone (1996: 155) concludes of some low-level aspects of Barbara Jordan's style that her language reflects 'her disregard for appearances, and her lifelong refusal to adapt to social expectations about how a southern black woman should live and behave'. In other words, Johnstone is arguing that, Jordon's language draws upon her individual social history and upon a construction of herself as a participant in that history. Such case studies are invaluable in demonstrating the development and persistence of a linguistic individual across a variety of sociolinguistic contexts. Perhaps even more important for theories of idiolect and for forensic authorship analysis such insights allow us to develop explanations for the specifics in an individual's style. In this respect, one possible criticism of these studies might be their choice of interesting individuals; Johnstone's case study of Barbara Jordan, a United States political figure famous for her oratory, and Kredens' case study of singer songwriter, Morrissey, known for his imaginatively gloomy lyrics, are together somewhat elitist choices, perhaps unrepresentative of the average language user. Both individuals may in different ways be aiming to project a particular persona through their public language and have the talent and linguistic skill to achieve this. These concerns aside, the approach taken by both Johnstone and Kredens suggests that individuals taking a constant or repeated linguistic stance can create stylistic traits which in turn can be construed as the creation of a linguistic individual.

In so far as these stylistic approaches only identify consistent and distinctive features of linguistic output for an individual, they fare no better than cognitivist approaches in suggesting a strong theory of idiolect. There is, however, rather more of an attempt at explanation for the creation of a linguistic individual amongst these theorists and in particular a live debate as to whether the intersection of sociolinguistic factors *determine* a linguistic individual (as discussed by Kredens 2002) or whether an individual's history and context are *resources* which can be drawn upon, a position preferred by Johnstone (1996, 2009). One advantage of this idea that we might draw upon our individual sociolinguistic resources in the creation of a linguistic persona is that it allows for the additional possibility that we might also draw upon other language resources. In particular, it is possible to speculate that a linguistic individual might draw upon a combination of sociolinguistic resources and cognitive resources. Accepting that an idiolect may not be determined by either cognitive capacities or sociolinguistic history, but that each may provide resources and constraints in the creation of a linguistic individual suggests the possibility of a more unified theory of idiolect.

A unified approach to the linguistic individual

Coulthard (2004) demonstrated just how individual an apparently everyday utterance can be. Using a series of Google searches he shows how the apparently everyday phrase 'I asked her if I could carry her bags', is probably a unique utterance. He points out that at each stage in the construction of the phrase from a one-word utterance, to a two-, three-, four- and eventually nine-word utterance it increases in rarity to become apparently unique. He suggests 'I asked her' may be a pre-formed idiom, and so too, 'if I could' but where these appear together to form, 'I asked her if I could **...** ', this showed only 7,740 Google hits in 2004. There is apparently a fairly open choice as to the verb which might follow this construction. In Coulthard's example, the

word ‘carry’ is used and shows its rarity by scoring only seven Google hits. A range of alternative words might have replaced it. These include, ‘take’, ‘hold’, ‘bring’, etc. One idiolectal question is why one individual would use ‘carry’, whilst another individual might use ‘bring’. Work on lexical priming offers one answer to such a question.

Hoey’s (2005) work on lexical priming is situated firmly in a corpus-based tradition and yet aspects of lexical priming have long been researched by cognitive psychologists interested in the mental lexicon. Hoey’s work concentrates on collocation, and details how one word *primes* the occurrence of its collocates. Although Hoey is not, in this work, interested in theories of idiolect he does discuss how such collocates emerge and from this one can infer how priming and collocation can spread from one individual to another and how an individual’s own language can be affected by these collocational pressures. In contrast, cognitive psychologists’ interest in priming has been experimental, and has described systematic patterns in reaction time as to how a word’s frequency, rarity and semantic relation affects our ability to recognise or recall it (e.g. Sloboda 1986). These two perspectives on lexical priming might be seen as coming together in the developing interest of the cognitivist neuroscientists in the malleability or plasticity of the brain.

Recent work in cognitive neuroscience considers not only the cognitive structures common between individuals but also how the brain is altered by environmental stimuli. Greenfield (2008) describes the plasticity of the brain to external stimuli. At a gross level this can be illustrated by the example of how London taxi drivers, who have to memorise ‘the Knowledge’ of the driving geography of London before obtaining a license, develop an expanded area of the hippocampus. A more linguistic example might include evidence that bilinguals develop different parts of their brain to speak their different languages (e.g Ibrahim 2008). Using evidence such as this Greenfield elaborates a description of the mind as the ‘personalisation of the brain’ by individual external stimuli each making tiny incremental changes to neuronal activity and structure. Extrapolating from such a model it is possible to conceive the beginnings of a theory of idiolect as the personalisation of the language systems by exposure to differing linguistic stimuli. One potent force of such personalisation would be the statistical weight of collocation. My exposure to a certain variety of language containing one set of collocates would be different from my neighbour’s and this personalisation would gradually cause individual differences in our language production. Idiolectal consistency and variation would draw on the resource of my cognitive capacity for language production and also draw on the complexity of my personal sociolinguistic history. According to this potential theory of idiolect, the cognitive capacity is itself structured but malleable and the sociolinguistic history is realised in incremental changes to that neuro-cognitive capacity.

In conclusion, theories of idiolect cannot merely notice consistent and distinctive features of the language of an individual. They should also attempt to provide explanations for these facts. We have seen that although cognitivist theories can provide convincing explanations for some aspects of language production these theories hold less power in and of themselves in explaining individual variation. Conversely, while stylistic approaches to the linguistic individual do concentrate on providing explanations for language variation between individuals they are perhaps less interested in

explaining how these might be realised psychologically. I have speculatively indicated a possible future path which might help these different and sometimes competing theories of idiolect to provide complementary explanations for the construction of an individual. The question that remains is how far these theoretical discussions of idiolect can or should impact on forensic authorship analysis.

Text messaging authorship analysis

In the two text messaging cases referred to at the beginning of the chapter, the problem brought to the linguist by the police was to determine which of two authors was more likely to have written a series of messages. In forensic casework, this is perhaps the most common type of problem, at least when the linguist is commissioned by the police. Typically, by the time the police approach a linguist they will have identified a suspect and are trying to build an evidential case to put to the suspect in interview. In the Danielle Jones and the Jenny Nicholl cases, the question put was whether it was more likely that the queried messages were written by the suspect or by the supposed victim. The police investigators may have, or believe they have, other non-linguistic evidence which makes the possibility of a third unknown person, already very unlikely or even impossible. It is of course possible to write a conditional opinion of the sort that, if it is known that one of the two candidate writers did write the disputed text message, then of these two X is a more likely author than Y. Clearly, however, such a conditional opinion is not ideal. In the UK system the expert works for the Court even if instructed by the police and it would be better practice ethically and methodologically to step back from the expectations of the police and truly account for the possibility of other potential authors. This raises the question of how rare one person's text messaging style might be, or even whether it could be unique.

The issue of linguistic distinctiveness between individuals has two levels which may be independent. If it can be demonstrated that the suspect exhibits a consistent style in text messaging and also that the victim has a consistent but different style then the first level of distinctiveness will have been proved. I shall refer to this as pair-wise distinctiveness and I will argue that answering this question does not depend upon a strong theory of idiolect, but only upon the degree of consistency of style within each author and the difference which is demonstrable between them. To this extent, any such analysis might be characterised as idiolect-free authorship analysis. The second possible level of distinctiveness, however, may have more profound implications for theoretical discussions of idiolect. This would occur if one person's text messaging style can be said to be distinctive, unusual or even unique against a reference population of text messages. This I shall refer to as population-level distinctiveness. As we shall see, it is possible to explore questions of consistency of style and both pair-wise and population distinctiveness using statistical methods. These methods were in fact developed in forensic psychology for the investigation of serial crime (e.g. Bennell and Canter 2002; Woodhams and Toye 2007).

The issue of consistency is also one of degree and has to be judged in the context of pair-wise as well as population-level distinctiveness. In a recent text messaging case in which I was involved, the linguistic issue involved determining which of two people was the more likely writer of a sequence of 20

text messages. For each writer I was provided with about 200 messages of known authorship. Within this known set, some features appeared to be absolutely consistent and absolutely discriminating. For example, every time Author A used the word 'don't' they spelt it 'dont', i.e. without the apostrophe. In contrast, every time Author B used the word 'don't' they used the abbreviation, 'dnt'. Other features demonstrated only degrees of consistency; Author A for example, always used the standard spelling, 'just', while Author B used 'just' about one third of the time, 'jst' two thirds of the time. The spelling 'jst' in a particular message obviously contains some authorship information but, it can be argued that, in the context of pair-wise distinctiveness, so too does the spelling 'just'. This spelling is more consistent with author A than B. Calculating the degree to which this can be used in determining an opinion, however, requires statistical sophistication (see Lucy 2005 for a good introduction on the application of Bayesian inferencing to resolving this sort of problem).

In the Jenny Nicholl murder case, Coulthard took a more traditional descriptive linguistic approach. He initially analysed a series of messages known to have been written by Nicholl and later also a series of messages known to have been written by Hodgson. From this examination, he identified nine low-level stylistic features which were seen to discriminate between the text messaging styles of the two possible authors. Some of these messages are now in the public domain and these include eleven messages known to have been written by Nicholl (reproduced in Table 33.1) and seven known to have been written by Hodgson (reproduced in Table 33.2). A further complication with Hodgson's messages was that two of the messages were produced on request in a police interview thereby giving Hodgson the opportunity to deliberately disguise his style. Finally, there were four disputed messages (reproduced in Table 33.3).

Example features used by Coulthard in this case include the abbreviation 'im' for 'I am', a lack of a space after using '2' for 'to' (both used by Nicholl and not Hodgson)

Table 33.1 Messages from the trial of David Hodgson for the murder of Jenny Nicholl: Known messages of Jenny Nicholl

Sum black+pink k swiss shoes and all the other shit like socks.We r goin2the Indian.Only16quid.What u doin x
Yeah shud b gud.i just have2get my finga out and do anotha tape.wil do it on sun.will seems keen2x
Shit is it. fuck icant2day ive already booked2go bowling. cant realy pull out. wil go2shop and get her sumet soon.thanx4tdlin me x
No reason just seing what ur up2.want2go shopping on fri and2will's on sun if ur up2it
Sorry im not out2nite havnt seen u 4a while aswel.ru free2moro at all x
No im out wiv jak sorry it took me so long ive had fone off coz havnt got much battery
Only just turned my fone.havnt lied bout anything.no it doesnt look good but ur obviously jst as judgmental than the rest.cu wen I cu&I hope its not soon

I havnt lied2u.anyway im off back2sleep

I know I waved at her we wer suppose2go at4but was a buffet on later on so waited.anyway he had a threesome it was great cu around

Im tierd of defending myself theres no point.bye

Happy bday!will b round wiv ur pressent2moz sorry i cant make it2day.cu2moz xxx

Table 33.2 Messages from the trial of David Hodgson for the murder of Jenny Nicholl: Known messages of David Hodgson

has he got his phone on him

ave dun he aint got it he will b in witherspoons she in

got puddings and tissues in me pnckets.ave2 hope he rings b4 he goes up back in 30

put it on at 3.30 at 150 ok and top on at 4.45 but dont put glass lid on just the suet ok and the spuds separate

put them on at ten 2 ok thats 4.50 ok

Messages produced in police interview

HI JENN TELL JACKY I Am KEEPING My PhONE of because I am living in Scotland with my boyfriend I mite be in trouble with my dad myself. DaDs going to kill me I told him I was leaving Keswick why Does he hate me everyone hates me in RICHMOND you are the only mate I have got Have to go see you.

Hi jenn tell jacky i am keeping my phone of because i am living in Scotland with my boyfriend i might be in trouble with dad myself dads going to kill me i told him i was leaving Keswick why does he hate me everyone hates me in Richmond you are the only mate i have got have to go see you

and the use of 'me' and 'meself' rather than 'my' and 'myself' (used by Hodgson and not Nicholl). He judged these to be consistently used by each of the two candidate authors. Coulthard was the only linguist to give evidence at trial and his opinion was careful and correct. He was able to say that the suspect messages were inconsistent with the described style of Jenny Nicholl. ~~A slide demonstrating this point and used by Coulthard in presenting his analysis can be seen at http://news.bbc.co.uk/1/hi/sci/tech/7600769. stm.~~ His conclusion with regard to Hodgson was measured. He gave the opinion that *'Linguistic features identified in Mr Hodgson's and the suspect texts are compatible with their*

Commented [TG1]: I can't find an alternative link…

Table 33.3 Messages from the trial of David Hodgson for the murder of Jenny Nicholl: Disputed

messages

Thought u wer grassing me up.mite b in trub wiv me dad told mum i was lving didnt giv a shit.been2 kessick camping was great.ave2 go cya

Hi jen tell jak i am ok know ever 1s gona b mad tell them i am sorry.living in Scotland wiv my boyfriend. shitting meself dads gona kill me mum dont give a shite.hope nik didnt grass me up.keeping phone of.tell dad car jumps out of gear and stalls put it back in auction.tell him i am sorry

Y do u h8 me i know mum does.told her i was goin.i aint cumin back and the pigs wont find me.i am happy living up here.every1 h8s me in rich only m8 i got is jak.txt u couple wks tell pigs i am nearly 20 aint cumin back they can shite off

She got me in this shit its her fault not mine get blame 4evrything.i am sorry ok just had 2 lve shes a bitch no food in and always searching me room eating me sweets.ave2 go ok i am very sorry x

having been produced by the same person' and when pressed at trial he emphasised that Hodgson was one of a group of possible authors, and that the linguistic evidence could not go further than that (personal communication). The description of the consistencies in style and this pair-wise distinctiveness contributed to the case which convinced the jury to convict David Hodgson of Jenny Nicholl's murder and an appeal on the grounds that the linguistic evidence was unsound failed.

One challenge for forensic authorship analysts when considering text messages is to adopt something like the approach demonstrated in Coulthard's method and expression of opinion and to develop this approach further. In particular, comparisons between authors could be enhanced if the descriptive methods used by Coulthard can be developed to enable the quantified comparison of degrees of consistency and distinctiveness. Fortunately, forensic linguistics can borrow from its sister discipline of forensic psychology to achieve this aim.

Forensic psychology and case linkage work

Forensic psychologists have been involved in developing methods to determine whether a particular crime is an independent event, or alternatively, whether it is in fact part of a series of linked crimes committed by the same offender. This work, known as case linkage, typically relies on the statistical or computational analysis of offenders' behaviours in databases of offences and depends upon the twin principles of behavioural consistency and behavioural distinctiveness. The parallels with authorship analysis as described are clear. These case linkage principles have been investigated and demonstrated across a series of types of crime including car crime (Tonkin *et al*. 2008), commercial burglary (e.g. Bennell and Canter 2002; Woodhams and Toye 2007), sexual crime (e.g. Santtila *et al*., 2005b; Woodhams, Grant and Price 2007), arson (Santtila *et al*. 2005a) and murder (Salfati and

Bateman 2005) and a theoretical discussion exploring the nature of behavioural consistency in forensic work is beginning to be well developed (Woodhams and Toye 2007; Woodhams, Hollin and Bull 2007). Methods taken from this body of work can be adapted and applied to text messaging authorship analysis. Instead of scoring the presence and absence of crime scene behaviours, we can score the presence and absence of stylistic features.

Statistical consistency and distinctiveness

Returning to the Nicholl case, these methods can be exemplified even with the relatively small number of publicly available text messages. Because of the small number of messages, it is a simple matter to code each text as having or lacking each of the features noticed by Coulthard. The presence of each feature in each text message is scored as a one and its absence is scored as a zero. This creates an array of zeros and ones for every message sent. An example is shown as Table 33.4.

Using these representations, pairs of messages can then be compared for similarity or dissimilarity using a binary correlation analysis called Jaccard's coefficient. Jaccard is a statistical tool for measuring the degree of similarity. It produces results ranging from zero to one, with zero indicating total dissimilarity and one indicating identity. For the purposes of this worked example, I wish to follow Coulthard's analysis and this produces a slight peculiarity in results. Coulthard's method is to use reciprocal coding to create a series of contrasts, for example, Nicholl's use of 'im' with the suspect's 'I am' and this produces two coding columns which indicate the presence of 'im' in some of Nicholl's messages but none of Hodgson's whereas for 'I am' the reverse pattern is true. This choice of features, along with the small number of messages, together produces the mathematical effect of reducing some of the Jaccard scores to zero and this in turn requires the use of one-sample t-tests (with a test score of zero) to make some of the comparisons. This, however, does not affect the theoretical or practical implications of the method more generally. Calculations for both t-tests and Jaccard coefficient will be performed by most statistics programme (such as SPSS) and described in their manuals and help files and also in most introductory text books on statistics (e.g. Dancey and Reidy 1999).

One feature of Jaccard which is crucial for both the analysis of text messages and for its parallel use in criminal case linkage is the fact that the occurrence of two absence scores, two zeros, has no effect on the overall similarity metric. A writer may be consistent in their preference of 'im' over 'I am' but this consistency will not be revealed in every message. In a similar vein in crime analysis, the absence of evidence of the carrying of a weapon at a scene is not evidence of its absence from that scene and Jaccard allows for this.

Having calculated Jaccard's coefficient between pairs of messages it is very straightforward to statistically demonstrate consistency of style and pair-wise distinctiveness between authors. To demonstrate the degree of consistency in Nicholl's messages using this coding system it is possible to take all of Nicholl's eleven messages and pair each message with every other. This produces 110 pairs and subsequently 110 Jaccard scores (mean = 0.23, SD = 0.20). A similar process can be carried out with Hodgson's seven messages creating 42 Jaccard scores (mean = 0.11; SD = 0.19). Removing the messages which Hodgson produced at interview leaves 20 Jaccard scores and raises the mean

Jaccard score slightly and reduces the standard deviation (mean = 0.15; SD = 0.12).

If we move to examine all the pairs of messages where each pair contains a Nicholl text and a Hodgson text the Jaccard scores fall to zero for each and every one of these possible between-author pairs. (Included in this analysis are those text messages elicited from Hodgson during police interview.) This zero score is a representation of the difference in style between Hodgson and Nicholl. It is atypical to score zero, rather than a low decimal close to zero, but as commented above this is at least in part an artefact of using Coulthard's features which result in reciprocal coding. The zero result perhaps argues for a broader description of the messages than the nine features chosen by Coulthard for

Table 33.4 Example coding of text message

Text message	*i m*	*1 a m*	*am I' m*	*not / not /*	*aint l*	*ive l*	*ave l*	*my/ myself /*	*me/ meself /*	*oi l*	*off /*	*to=2-space /*	to=2 + *space /*	*cu /*	*cya l*	*tone /*	*phon e*	sM */*	*shite /*
got puddings and tissues in me pnckets.ave 2 hope he rings b4 he goes up back in 30	0	0	0		0	0	1	0	1	0	0	0	1	0	0	0	0	0	0

their absolute discriminatory power. Nevertheless, the zero score makes the point statistically that Coulthard was making descriptively; Nicholl's and Hodgson's texts are demonstrably stylistically distinct from one another. We have demonstrated that pair-wise distinctiveness exists in this case. It is possible to reinforce this assertion by statistical testing. The appropriate test is a one-sample t-test and this shows a significant reduction in similarity when messages paired between the two authors are compared with Nicholl's within-author pairs ($t_{(109)} = 12.02$, $p < 0.01$, Cohen's $d = 1.55$). There is also a significant reduction in similarity when the between-author pairs are compared with Hodgson's within-author pairs ($t_{(41)} = 3.79$, $p < 0.01$, Cohen's $d = 0.81$). Collectively these results demonstrate statistically consistency of style within the text messages of Nicholl and consistency in the style within the text messages of Hodgson and also distinctiveness between the two styles.

Thus far, only texts of known authorship have been examined. The forensic questions require consideration of the disputed messages. When these disputed messages are paired with Nicholl's messages these mixed pairs are shown to be significantly less similar than the Nicholl-only pairs of messages ($t_{(145)} = 9.38$, $p < 0.01$, Cohen's $d = 1.41$). In contrast to this result there is no significant reduction in similarity when pairs of texts known to have been written by Hodgson are compared with

pairs with one Hodgson text and one disputed message ($t_{(62)} = 8.36$, $p = 0.41$, Cohen's $d = 0.14$). In summary, Nicholl's and Hodgson's styles each demonstrate a degree of internal consistency and distinctiveness from one another. Nicholl's texts can also be shown to be distinctively different from the disputed texts but Hodgson's texts cannot.

This statistical demonstration of pair-wise distinctiveness and its post hoc application to Coulthard's case supports but adds little evidential weight to Coulthard's own descriptive analysis. Being able to measure consistency and distinctiveness is a methodological advance in that it allows some quantification of stylistic distance between groups of texts and thus some quantification of probabilities that one group of texts is inconsistent with another. The method however is intended to address only pair-wise distinctiveness. This distinctiveness can be shown to exist irrespective of whether there is any strong explanation for it and in this sense the method might be said to be idiolect free.

The pair-wise approach, does, however, suggest a further method for demonstrating population-level distinctiveness. The forensic psychology studies investigate which sets of features are most discriminating at a population level (e.g. Woodhams and Toye 2007) and a similar analysis can be carried out on text messaging features. Such an analysis would help determine empirically which sorts of features are most useful in idiolectal discrimination. Such an empirical finding might then have theoretical implications. For example, it might be shown that in text messaging a tendency for abbreviation is more generally discriminating between authors than the use of grammatical ellipsis. If such a finding arose, it would provoke questions as to why one type of feature might show more between-author variation than another.

Commented [TG2]: ?

This is just one aspect of the considerable further work to be carried out on these techniques and some of it is already underway. A general description of texting language is already developing outside of the forensic field (e.g. Crystal 2008) and this is already proving useful in exploring the population-level questions. In addition the statistical techniques used in case linkage are also under rapid development not least with the creation of a taxonomic similarity measure (Woodhams *et al.* 2007a) developed in relation to sexual crime. The application of this taxonomic similarity to text messaging forensics is also being explored. In spite of the speed of development, it is already possible to reflect on the implications of methods such as these for understandings of idiolect and of the role of idiolectal theories in forensic casework.

Commented [TG3]: move from texting to considerable description of CMC – because internet

Implications for theories of idiolect

As we have seen, it is possible to construct a method for authorship analysis based on stylistic variation. The steps which comprise this method can be clearly described and followed to produce replicable results on the same data set and can also be applied to different data sets. The method primarily demonstrates that different authors can be consistent and distinctive in their style of textual production. This does not mean that individuals are absolutely consistent; language is naturally variable. Neither does it mean that every author will be consistent in the same way. This method allows for and detects the fact that one author may be consistent in, for example, a form of abbreviation, whilst another author may tend to punctuate in an idiosyncratic manner. This is a strength of this method

and it is a contrast with more traditional stylometric approaches. The stylometric approaches tend to carry with them the assumption that a 'good' marker or feature of authorship is one which will show between-author variation and within-author consistency across a sample of authors (e.g. Chaski 2001; Grant 2007). Examples of such stylometric markers might include measures involving word frequency distributions, frequency of use of functional words, or measures of syntactic structures. Many stylometric approaches are very successful in dealing with longer texts written in standard language variants but they do tend to struggle with the short and fragmentary language of text messaging.

Using the technique described here, it is possible to demonstrate not only consistency but also to show pair-wise distinctiveness between text messages by two authors. Observation of stylistic consistency and distinctiveness in this way is good evidence that idiolect exists. Observation that the writings of some, many or most authors can be discriminated using stylometric markers of authorship is also good evidence that idiolect exists. As I have argued above, however, mere observation and description of consistency and distinctiveness is not a theory of idiolect. Theories have to have explanatory power. Any investigation limiting itself to observation and description of consistency and distinctiveness in authorship style might fairly be considered idiolect free authorship analysis.

It is possible to draw separate parallel conclusions outlining the possible contribution to a theory of idiolect of both the stylistic and the cognitivist stylometric approaches to authorship analysis.

Using a more stylistic, sociolinguistic or variationist approach in observing specific features of a particular author's language we may be able to explain some of those features by appealing to that author's social and linguistic background. The use of 'me' for 'my' in a text message might, for example, be explained in terms of the dialect background and pronunciation of that writer. Such specific explanations, however, may not always be available to us. Why a second individual with a similar social and geographic background, and perhaps with a similar pronunciation, chooses to follow the more standard spelling may well seem inexplicable. At a general level, however, we can provide some explanation of stylistic variation between individuals. This explanation rests on the fact that individuals vary in their social and linguistic history, and in their lexical priming, and this produces variation in the sociolinguistic resources upon which they draw for language production.

Using a more stylometric approach in observing specific features in an individual's language may not commit one to an interest in cognitivist theories of language production but many stylometric measures will be based on insights derived from such theories. To claim that a measure is based on a cognitive or neuropsychological understanding of language production does not of itself explain between-author variation in that measure. Without relying on sociolinguistic explanations, why two individuals with similar cognitive and neurological structures vary in such a measure may well seem inexplicable. At a general level, however, we can provide some explanation of cognitive variation between individuals. This explanation rests on the fact that individuals may show some variation in their biology, but there will also be variation in sociolinguistic history and thus in lexical priming, and this produces personalisation of the neurological and cognitive resources upon which they draw for language production.

With regard to theories of idiolect, I would argue that consistency and pair-wise distinctiveness are matters of empirical observation upon which forensic authorship analysis can

rely. Any such comparison must be based in sound methods which can convincingly demonstrate the degrees of consistency and distinctiveness found in a particular comparison of texts known to have been written by the authors but the results of such comparison have little to contribute to theoretical discussions of idiolect. Such matters of fact do not of themselves explain idiolect. The possibility of pair-wise distinctiveness, wider distinctiveness or even population-level distinctiveness, however, does seem to demand some explanation. To the extent that it can be shown that one individual's language is measurably unique in the population of all language users, this is, or would be, an astounding fact. Even less extreme individual linguistic distinctiveness demands a combination of cognitive and social investigation and demands a combination of cognitive and social explanations. Observable individual linguistic uniqueness demands a theory of idiolect.

Postscript - Txt4n6 ten years on

Hodgson was convicted in 2008 and appealed his conviction in 2009, on the basis that Coulthard's linguistic evidence was flawed (*R v Hodgson [2009] Cr App 742*). The full appeal judgement however was not available until after the book had gone to press. In turning down the appeal the judgement notes that:

> The judge reminded the jury in terms that [Coulthard] was not saying that in his opinion the applicant had written the texts, merely that he could have done, as could a number of other people. [§62]

and that

> The professor responded [in cross examination] that the applicant's style seemed consistent with his having been the author, but he was not saying that the applicant was the author. [§64]

and that

> Ultimately this was always a matter for the jury to determine the authorship of the suspect text messages and they would have taken into account all the evidence in the case. [§65]

Coulthard's reliance in his evidence on the ideas of consistency and compatibility, his discussion of issues of distinctiveness, and further to this his avoidance at trial of the temptation to make a strong attribution all combined to render his evidence and the overall conviction of Hodgson safe at appeal. These issues are all picked up further in Grant and MacLeod (2020, Ch 6) and of

particular importance is this last issue. Framing authorship work as *analysis* of consistency and distinctiveness leaves the question of *attribution* to the finder of fact, the jury in Hodgson's trial. It is my view that not only is this correct as a matter of jurisprudence and as a matter of forensic decision making , it is also correct in terms of our understanding of the linguistics of the individual and the extent of within-person linguistic variation.

In terms advancing the idea that identification of consistency and distinctiveness are sufficient to for linguistic authorship analysis Grant (2013) discusses this further in the context of the Birks murder case and suggest a protocol for working cases such as these. In addition Grant and MacLeod (2018, 2020) writing in the context of examining identity disguise as used by online undercover police, discuss further the idea of linguistic online identities and propose a more detailed theoretical framework for understanding the idea of an author. In this theoretical context, Johnson and Wright (2017) pick up an interesting point which could be developed further. This is that some authors may be more distinctive than others. Once stated this may seem a somewhat obvious point , but it is enormously important and often unnoticed in academic discussions. Just as with person description, where identifying a 195cm tall man with a flaming red beard is easier than discriminating a more non-descript character, so too distinguishing two authors who have relatively non-descript writing styles will always be a harder task than if one of them has unusual markers of style. To the extent that stylometric approaches are based on population level distinctiveness there are less likely to be interested in or take account of this sort of variation in potential individuation. This observation needs more empirical and theoretical discussion. In this context it is perhaps notable that detailed description of particular individuals tend to focus on professional communicators rather than the man or woman on the street. Thus Johnstone (1996) discusses as a linguistic individual the style of former Texas ste Senator Barbara Jordan, and Kredens (2002) examines the performer Morrissey in terms of his idiolect. There is now exciting work by Kredens et al (2019) examining tens of thousands linguistic individuals addressing these issues and I for one await the full findings with interest.

One advance suggested in this paper that has been recently taken up and developed is the use of presence-absence of features rather than feature counts in the determination of authorship. Grieve et al (2019) comment that traditional stylometric methods tend to fail below a 500 word threshold and so adopt a presence absence approach applied to n-grams for their analysis of the Bixby letter. Interestingly as a measure of similarity and difference they prefer to use the overlap coefficient rather than the Jaccard method – mostly as this is less sensitive to difference in text length than Jaccard, an issue that less important in the comparison of SMS messages with one another, than in a comparison of the short Bixby letter with mostly longer documents.

A final suggestion I make towards the end of the paper can also be addressed by Kredens and colleagues' new project. This is the question of whether there are types of linguistic or stylistic features which are generally discriminating when moving from population level feature analysis

to comparison of a small number of individuals. Thus I ask above whether an empirical study might allow it to be shown that "a tendency for abbreviation is more generally discriminating between authors than the use of grammatical ellipsis" The informally reported results so far (in Kredens et al, 2019) seem to suggest that there are no set of generic types of feature like this and if this is true this has implications - which will unroll over the next 10 years - for both practical forensic authorship analysis work and for the development of ideas of the linguistic individual.

Further reading

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