

Available online at www.sciencedirect.com

SciVerse ScienceDirect

Journal homepage: www.elsevier.com/locate/cortex

Special issue: Research report

Linguistic biomarkers of Hubris syndrome

Peter Garrard ^{a,*}, Vassiliki Rentoumi ^a, Christian Lambert ^a and David Owen ^b

^a Stroke and Dementia Research Centre, St George's University of London, UK

^b House of Lords, London, UK

ARTICLE INFO

Article history:

Received 18 June 2013

Reviewed 22 July 2013

Revised 6 August 2013

Accepted 28 August 2013

Published online xxx

Keywords:

Hubris syndrome

Language

Shannon entropy

Keyness

ABSTRACT

Owen and Davidson coined the term 'Hubris Syndrome' (HS) for a characteristic pattern of exuberant self-confidence, recklessness, and contempt for others, shown by some individuals holding substantial power. Meaning, emotion and attitude are communicated intentionally through language, but psychological and cognitive changes can be reflected in more subtle ways, of which a speaker remains unaware. Of the fourteen symptoms of HS, four imply lexical choices: use of the third person/'royal we'; excessive confidence; exaggerated self-belief; and supposed accountability to God or History. One other feature (recklessness) could influence language complexity if impulsivity leads to unpredictability. These hypotheses were tested by examining transcribed spoken discourse samples produced by two British Prime Ministers (Margaret Thatcher and Tony Blair) who were said to meet criteria for HS, and one (John Major) who did not. We used Shannon entropy to reflect informational complexity, and temporal correlations (words or phrases whose relative frequency correlated negatively with time in office) and keyness values to identify lexical choices corresponding to periods during which HS was evident. Entropy fluctuated in all three subjects, but consistent (upward) trends in HS-positive subjects corresponded to periods of hubristic behaviour. The first person pronouns 'I' and 'me' and the word 'sure' were among the strongest positive temporal correlates in Blair's speeches. Words and phrases that correlated in the speeches of Thatcher and Blair but not in those of Major included the phrase 'we shall' and 'duties' (both negative). The keyness ratio of 'we' to 'I' was clearly higher throughout the terms of office of Thatcher and Blair than at any point in the premiership of Major, and this difference was particularly marked in the case of Blair. The findings are discussed in the context of historical evidence and ideas for enhancing the signal to noise ratio put forward.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

'Take care of the sense and the sounds will take care of themselves'

Lewis Carroll: Alice in Wonderland (1865)

The phenomenon of exuberant overconfidence (hubris), and subsequent humiliation or destruction (nemesis) of powerful leaders is a familiar one: it is a recurring theme in Ancient

* Corresponding author. Stroke and Dementia Research Centre, St George's University of London, London SW17 0RE, UK.

E-mail addresses: pgarrard@sgul.ac.uk, peter.garrard@gmail.com (P. Garrard).

0010-9452/\$ – see front matter © 2013 Elsevier Ltd. All rights reserved.

<http://dx.doi.org/10.1016/j.cortex.2013.08.014>

Greek tragedy, runs through the Western dramatic canon in depictions of doomed tyrants, and has been played out in the rise and fall of dictators throughout history, right up to the present century. The English language itself reflects the cultural impact of the phenomenon in cliché (“power has gone to his head”), proverbs (“pride goes before a fall”), and dicta [“power tends to corrupt and absolute power corrupts absolutely” (Acton, 1887)]. Recent events in Western democratic politics, business and finance have brought wider issues of leadership, and what Bertrand Russell (1961) referred to as ‘the intoxication of power’, under renewed scrutiny.

The political sphere is particularly worthy of close study because events take place in a public space, allowing the interacting influences of circumstance, behaviour and decision-making on outcomes (both favourable and unfavourable) to be observed and interpreted from a historian’s perspective. Owen (2006, 2008; Owen & Davidson, 2009) used his first-hand experience of politics and government to examine the careers of UK Prime Ministers and US Presidents who held office during turbulent periods of the 20th and 21st Centuries. He identified a series of distinctive behavioural features in a subset of these figures, and proposed that when some or all of these features co-occur in an individual occupying a position of power, that individual may be regarded as suffering from ‘Hubris Syndrome’ (HS).

Of course, personality may predispose to the development of HS, particularly if the factors that lead individuals to seek positions of power are similar to those that make them vulnerable when in office. However, the full-blown syndrome emerges only after ‘substantial power’ has been acquired, and in most cases remits when the subject leaves office. On this basis, Owen and Davidson (2009) defined HS as ‘a disorder of the possession of power, particularly power that has been associated with overwhelming success, held for a period of years and with minimal constraint on the leader’ (Owen & Davidson, 2009) [italics added].

The 14 clinical features, or symptoms, that have been proposed for HS are listed in Table 1. Some are similar to those listed in the Diagnostic and Statistical Manual of Mental Disorders version four (DSM-IV) (Cooper, 2001) as suggestive of other personality disorders, namely Antisocial (criterion 11), Histrionic (criterion 14) and Narcissistic (criteria 1–4 and 7–9) types. The remaining five criteria however, which appear in the table in bold type, are unique to HS. It is proposed that, to make a diagnosis of HS, at least three out of the 14 defining symptoms should be present, including at least one of the unique features. Finally, there should be no other potential medical or psychiatric explanations (such as organic brain diseases, bipolar disorder, drug or alcohol abuse) for the atypical patterns of behaviour. This exclusion criterion proved important, as many of the candidates for HS displayed behaviours for which plausible alternative accounts were available.

Applying these criteria, Owen and Davidson (2009) identified five cases of HS among 14 US Presidents and UK Prime Ministers, whose histories in office indicated that they were candidates for the diagnosis (bracketed dates indicate term of office): US President George W. Bush (2001–9); and UK Prime Ministers David Lloyd-George (1916–22), Neville Chamberlain (1937–40), Margaret Thatcher (1979–90) and Tony Blair (1997–2007).

Garrard (2009, 2010; Peters & Garrard, 2013) has argued that language provides a rich source of biologically eloquent data for historians interested in the mental and cognitive states of individuals whose written or spoken discourse has been preserved in large quantities. Central to this claim was the finding of striking differences in lexical variety and syntactic complexity between the texts of the early and late works of the novelist Iris Murdoch, whose final novel was composed shortly before the emergence of the earliest symptoms of Alzheimer’s disease, and almost certainly influenced by the disease (Garrard, Maloney, Hodges, & Patterson, 2005) [though

Table 1 – The symptoms of HS (adapted from Owen & Davidson, 2009).

Proposed criteria for Hubris syndrome; abbreviations indicate overlap with features of personality disorder listed in DSM-IV	
1.	A Narcissistic propensity to see their world primarily as an arena in which to exercise power and seek glory; NPD 6
2.	A predisposition to take actions which seem likely to cast the individual in a good light – i.e., in order to enhance image; NPD 1
3.	A disproportionate concern with image and presentation; NPD 3
4.	A messianic manner of talking about current activities and a tendency to exaltation; NPD 2
5.	An identification with the nation or organisation to the extent that the individual regards his/her outlook and interests as identical; (unique)
6.	A tendency to speak in the third person or use the royal ‘we’; (unique)
7.	Excessive confidence in the individual’s own judgement and contempt for the advice or criticism of others; NPD 9
8.	Exaggerated self-belief, bordering on a sense of omnipotence, in what they personally can achieve; NPD 1 and 2 combined
9.	A belief that, rather than being accountable to the mundane court of colleagues or public opinion, the court to which they answer is: History or God; NPD 3
10.	An unshakeable belief that in that court they will be vindicated; (unique)
11.	Loss of contact with reality; often associated with progressive isolation; APD 2 and 5
12.	Restlessness, recklessness and impulsiveness; (unique)
13.	A tendency to allow their ‘broad vision’ about the moral rectitude of a proposed course to obviate the need to consider practicality, cost or outcomes; (unique)
14.	Hubristic incompetence, where things go wrong because too much self-confidence has led the leader not to worry about the nuts and bolts of policy; HPD 5

APD = Antisocial Personality Disorder; HPD = Histrionic Personality Disorder; NPD = Narcissistic Personality Disorder.

see Todd (2001) for an alternative view]. A later examination of samples of parliamentary speeches made by Harold Wilson shortly before his surprise resignation as Prime Minister of the United Kingdom in 1976, found evidence of a change in the distinctiveness of his vocabulary when compared with similar speeches made in earlier years (Garrard, 2009). Wilson also famously succumbed to Alzheimer's disease in later years, and it was proposed that these later speeches also contained presymptomatic clues to an evolving pathological process (Garrard, 2009).

A wider implication of these studies is that lexical choice and linguistic structure could be considered among the 'honest signals' (behaviours by which attitudes and motivations are unconsciously communicated) that have been extensively explored by Pentland (2008) and his co-workers. Detailed studies of unconscious lexical choices have shown clear differences between transcripts of language produced under a range of psychological conditions, including positive versus negative mood, and superior versus inferior position within a hierarchy (Pennebaker, 2012). Lewis Carroll's Duchess (see the epigraph) appears to have arrived at a similar conclusion some 150 years earlier.

Might any of the 14 clinical features of HS that are listed in Table 1 also be reflected in the language produced by those suffering from the disorder? One very explicit prediction is inherent in symptom 6 ('a tendency to speak in the third person or to use the "royal we"): if present, this should give rise to increased usages of the terms 'he/she', 'him/her', 'his/her(s)', 'we', 'us', 'our', or the speaker's own name, in contexts where the first person pronoun would be expected. The presence of symptoms 7 ('excessive confidence in the individual's own judgement and contempt for the advice or criticism of others') and/or 8 ('exaggerated self-belief, bordering on a sense of omnipotence, in what they personally can achieve') might be expected to give rise to increased usages of terms such as 'certain', 'sure', 'confident', and 'succeed/success'. Finally, symptom 9 ('a belief that rather than being accountable to the mundane court of colleagues or public opinion, the court to which they answer is History or God') would clearly predict increased usages of the terms 'History' and 'God'.

Other symptoms may be reflected in higher order characteristics of language use: symptoms 12 ('restlessness, recklessness and impulsiveness'), and 14 ('hubristic incompetence, where things go wrong because too much self-confidence has led the leader not to worry about the nuts and bolts of policy') imply the development of a casual, slipshod style of thinking and planning. Such a change could plausibly be marked by variation in metrics of language complexity in samples produced under conditions of HS.

The overarching hypothesis of the present study, therefore, was that the language produced by political leaders who had been independently identified as developing HS while holding office, would show consistent differences from that of a leader who was judged not to have succumbed to the disorder, and that the time course of these changes would correlate with the historical context in which HS was judged to have emerged. In searching for linguistic markers of HS, we adopted three broad analytical approaches: First, we computed a global measure of complexity across the time

span of each subject's period of office, hypothesising that complexity in the language produced by a speaker whose attention to detail is dwindling (symptom 14) or who is showing 'restlessness, recklessness and impulsiveness' (symptom 12) would be higher than that of a control speaker, and that longitudinal samples would show distinct trajectories of change in this variable.

Secondly, because of the importance of the duration of power in conferring vulnerability to HS we used a longitudinal analysis of word frequency rates to identify individual words and phrases whose rate of use changed (in a positive or negative direction) as a function of time in office.

Finally, we examined discourse samples for single words that appeared significantly more often in the language of each of the subjects than in that of others whose language was recorded over the same period and under similar circumstances (i.e., 'keywords'). We predicted that one or more words indicative of symptoms 6, 7, 8 or 9, as outlined above, would achieve high levels of 'keyness' (Scott & Bondi, 2010) and that this might be evident in differences between samples produced before versus after the emergence of HS.

We tested these hypotheses in a longitudinal sample of transcribed spoken language that had been produced by two of the leaders in whom Owen (2008) identified HS. The language of a third leader from the same era who was judged not to have developed HS was used as a control sample.

2. Subjects, materials and methods

2.1. Study subjects

The subjects whose spoken language formed the basis of the study were the three British Prime Ministers who held office between 1979 and 2007. These included two of the four Prime Ministers who met criteria for HS in Owen and Davidson's (2009) paper (Margaret Thatcher and Tony Blair), and one whose time in office did not provide evidence for the diagnosis (John Major). Major succeeded Thatcher in 1990 and served a full term as Prime Minister after winning the 1992 general election. The data that we submit to analysis in this paper therefore relate to an unbroken period of British political history between 1979 and 2007.

Timelines of the key events of the three subjects' terms of office, with the putative period(s) of HS indicated, are provided in Figs. 1–3. For more detailed historical summaries the reader is referred to the relevant entries in the online edition of the Encyclopaedia Britannica <<http://www.britannica.co.uk>>.

2.1.1. Margaret Thatcher (1979–1990)

Following the replacement of Edward Heath's Conservative government with a minority Labour administration in the February 1974 general election, and the emergence of a small overall majority for Labour in a further election eight months later, Heath opened his leadership of the Conservative Party to a poll of its MPs. The contest was won in February 1975 by Margaret Thatcher, who had served in Heath's government as Secretary of State for Education and Science.

Under Thatcher's leadership the Conservatives won the 1979 general election, and were re-elected in 1983 – their (and

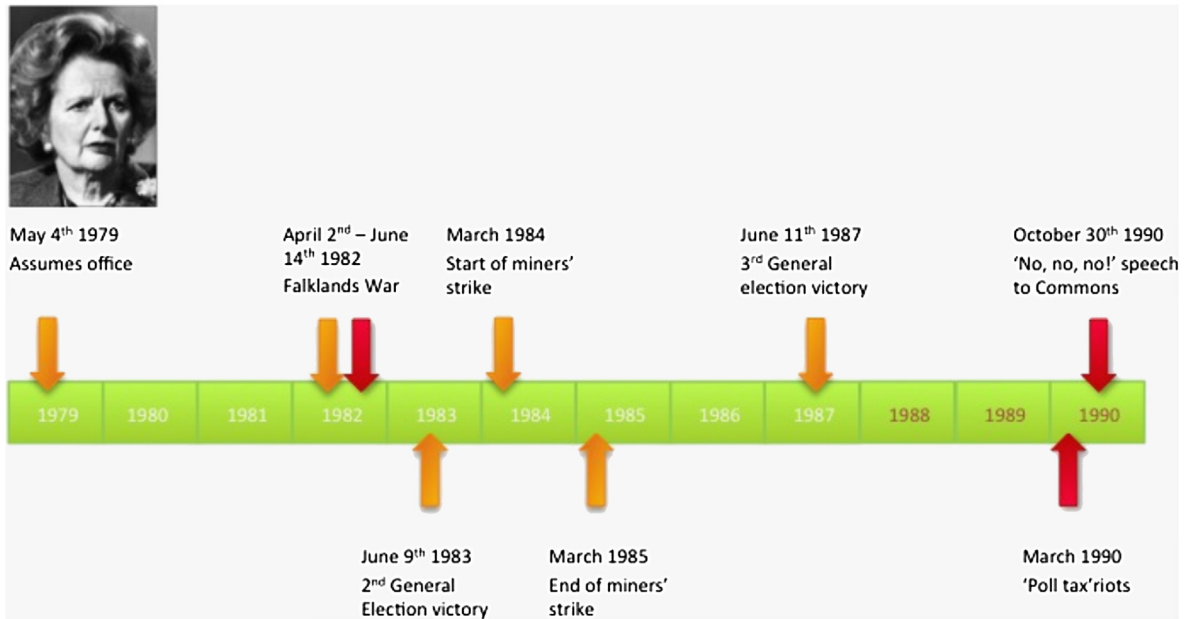


Fig. 1 – Timeline of the Prime Ministerial career of Margaret Thatcher – May 4th 1979 to November 28th 1990: Thatcher had been a Cabinet Minister in Heath’s 1970–74 Government, and a constituency MP since 1959. She entered 10 Downing Street four years after succeeding Edward Heath as Conservative Party leader. During the early years of her premiership, her Government’s monetarist economic policies coupled with the recessionary economic conditions led to widespread unpopularity, but she won a second general election with an increased majority in 1983, having benefited from both an economic recovery and the successful outcome of the Falklands War. Hubris emerged first (red arrows) during post-war victory celebrations, but appears to have subsided, supposedly under the influence of her Deputy Prime Minister, William Whitelaw. When Whitelaw resigned after suffering a stroke in December 1987, Thatcher began to show increasing evidence of HS, giving rise to deep divisions within the Cabinet, damaging resignations, and ultimately a leadership challenge by her former Secretary of State for Defence, Michael Heseltine. Thatcher was unable to garner sufficient support to justify continuing in office, withdrew from the contest, and was replaced as Party leader and Prime Minister shortly afterwards.

particularly her) faltering popularity having been dramatically restored by the success of the Falklands campaign in 1982. Initially attentive to both advice and policy detail (Lawson, 1992) her behaviour militated against an early diagnosis of HS under Owen and Davidson’s criteria. Her famous ‘Rejoice’ comment following the Argentine surrender of South Georgia in April 1982 can be understood as an expression of relief rather than triumphalism. Thatcher’s hubris seems to have first emerged immediately after the war (Owen, 1987, pp. 199–200). As the journalist Hugo Young (1989) observed: ‘In October, a march was held in the City... this was perhaps the pinnacle of the Prime Minister’s self-glorification. Unusually, no member of the Royal Family was invited to be present at this great ceremonial occasion. In the 1945 parade celebrating victory in the Second World War, Churchill and Attlee were positioned at a discreet distance from the saluting base.’

Following her third and final general election victory Thatcher directed her energies towards the idea that local government should be funded by a flat rate of tax (the Community Charge, or ‘Poll Tax’). Nigel Lawson (who opposed the tax), disagreed with her, but noted that she was nonetheless ‘attentive to the extensive studies’ (Owen & Davidson, 2009). Ultimately, however, it was Thatcher’s opposition to European monetary union that caused the deepest divisions of opinion among her Cabinet colleagues. This period dated from January 1988, after Viscount Whitelaw (who had served as

Deputy Prime Minister) left the Cabinet because of ill health. According to Nigel Lawson, Thatcher’s behaviour had been held in check by her deputy for more than eight years, but after his resignation, she ‘was never the same again’ (Garnett & Aitken, 2003, pp. 325–329).

On her return from the Rome summit of the European Heads of Government in October 1990, Thatcher’s behaviour and bombastic rhetoric emerged both in Cabinet (accurately portrayed by Meryl Streep in the film ‘The Iron Lady’) and very obviously in the House of Commons (the famous “No, no, no!” speech). It provoked the Leader of the House and former Foreign Secretary Sir Geoffrey Howe to resign from the Cabinet, urging his colleagues to “consider their own response to the tragic conflict of loyalties with which I have myself wrestled for perhaps too long” (Hansard, 13th November, 1990). A leadership challenge followed (see below), leading to her resignation. A three-times election winner had been deposed by her own MPs. She retired from Parliament in 1992.

2.1.2. Tony Blair (1997–2007)

Tony Blair was elected leader of the Labour Party in 1994, after the sudden death of his predecessor, John Smith. In the 1997 general election Blair led Labour to a landslide victory becoming, at the age of 43, the youngest Prime Minister since 1812. While leader of the opposition, he had reconfigured his Party’s political philosophy to one of ‘democratic socialism’,

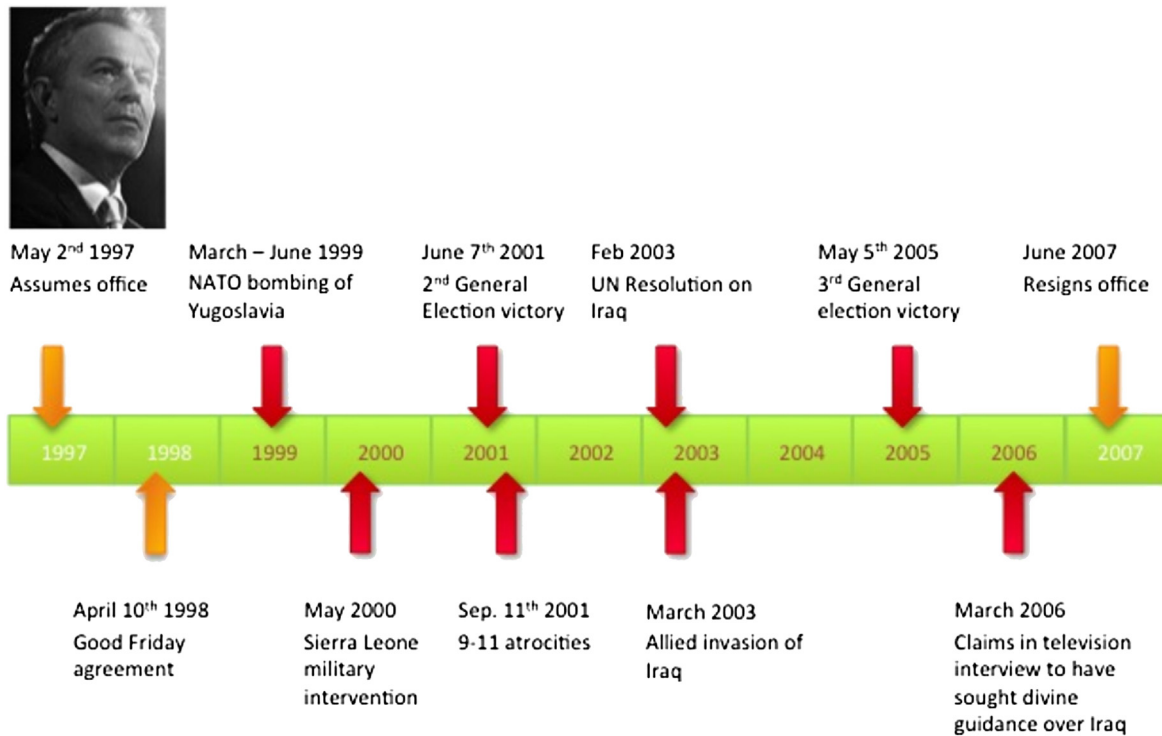


Fig. 2 – Timeline of the Prime Ministerial career of Tony Blair – May 2nd 1997 to June 27th 2007: Blair became Prime Minister after 14 years as a constituency MP, for nine of which he was a member of the opposition front bench, but no experience of government at any level. He led New Labour to three general election victories, and served two full terms as Prime Minister, resigning two years into his third, under pressure from his Parliamentary Party. Among the most significant achievements of his Premiership was the signing of the Good Friday Agreement in 1998. However, aspects of his behaviour and decision-making during and after the Kosovo War, in which he was a key ally of President Clinton, were judged to meet criteria for HS. Key events in this category are indicated in the diagram by red arrows. HS may have subsided by the time Blair left office, though it is notable that he refers, in his autobiography, to ‘the final hubris overwhelm[ing him]’ at this point (Blair, 2010).

and fought the 1997 election under the banner of ‘New Labour’. The most significant achievement of his government’s first term was the successful negotiation, in 1998, of the ‘Good Friday Agreement’ between the Governments of Great Britain and the Irish Republic, in which the policies of each towards Northern Ireland were mutually agreed, thus ending, in principle, 30 years of violent conflict.

Between 1999 and 2000, Blair played a leading international role in the resolution of the Kosovo crisis, and ordered a military operation that contributed to the end of civil war in Sierra Leone. These early foreign policy successes led to criticisms of overconfidence and personal aggrandisement, particularly in his relationship with President Clinton’s administration. The latter led one aide to suggest that Blair was ‘sprinkling too much adrenalin on his cornflakes’ (Owen, 2008). Soon after winning a second term as Prime Minister in 2001, Blair continued to display signs of HS when he introduced into his Downing Street office a new administrative structure under which decision-making on foreign affairs and defence strategy were effectively transferred from their respective Government departments. This change provoked criticisms of a ‘presidential’ style of government. Blair’s HS around this time is also exemplified by an uncritical adherence to the American determination to respond militarily in Iraq to the terrorist

attacks on the US mainland on September 11th 2001, and by the hubristic incompetence of post-occupation planning for the country following the downfall of Saddam Hussein. It is probable, on the basis of his public justifications of his policies over Afghanistan and Iraq, that HS was still present in 2006, when he stated in a television interview, that God would judge him for his decisions, claiming that “...if you have faith about these things, you realise that judgement is made by other people... and if you believe in God, it’s made by God as well”. Tony Blair was forced from office in 2007 (earlier than he had intended), by what he himself refers to as a ‘coup’ by Labour MPs. It came, he writes, after he felt the Parliamentary Party had moved (over the Lebanon rather than Iraq) to a ‘querulous position’, but that he retained a feeling of ‘...determination to comfort me, and by and large it did (which is, I suppose, what always happens to leaders when the final hubris overwhelms them)’ (Blair, 2010, pp. 600–618). Blair retired within months from the House of Commons.

2.1.3. John Major (1990–1997)

Major had been Foreign Secretary and Chancellor of the Exchequer in Thatcher’s government. He was her (somewhat reluctant) proposer in the 1990 Conservative Party leadership election that was triggered by a backbench challenge from

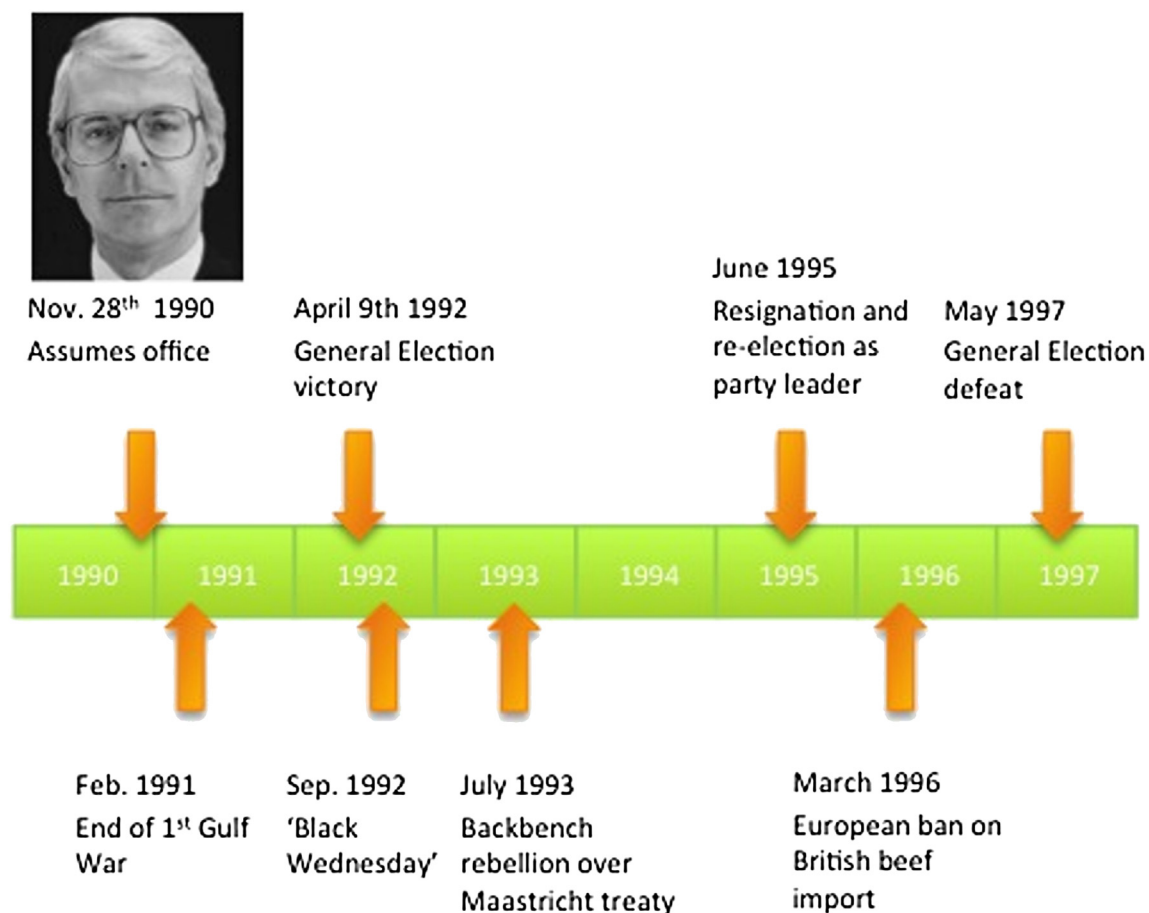


Fig. 3 – Timeline of the Prime Ministerial career of John Major – November 28th 1990 to May 2nd 1997: Major held the post of Chancellor of the Exchequer when he entered the 1990 Conservative Party leadership contest at a second ballot, after Thatcher had failed to secure an overall majority and withdrawn. Although his share of the vote fell marginally short of an outright majority, it was sufficient to persuade his two rival candidates to withdraw. Major assumed the duties of Prime Minister the following day. His leadership style (particularly during the First Gulf War) was seen as modest in comparison with that of his immediate predecessor, and although this played to media representations of colourlessness, or even weakness, he enjoyed consistently high opinion poll ratings, and went on to win the 1992 general election. His full term of office was, however, dogged by the UK's forced exit from the ERM, Cabinet level disagreements over policy towards Europe and the single currency, the BSE scare, and the sexual and financial misdemeanours of some of his senior Party colleagues. In spite of a prolonged period of economic recovery over the years that followed 'Black Wednesday', the 1997 general election resulted in a decisive defeat, leading Major to step down as Party leader.

Michael Heseltine, the former Secretary of State for Defence. Although Thatcher won the initial ballot, her margin of victory was too narrow to avoid a second round, and she withdrew. Major entered the contest in the second ballot, and his share of the vote led his two rival candidates (Heseltine and Douglas Hurd) to concede. He was declared Party leader, and became Prime Minister in November 1990.

Major's premiership coincided with the First Gulf War of 1991 – a UN sanctioned military operation by a 34-nation coalition under US leadership that followed Saddam Hussein's invasion and annexation of Kuwait. The successful allied campaign of aerial bombardment followed by ground troop deployment was brief and effective, and Major's modest approach and his refusal to take partisan political advantage (in marked contrast to Thatcher after the Falklands War), was rewarded by favourable opinion polls, both personally and for

the Conservative government, which was returned to power in the 1992 election. Major also opened the dialogue with the provisional Irish Republican Army (IRA), which led eventually to the signing of the Good Friday Agreement.

On 'Black Wednesday', September 16th 1992, just five months into Major's first full term as Prime Minister, the United Kingdom was forced out of the Exchange Rate Mechanism (ERM), leading to a collapse of popular support for the Government. In contrast to the hubristic behaviours displayed by Thatcher and Blair, criticism of Major's leadership emphasised what was seen as his indecisiveness. To counter this perception, he decided to resign and seek re-election as Party leader, famously inviting dissident members to 'put up or shut up', a gamble that he technically won in the vote in June 1995, but which provided no boost to either his or his Party's political fortunes.

The remainder of Major's premiership came to be dominated by three factors: continued schisms within Cabinet over European policy, particularly membership of the single currency; domestic alarm with, and foreign reaction to, the rising incidence of bovine spongiform encephalopathy (BSE) and variant Creutzfeldt Jakob disease (vCJD); and a series of high-profile sexual and financial misdemeanours by senior Party members. Major stepped down as Party leader and retired from the House of Commons in 2001.

2.2. Language data

We conducted our search for linguistic biomarkers of HS using transcribed samples of spoken language produced by each subject over a number of years at weekly House of Commons debates in which the Prime Minister of the day answers questions (both hostile and friendly) from fellow MPs ['Prime Minister's Questions' (PMQ)]. Unlike 'set piece' speeches (such as Party conference addresses) PMQ consists of largely unscripted verbal activity, whose content is reliably [albeit not *verbatim* (Garrard, Haigh, & De Jager, 2011)] transcribed for the Official Report of proceedings (Hansard).

These debates allowed us to compare the index speaker's language with a contemporaneous control sample, provided (with at least equal spontaneity) by all the other participants in the debates. Although the transcribed versions include corrections of both grammatical and factual errors, and exclude potentially informative paralinguistic elements, such as dysfluencies and self-corrections, lexical content is preserved to a high criterion of reliability (Garrard et al., 2011). Transcripts can therefore be considered as valid data for the purposes of comparative lexical analysis of spoken discourse.

2.2.1. Document identification

Transcripts of all debates that took place during the terms of office of the three subjects were downloaded from the Hansard online archive <<http://www.parliament.uk/business/publications/hansard>>. PMQ sessions were uniquely identified by the appearance of the tag "engagements", which is used in Hansard to index the start of these sessions.

For each subject, texts of every PMQ debate that occurred within her/his period of office were selected for further analysis. The numbers of documents retrieved for each of the three subjects were: 603 for Thatcher; 338 for Major; and 305 for Blair. The smaller number of documents retrieved for Major than Thatcher is a reflection of the difference in the duration (4164 vs 2315 days) of their respective premierships, while the difference between Thatcher and Blair is due to the reduced frequency of PMQs from twice weekly (Tuesdays and Thursdays) to one longer Wednesday morning session, which took effect when Blair assumed office.

2.2.2. Text pre-processing

All text pre-processing steps and data analyses were performed in MATLAB 2010. Native documents were converted to .txt files using the function `textutil`, and the resulting files were then parsed to separate the utterances of the Prime Minister from those of all other speakers. This was accomplished by inserting a hash-tag (#) before each individual speaker hypertext label (by which every change of speaker is indicated),

and then sub-selecting those that were followed by the string 'The Prime Minister'. The speaker-parsed texts were then converted to lower case, and all special symbols, non-text characters, references, hyperlinks and other non-verbal components were removed. Punctuation marks (other than apostrophes, which have an impact on meaning) were also removed.

2.3. Statistical measures

2.3.1. Analysis 1 – Complexity

In information theory, entropy (H) is equivalent to the amount of information (measured in bits) that is added when the value of a previously unknown variable is obtained. The entropy of a random variable equates to its unpredictability (thus, the entropy of a fair coin toss equates to 1 bit, that of two fair coin tosses 2 bits, etc.). Shannon (1951) showed how information content could also be measured in written language, empirically determining the accuracy with which a reader could predict the identity of sequentially revealed characters (including spaces) in a segment of text. In a truly random sequence of characters, each has an entropy value of $\log_2 27$ (26 letters and space), or approximately 4.75 bits. However, next character predictability in a meaningful text will vary according to the contextual information (lexical, semantic, syntactic and grammatical) inherent in what has already been revealed. As a simple example, given a value of 'q' (in an English text), a value of 'u' for the next character is highly predictable. Most character sequences, however, are less so: one of Shannon's most famous examples begins "there is no reverse on a motorcycle...", in which the underlined characters could be expected to be predicted with confidence from the preceding context, while others would offer a wider range of possibilities, limited mainly by spelling conventions. Averaging the number of guesses required per letter across the whole sample provided a value of around 2, giving estimated entropy of approximately 2 bits per letter for this sample.

A number of formulae have been proposed for estimating the entropy of a piece of text based on both letter and word sequences [see Zanette (2012) for a review]. For the present analysis we used Shannon's letter-based formula [Equation (1)], in which $p(x_j)$ is the probability mass function of outcome x_j . Because entropy is sensitive to document length, we obtained values of 'relative entropy' by taking mean values across sequential blocks of 100 words within each speech episode, using the relative frequencies of each character in the block to estimate $p(x_j)$. Entropy was expressed as a proportion of the maximum entropy possible (i.e., where every word is unique and occurs once).

$$H(X) = - \sum_{j=1}^n P(X = x_j) \log_2(P(X = x_j)) \quad (1)$$

Data were analysed by: (1) examining the influence of two factors (subject and years since assuming office) on the mean value of Shannon entropy across each year of office; and (2) regression of the value of the variable against a time variable. Because of the variation in the three subjects' duration of office, the time variable was represented as a fraction of total

time in office [normalised time in office (nTiO)], equal to the number of days since assuming office divided by the total number of days in office. Because the time variable is non-uniform, data were binned into 1% nTiO time-windows, and the average word frequencies within these periods taken as the dependent variable.

2.3.2. Analysis 2 – N-gram trends

In this analysis, we examined the sequence of language samples produced by each subject for statistical correlations (positive or negative) between the relative frequency of single words (1-grams) or sequences of words (*n*-grams), and the duration of time spent in office. The duration of power (as well as its extent and the constraints imposed on the exercise of it) are key external factors contributing to HS (Owen & Davidson, 2009). It follows that words or phrases whose frequencies correlate closely with time (represented as already described, in the form of nTiO) in subjects who exhibited HS would be plausible candidates for linguistic markers of the condition.

We used a multiple correlation analysis to look for and define the strengths of these theoretical associations. Word frequency values were normalised by dividing the individual word frequency by the total number of words during each normalised time interval. To facilitate between-subject comparisons, we restricted the analysis to the set of words that were used more than once by all three speakers. Linear interactions with nTiO (as defined above) were explored using Pearson's correlation coefficient, with resulting *p* values corrected for multiple comparisons using the false discovery rate *p* value (p_{FDR}) implemented in MATLAB.

2.3.3. Analysis 3 – Keyness

Two analyses were performed using the 'keyness' metric (Scott & Bondi, 2010). A keyword is one that occurs with a proportional frequency that is significantly higher or lower (using the log-likelihood statistic) in the index sample than in the reference sample. The larger the difference, the greater the (positive or negative) value of keyness.

To calculate keyness values of words spoken by the three subjects we used the 'WordSmith' software package (Scott, 1996). For each calendar year, separate word frequency tables were created from the parsed PMQ texts (see above under 'Text pre-processing') attributable to the Prime Minister, and those attributable to other speakers in the debates (reference sample).

Tables of the Prime Minister's keywords and their keyness values in each year were then created by comparing the

frequencies in each pair of samples using WordSmith's 'KeyWords' facility. Keyword tables were used in two ways: (i) to examine the keyness of an *a priori* marker of HS (the first person plural pronoun); and (ii) to identify other 'Hubris words', whose keyness changed over a similar time course to that of the historically identified onset of HS (see Figs. 1 and 2):

- (i) *First person plural pronoun usage*: Symptom 6 in Owen and Davidson's (2009) formulation (the tendency to speak in the third person or use the royal 'we') would predict that the frequency of the first person plural pronouns ('we', 'us' and 'our') will be higher, in relation to their singular equivalents ('I', 'me' and 'my') in the language of the two hubristic subjects. The individual entries for each form [(*<WE>* *<OUR>* *<US>*) and (*<I>* *<MY>* *<ME>*)] were therefore combined (lemmatised), and given the labels *<WE>* and *<I>*.
- (ii) *Identification of other 'Hubris words'*: We defined as 'Hubris words' those for which the mean keyness value was lower in the years before HS onset than in the years following it (i.e., before vs after 2000 in the case of Blair, and before vs after 1988 in the case of Thatcher). To increase the specificity of this measure, we considered only those words that emerged as keywords in more than half of the calendar year samples from the subject's term of office.

3. Results

3.1. Overall vocabulary characteristics

The total numbers of words (tokens and unique word types) used by the three subjects at PMQ, and the mean values of each per session (in italics) are displayed below in Table 2. Also shown are the mean sentence lengths [calculated by dividing the total words by the total number of sentence ending marks (full stops, question marks and exclamation marks)], and the mean overall and per PMQ values of Shannon entropy obtained from the texts of each subject's speeches.

The table indicates that, of the three subjects, Blair not only uttered the largest number of words per PMQ (which could be explained simply on the basis that each of his once-weekly debates occupied twice as much parliamentary time as the twice-weekly sessions of his predecessors), but also he used a wider variety of different words, and spoke in somewhat longer sentences. By contrast, there are only small differences across the three speakers in the complexity measure, though

Table 2 – Overall characteristics associated with the discourse samples obtained from the three subjects in the study.

Summary measure	M.T.	J.M.	T.B.
Word tokens ^a	613,649	383,192	816,242
Mean per PMQ session (SD)	1017.7 (140.3)	1127.9 (154.8)	2658 (281.7)
Word types ^a	13,115	10,861	14,450
Mean per PMQ session (SD)	423.6 (48.2)	458.4 (52.8)	838.8 (68.3)
Mean sentence length (SD)	18.9 (1.88)	20.69 (2.03)	22.4 (2.0)
Mean sentences per PMQ	54 (7.8)	55 (7.5)	120 (12.2)
Mean Shannon entropy	5.84 (.16)	5.82 (.15)	5.85 (.14)

a The word token count is the total number of words in a text, while a word type count increases only with the first instance of each word. The ratio between these two textual features can be used as an index of the richness of the vocabulary in a passage of text.

it can be seen that the smallest value attaches to the language of Major, and that the standard deviations (SDs) are small. More detailed analyses of these measures will therefore focus on longitudinal patterns of change rather than absolute overall differences.

3.2. Complexity

The mean values of entropy for all text samples produced in each of the calendar years in which the subjects held office are displayed in Fig. 4. Suggested interpretations of the trends commencing at points 'A' and 'C', and the peak marked 'B' are provided in the figure legend.

Separate 3 (subject) by 12 (year of office) analyses of variance (ANOVAs) confirmed that the values did not vary significantly by subject ($F = 2.3, p > .05$), or by year ($F < 1$), nor was there any interaction ($F = 1.3, p > .05$). Exploratory regression analyses for each subject in turn failed to identify either linear or logarithmic relationships between Shannon entropy and year of office for either Blair or Major, but there was a small linear increase in this variable over time in the texts of Thatcher ($R^2 = .01, p < .05$).

3.3. N-gram trends

In the interests of space we display only the 10 most positive and 10 most negative unigram, bigram and trigram correlates with nTiO in the text corpora of the three subjects. These are displayed in Table 2 (positive correlates) and Table 3 (negative correlates). A more extensive list, containing the top 30

positive and negative unigram correlates, together with their coefficients, is available online.

Although markers specific to symptoms 6 ('royal we') and 9 ('History', 'God') do not appear in these lists, two positive correlations stand out as possible HS markers in Blair's discourse: the use of the first person singular forms 'I' and 'me' are among the strongest positive correlates, pointing to a growing sense in the speaker's estimation, of his personal importance in the work of his Government (symptoms 1, 5 and perhaps 4). In contrast, these items become significantly less frequent in Major's utterances over the course of his time in office (see Table 4). The second strong correlate of interest is the word 'sure', which was identified in the Introduction as a possible marker of symptoms 7 ('excessive confidence in the individual's own judgement and contempt for the advice of criticism of others'), and 8 ('exaggerated self-belief, bordering on a sense of omnipotence, in what they personally can achieve').

Whilst it is clear that individual elements of a common prime ministerial vocabulary show strong correlations with the duration over which the speaker held office, it does not follow that such a relationship indicates the development of HS over the period in question, and some word correlates clearly mark other trends: Thatcher's decreasing references to 'unemployment' perhaps reflect the improvement in the employment statistics during the second half of her premiership; Major's increasing references to the opposition Party, its ('shadow') front bench, 'leader', and the name of his parliamentary constituency ('Sedgefield') seem likely to have been driven by the increasing influence of New Labour in the years preceding the 2007 general election; the same

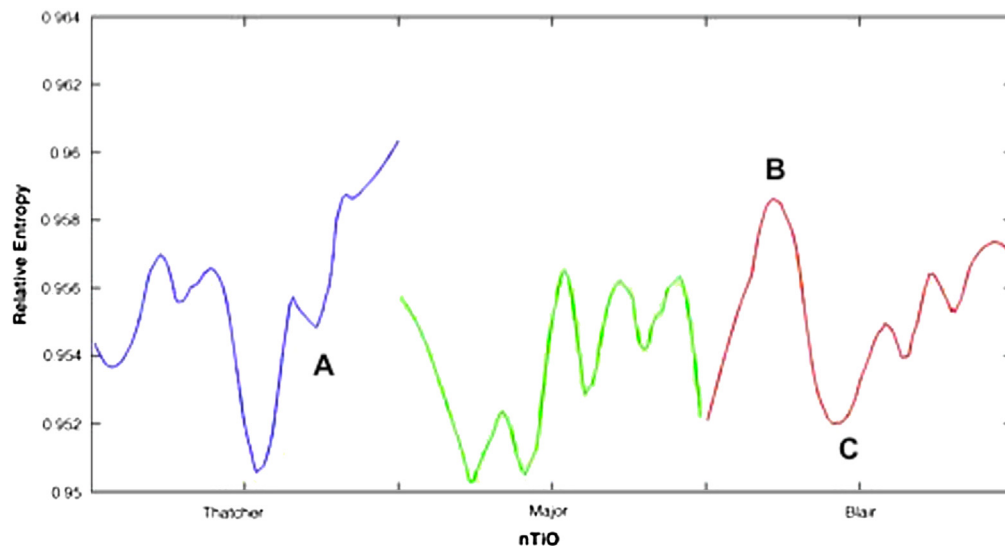


Fig. 4 – Changes in mean values of Shannon entropy by year of office in the three subjects: The rise in entropy (indicating greater informational complexity) above baseline over the final years of Margaret Thatcher's premiership (point A), aligns with the evidence that her HS emerged when the moderating influence of William Whitelaw had been lost. Points B and C accord with historical interpretations of Tony Blair's HS having early and late manifestations, the former (B) coinciding with his early and successful military interventions in Kosovo and Sierra Leone, and the latter (C) reflecting 'hubristic incompetence' in the aftermath of the invasion of Iraq. The values derived from John Major's discourse fluctuate, showing no sustained periods of increase, and maxima consistently lower than those of the two HS subjects. Relative entropy is entropy that has been normalised for document length by dividing mean entropy for a 100 word block by the maximum entropy possible i.e., where every word is unique and occurs once.

Table 3 – Top 10 positive unigram, bigram and trigram temporal correlates (i.e., those becoming consistently more frequent with increasing time in office) for the three subjects. The capitalised entries indicate linguistic changes that might be predicted from the diagnostic features of HS.

Rank	Margaret Thatcher			John Major			Tony Blair		
	1-grams	2-grams	3-grams	1-grams	2-grams	3-grams	1-grams	2-grams	3-grams
1	Moments	Reply that	Reply I gave	Member	Hon member	The rest of	Engagements	Position exactly	Will have further
2	Ago	Some million	The regime but	Not	But export	The hon member	Learned	Things about	I will have
3	Gave	Are distributed	Gave some moments	Deputy	Long recession	Hon member for	Condolences	Our human	House my hon
4	Refer	Moments ago	Some mobility to	Shadow	The shadow	Of the Labour	ME	For allocation	And learned gentleman
5	Some	I gave	I gave some	Labour	Member for	Deputy leader to	Killed	I will	My engagements I
6	Reply	The reply	That I have	Leader	Labour Party	The Labour Party	SURE	Get under	Hon and learned
7	Yes	I refer	To the reply	Party	The Labour	Members should listen	I	Can working	Right that is
8	Charge	That I	Moment we heard	Sedgefield	Leader of	Member to the	Listing	Rejoin the	Have further such
9	And	Gentleman if	Gentleman to the	He	Answer I	Hon member to	Important	Let me	Condolences to the
10	Community	Refer the	Hon gentleman if	If	Does not	Leader of the	Antisocial	Of enforcing	Me in wishing

Table 4 – Top 10 negative unigram, bigram and trigram temporal correlates (i.e., those becoming consistently less frequent with increasing time in office) for the three subjects. The capitalised entries indicate linguistic changes that might be predicted from the diagnostic features of HS.

Rank	Margaret Thatcher			John Major			Tony Blair		
	1-grams	2-grams	3-grams	1-grams	2-grams	3-grams	1-grams	2-grams	3-grams
1	Shall	Reply which	Reply which I	Reply	Reply that	That I gave	Shall	Previous government	The previous government
2	If	Which I	Which I have	Gave	That I	The reply that	Conservative	WE SHALL	The Conservative government
3	Vast	Gave earlier	The reply which	Refer	The reply	Reply that I	Previous	The previous	By the previous
4	Public	Just given	I gave earlier	Moments	I refer	My hon friend	The	The Conservative	We shall do
5	Earlier	Cabinet in	Have just given	Ago	Some moments	Gentleman to the	Government	Conservative members	Right hon gentleman
6	Unemployment	Have just	The Cabinet in	Community	Gave some	To the right	Inherited	Conservative government	We shall save
7	Industries	Vast majority	Duties in this	Friend	I gave	Gave some moments	Party	I shall	Inherited is quite
8	Opportunities	The vast	Further meetings with	MY	My hon	Some moments ago	Conservatives	The Conservatives	We inherited from
9	Goods	I shall	Cabinet in addition	Some	Moments ago	I gave some	Term	Inherited from	Schools and hospitals
10	Member	Member of	Member of the	I	Hon friend	The hon gentleman	Opposition	Shall have	Shall be making

rebalancing of political power is suggested by Blair's decreasing references to the ('Conservative') opposition, while his increasing expressions of 'condolence' for (British soldiers) 'killed' indicate the political dominance of the Afghan and Iraq wars in the years following the 9/11 attacks.

It is intriguing that Thatcher's discourse correlates both positively and negatively with bi- and trigrammatic components of the phrase "I refer [the honourable] gentleman to the reply I gave moments ago": closer inspection, however, reveals that the negative correlation marks a shift from the use of the non-restrictive relative pronoun ('which') to the restrictive form ('that'). In the context, the latter is syntactically more appropriate (Burchfield, 1998), though this corrective trend could have come about at the stage of transcription. A final, notable trend is the increasing use of the word 'learned' by Blair: in the language of the UK Parliament, MPs with a background in the legal profession are conventionally referred to as 'the honourable and learned member'; it remains to be established whether the proportion of lawyers in the House of Commons (a group that included Blair himself) increased over the course of his premiership.

To increase the specificity of temporal correlations to the diagnostic status (HS vs non-HS) of the subjects, we considered as potential HS markers, the *n*-grams that correlated significantly with nTiO in the speeches of the two HS subjects (either positively or negatively, but with the same sign in each), but failed to do so in the speeches of the control subject. These items are displayed in Table 5.

Two of the trigram correlates suggest that Blair and Thatcher became less likely to discuss their 'duties' the longer they remained in office, an observation broadly in keeping with a hubristic attitude, albeit not explicitly captured by any of the Owen and Davidson criteria. The decreasing use of the phrase 'we shall' challenges the possibility that HS symptom 6 ('a tendency to speak in the third person or to use the "royal we"') emerges over time in both Thatcher and Blair, though this point requires closer scrutiny of each of the contexts in which the phrase was uttered. Further exploration of first person plural pronoun usage is reported in the next section.

3.4. Keyness

The availability of word keyness values over a series of discrete time-intervals (calendar years), allowed temporal variations in keyness to be examined. We used this variation first to look for individual words in which temporal fluctuations in keyness values made them candidate markers of HS ('Hubris words'), and secondly to examine each subject's usage of the first person plural pronoun in greater detail.

3.4.1. Identification of other 'Hubris words'

Selection of candidate 'Hubris words' from the vocabulary of the two HS subjects was guided by a comparison of their keyness values during periods before and after the onset of HS as identified by Owen and Davidson: that is, before and after 2000 for Blair and before and after 1988 for Thatcher. Candidate words were those with significant (positive or negative) values of keyness in at least half of the number of calendar years in which a subject held office, and whose mean keyness value was numerically higher in the post-HS than the pre-HS period. The full lists of these words, and their associated keyness values in each of the subjects' years of office (available in the online materials) partially overlapped with the lists of positive and negative temporal correlates identified in Analysis 2 (as would be expected). The single inconsistency was that, in contrast to its decline over time in office in Analysis 2, the word 'duties' had higher keyness in Thatcher's utterances in the period after than before the putative onset of HS. This finding appears to contradict the negative correlation with two trigrams containing the word 'duties' that was reported in Analysis 2. The inconsistency between these two approaches may have arisen because keyness depends on changes in the frequency of the same word in a reference corpus, while proportional frequency trends do not. In contrast, elements of the phrase 'I refer the honourable gentleman to the reply that/which I gave some moments ago' were consistently identified by both analyses. 'Hubris' keywords from both Blair and Thatcher also included the word 'I'; and 'we' was among the 'Hubris' keywords identified from Thatcher's discourse. Among newly identified items of

Table 5 – HS words and phrases: uni- bi- and trigrams that correlated (positively or negatively) with time in office in discourse obtained from M.T. and T.B. but showed no significant change over time in the language of J.M.

Words/n-grams correlating only in HS	Margaret Thatcher		John Major		Tony Blair	
	R	<i>p</i> _{fidr}	R	<i>p</i> _{fidr}	R	<i>p</i> _{fidr}
1-grams						
And	.4785	.0084	.2195	ns	.5215	.0006
Question	-.4264	.0416	.126	ns	-.5242	.0018
No	-.4789	.0093	-.2616	ns	-.4394	.01
Shall	-.5769	.0001	.2598	ns	-.7589	<.0001
2-grams						
We shall	-.5111	.0106	.2757	ns	-.5965	.0012
3-grams						
My duties in	-.5794	.0002	.4027	ns	-.5622	.0008
To my duties	-.5484	.0006	.4165	ns	-.5638	.0009
Addition to my	-.5399	.0008	.4037	ns	-.5352	.0022
Meeting the economic	-.4294	.0344	.4272	ns	-.5019	.0067

interest, was the term ‘obviously’ in Blair’s post-HS period – an indication, perhaps, of the presence of symptom 7 (‘excessive confidence in the individual’s own judgement and contempt for advice or criticism from others’).

3.4.2. First person plural pronoun usage

The keyness values associated with the first person plural and first person singular pronoun lemmas in the discourse of the three subjects during each of the calendar years during which they held office were used to calculate the keyness ratio of the former to the latter (the ‘WE:I ratio’). The higher the value of this index, the greater the relative frequency of the items ‘WE’, ‘US’ and ‘OUR’ in comparison to that of the terms ‘I’, ‘ME’ and ‘MY’. The values for each subject in successive years of office are displayed in Fig. 5. It is clear that Blair’s use of first person plural pronouns in comparison to their singular equivalents is higher, throughout his term of office, than those of the other two subjects ever achieve in theirs, and that it shows considerable fluctuation, with its highest values occurring in the period between 1999 and 2001, during which Owen and Davidson postulated the onset of hubristic behaviour.

3.5. Discussion

It is firmly established that many neurological and psychiatric syndromes can cause distinctive patterns of change in spoken

and written discourse, and that such changes can be described and quantified using a range of manual and automated analytical approaches (Ahmed, de Jager, Haigh, & Garrard, 2012, 2013; Elvevåg, Foltz, Weinberger, & Goldberg, 2007; Wilson et al., 2010). The application of similar methodologies to recorded or archived samples of language, with the aim of establishing medical information of cultural or historical importance, is a more recent enterprise (Garrard, 2009, 2010; Williams, Holmes, Kemper, & Marquis, 2003). Opportunities for carrying out such analyses have been greatly enhanced by the growing availability of large volumes of digitised texts.

The present study made use of a publicly available digital archive of transcripts of British political debate between 1979 and 2007, and attempted to identify changes in spoken language that might be associated with specific clinical features of the acquired personality disorder, HS. Diagnoses of HS in two of the three Prime Ministers who held office during this period, and its absence in the third, had already been made on independent grounds. We applied three different computerised approaches to analyse samples of these individuals’ language, and obtained results which, although of variable statistical significance, all raised questions for further study and prospects for methodological refinement. Although language has been used before to mark the psychological status of politicians (Garrard, 2009), and specifically as an index of HS [in the written communications of a financial sector leader (Brennan & Conroy, 2013)], neither spoken language data nor the specific analytical methods employed here have previously been used to investigate HS.

We began by considering the global characteristic of discourse complexity, the extent to which this variable changes over time, and its correspondence with diagnostic status in HS. We hypothesised that the reckless, slipshod decision-making that is a feature of HS would be reflected in greater unpredictability within discourse samples. This characteristic should be captured by higher levels of informational complexity, which was quantified using Shannon entropy. Although statistical significance seemed to be driven mainly by the large number of data points available for analysis, entropy showed a marginal increase with time in one of the HS subjects, in keeping with predictions, and patterns of temporal fluctuation in both that were compatible with historical interpretations of their behaviour while in power.

Because of the association between duration of power and the development of HS, lexical usages (both single words and groups of words) that became more or less common with each year of office were considered to be potential markers of the syndrome. We argued that certain words or phrases would be indicative of one or more of the symptoms of HS listed in Table 1. Some of these clinical features embody explicit predictions concerning word use (such as symptoms 6 and 9), while others suggest an association with a particular content or presentational style. References to God or History did not emerge as temporal correlates, and the ‘royal we’ became less, rather than more, common in both Thatcher and Blair’s discourse. There were also changes in the frequencies of words that were indirectly associated with symptomatic behaviours in one or more of the HS subjects: Blair was increasingly ‘sure’, increasingly self-referential in his choice of pronouns (‘I’ and ‘me’) and more likely to consider his statements ‘important’.

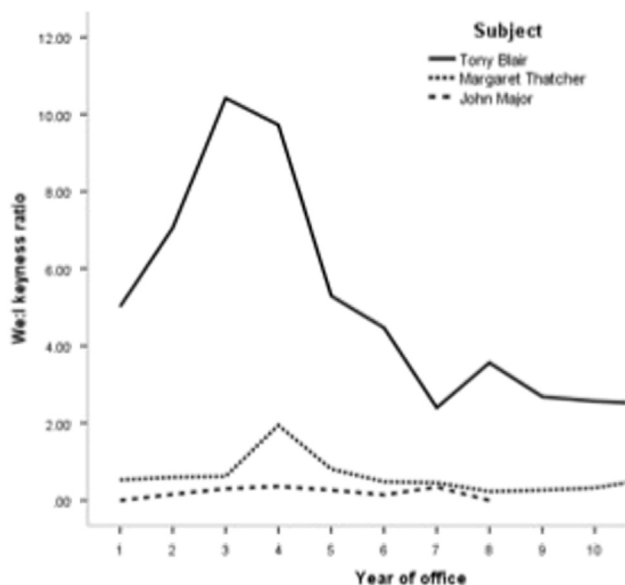


Fig. 5 – Changes in the keyness ratio of ‘we’ to ‘I’ by year of office in the three subjects: Tony Blair’s markedly higher rate of ‘we’ usage, compared to ‘I’, over the entire duration of his term of office, is the most striking finding, but a number of additional features are worth noting: First, the early peak in Blair’s speeches corresponds temporally to point B in Fig. 4, and may have a similar origin. Secondly, the smaller peak in Margaret Thatcher’s values coincides with the year of her re-election and the aftermath of the Falkland’s War. And finally, John Major’s speeches show consistently the lowest level of ‘we’ usage throughout his time in office.

Both Thatcher and Blair were decreasingly likely to refer to their 'duties' the longer they stayed in office.

Naturally, interpretation of the outcomes of multiple statistical tests based on such a large quantity of data should be tentative, even when values are corrected (as here) for multiple comparisons. We would argue, however, that the clear associations of other frequency correlates with political and social change provided collateral support for the reality of the HS related findings. Indeed, a similar set of phenomena were illustrated in an analysis of word and phrase frequencies across a much larger digitised corpus (5 million books published between 1800 and 2000): Michel et al. (2011) plotted the points and rates of entry into written language of new concepts (such as inventions and scientific discoveries) and the rates at which ideas and celebrities fade from collective consciousness. An illustration of how changes in a smaller and more restricted language corpus can also reflect similar 'culturnomic' changes is displayed in Fig. 6, which plots a steady decline in the relative frequency of the phrase 'honourable gentleman' over a period that saw an unprecedented increase in the number of female Members of Parliament following Blair's first election victory.

Finally, we considered the frequencies of individual words in the three subjects' discourse relative to their frequencies in a reference sample (for which we used the questions, replies and contributions made during PMQ by all other speakers in the debates). The shared context, and the speakers' common profession, made this a particularly suitable comparison. Moreover, the availability of discrete time-windows within which relative frequency ('keyness') was calculated made it possible to compare periods either side of the year in which HS had been independently judged first to appear. Using this method we identified a number of candidates for linguistic markers of HS: although the lists for Blair and Thatcher showed little overlap, the first person singular pronoun appeared in both, and the ratio of first person plural to first person singular pronouns increased markedly in Blair's discourse after HS was said to have become first apparent.

Although Thatcher's use of 'we' relative to 'I' remained stable over her period of office, and well below the rates associated with Blair, it was always consistently higher than the ratios in Major's discourse. The contrast between individuals, and (in Blair's case) the temporal trend, would be consistent with the association (Pennebaker, Mehl, & Niederhoffer, 2003) between an individual's status within a hierarchy and greater use of the first person plural pronoun. The difference may be alternatively explained by the notion that Blair showed less respect for the House of Commons than Thatcher and Major, perhaps in part because he had not benefited from a ministerial 'apprenticeship' before becoming Prime Minister. In this regard it would be useful to study the parliamentary language of David Cameron, whose path to office was similar to that of Blair. It would also be useful to carry out similar analyses on speeches delivered to Party conferences, from which any inhibitory effect of addressing the legislative body would have been absent. The keyness metric also lends itself to other contrasts of potential interest, such as comparisons across time-intervals shorter than a year, and the use of each PM's pre-HS discourse as a reference vocabulary for the identification of the relevant keywords in the post-HS sample; assignment of an arbitrary set of cut-points for J.M.'s discourse would allow the reliability of this approach to HS language to be examined.

Although the large volumes of language data available for analysis and the relative spontaneity of the discourse samples produced were a major strength of the study, the ability to parse samples so as to dissect out usages of interest in more detail according to context would have provided greater specificity. This is particularly true of the putative HS marker 'we', for which Pennebaker (2012) has identified five separate senses, including the 'we-as-I we' (of which the 'royal we' is a special case). Other senses are equally imperious: the 'we-as-you we' is used to issue instructions and commands, and the 'every-like-minded-person-on-earth we' which identifies the speaker's interests or opinions with those of a wider public (cf. symptom 5 of HS). Also of potential interest to future studies

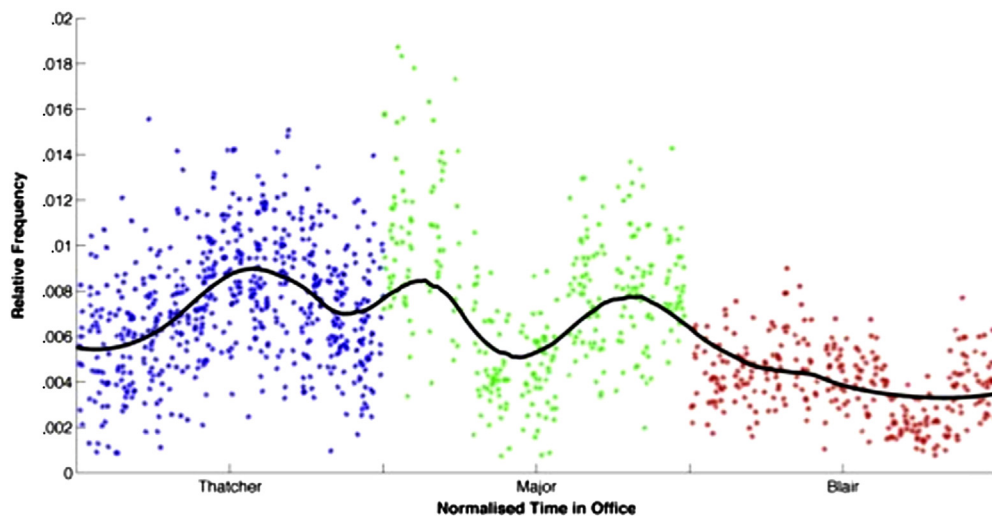


Fig. 6 – The rise and fall of 'honourable gentleman': This bigram is the male-specific manner of referring to other members of the House of Commons, and has been falling consistently since Tony Blair first came to office, reflecting the larger numbers of female MPs among the 1997 intake, and the increasing use of gender-neutral terms such as 'Honourable member'.

will be the contexts (linguistic and political/historical) within which temporally correlating words and phrases occur.

The complexity analyses were disappointingly unrevealing, yet we believe that the potential importance of these measures should not be disregarded, for a number of reasons: First, when the values were plotted against a time variable, sustained trends were evident in the values obtained from the two subjects with HS, which seemed consistent with the time course of the condition in each. Secondly, the complexity inherent in the original spoken message might have been diluted during the process of transcription for Hansard, which would tend to remove more unpredictable elements such as clumsy grammar and syntax. An examination of complexity metrics in transcripts of parliamentary debate or broadcast interviews that have been prepared for the purpose of analysis (and therefore not subject to the transcriptional modifications created by Hansard) would therefore be worthwhile. The third reason not to abandon complexity is the availability of alternative, word- rather than letter-based methods of quantifying it that may be more appropriate to heard speech than a measure based on the information content of sequentially revealed letters in a written script (Zanette, 2012). Coherence measures derived from latent semantic analysis (Landauer & Dumais, 1997) may also prove helpful in this regard. The final and most important reason for persisting in identifying informative measures of complexity is its potential for providing objective data in real time, and thus timely alerts of the onset of HS, not only in the political sphere, but also in business, finance, and public service (Brennan & Conroy, 2013; Coates & Herbert, 2008; Parman, 2012; Robertson, 2013), where the effects of HS on the judgement of those invested with relatively unfettered power have been equally devastating. Transcripts of the language used by CEOs at shareholders' meetings held in the years leading up to the recent financial crisis would be one potential source of such data.

A final aim must be to isolate the neural and/or physiological basis for HS, an objective that will be greatly assisted by the identification of reliable and measurable markers of the condition. Structural and functional magnetic resonance (MR) imaging studies involving groups of individuals affected by or at risk of HS could provide important insights into its neural basis. Coates and Herbert (2008) recently described a cycle of neuroendocrine changes associated with phases of successful and unsuccessful risk-taking by financial traders. Corresponding cyclical trends in linguistic features such as those described in this paper would be a powerful test of their status as robust biological markers of psychological status.

Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.cortex.2013.08.014>.

REFERENCES

- Acton, J. (1887). Letter to Bishop Mandell Creighton. In J. N. Figgis, & R. V. Laurence (Eds.), *Historical essays and studies*. Macmillan.
- Ahmed, S., de Jager, C. A., Haigh, A. M. F., & Garrard, P. (2012). Logopenic aphasia in Alzheimer's disease: clinical variant or clinical feature? *Journal of Neurology, Neurosurgery and Psychiatry*, 83, 1056–1062.
- Ahmed, S., de Jager, C. A., Haigh, A. M., & Garrard, P. (2013). Semantic processing in connected speech at a uniformly early stage of autopsy-confirmed Alzheimer's disease. *Neuropsychology*, 27, 79–85.
- Blair, T. A. (2010). *Journey*. London: Hutchinson.
- Brennan, N. M., & Conroy, J. P. (2013). Executive hubris: the case of a bank CEO. *Accounting, Auditing & Accountability Journal*, 26, 172–195.
- Burchfield, R. W. (1998). *Fowler's Modern English Usage* (3rd ed.). Oxford University Press.
- Coates, J. M., & Herbert, J. (2008). Endogenous steroids and financial risk taking on a London, trading floor. *Proceedings of the National Academy of Sciences of the United States of America*, 105, 6167–6172.
- Cooper, J. (2001). Diagnostic and statistical manual of mental disorders (4th edn., text revision) (DSM-IV-TR). *British Journal of Psychiatry*, 179, p. 85.
- Elvevåg, B., Foltz, P. W., Weinberger, D. R., & Goldberg, T. E. (2007). Quantifying incoherence in speech: an automated methodology and novel application to schizophrenia. *Schizophrenia Research*, 93, 304–316.
- Garnett, M., & Aitken, I. (2003). *Splendid! Splendid! The authorised biography of Willie Whitelaw*. London: Cape.
- Garrard, P. (2009). Cognitive archaeology: uses, methods, and results. *Journal of Neurolinguistics*, 22, 250–265.
- Garrard, P. (2010). Literature, history and biology. *The Psychologist*, 23, 262–263.
- Garrard, P., Haigh, A. M., & De Jager, C. A. (2011). Techniques for transcribers: assessing and improving consistency in transcripts of spoken language. *Literary and Linguistic Computing*, 26, 389–405.
- Garrard, P., Maloney, L. M., Hodges, J. R., & Patterson, K. (2005). The effects of very early Alzheimer's disease on the characteristics of writing by a renowned author. *Brain*, 128, 250–260.
- Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: the latent semantic analysis theory of acquisition, induction, and representation of knowledge. *Psychological Review*, 104, 211–240.
- Lawson, N. (1992). *The view from no. 11: Memoirs of a Tory radical*. London: Bantam Press.
- Michel, J. B., Shen, Y. K., Aiden, A. P., Veres, A., Gray, M. K., Pickett, J. P., et al. (2011). Quantitative analysis of culture using millions of digitized books. *Science*, 331, 176–182.
- Owen, D. (1987). *Personally speaking to Kenneth Harris*. London: Weidenfeld and Nicholson.
- Owen, D. (2006). Hubris and nemesis in heads of government. *Journal of the Royal Society of Medicine*, 99, 548–551. discussion 552–553.
- Owen, D. (2008). Hubris syndrome. *Clinical Medicine*, 8, 428–432.
- Owen, D., & Davidson, J. (2009). Hubris syndrome: an acquired personality disorder? A study of US Presidents and UK Prime Ministers over the last 100 years. *Brain*, 132, 1396–1406.
- Parman, R. (2012). *Hubris: How HBOS wrecked the best bank in Britain*. Edinburgh: Birlinn Limited.
- Pennebaker, J. W. (2012). *The secret life of pronouns: What our words say about us*. New York: Bloomsbury Press.
- Pennebaker, J. W., Mehl, M. R., & Niederhoffer, K. G. (2003). Psychological aspects of natural language use: our words, our selves. *Annual Review of Psychology*, 54, 547–577.
- Pentland, A. (2008). *Honest signals*. London: MIT Press.
- Peters, T., & Garrard, P. (2013). Computer-based diagnosis of illness in historical persons. *Journal of the Royal College of Physicians of Edinburgh*, 43, 161–168.
- Robertson, I. (2013). How power affects the brain. *The Psychologist*, 26, 186–189.

- Russell, B. A. (1961). *History of Western philosophy*. London: George Allen & Unwin.
- Scott, M. (1996). *WordSmith tools*. Oxford University Press.
- Scott, M., & Bondi, M. (Eds.). (2010). *Keyness in texts*. Amsterdam: John Benjamins.
- Shannon, C. E. (1951, Jan). Prediction and entropy of printed English. *Bell System Technical Journal*, 50–64.
- Todd, R. K. (2001). Realism disavowed? Discourses of memory and high incarnations in Jackson's Dilemma. *Moder Fiction Studies*, 47, 674–695.
- Williams, K., Holmes, F., Kemper, S., & Marquis, J. (2003). Written language clues to cognitive changes of aging: an analysis of the letters of King James VI/I. *Journals of Gerontology Series B – Psychological Sciences and Social Sciences*, 58, P42–P44.
- Wilson, S. M., Henry, M. L., Besbris, M., Ogar, J. M., Dronkers, N. F., Jarrold, W., et al. (2010). Connected speech production in three variants of primary progressive aphasia. *Brain*, 133, 2069–2088.
- Young, H. (1989). *One of us*. London: Macmillan.
- Zanette, D. H. (2012). *Statistical patterns in written language*. creativecommons.org/licenses/by-nc-nd/3.0.