

## Reflections on Psycholinguistic Theories

### *Raiding the Inarticulate*

In a work that is part memoir, part monograph, Nigel Duffield offers a set of lyrical reflections on theories of psycholinguistics, which is concerned with how speakers use the languages they control, as well as with how such control is acquired in the first place. Written for professionals and enthusiastic amateurs alike, this book offers a 'well-tempered' examination of the conceptual and empirical foundations of the field.

In developing his ideas, the author draws on thirty years of direct professional experience of psycholinguistic theory and practice, across various sub-disciplines (including theoretical linguistics, cognitive psychology, philosophy and philology). The author's personal experience as a language learner, and as the father of three bilingual children, also plays a crucial role in shaping the discussion. Using examples from popular literature, song, poetry and comedy, the work examines many of the foundational questions that divide researchers from different intellectual traditions: these include the nature of 'linguistic competence', the arbitrariness of language and the theoretical implications of variation between speakers and across languages.

Born and raised in Belfast, Northern Ireland, Nigel Duffield received his university education in language and linguistics in England (Cambridge and London) and the USA (Los Angeles). A professor of English and Linguistics at Konan University (Kobe, Japan) since 2012, he has held previous positions in Germany, Canada, The Netherlands and England. His unique perspective on psycholinguistics is informed by his interactions with psycholinguists over a wide theoretical spectrum, and, especially, by his observations of the language development in his children, the youngest of whom was born with Down's Syndrome.

# Reflections on Psycholinguistic Theories

## Raiding the Inarticulate

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*So here I am, in the middle way, having had twenty years –  
Twenty years largely wasted, the years of l'entre deux guerres –  
Trying to learn to use words, and every attempt  
Is a wholly new start, and a different kind of failure  
Because one has only learnt to get the better of words  
For the thing one no longer has to say, or the way in which  
One is no longer disposed to say it. And so each venture  
Is a new beginning, a raid on the inarticulate,  
With shabby equipment always deteriorating  
In the general mess of imprecision of feeling,  
Undisciplined squads of emotion.*

T. S. Eliot, 'East Coker' (*Four Quartets*, 1943)

*There seem to be only two kinds of people: those who think that metaphors  
are facts, and those who know that they are not facts. Those who know they  
are not facts are what we call 'atheists', and those who think they are facts  
are 'religious'. Which group really gets the message?*

Joseph Campbell, *Thou Art That: Transforming Religious Metaphor* (2013)

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## Introduction

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In 2011, I was commissioned by a different publisher to produce an undergraduate introduction to psycholinguistics. The brief was to write a textbook that would cover the two main sub-fields of the discipline: EXPERIMENTAL PSYCHOLINGUISTICS – also known as language processing – which is concerned with how speakers understand and produce the languages they control, and DEVELOPMENTAL PSYCHOLINGUISTICS (language acquisition), which focuses on how such control is acquired in the first place. Although there are a number of excellent books available on one or other of these topics – Warren (2013), for example, provides a competent introduction to language processing, while Saxton (2010) offers a balanced and engaging discussion of many aspects of first language acquisition – there is currently no book that does dual service, so the commissioned title would have filled an awkward gap in the textbook market.

The gap remains, however, for this is not that book. It is not a conventional introduction to the field, inasmuch as it critically examines foundational issues in psycholinguistics, and sketches some (partially original) solutions to larger theoretical questions. Nor is it, especially, a survey of psycholinguistic research: I only discuss a handful of the hundreds of experimental studies that are relevant to the issues outlined here, postponing substantive discussion of experimental data to another volume.<sup>1</sup> It's probably not an undergraduate textbook either: whilst I hope that linguistics students will enjoy reading it, the book is unlikely to be assigned as a course text, since it's light on tested facts – an essential commodity of most undergraduate courses – and there are no graded exercises.

Even before the manuscript was halfway complete, it was clear to me (and to the original publisher) that this ugly duckling of a text was not going to walk or talk like a duck. Belatedly cut loose from my original contract, I was able to write unhampered by the need to provide an objective or comprehensive survey of contemporary psycholinguistics. What has emerged instead is a set of personal reflections on psycholinguistic theories; more generally, on the relationship between languages and the speakers who know and use them.

Several people have asked who this book is written for. The answer is simple: I wrote it for myself, in the first instance, to help me to make some sense of the theoretical issues and professional controversies that have engaged my attention for more than twenty years (*twenty years largely wasted*). To raid the inarticulate. As a reviewer of an earlier draft manuscript pointed out, everyone has their own way of making sense of their personal and professional lives: my way – like the protagonist in Nick Hornby’s 1995 novel *High Fidelity* – is through popular music, also poetry, literature and verbal comedy. This book is an attempt to examine the foundations of psycholinguistics by these means.

So I didn’t write it with a particular academic audience in mind. Still, I hope it will be of interest to anyone, from the lay reader to the less ideological of my professional friends and colleagues, who shares my passion for languages and love of literature, and who has some appreciation of irony.

Admittedly, some sections will be tough going for the former group. The book might be non-technical and is relatively free of jargon, but it is not ‘dumbed down’; on the contrary, this is as intelligent a work as I am capable of writing. It would have been far easier to write a more difficult book. Conversely, the experts who read this will need to approach the arguments presented here in the same ecumenical spirit that I have tried to embrace, in setting them down. There are more inconsistencies and loose ends than would normally be permitted in a more conventional academic monograph: that, I suppose, is the fair price of being interesting. In the final analysis, this is a diversion, not a manifesto.

I am extremely grateful to Helen Barton, my commissioning editor at Cambridge University Press, and to the manuscript reviewers, for sharing my confidence in the feasibility of such an unlikely project. Scores of other people have helped me to bring the work this far: their contributions are acknowledged at the end of the book. See Acknowledgments, credits and permissions.

To set matters in context, I can do no better than to quote from one of the pre-eminent linguists of the modern period, Hermann Paul. In 1886, Paul published the second edition of his seminal work *Principien der Sprachgeschichte*. In the Preface (*Vorwort*), he wrote:

*Auch diese zweite auflage wird vor den augen mancher fachgenossen nicht mehr gnade finden als die erste. Die einen werden sie zu allgemein, die anderen zu elementar finden. Manche werden etwas geistreicheres wünschen. Ich erkläre ein für allemal, dass ich nur für diejenigen schreibe, die mit mir der überzeugung sind, dass die wissenschaft nicht vorwärts gebracht wird durch complicierte hypothesen, mögen sie mit noch so viel geist und scharfsinn ausgeklügelt sein, sondern durch einfache grundgedanken, die an sich evident sind, die aber erst fruchtbar werden, wenn sie zu klarem bewusstsein gebracht und mit strenger consequenz durchgeführt werden.<sup>2</sup>*

*This second edition will find no more favour in the eyes of many professional colleagues than did the first. Some will find it too general, others too elementary. Some will wish for something more intellectually rigorous. I declare once and for all that I only write for those who share my conviction: that science is not advanced by complicated hypotheses – no matter the intellect or incisiveness of the minds that produced them – but rather by simple basic ideas, which are rather trivial in themselves, but which yield insight once they are clearly articulated, and consistently followed through [original: mit strenger consequenz].*

Hermann Paul, *Principien der Sprachgeschichte* (1880: ix)

[M]it strenger consequenz. Not being German, I might have some issues with *streng[e] Konsequenz*, but otherwise, Paul's remarks just about cover it, 130 years on. This book is written for serious amateurs – in the etymologically faithful sense of the word – and for light-hearted professionals like myself, not for ideologues or theoretical purists. To those, like Leon Jaworski, that 'would rather have a competent extremist than an incompetent moderate', I'd point out that there are other logical possibilities, that sometimes one learns more by sitting on the fence than sniping over it.<sup>3</sup>

No-one likes to lose friends, however. In addition to Paul's predictions, I well foresee that some colleagues will interpret this book as an attack on Chomskyan linguistics; hence – given that I have been a card-carrying generativist for more than 25 years – as some kind of betrayal. If it is so construed, then I will have failed in one of my goals in Part I, namely, to articulate the difference between a 'Level 1 theory' of grammar on the one hand, and a viable theory of psycholinguistics, one that appropriately captures the rich imperfections of our knowledge of languages, on the other. Any regard that I may have as a theoretician for the austere simplicity of Minimalist theory is more than offset by my deep suspicion and antipathy – as a parent, as a human being, as a sentient organism – towards something as unnatural and biologically implausible as invariant perfection. We are, at every level of our being, from the genetic to the metaphysical, confused and contradictory, full of redundancies in some areas, gross inadequacies in others; we are shaped by our material circumstances, by our interactions with others, by our deficiencies.

*There's a divinity that shapes our ends  
 Rough-hew them how we will.*

William Shakespeare, *Hamlet* (5.2.10–11)

Throughout the history of philosophy and religion – those 'B-class cell-mates' of the Library of Congress Classification (LCC) – people have found different ways of interpreting these famous lines from *Hamlet*. To the more religious or spiritual, divinity means just that: a divine spirit. To some atheists, especially those unduly impressed by biological determinism, what 'shapes our ends'

more than the vagaries of experience is the genetics of our ‘initial state’: UG, as Chomskyans would have it. But divinity can just as profitably be understood in terms of our personal histories, the incremental sum of our prior interactions. It could even be claimed that it is the apprehension of these histories – more than general consciousness or the faculty of language – which distinguishes us from other animals. Whether or not that is the case, I am convinced that all of this rich imperfection is reflected in our knowledge and use of languages, and that an appropriate theory of psycholinguistics is one that embraces a significant chunk of that flawed estate. Echoing Hermann Paul, I write for those who share this conviction.

For what it is worth, even though I ultimately reject UG as an explanatory concept in language acquisition, and am sceptical of its relevance to theories of language processing, I subscribe to a considerably stronger and more substantive form of Universal Grammar than most current Chomskyans would be comfortable with. My theoretical research on the grammar of Modern Irish (latterly, on the syntax of Vietnamese) leads me to endorse Chomsky’s early claim that:

*[A]ll languages are cut to the same pattern.*

Noam Chomsky, *Aspects of the Theory of Syntax* (1965: 30)

Or, as the thirteenth-century English philosopher Roger Bacon (1214–1294) had it:

*Grammatica una et eadem est secundum substantiam in omnibus linguis, licet accidentaliter varietur.*

*Grammar is in its essence one and the same in all languages, even though it differs in superficial features.*<sup>4</sup>

Roger Bacon, *Grammatica Graeca* ‘Greek Grammar’

What we disagree on is the evidential base. My theoretical hunch about a version of the UNIVERSAL BASE HYPOTHESIS, broadly construed,<sup>5</sup> stems from a comparison of the surface properties of genetically and areally unrelated languages – properties that Chomsky once designated part of E-LANGUAGE when he still appeared interested enough in *languages*, in the popular understanding of the term, to dismiss them as objects of study. My intuition does not arise from any consideration of ‘the child’ as an idealised object, of ‘discrete infinity’, or of ‘virtual conceptual necessity’. And since this book is about the fragments of languages in our minds, and not about generativist typology, I’ll have very little to say here about the substance of any kind of Universal Grammar, abbreviated or otherwise.

I am also keenly aware of the fact that many of Chomsky's students and colleagues – some of whom I count as friends – have devoted their research careers to exploring grammatical variation within particular language families and across an extraordinarily diverse range of languages, and that the discoveries they have made in the course of these explorations have been inspired, facilitated and guided by some version of generative theory. From at least the 1980s onwards, the constant flow of MIT dissertations offering detailed analyses of the grammatical properties of almost every language family on earth gives the lie to the idea that generativist linguists (as a group) do not care about grammatical variation. However, virtually none of that work crucially depends on the deeper metatheoretical assumptions concerning innateness and the mental representation of grammar(s) that are the subject of this book, any more than the proper characterisation of String Theory depends on infants' understanding of gravity or object permanence. See Chapters 2 and 3 below.

The important thing, in science as in the law, is to respect the evidence at hand. It's no better to acquit an innocent defendant on the basis of a false alibi than it is to convict a guilty one on tainted testimony. So, even if it turned out that languages as diverse as French and Mohawk and Navajo were cut from the same grammatical cloth – see Mark Baker's excellent *Atoms of Language* (2001) for some compelling arguments in support of this idea, also Jonathan Bobaljik's *Universals of Comparative Morphology* (2012) – this wouldn't rescue UG from the charge of irrelevance when it comes to human psychology. In short, this book is not against Chomsky or Chomskyan theory, supposing it were rational to be against a theory, any more than a handbook on mediaeval architecture is against a theory of quantum mechanics. It is *for* something else.

Of course, there will also be those on the other side of the fence (and there are so many fences in linguistics) who may give this book a warmer reception, while protesting 'This is what we've been saying for years.' If your name is Joan Bybee, Peter Culicover, Hilary Putnam,<sup>†</sup> Stephen Levinson or Brian MacWhinney – to name only a few, on the other side of some fence or other – your complaint may be especially well-founded.<sup>6</sup> To those critics, my response must be that you haven't said it loudly, clearly or entertainingly enough, or with enough empirical evidence, for most generativists to pay attention. They're not a charitable bunch, on the whole, generative linguists: some of them are downright mean. In most cases, the problem lies with the fact that you haven't used their discourse or engaged with their data. With the exception of the discussions in I is for Internalism and O is for Object of Study below – which will probably be no more congenial to mainstream psychologists than to Chomskians – I don't pretend to offer any original thesis in this book.<sup>7</sup> What *is* fairly unusual about the approach taken here is its critical engagement with the kinds of grammatical phenomena that generativists care about: co-reference relations, VP-ellipsis, constraints on *wh*-movement, *that*-trace

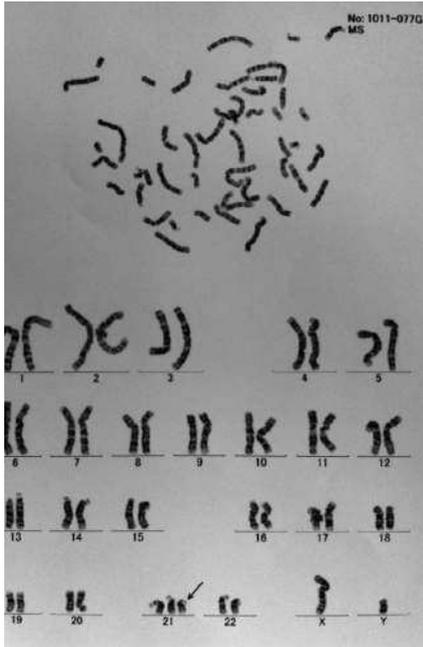


Figure 1 Austin's karyogram.

effects, discontinuous agreement, recursivity and the like. Twenty-something years of teaching generative syntax has given me a better appreciation of the empirical pressure points of grammatical argumentation than is enjoyed by many of Chomsky's opponents, and in this book, I aim to test them all – the pressure points, that is.

Before we begin properly, I need to mention the person who has taught me more about language and linguistics than I have learned in half a lifetime of research and teaching, through his *inarticulate speech of the heart*. I am not referring to my countryman Van Morrison (though several of his songs feature in this book), but to my youngest child, Austin,<sup>8</sup> born on 1 November 2010.

The circumstances leading up to Austin's birth were unremarkable – at least to me, as the father of two boys already – yet the events that immediately followed his arrival, from the initial reaction of the obstetrician through the downward glances of the nursing staff, intimated that Austin was not a typical baby. Although it was ten days before we received official scientific confirmation (in the form of the karyogram in Figure 1), we knew by the next morning that our third son *had* – or, as we have now learned to say, *was a child with* – Down's Syndrome (US Down Syndrome). A different book could be written

about how our feelings changed in the first year: from shock, to acceptance, to something much more complex and altogether more joyful. That is not relevant here, other than to say that I will never again begin a lecture or a research paper on language acquisition with the dismissive words: ‘Barring pathology, all children ...’

What is much more significant is that, six years on, Austin has grown into a more beautiful, healthy, communicative and unusually empathetic child than I ever could have wished for, who knows where he is, who his friends are, what he likes, what he did last week, what he wants to do tomorrow. A child with excellent metalinguistic skills, who says <adyu, ada> <‘<than>k you, dad’> in English and <tou, mama> <<ありが>とう、ママ> <‘thanks, mum’> in Japanese, who bows appropriately or offers his hand when he meets someone for the first time, and who just laughs at me whenever I say anything in his mother’s language. My Japanese pronunciation is not so terrible – I can get by with most adults and other children of his age – but to him, it is a source of derision mingled with mild irritation.

Yet Austin *is* different from other typically developing six-year-olds in several ways, and the most striking contrasts are observable in his spoken language.

*After six years of continuous language input and rich interaction, in spite of demonstrating a clear willingness to communicate, and excellent use of compensatory paralinguistic gestures, his comprehension of Japanese hardly extends beyond contexts where the utterance-meaning is obvious from the context. As for his production, this is mostly limited to proper names, a few highly frequent concrete nouns, some deictic terms, and a moderately large set of unanalysed greetings and formulaic phrases (<こんにちは、ごちそうさまでした、すみません、。 。 >) ... Very few utterances contain more than two or three morphemes. His production lags well behind that of a typical four-year-old Japanese child.*

That’s me, sadly. Given that I’m a fifty-something late learner of Japanese, it’s perhaps unsurprising that my control of the language is so poor. It may be frustrating to my colleagues and is certainly personally disappointing, but it’s hardly unusual. In Austin’s case, on the other hand, Japanese and English are his two first languages, and his production abilities in either language (at the time of writing) are little better than is implied by the same description. This makes him special when compared to almost all children of his age, irrespective of ethnicity, gender or social experience.

It’s unclear whether Austin will eventually come to understand and produce English or Japanese as his older brothers do, whether he will ever be able to express his needs and desires, aspirations and regrets – always supposing that regrets, and the counterfactual thoughts they imply, are possible without complex syntax: see F is for Functions of Language below. The range of outcomes for adults with Down’s Syndrome is much wider than for typical children from

similar backgrounds: a few will graduate from university, a few may become film and television actors, some will manage their own businesses. And some will remain as dependent and socially inept as typical five-year-olds, requiring constant supervision and support throughout their lives. Most, like the rest of us, fall somewhere in between: in many cases, towards the lower end of the general population in terms of lifetime income, towards the upper end in openness, empathy and likeability.

Austin's medical prognosis is equally uncertain: even though life expectancy for people with Down's Syndrome has improved dramatically over the last forty years,<sup>9</sup> the condition still brings with it markedly higher health risks than for typical children and adults, including – for those who make it to their forties or fifties – a significantly higher risk of early onset dementia.

Given all these imponderables, it's hard to be certain of much. What I am reasonably sure of, however, is who I should talk to to gain a better understanding of what's going on in Austin's mind, of how he represents and processes his fragments of Japanese and English, of how linguistically able he may be in five or ten years' time. First and foremost, I should talk to him: if I can learn to ask the right questions – and ask the questions right – I am certain that no-one can tell me more. After that, I should talk to other children in his class, then to his nursery teachers, then to specialist paediatricians. Then perhaps to other parents of children with Down's Syndrome, since – though children like Austin do not all show the same personality or behavioural traits – they are 'similar enough in their difference' that I can learn from their experience.

The only specialist it would be wholly pointless to talk to is the geneticist who analysed Austin's karyotype. There are no answers to be found there. I might as well consult an astrologer, or read tea leaves, as attempt to divine grammatical knowledge or specific cognitive abilities from a chromosomal pattern. For while it is incontrovertible that the ultimate cause of Austin's language difficulty lies in his genetic makeup – the chromosomal evidence is there towards the bottom of Figure 1, quite literally in black and white – it would be asinine to assume that this ultimate cause plays any significant role in understanding his language development, or indeed of any other aspect of his psychology.

Genetics is at once crucial and irrelevant in this case – the more so than with other acquired disorders – since what makes children with Down's Syndrome biologically distinct does not lie in the genes themselves, but in their disposition: as far as is known, it is that extra twenty-first chromosome (trisomy) that *makes all the difference in the world*, not a deletion or translocation of genetic material. Furthermore, even if a particular set of genes were somehow implicated in language acquisition, this wouldn't make genetics a relevant source of explanation of what we know about how languages are acquired and processed. *Pace* Chomsky, there is no reason to suppose that the genetic writ

runs far beyond physiology – indeed, it only rarely extends that far. Even where phenotypical traits are relatively pure reflections of the genome, unaffected by environmental factors – as is the case, for example, for eye colour – these traits are invariably the result of polygenic interactions: see N is for Nativism below. And grammatical knowledge, on almost everyone’s account, is massively affected by time and experience, especially experience of language (speech, text, discourse) itself. It makes as much sense to try to understand human language processing without considering human languages, in the ordinary sense of the word, as to explain social relationships without considering other people, or architecture without considering physical buildings and their physical and historical contexts ...

... But I’m getting ahead of myself. Suffice it to say that before Austin came along, this book would have been a much more straightforward, dispassionate undertaking. It would certainly be much less worthwhile.

To understand what a child knows, or how someone acquires and processes their language(s), it can’t hurt to listen to what they actually say and do. Linguistic behaviour – whether it is spontaneous or elicited – may not be a perfect clue to underlying knowledge and process, but it’s the best clue available. While theories are no doubt crucial, it is my belief that, without a constant eye on behaviour, they tend to distort more than they disclose.

If that conclusion makes me a Wicked Empiricist – and it is a truism for most generativists that Empiricists, like Behaviourists, are essentially wicked – so be it. But, as Leonard Cohen said in a different context: *That Don’t Make It Junk*.

### Scope

The book is concerned with philosophical and empirical questions at the heart of what might be called ‘classical psycholinguistics’. As implied in the opening paragraph, the field comprises two historically separate areas of enquiry: EXPERIMENTAL PSYCHOLINGUISTICS, which has mainly been concerned with theories and models of adult language processing, and DEVELOPMENTAL PSYCHOLINGUISTICS, where researchers’ primary focus has been on how children come to know and use their first language(s). Previously, the boundary between these two areas was clearly demarcated by differences in the technologies applicable to each, and their associated modes of analysis. Early experimental psycholinguistics was invariably laboratory-based, employing technologies – and research assistants – that could not readily be used with young children: too many heavy monitors, too few social skills. Early developmental psycholinguistics, by contrast, tended to be based on longitudinal observations of children’s language development, archetypally in the form of diary studies of researchers’ children.<sup>10</sup> Within current psycholinguistics, the distinction is much less robust than it once was: technological advances have

allowed most experimental methodologies to be adapted for much younger participants; at the same time, researchers have become more skilled at devising age-appropriate experimental paradigms (see, for example, McDaniel, McKee and Cairns 1996); they have also begun to investigate acquisition and language processing in adult second language learners and other groups of multilingual speakers (see, for example, Juffs and Rodríguez 2015) as well as the abilities of atypical language users.

More recently however, some psycholinguists have moved beyond these established behavioural paradigms to embrace more neuro-physiological measures of brain activity that are associated with language processing: the use of ERP and fMRI measures, for instance; see Morgan-Short and Tanner (2014) and Newman (2014) (same volume) for useful overviews of these techniques. Although I will occasionally refer directly to some key studies in neurophysiology – work by Michael Ullman, Angela Friederici and David Poeppel, for example – I will generally limit attention to more traditional kinds of behavioural data.

One practical reason for this restriction is precisely that most classical psycholinguistics is not ‘rocket science’:<sup>11</sup> standard behavioural tasks can be carried out by anyone equipped with a personal computer, a reasonable degree of motivation, ethics clearance and some basic instruction in experimental design. Neuroscience, by contrast, makes literal rocket science look like a facile exercise in trial-and-error ballistics; its experimental paradigms are correspondingly complex and intricate.<sup>12</sup> Neurolinguistic experiments currently require extremely expensive equipment and laboratory time, trained and skilled technicians to run the experiments and analyse the raw data, and – not infrequently – fairly elaborate ethics procedures. It is also much harder to recruit participants for neurolinguistic studies without access to a pre-registered pool of volunteers; only very fortunate, well-placed students able to run their own neurolinguistic experiment. For all of these reasons, and thanks in large part to advances in software development, classical psycholinguistics wins hands down over neurolinguistic research in any cost–benefit analysis of the best way to spend research time.

However, even if all the necessary technical and human resources were freely available, I remain to be convinced that it would be worthwhile carrying out neurolinguistic experiments, given our current ignorance of the applicable ‘bridging theories’ to connect neurolinguistic results to psycholinguistic theories. This concern echoes remarks by the cognitive scientist Gary Marcus, in a 2014 *New York Times* opinion piece:

*What we are really looking for is a bridge, some way of connecting two separate scientific languages – those of neuroscience and psychology. Such bridges don’t come easily or often, maybe once in a generation, but when they do arrive, they can change everything. An example is the discovery of DNA ... Neuroscience awaits a similar*

*breakthrough. We know that there must be some lawful relation between assemblies of neurons and the elements of thought, but we are currently at a loss to describe those laws. We don't know, for example, whether our memories for individual words inhere in individual neurons or in sets of neurons, or in what way sets of neurons might underwrite our memories for words, if in fact they do.*

Gary Marcus, 'The trouble with brain science'  
 (*New York Times* opinion, 11 July 2014)

The problem of bridging theories is examined further in Part I below; see also Coltheart (2013).

### Other languages, other language learners

*I think it is broadening to the mind to study a language that is so altogether different from all past experiences in that line. Imagine a language that contains only three parts of speech, the noun, the verb, and the adjective, and in which any one word may be all three, so that if you hear a word that you happen to be familiar with as a noun, you cannot tell whether it is behaving like a noun on this particular occasion, or whether it is not doing the work of a verb or an adjective. I am beginning to understand a great many of the apparently stupid mistakes that my pupils make in English, as I see what an absolutely fluid thing their native tongue is.*

Alice M. Bacon, *A Japanese Interior* (1893: 125)

One distinctive feature of this book is a focus on data from language varieties other than (Standard) English.<sup>13</sup> The main purpose of presenting such examples is to draw attention to the ways in which alternative forms of construal and different patterns of phonological, lexical and grammatical organisation shape models of language processing, and force a reconsideration of overly narrow constraints on theories of language acquisition. If our native language appears to us to be the most intuitive, logical, reasonable and economical way of verbalising our thoughts – of moving from 'intention to articulation', as Levelt (1989) expresses it – that is only because it is precisely that: our own.

A discussion of one phenomenon, in the domain of speech segmentation, should suffice to illustrate this point. Take the nonce word <kaitch>. To a native speaker of Standard British or American English, it seems self-evident that the string of letters comprises three 'speech sounds' (phonemes) contained within one syllable [kɑɪtʃ]. By contrast, it is just as obvious to a native speaker of most varieties of Japanese<sup>14</sup> that the same string should be analysed as three (different) 'speech sounds': three MORAE [ka.i.tʃi], represented as カイチ in *katakana*, the syllabary used by literate Japanese speakers to represent most non-native Japanese words, including nonce words. Two radically different analyses, therefore: what counts intuitively as a discrete phonetic constituent in one language has no readily accessible correlate in the other. It is certainly possible for a Japanese listener to analyse a word like *tako* (たこ 'octopus') as

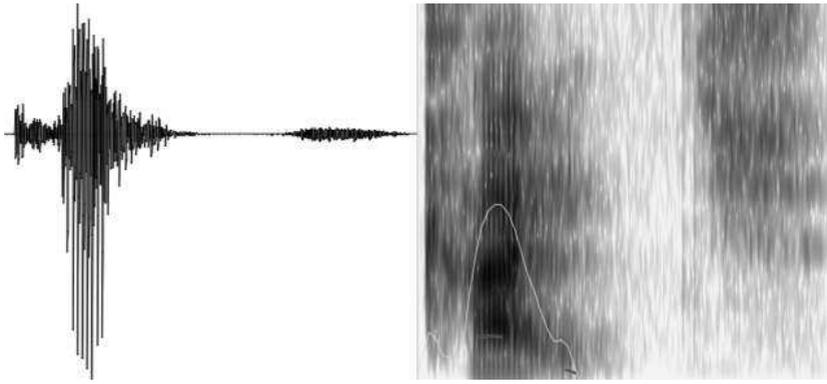


Figure 2 Two visual representations of <kaitch>.

containing four phonemes (*/t/-/a/-/k/-/o/*), but this is as unintuitive for him or her as it is for an English listener to treat the Japanese word *fukurō* ‘owl’ as containing four morae (*ふくろう*, */φu/-/ku/-/ro/-/u/*), as opposed to three syllables, which is the more natural English analysis. For more detailed technical discussion, see Otake et al. (1993), Cutler and Otake (1994).

As an aside, notice that [katʃ] is a possible pronunciation of a real word in some varieties of Northern Irish English; it is, at least, a near-homophone of the word <couch>, as in <sittin’ on the couch> (which means precisely what it does in many other varieties of English). See H is for Homogeneity below.<sup>15</sup>

The main point of presenting this non-word is to make clear that none of these analyses is ‘out there’, in the acoustic signal: Northern Irish, Southern British English and Japanese speakers each assign their own internal analyses to the same continuous acoustic–phonetic stimulus, visualised in Figure 2. Whatever corresponds to phonetic or phonological segments, or to timing units, like many of the more interesting concepts discussed in this book, pertains to a level of psychological – rather than external, acoustic – reality. Except, I will suggest, for language itself.

This internal property is not exclusive to linguistic analysis. Devlin (1998: 96) makes a similar observation regarding the calculus:

*[The] methods of the calculus say as much about ourselves as they do about the physical world to which they can be applied with such effect. The patterns of motion and change we capture using the calculus certainly correspond to the motion and change we observe in the world, but, as patterns of infinity, their existence is inside our minds. They are patterns we humans develop to help us comprehend our world.*<sup>16</sup>

Keith Devlin, *The Language of Mathematics: Making the Invisible Visible* (1998: 96)

The distinction between syllables and MORAE – the Japanese term is *haku* 拍 – is brought out particularly sharply when we consider the Japanese verse-form known as *haiku*. As a child, this verse-form was unknown to me; Wordsworth and Tennyson were *de rigueur* in school, with Hilaire Belloc or Ogden Nash thrown in for light relief. These days, however, it seems that every primary school class involves at least one annual stab at *haiku*, as though brevity was the guarantor of poetic accomplishment. (Or perhaps brevity is its own reward: it must be easier to mark third-grade attempts at 17-syllable completeness than to trundle through re-hashes of ‘The Charge of the Light Brigade’.)

The only problem with the assignment is that traditional Japanese *haiku* doesn’t involve seventeen syllables, as is commonly supposed, but instead calls for seventeen morae, arranged in a five-seven-five configuration. To appreciate the difference, have a look at the following two *haiku* – presented together with their transliterations and free English translations – and try to decide which best conforms to the classical metre:

ISSA: 江戸の雨何石呑んだ<sup>6</sup> 時鳥  
 Edo no ame/Nan goku nonda/Hototogisu  
 ‘Of Edo’s rain/How many gallons did you drink/Cuckoo?’

BASHŌ: 富士の風や扇にのせて江戸土産  
 Fuji no kaze ya/Ōgi ni nosete/Edo miyage  
 ‘The wind of Mt. Fuji/I’ve brought on my fan!/A gift from Edo.’

If you read the transliterations of these *haiku* as though they were English words, you might well have concluded that neither of these poems is very well behaved: the first poem apparently consists of only 15 syllables (5-5-5), whereas the second seems to contain the correct total number of syllables, but in the wrong configuration (6-6-5). In (Japanese) fact, the Issa poem conforms strictly to the traditional verse-scheme, whereas that by Bashō breaks the classical rule by containing an extra mora in the first line, but is otherwise complete. Most significantly, the second line of both poems contains exactly seven morae:  $na_1-n_2\ go_3-ku_4\ no_5-n_6-da_7$  and  $o_1-o_2-gi_3\ ni_4\ no_5-se_6-te_7$ , respectively. This ‘fact of analysis’ is as transparent to a native speaker of Japanese as end-rhyme is to a four-year-old English child.

This brief discussion of the syllable vs. mora distinction shows that by examining data from languages other than our own we discover that a lot of what seems to be reflexive cannot be innate: typically developing children may be born with the capacity to acquire and to process any language, but the particular systems of categorisation and analysis they end up regarding as intuitive arise through rich experience and extensive interaction with other language users, as well with discourse and text (ambient language).<sup>17</sup>

By recognising these cross-linguistic differences in representation and processing, we gain some greater insight into our own language. Goethe asserted that ‘Those who know nothing of foreign languages know nothing of their own’ – or better, *Wer fremde Sprachen nicht kennt, weiß nichts von seiner eigenen* (Goethe [1821] 1907). *Nichts* is doubtless an exaggeration, but the aphorism still holds an important truth.

Finally, it may have been noticed that the title of this section is ‘Other languages, other language learners’. The plural affix is significant: real children do not acquire ‘Language’, they acquire (varieties of) English, Irish, Hindi, Thai, Fijian, Malayalam, and so on. Nor do real speakers process ‘Language’; rather, they process varieties of these different languages. This subtle distinction implies a crucial shift of perspective from philosophical (Platonic) abstraction to empirical investigation. I’ll suggest that this shift is indispensable if we want to understand what is in the minds of language users. The reification of Language, as conventionally indicated by the capital letter, is anything but harmless – especially since there may be no such thing: *A grin without a cat*, as Alice once remarked.

### The songs, poems and sketches

*Just where it now lies I can no longer say  
 I found it on a cold and November day  
 In the roots of a sycamore tree where it had hid so long:  
 In a box made out of myrtle lay the bone of song.*

*The bone of song was a jawbone old and bruised  
 And worn out in the service of the muse.  
 And along its sides and teeth were written words  
 I ran my palm along them and I heard:*

*‘Lucky are you who finds me in the wilderness  
 I am the only unquiet ghost that does not seek rest ...’*

♪ Josh Ritter, *Bone of Song* (2003)

Many parts of this book – *my treasure[s], you [could] say* – have been written by other people: the lines set in italics were all originally composed or first incorporated by poets, authors, singer-songwriters, comedians and satirists, most of whom were active a generation or more ago. These extracts have been chosen to illustrate a particular linguistic point, or as musical or lyrical scene-setting to the different themes and topics discussed. A few are included simply to keep the reader entertained through especially difficult sections. *A spoonful of sugar*. Whatever the intended function of any particular example, they all serve to show that linguistic theories need not be viewed as something arcane or esoteric, that they are immediately relevant to the analysis of the

most affective forms of language use: popular music, poetry and comedy. Just as importantly, many of the quotations provide easily verifiable, independent evidence of the violability of grammatical rules: people who are sceptical of the value of linguists' constructed examples – *Colourless green ideas raced past the barn slept furiously*, and its/their ilk – may be more convinced by language that is actually used by real authors and artists.

Very little of the quoted material is likely to be found in any canonical survey of British, Irish or North American literature; indeed, some of it isn't even in English. With the obvious exceptions of Shakespeare, T. S. Eliot, Joyce and Flaubert, the majority of the other extracts are drawn from songs and comedy sketches of the last fifty years; in particular, from those that were popular in the UK in the 1970s and 1980s. The autobiographical basis of this selection will be obvious: most of us invest in our treasury of songs, writing, music and language as teenagers and young adults, and live off the dividends thereafter (though see Bonneville-Roussy, Rentfrow et al. 2013).<sup>18</sup> It is true that I cite a few younger singer-songwriters, including the marvellous Swedish singer Anna Ternheim, and most especially, the *génial* Josh Ritter, one of the most thoughtful and intelligent songwriters of his generation. For the most part, though, the songs, poems and sketches are more than thirty years old: my appreciation of popular music fossilised around 1990, and since then I have moved backwards rather than forwards – into the 1960s and 1950s – for inspiration. The advice to write about what you know seems just as valuable in academic as in creative writing, and the cited or quoted material is simply what comes most easily to mind.<sup>19</sup>

### A route-map

*Pour l'enfant, amoureux de cartes et d'estampes,  
 L'univers est égal à son vaste appétit.  
 Ah! que le monde est grand à la clarté des lampes!  
 Aux yeux du souvenir que le monde est petit!*

*To a child, enamoured of prints and maps  
 The universe has the size of his vast appetite.  
 How large the world seems by the light of a lamp!  
 How small it is, yet, in memory's eyes!*

Charles Baudelaire, 'Le Voyage' (*Les Fleurs du Mal*, 1861)

From the outset I have insisted that this book is intended as an informal conversation about psycholinguistic theory, rather than as a treatise or manifesto. Yet I'd be lying if I claimed to have no higher agenda. I care deeply about our knowledge and use of languages and the intellectual value of linguistic analysis, and want to convey that passion to as broad an audience as possible. Theoretical linguistics offers us a framework and a set of tools with which to explore one

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of the most inherently fascinating and complex aspects of human experience. The enquiry should be enjoyable, and it should be accessible to any intelligent reader who is prepared to make some effort. Too often, though, linguistics comes across as leaden and irrelevant, and a good deal of this impression is due to its being too abstract and unnecessarily technical. Of course, some abstraction is essential, otherwise we can't say anything interesting; some technical terminology is unavoidable if we are going to draw the right distinctions. Still, it is easy to get carried away by jargon or theoretical aesthetics, and so to 'lose the plot'. And when this happens, the search for the simplest, most elegant theory may result in a dismissal of the very phenomena it was intended to account for: in the limit, it may lead to a preference for a theory with zero empirical coverage over one with partial coverage; see Epstein and Seely (2006: 1–3). In this connection, the second part of Einstein's famous dictum (below) is as important as the first:

*The supreme goal of all theory is to make the irreducible basic elements as simple and as few as possible ... without having to surrender the adequate representation of a single datum of experience.*

Albert Einstein, 'On the method of theoretical physics:  
 The Herbert Spencer lecture' (1934)<sup>20</sup>

Thus, to the extent that this work has a serious purpose, it is to try to get to grips with the stuff of languages (that plural -s, again), to impress upon the reader what it is exactly that must not be surrendered.

For all that, the book is mostly intended as the academic equivalent of taking the dog for a weekend ramble. We'll get there eventually, but the value of such a trek is in the scenery along the way, not in the shortest distance between two points. If what you were looking for was a quick and dirty guide to (psycho) linguistic theory, you're in the wrong place. But surely you must have worked that out already. That said, there may be readers who are prepared to follow me up and down the many 'rabbit holes' in the text – to use a prospective publisher's analogy – but who'd still like to know where the conversation is leading and (roughly) how we are going to get there. If you are one of those people, here is a brief route-map of the next 400-odd pages.

- The book consists of four principal parts. Part I offers a brief introduction to the intellectually fragmented world of classical psycholinguistics, in which I outline some of the key research questions in language acquisition and processing. I begin as I mean to continue, with Noam Chomsky, whose views on language and mind have galvanised supporters and detractors in almost equal measure. Following a brief historical overview, I first consider *how* Chomsky's framing of the big questions led to a major rift in the

theory and practice of psycholinguistic research. A proper understanding of *why* this rift came about requires a consideration of Chomsky's ideas from a wider intellectual perspective. In pursuit of this latter question, I spend some time considering the relationship between elementary-school knowledge of 'times tables' (declarative knowledge) and the more abstract, algorithmic properties of arithmetic, an analogy that I'll return to several times in the course of the book. This is the first major rabbit hole.

Which then leads on (in Chapters 2 and 3) to a discussion of the interplay between the ideas of Chomsky and those of the neuroscientist and psychologist David Marr, a leading proponent of what has become known as the COMPUTATIONAL THEORY OF MIND (CTM).<sup>21</sup> Emerging from this discussion – and equipped with a slightly better knowledge of the algorithmic differences between humming birds and eagles in flight – we return to the main path. And to an interim conclusion, namely, that whatever position one takes on 'Level 1 questions', it is vital to be able to distinguish (within a 'Level 2 theory') between linguistic representation and process, between declarative and procedural knowledge.

- Deciding this question in practice turns out to be a really difficult problem. In Part II (Chapters 4–9), I consider six different grammatical phenomena, any of which might be determined to be essentially declarative or procedural in nature. *Six Different Ways*. In each case, there is presumably a fact of the matter, though with scope for individual as well as cross-linguistic variation. My purpose here is less to persuade the reader of one or other position than to use the test cases to explore the intricate nature, and tremendous variability, of our knowledge of languages. Each case can be seen as a separate rabbit hole – though *warren* might be a more appropriate allusion. Indeed, the whole of Part II could be skipped by readers who don't need to be persuaded of the difficulty of the task. But those same readers would be missing out on a more entertaining diversion than this summary implies.
- Part III presents a glossary of idealisations. Psycholinguistics, like every domain of academic research, is chock-full of *a priori* assumptions and idealisations. Most of these appear innocuous when considered in isolation. In interaction, however, they can produce significant distortions; in some cases, idealisations can lead to absurd conclusions that threaten to undermine the value of the empirical research on which they are based. (There's a nice Escherian sentence to be getting on with.) So, in this section, through a set of largely self-contained essays, I offer a critical

examination of some of the key notions that have underpinned classical psycholinguistic research over the last fifty years. Once more, the intention is not to reject the idealisations outright, but rather to give the reader a clearer appreciation of their effects, and unintended consequences. An extended *caveat lector* to work in linguistics more generally.

- Part IV focuses attention on two case studies in language acquisition, taking the second language first. The ‘French Class’ sketch, by the English comic writers Catherine Tate and Aschlin Ditta, is not only a brilliant example of comedic writing: I argue that it is also an object lesson in second language learning, with significant implications for psycholinguistic theories of acquisition and processing. Another rabbit hole, based on a comic fiction – or worthwhile diversion, depending upon your frame of mind. Following discussion of (Catherine Tate’s character) Lauren, I consider another language learner – less hilarious, perhaps, but no less captivating, to me at least: my middle son, Adrian. ‘Adrianish’ (Adrian’s language between the ages of five and ten years) offers a different kind of lesson, namely, how perfect generalisations can lead to ‘imperfect competence’. Here, as throughout, I will suggest that the search for grammatical perfection is as Quixotic and vain as the search for perfection in any other area of human experience.

So, there you have it, a three-page route-map. I make no guarantees (as) to its accuracy, but warrant that the journey is more interesting, and the terrain more challenging, than this preview suggests. Yet, as was observed at the beginning, you really shouldn’t need a map. Baudelaire said it much better ...

*Mais les vrais voyageurs sont ceux-là seuls qui partent  
 Pour partir; coeurs légers, semblables aux ballons,  
 De leur fatalité jamais ils ne s’écarterent,  
 Et, sans savoir pourquoi, disent toujours: Allons!*

*But real travellers are just those for whom departure  
 Is its own reward; [who leave], hearts light as air  
 Not to evade their fate/[but] always declaring  
 – without knowing why – ‘Let’s go there!’*

Charles Baudelaire, ‘Le Voyage’ (*Les Fleurs du Mal*, 1861)

## Notes

- 1 That volume may not be forthcoming. Life is short, and in the meantime others may well have done a better job in covering some or all of the bases. Anne Cutler’s recent book *Native Listening* (2015), for example, offers a brilliant summary of spoken

word recognition research from a cross-linguistic perspective, written with a deep professionalism that I could not hope to emulate.

- 2 It is interesting to observe that the second edition, published in Halle by Max Niemeyer, uses more English-like spelling: no capitalisation of common nouns, plus the use of <c> in lexical borrowings (*complicerte*, *consequenz*). Although *Duden* had been declared the official orthography throughout Prussia six years earlier in 1880, it still took time for these changes to be reflected in all printed works.
- 3 According to *Wikipedia*, Leon Jaworski was a Texan lawyer, a war crimes prosecutor in World War II, and second special prosecutor during the Watergate Scandal. In that role, he presumably had to deal with extremists of varying levels of competence. Perhaps the methodical ones were easier to convict.
- 4 See Hovdhaugen (1990). Goddard and Wierzbicka (2002) take the view that Chomsky's notion of universal grammar is fundamentally different from Roger Bacon's:

Why did Bacon believe this? Essentially, it is because he believed that the fundamentals of grammar arise from fundamentals of human thought, which are shared by all people and all languages. This is the time-honoured tradition of universal grammar, now largely displaced by Chomsky's structure-based conception of UG in which meaning plays no real part.

(Goddard and Wierzbicka 2002: 41)

- 5 The more traditional generativist notion that I endorse receives short shrift from recent commentators. See the following quote from David Adger (responding to the challenge of Construction Grammar):

I don't think that anyone has said that all languages are 'underlyingly the same' since people were discussing the Universal Base Hypothesis [UBH] in the '70s. When Chomsky says that there is only one human language, he's saying that there is one set of principles that govern all human languages, not that all languages are underlyingly the same. Generativists argue that all languages obey a certain set of principles (and indeed make proposals as to what those principles are), and that individual languages vary from those principles in constrained ways. It's important, when one is criticizing a framework of ideas, not to criticize proposals that have been abandoned for 40-odd years.

(Adger 2013: 3)

*Pace* Adger, I'm fairly sure that I am not the only one to hold on to a version of the UBH (that is to say, to the idea of a universal hierarchy of functional categories – rather than a base, in a very literal sense). The syntactic cartography movement – see for example Cinque (1999, 2002, 2005) – may also be viewed as advocating such an approach, with a new proof of concept. Kayne's *Antisymmetry* proposals (Kayne 1994), and subsequent work, also explicitly advocate an underlying SVO (Specifier-Head-Complement) order for all constituent phrases, across all languages. It hardly seems, then, that these ideas have been abandoned.

- 6 To steal from the acknowledgments section of Simon Conway Morris's book *Life's Solution* (Conway Morris 2003), who himself borrowed the phrase: 'To copy one paper is plagiarism, to copy many is scholarship.' I haven't knowingly stolen any unacknowledged proposal, though I freely acknowledge not knowing about everything I may have stumbled upon.

- 7 It has been suggested to me recently that the ideas advanced in those chapters are derivative of the work of Lev Vygotsky (1896–1934). Unfortunately, Vygotsky’s work did not feature in my linguistic education; so while the charge may be valid – or perhaps not, given that Vygotskian research seems to be as much a question of exegesis as of canonical doctrine – I can only declare that the ideas presented there were ‘independently arrived at’.
- 8 Children’s names have been modified to respect privacy.
- 9 Average life expectancy for people with Down’s Syndrome has increased dramatically from 25 years in 1983, 49 years in 1997 to 60 years in 2010, according to Weijerman and de Winter (2010); this is largely due to radical improvements in post-natal and early infant care. Frankie Boyle, listen up! ([www.theguardian.com/society/2010/apr/08/frankie-boyle-downs-syndrome](http://www.theguardian.com/society/2010/apr/08/frankie-boyle-downs-syndrome)).
- 10 Often cited works include Stern and Stern (1907) and Leopold (1949). Observational research on early language development has been going on for millennia, however: Campbell (2006) provides a survey of these pre-modern studies. This tradition continues up to the present, notable studies including Smith (1973), Bowerman (1982), Clark (1993), Dromi (1987), Tomasello (1992) and Lieven, Tomasello, Behrens and Speares (2003).
- 11 Aside from the fact that one has to draw a line somewhere. Since almost every aspect of language has some psychological correlate, any restriction on subject matter will necessarily be *ad hoc*. It will also become clear that I have little to say, except in passing, about computational psycholinguistics, that is to say, about work that focuses on the results of computer simulations of language processing and acquisition: as interesting as this topic seems to be, my lack of knowledge and experience of the field leaves me unqualified to assess its relevance.
- 12 As is well known, the computing power of the Apollo 11 guidance computer is dwarfed by that of the average smartphone (*iPhone 5s*): viz. 1 MHz vs. 1.3 GHz (processing speed); 4 kb vs. 64 Gb (memory). Source: [www.thedailycrate.com/geek-tech-apollo-guidance-computer-vs-iphone-5s/](http://www.thedailycrate.com/geek-tech-apollo-guidance-computer-vs-iphone-5s/).
- 13 I assume no familiarity on the part of the reader with languages other than Standard English – something that I could have done a generation ago. George Steiner, for example, is able to rely on readers’ knowledge of Latin, Greek and most ‘Standard Average European’ varieties, including Russian: see, for instance, Steiner (1976, 1978). These days, there aren’t many monolingual native speakers of British or American English whose reading knowledge of other languages extends beyond Lauren’s grasp of French; see Part IV.
- 14 Kagoshima Japanese is an exception, according to Kabuzono (2006).
- 15 An example of Northern Irish speech can be found at [www.bl.uk/learning/langlit/sounds/text-only/ni/ballymoney](http://www.bl.uk/learning/langlit/sounds/text-only/ni/ballymoney) (British Library); see also H is for Homogeneity. Here, and in what follows, I will distinguish among three types of conventional bracketing: angle brackets <x> indicate the standard orthographic representations of a word or morpheme in roman script (i.e. its usual British English spelling); square brackets [x] indicate the pronunciation of a word in IPA phonetic transcription – usually ‘broad’ (more approximate) transcription; slash bracketing /x/ points to the more abstract representation of the pronunciation of particular speech sounds in our heads. I do not take a stand here on whether segmental phonology is as discrete from phonetic implementation as has traditionally been supposed; I do assume, however – as a matter of ‘empirical necessity’ – that a fair measure of phonological

- abstraction is involved in spoken language comprehension and production. See also A is for Abstraction. No two speakers share exactly the same pronunciation of any word; even the same speaker will pronounce a word quite differently depending on its immediate phonetic context (co-articulation effects). Yet there is a clear sense that something is shared by all those who know a word in a particular language variety: the segmental properties of that something belongs inside slash brackets.
- 16 Some would maintain that there is a crucial difference between the putatively universal notions of mathematics and the language-particular patterns of categorisation that distinguish English from Japanese, French from Fula, Chinese from Korean, etc. Others object to any form of linguistic relativity. See Pinker (2007) for useful discussion. Still others might maintain that mathematics also exhibits cultural relativity (although this is, I'd suppose, more of a fringe position). There's no obvious limit to our capacity for disagreement on this point.
  - 17 A note to the more trigger-happy of (generativist) critics: read the previous sentence carefully. I might be brandishing the can-opener, but the worms are still secure. If you are looking for controversy, the place to C is for Competence~Performance, I is for Internalism, N is for Nativism, and beyond.
  - 18 I am grateful to Heidi Harley for referring me to this work.
  - 19 Most of the songs that I would have liked to have cited from turned out to be unaffordable. In general – as I found out the hard way, and in spite of the fact that almost all lyrics are freely available on dedicated websites such as [www.azlyrics.com](http://www.azlyrics.com) – republishing song lyrics is an expensive and vexatious business. See *Acknowledgments, Credits and Permissions* below. The largely demoralising experience of dealing with mainstream music publishers, and the scandalously anti-competitive practice of 'MFN' (= most favoured nation), makes me particularly grateful to those songwriters and their publishers and agents who allowed use of their lyrics *gratis* or for a nominal fee. Erik Gilbert (Duchamp, Inc.) deserves particular credit, up front, for issuing the most generous licence I could have hoped for in respect of Josh Ritter's songs. I came to Erik at the very beginning of the process, for five songs, and three months later for another five (including what was, for a time, the 'title track' to this book – *Lark*: see v is for von Humboldt); on both occasions, he was prompt and magnanimous to a fault.
  - 20 Albert Einstein: 'On the method of theoretical physics', the Herbert Spencer lecture, delivered at Oxford, 10 June 1933, published in *Philosophy of Science*, vol. 1, no. 2 (April 1934), pp. 163–9. The shorter variant *Make things as simple as possible, but no simpler* may be pithier, but it is less apposite.
  - 21 This book assumes the basic correctness of the CTM approach; indeed, it can be viewed as providing additional support for it. Not everyone accepts that language or indeed any other aspect of our cognitive faculties can be dissociated from our physiology or even from our environment: more radical variants of the theory of 'embodied cognition' explicitly reject this assumption.