

Part I

Linguistic Diversity: Origins and Measurement

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Linguistic Theory, Linguistic Diversity and Whorfian Economics

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Abstract

Languages vary greatly in their words, sounds and sentence structures. Linguistic theory has shown that many aspects of variation are superficial and may not reflect underlying formal similarities between languages, which are relevant to how humans learn and process language. In this chapter, I show both how languages can vary and how the surface variations can be manifestations of underlying similarities. Economists have sometimes adopted a ‘Whorfian’ view that differences in languages can cause differences in how their speakers think and behave. Psychological experiments have shown both support for this hypothesis and evidence against it. Specific arguments that language causes thought, which have been made in recent economics papers, are examined in the light of what linguistics tells us about superficial and underlying variation.

1.1 Introduction

I begin this chapter by illustrating what theoretical linguists do and why generative linguistics in particular has argued that linguistic data is more abstract and more complex than at first appears. I then illustrate language diversity by comparing aspects of two languages, English and Ma’di, an East African language. Sections 1.2 and 1.3 focus on specific aspects of linguistic data, which are chosen to illustrate general points about linguistic theory and linguistic diversity. In Section 1.4, I briefly note several different theories of linguistic diversity which explore why languages vary and whether variation is limited by internal (psychological) or external (cultural) factors. In Section 1.5, I examine the ‘Whorfian’ hypothesis that linguistic form has a causal relation with thought and behaviour, summarize some of the relevant psycholinguistic work and then examine some articles by economists

which claim causal relations between linguistic and social variation. Based in part on what I have said about linguistic theory and linguistic diversity, and in particular the abstractness of linguistic data, I will argue that the economists' claims cannot be sustained. In the final part of the paper I discuss some ways in which stylistic variation within a language might affect thought.

1.2 Abstract linguistic form, and the rules and conditions which govern it

Linguistic theory is an attempt to understand the regularities and patterns which can be found in language. The fundamental discovery of modern linguistic theory is that a word or sentence can have a complex and multi-layered abstract structure; our knowledge of language is knowledge of that abstract linguistic form. These discoveries about language usually take as a starting point Noam Chomsky's (1957) *Syntactic Structures*, and in the first part of this section I outline some of the ideas presented in that book. I then illustrate the evidence for abstract linguistic form with a number of examples, because linguistics is always a matter of how specific problems are discovered and solved, and how these solutions fit into a larger theory of language.

1.2.1 Chomsky's *Syntactic Structures*

Modern linguistic theory begins with the publication of Noam Chomsky's 1957 book *Syntactic Structures* which was consolidated in his 1965 *Aspects of the Theory of Syntax*; in this section, I summarize some of the aspects of the early 'generative grammar' or 'generative linguistics' initiated by these books. Though no one still pursues this particular theoretical model, many of its findings remain true of theoretical linguistics. Chomsky begins by arguing for a distinction between two types of sentence: grammatical and ungrammatical. Ungrammatical sentences are combinations of words which are not accepted as sentences by native speakers, with the proviso that this is not a judgement based on meaning or social acceptability: that is, that speakers can make judgements of grammaticality based just on the form of a sentence. Chomsky proposes that a grammar of a language should be a device which generates all and only the grammatical sentences for that language. This type of grammar is identified with a psychological capacity, the human knowledge of language. The grammar of each language is a variation on principles of a 'universal grammar' which is

innate and shared by all humans; the universal grammar offers ‘switches’ which are turned on in some specific combination to produce the grammar of a specific language.

Chomsky’s goal is to establish what kind of grammar will generate the grammatical sentences of English (hence ‘generative grammar’). He notes that English comprises an infinite number of different grammatical sentences which must be generated by a finite device; this is possible because the grammar allows recursion, where for example a sentence can contain a sentence repeatedly, without limit. A sentence is a sequence of words, but there is evidence that these words are grouped into constituents which are subject to generalizations. Thus the grammar does not just generate the sequence of words which makes up the sentence, but generates a structured sequence, organized into hierarchically arranged constituents (see Rizzi, 2013 for detailed discussion). For example, the sequence of words in Figures 1.1, 1.2 and 1.3 are given a structure by the grammar (in the title of each figure), and shown schematically as a tree structure. As can be seen, the structures differ in whether they allow the pronoun and *John* to refer to the same person (note that the structures are simplified and schematic, and not a full linguistic structure for the sentences).

Note that *his* in Figure 1.1 can be interpreted as referring to John (but can also be interpreted as referring to someone else), while in Figure 1.2 *he* cannot be interpreted as John. This is not just a matter of which pronoun is used, because in Figure 1.3, *he* can be interpreted as John. This difference cannot be derived from the sequences directly, either from the sequences of words or from the number of words between the pronoun and the name. Instead, the difference is in how they are hierarchically related in the constituent structure as shown in the three figures. The explanation is based on a discovery made by theoretical linguists about the hierarchical relations between items in a tree, as I now explain.

A node in a tree dominates other nodes (i.e. all the nodes underneath it). The nodes immediately underneath a node (i.e. with no intervening nodes) are ‘immediately dominated’ by the node. So for example the topmost S dominates all the nodes in the tree, but immediately dominates only a noun phrase (NP) and a verb phrase (VP) in Figures 1.1 and 1.2 and an S and a VP in Figure 1.3. The discovery about language is that there is a special kind of relation, called a ‘c-command’, based on the relations of dominance (the nodes under a node) and immediate dominance (the nodes immediately under a node). Given a node X and a node Y which immediately dominates X, X c-commands all the nodes dominated by Y.

Thus for example in Figure 1.4, B c-commands B, C, D and E, while E c-commands only D and E (the definition as given here means that a node always c-commands itself).

In Figure 1.1, the NP *his* does not c-command the NP *John*. But in Figure 1.2, the NP *he* does c-command the NP *him*. This is why co-reference is possible in one case but not the other. The rule for English (and most if not all other languages) is as follows:

A name cannot be c-commanded by a noun phrase (NP) which refers to it.

This rule is what prevents the pronoun in Figure 1.2 referring to the name: the pronoun c-commands the name because its NP is immediately dominated by the node S which dominates the name, and c-command prevents co-reference. In Figures 1.1 and 1.3, the NP which is the pronoun is buried deeper in the tree and so does not c-command the name; hence co-reference is possible. (At this point, I note again that this is a simplified account: the relevant structural relation is more complex than just ‘c-command’, here and elsewhere in the chapter, and has been subject to theoretical revision.) This example demonstrates two fundamental principles of linguistic theory, agreed by almost all linguists: that there is abstract form (in this case, the abstract constituent structure which holds of the words), and that linguistic principles refer to the abstract constituent structure.

Chomsky wants linguistic theory to formulate a grammar of a language which can explain aspects of the language, such as the co-reference possibilities described above. Another thing to explain is the ambiguity of the sequence of words *visiting relatives can be annoying*. This is ambiguous because there are two different constituent structures for the same sequence, one of which means that relatives are visiting (the subject is an NP referring to the relatives and can be restated as *relatives who visit*) and the other which means that relatives are being visited (the subject is a kind of clause referring to the visiting and can be restated as *to visit relatives*). To explain this fact demands that we accept some degree of abstractness, in the form of different constituent structures, and that the constituent structures can play a role in determining the meaning of the sequence of words.

A fundamental part of the *Syntactic Structures* theory is ‘transformational rules’ which relate different structured sequences to one another; because of the importance of these rules in this version of the theory it was called ‘transformational generative grammar’. Thus the sequence *the man hit the ball* has the same truth conditions as *the ball was hit by the man*,

and this can be achieved by a mechanism in the grammar (a transformational rule) which takes a structure and rearranges it: the phrase before and the phrase after the verb are changed in their locations in the constituent structure. Note that this rule affects multi-word constituents and not individual words, thus showing that knowledge of a sentence is knowledge not just of the sequence of words (audible on the surface) but knowledge of the structural relations between words. We have seen that there is an abstract level at which a constituent structure holds a string of words. Transformational rules show that there must be more than one such level, such that a final string of words can be derived from distinct constituent structures at different levels, related by transformational rules. Chomsky concludes: 'to understand a sentence it is necessary (though of course not sufficient) to reconstruct its representation on each level'. There are multiple abstract representations on different abstract levels which underlie the surface sentence, and these abstract representations are claimed to be psychologically real. This has significant consequences for our understanding of what language and 'knowledge of language' are, with problematic consequences for Whorfian theories under which linguistic forms are caused by or cause extra-linguistic thought and behaviour.

Distinct 'levels' are hypothesized as domains within which certain types of representation exist, and rules map representations from one level to another: each sentence has a representation on all of these levels. One model of levels of representation, the 'government and binding theory' model (Chomsky, 1981), is shown in Figure 1.5.

In this model, phrase structure rules build constituent structures at D-structure, and transformational rules produce derived constituent structures at S-structure. The constituent structures at S-structure are then subject to rules which produce representations of sentences, which at the level of phonetic form constitute speakable sentences; separately, the constituent structures at S-Structure are subject to rules which form representations of sentences at the level of logical form which can be interpreted as meaningful (e.g. using the language and form of predicate logic). As we will see shortly, two languages can have the same rule operating at different levels, leading to different surface forms (but with an underlying similarity). Much current generative linguistics follows the 'minimalist program' (Chomsky, 1995). It is a tenet of this approach that 'intermediate' levels of syntactic representation are dispensed with, but the distinction remains between how a sentence is represented for

interpretation (its logical form) and how a sentence is represented for pronunciation (its phonetic form).

In the remainder of this section, I summarize three ‘classic’ examples (widely known and taught in introductory linguistics classes) of how generative linguistics has dealt with patterns and regularities in language. Generative linguistic theory stands or falls by its capacity to solve specific problems presented by a language and to fit the solutions into a model which can explain similar problems in any language.

1.2.2 Vowel shift in English

I begin by considering a problem presented by the sound patterns of English, which comes under the type of linguistics called ‘phonology’. The English words *profane* and *profanity* are related: *profanity* is a noun produced by adding the suffix *-ity* to the adjective *profane*. However, when we inspect the sounds of the words we see that the second vowel in each is a different spoken vowel (the vowel spelled with an ‘a’). This difference is called ‘vowel shift’ because one vowel has shifted into another (or more specifically, as we will see, an abstract underlying vowel has differently shifted into the two different surface forms). In all languages, distinct vowels can be differentiated by vowel ‘height’ (roughly, how high in the mouth the topmost part of the tongue is when the vowel is produced), and English has high, mid- and low vowels. *Profane* has a long mid-vowel (more accurately a diphthong) phonetically represented as [ēy], and the phonetic representation of the word is [profēyn]. However, when the suffix is added, the word has a short low vowel [æ] as in [profænty]. This alternation is typical of the whole of the English vocabulary, where two versions of the same word alternate a long vowel at one height with a short vowel at a different height: the alternations are predictable and found throughout the vocabulary of English. We see it also in the changing vowels of *divine* and *divinity* (a contrast between low diphthong and high short vowel), and *serene* and *serenity* (a contrast between high diphthong and mid-short vowel). And it shows up also in the irregular verb forms, for example in the long high vowel of *meet* as opposed to the short mid-vowel of the past form *met*. Here we have a standard kind of problem for linguistic theory, similar to problems described in the previous section: two linguistic items are the same in one way and different in another, in a pattern which is characteristic of the language as a whole.

The solution to this problem is at the core of *The Sound Pattern of English*, the 1968 book by Noam Chomsky and Morris Halle (Chomsky and Halle 1968) which has the foundational role for phonology analogous to *Syntactic Structures* for syntax. They propose a universal theory (holding for all languages) of how sounds are organized in a language. In this theory, all words have an underlying form (the form in which they are stored in the mental lexicon), and the underlying form is subject to a fixed sequence of rules specified by the language, some of which leave the word unaffected and some of which change it, so that the surface form of the word can be different from the underlying form. For *profane* and *profanity*, they argue that the underlying form of the word is [profæ̃n], a form which is then changed in different ways, depending on whether the suffix is added, to produce the two surface forms [profēyn] and [profæ̃n+ɪty]. Note that the underlying vowel is different from both of the surface vowels (either in quality or in length). In Table 1.1, I show a simplified version of the sequence (omitting in this example other intervening rules which are part of English), which takes the word from its underlying form to its surface form.

The difference between dialects of English can sometimes be traced to a difference in whether or not the vowel shift rule applies; thus in the dialect of the south of England the word *house* has a low long diphthong [hāws] while the equivalent word in some Scottish dialects has a high long vowel [hūs] (hence the dialect spelling ‘hoose’). Both dialects may have the same underlying form with a high back vowel [hūs] but the vowel shift rule changes the vowel only in the English dialect, and not in the Scottish dialect. The long vowels of southern standard English changed in quality over the early modern period, so that there was a historical process of vowel shift; this historical process operated differently in different dialects, leading to differences between dialects. (This is how variation often emerges, starting by splitting dialects over time, ending with the dialects being identified as distinct languages.) Chomsky and Halle argue that the historical change can be understood as the introduction of the rule of vowel shift into the phonology of English. The historical change in long vowels (but not the related short vowels) partly explains why English spelling does not match surface sounds in a clear way: the use of the same written vowel ‘a’ in the spelling of *profane* and *profanity* reflects an earlier pronunciation of these words before the vowel shift rule was added, at a time when the two vowels were closer. The approach to phonology taken by Chomsky and Halle has been largely replaced by a different type of phonological theory called optimality theory. Optimality theory shows some theoretical continuity: there is an underlying form (the input) and a surface form (the output) and the relation between them is

controlled by a set of ranked constraints (rather than rules); constraints are always violated, and the optimal matching of output to input involves the least-worst violation of constraints. What vowel shift shows is that the sounds of words in their underlying forms (as stored in the mental lexicon, before the operation of phonological rules) is not the same as the sounds of words as they are pronounced: a description of the surface sounds of the language does not represent every aspect of a speaker's knowledge of the language, which is multi-layered.

1.2.3 Verb second in German

In this and the next section, I consider problems presented by sentence structures and their interpretation, which comes under the study of 'syntax'. In German, a finite verb is in second position in a main clause. Thus the finite verb *kommt* ('comes') can be preceded by one constituent (which can consist of one or more words). The constituent can be one of a number of different types of syntactic entity, including as the subject (1) or an adverb (2) or indeed a whole subordinate clause as in (4). The verb-second constraint is that in a main clause the finite verb must be in second position, as the asterisk next to (3) indicates in a sentence where the verb is final: an asterisk indicates that a sentence is ungrammatical. The finite verb might be a main verb as in (1)–(2) or an auxiliary verb as in (4).

(1) Er kommt morgen.

he comes tomorrow

(2) Morgen kommt er.

tomorrow comes he

(3)* Er morgen kommt.

he tomorrow comes

(4) Dass er gestern gekommen ist habe ich gesagt.

[That he yesterday come is] have I said

In contrast, in subordinate clauses, the finite verb – here *komme* (conjunctive ‘comes’) – usually comes at the end, as (5) shows; the verb can no longer follow the subject as (6) shows.

(5) Er sagte, dass er morgen komme.

He said, that he tomorrow comes.

(6)* Er sagte, dass er komme morgen.

He said, that he comes tomorrow.

The location of a verb relative to its subject and object, and relative to other aspects of a sentence, is one of the most widely noted syntactic differences between languages. Thus in English the subject usually precedes the verb and the verb precedes the object and English is called an SVO (subject-verb-object) language, while in Japanese the verb usually comes at the end and Japanese is called an SOV language. German is a mixed case – in main clauses it has verb second (preceded by subject or object or some other item) while in subordinate clauses it appears to be SOV. There are two related approaches to these matters taken by theoretical linguists. The first is that in a language with two distinct orders, one or both of the orders are derived from some single underlying order: German underlyingly always has the verb in the same place in all sentences and clauses, but a rule moves the verb to a different position. The alternative approach is more ambitious: it is that all languages have the verb in the same underlying position, and the differences between languages such as SVO and SOV, or verb second, are surface differences derived by rules. Questions of abstractness thus hold both within a language and more generally for all languages, with major consequences for how we understand variation, and how we interpret typologies of surface variation.

My goal here is to note briefly a single, very influential, argument about German which was first formulated by Hans den Besten in 1977 (Den Besten, 1983) and involves the grammatical sentence in (7).

(7) Er sagte, er komme morgen.

He said, he comes tomorrow.

This is a subordinate sentence in which one would expect to find the verb in final position as in (13), but now it is in second position and yet the sentence is grammatical. Den Besten argued that the crucial factor was not whether the sentence was main or subordinate, but whether it related to the ‘complementizer’ of the sentence. The complementizer is an abstract component of a sentence’s structure, which c-commands the rest of the sentence; in addition to providing a place where a word can move to, it also has a function of typing the sentence as a question, statement, etc. The complementizer position may or may not be filled by a word: it is an abstract form which is not necessarily audible in the spoken sentence. Den Besten argued that the complementizer position must be filled in German. If there is a word like *dass* (introducing a sentence as in (4), (5) or (6)) then this word fills the complementizer position. If that word is absent, as it is in most main sentences and in the subordinate sentence in (7), then the verb fills the complementizer position. If the verb does not fill the complementizer position, it is final in a German sentence. The position preceding the second-position verb is a position preceding the complementizer position, and any item can be moved up into it (e.g. the subject, object, adverb). This means incidentally that the subject which precedes the second position verb has also been moved to this position and is no longer ‘in subject position’. Thus the hypothesis that there is a complementizer position (extensively supported by other theoretical work) and the possibility of moving a verb to fill it together explain the pattern of verb second in German.

Den Besten’s was the first of a series of accounts of verb second which have now much elaborated on his account. The sequence of subject, verb, object and other items is dependent now on a significant amount of restructuring of underlying abstract structure. The rules which do the restructuring (the descendants of the transformational rules of *Syntactic Structures*) are manipulations of abstract structure which are found in all languages.

1.2.4 Long distance reflexives in Chinese

My third example of a problem identified by linguistic theory relates to a difference between English and Chinese, as illustrated in (8)–(9), from Cole et al. (1990).

(8) [_S Zhangsan renwei [_S Lisi zhidao [_S Wangwu xihuan ziji]]]

[_S Zhangsan thinks [_S Lisi knows [_S Wangwu like self]]]

‘Zhangsan thinks that Lisi knows that Wangwu likes himself.’ (ambiguous: Wangwu likes Wangwu, Wangwu likes Lisi, or Wangwu likes Zhangsan)

(9) [_S John thinks [_S Tom knows [_S Bill likes himself]]] (unambiguous)

These two sentences are roughly word-for-word equivalents, consisting of a sentence which contains a sentence which contains a sentence, each with its own subject. A reflexive pronoun must in all languages find a co-referent, which is the NP which co-refers to it. The difference is that in the Chinese example (8), the reflexive pronoun *ziji* ‘self’ can have as its co-referent any of the three subjects (underlined), and so the overall sentence is ambiguous. In the English example (9) the reflexive pronoun *himself* can have as its co-referent only the subject of the sentence which contains it, *Bill*, and so the overall sentence is unambiguous. Chinese is said to have ‘long distance reflexives’, while English has only local reflexives; this is one of the characteristic ways in which languages can vary. I will however show that the ‘long distance’ describes how the reflexive is abstractly moved, not how it is interpreted.

As a general principle, a reflexive pronoun such as *ziji* or *himself* must be c-commanded by its co-referent (the NP which co-refers with the reflexive). Hence it is possible to say *Bill likes himself* but not *Himself likes Bill*, because the subject c-commands the object (as we saw earlier) but not vice versa. Reflexive pronouns in English must also find their co-referent within a local domain; they must be in the same sentence. This is why (9) has the interpretation that it does. Constituents thus function not only as ways of grouping words, but also as domains within which syntactic (and semantic) relationships are established; this is further evidence for the reality of syntactic constituent structure.

Why, then, does Chinese allow the reflexive apparently to find a co-referent in a different, higher sentence? The answer offered by Cole et al. is that it does not – instead, the reflexive is moved by a transformational rule into the higher sentence and thus finds its co-referent in the same sentence as it ends up in, after movement. Some types of movement have an effect on the pronounced order of words (as is the case for verb second in German, for example). But movement can also be covert, taking place in the abstract syntax without an effect on the phonological output, and Chinese has covert movement of this kind. The proposal is as follows (simplified). It depends on the existence of a covert piece of structure,

similar in kind to the ‘complementizer’ position which we saw in the previous section, but this time between the subject and the verb, and which is called the ‘Infl’ position. Generative linguists think that all sentences in all languages have such a position (it has very significant indirect effects on the syntax of the sentence, including for example controlling whether a subject pronominal can be dropped, ‘pro-drop’, as discussed later in this chapter). This means that sentence (8) has a more elaborated structure, as shown in (10):

(10) [_S Zhangsan *Infl* renwei [_S Lisi *Infl* zhidao [_S Wangwu *Infl* xihuan ziji]]]

Now, in Chinese the reflexive pronoun must move to Infl in order to find a co-referent (as a rule specific to Chinese, not found in English); but once it moves to Infl it can move to any Infl. The three interpretations thus involve covert structures as in (11), (12) and (13).

(11) [_S Zhangsan *Infl* renwei [_S Lisi *Infl* zhidao [_S Wangwu **ziji-Infl** xihuan ____]]]

‘Zhangsan thinks that Lisi knows that Wangwu likes Wangwu.’

(12) [_S Zhangsan *Infl* renwei [_S Lisi **ziji-Infl** zhidao [_S Wangwu *Infl* xihuan ____]]]

‘Zhangsan thinks that Lisi knows that Wangwu likes Lisi.’

(13) [_S Zhangsan **ziji-Infl** renwei [_S Lisi *Infl* zhidao [_S Wangwu *Infl* xihuan ____]]]

‘Zhangsan thinks that Lisi knows that Wangwu likes Zhangsan.’

Each of the interpretations thus has a different syntactic structure associated with it, thus using the syntax to disambiguate the string. This disambiguation takes place by a rule which moves a part of the sentence to another place, which has consequences for interpretation but no consequences for phonology; in terms of the structure of the grammar in Figure 1.5, the movement takes place between S-structure and logical form.

The difference between English and Chinese is that in Chinese the reflexive moves to Infl, and can move to any Infl; in English it does not. The principle remains true for both languages that a reflexive always finds its co-referent in the same sentence. This is a theoretical way of stating the variation, which is fundamentally different from a more

surface-oriented way, which would say that in Chinese a reflexive can find its co-referent in a different clause. The justification for the approach presented here is that, as Cole et al. show, it fits both with general principles but also explains other aspects of Chinese. For example, in Chinese, the reflexive pronoun must take a subject as its antecedent not an object. In English it is possible to say *John told Mary about herself*, which is legitimate because the object *Mary* c-commands the reflexive pronoun *herself*. However, this is not possible in Chinese, because in Chinese the equivalent reflexive must move to Infl position before the co-reference is established, at which point it cannot be c-commanded by the object and so cannot find the object as a co-referent.

Linguistic theory tells us that variation can involve abstract structures which are not audible in the pronounced sentence, and can involve ‘transformational’ rules which transform one representation of a sentence into another. Certain principles and mechanisms are found in all languages: the structural relation of c-command, the Infl node, the principle that reflexives must find their antecedents in the same sentence. An account of something that varies between languages that can be considered genuinely explanatory must do more than just describe the variation. In this case the account provides a single underlying explanation for two apparently distinct phenomena (but which prove to co-vary across languages) – the ability of Chinese reflexives to find a co-referent outside their own clause and the restriction that the co-referent can only be a subject.

1.2.5 Summary: Linguistic problems and generative linguistic theory

In this section I have described three ‘classic’ linguistic problems and in each case have described one of the possible solutions to these problems. The three solutions all come from the ‘generativist’ approach to language, initiated by Chomsky. Other linguistic theories have offered other accounts of how to solve these problems. Almost all linguistic theories have certain things in common, and I conclude this section by noting two of them, since they are relevant to the questions of causal factors in linguistic variation which have been of interest to economists.

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- (i) A linguistic argument focuses on specific problems in the data and shows how their solution is part of a larger theory of language. New data is primarily of interest to the extent that it challenges or confirms an existing larger theory. Linguistic theories

change and diverge; none of the accounts here correspond exactly to current accounts of the same problems and some current accounts are very different. This is all worth emphasizing because the underlying complexity of the problems can be lost in descriptive accounts of languages and typological overviews, both of which may be radical simplifications of the theoretical approach taken at any specific time.

- (ii) Most linguistic theories are committed to the psychological reality of abstract linguistic form which is not audible in the spoken language. This can include constituent structure, rules and conditions, and perhaps most significantly the possibility that the heard ('surface') sequence and form of a word or sentence is not the same as its underlying form. Knowledge of a language is largely unconscious knowledge of all aspects of its form, including the underlying forms. This is important when assessing the extent to which knowledge of a language has 'Whorfian' effects on thought or behaviour, because these effects are almost always judged on the assumption that only surface form has psychological reality, an assumption which linguistic theory shows must be incorrect.

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1.3 Linguistic diversity: An illustrative comparison between two languages

Ethnologue is a widely used database of languages, maintained by the SIL organization which 'contains information on 7,106 known living languages', and is a subset – we do not know how small – of all the languages which have existed, which currently exist, and which will exist in the future. Information about a selection of these languages, and how they vary, has been extracted from grammars, articles and other sources, and organized in some major typological projects of which the largest and most diverse is probably the World Atlas of Language Structures (WALS). This has been used by some economists seeking typological correlations between linguistic forms and cultural values. In this section I illustrate linguistic diversity and discuss some of the gaps between a language and its representation in a database, by looking at specific differences between English and Ma'di, a language spoken mainly in South Sudan and northern Uganda. I am the co-author of the most substantial existing grammar of Ma'di (Blackings and Fabb, 2003), and this grammar is the source of most of the information about Ma'di in WALS.

When we call Ma'di or English 'a language' we are idealizing over a set of dialects which are considered to belong together, but which differ from one another: there are at least five for Ma'di, and there are very many for English. Ma'di is spoken in South Sudan and northern Uganda by around a quarter of a million Ma'di people, and by a diaspora

population. It is not an official language; the official language of South Sudan is English (one of about 60 languages spoken in the country). Most Ma'di will also speak at least one other language, including English, Swahili or Juba Arabic (a dialect of Arabic not necessarily understood in the north). Facts like these problematize language-to-nation correlations of the kinds made by some economists (and discussed later).

Languages have common ancestors, most of which have to be reconstructed based on familial resemblances. Ma'di is classified as belonging to the subfamily Central Sudanic of the genus Moru-Ma'di and the family Nilo-Saharan; in principle this might mean that Ma'di is one descendent of a hypothetical language which we could call proto-Nilo-Saharan. English is classified as belonging to the genus Germanic of the family Indo-European, and may be a descendent of a language which might be called proto-Indo-European. Note that though classified as in the genus Germanic, English has also been strongly influenced by French (in the genus Romance) and other European languages (because of its mixed history and the influence of French speakers in mediaeval Britain). There is no known ancestor connecting proto-Indo-European and proto-Nilo-Saharan, and perhaps there is indeed none. For a sceptical discussion of the possibility of ancient common ancestors for contemporary language families, see Nichols (2012).

In the remainder of this section I look at a selection of variations between languages, as manifested by differences between English and Ma'di, and begin with the sounds of languages. WALSL is divided into chapters of which Chapter 1 (Maddieson, 2013) compares 'consonant inventories'; I refer to this as WALSL-1. If we look at its inventory of consonants, we find that Ma'di has more consonants than English, mainly because the inventory of Ma'di includes complex consonants such as [kp]. For WALSL, Ma'di would be classified as having a 'moderately large' inventory, compared to the English 'average'. The languages in WALSL-1 vary in size between 6 and 122 consonants. Maddieson notes that theory influences any decision about how many consonants there are (as is true of every aspect of WALSL). Ma'di has some types of consonants not found in English, with three implosive consonants including the [ɗ] of *màdĩ*, which is the name of the language ([ɗ] is orthographically written as apostrophe-d as in Ma'di). Implosives require the closure of the vocal tract followed by an intake of air (rather than the more usual expulsion of air), and are found mainly in this part of Africa according to WALSL-7 (Maddieson, 2013). English has types of consonants not found in Ma'di including the dental non-sibilant fricative consonants [θ] and [θ̥] (the initial

consonants of *this* and *thick* respectively); these are also quite rare cross-linguistically but unlike the implosives belong to a rare consonant type which is scattered throughout the world's languages (WALS-19, Maddieson, 2013).

Now consider the inventory of vowels (WALS-2, Maddieson, 2013), where we find the reverse situation. English has a large vowel inventory, though the actual vowels (and the number of vowels) vary greatly between dialects; the inventory's size and variation are partly due to the complex relation between long and short vowels in the history of English. In contrast, Ma'di has an average vowel inventory of nine with no distinction between long and short. Ma'di (but not English) vowels are differentiated into those with 'advanced tongue root' and 'retracted tongue root' (differentiated by how far retracted the root of the tongue is, with no direct equivalent in English). In Ma'di, there is also an interesting rule in operation, which is that the vowel of an affix will (depending on other factors) take on the same advanced tongue root characteristic as the main word it is attached to. Thus for example the word [tū] means 'climb' and has an advanced tongue root vowel; if the prefix meaning 'repeatedly' is added to it the word is [ūtú], so that the vowel of the prefix is also advanced tongue root. If the same prefix is added to the word [zǝ] 'grow' to form the word [ōzǝ] we find that the vowel of the prefix is now retracted tongue root. A phonological rule is in operation here (just as we saw a phonological rule in Section 1.2, with the vowel shift). This is not just a variation in vowel inventory but a variation in the rules which apply within a word: Ma'di has a 'vowel harmony' process which harmonizes features of a vowel within a word. Various kinds of vowel harmony process are found throughout the world's languages (but not in English).

Consonants and vowels are combined into syllables, and languages can vary in the types of syllables they permit (WALS-12, Maddieson, 2013). Ma'di is classified as having a 'simple syllable structure' allowing only two types of syllable, either consonant plus vowel or just vowel. English allows both of these plus other types of syllable and has 'complex syllable structure'. Maddieson in WALS-12 chapter notes that there is a correlation in the database between having simple syllables and having smaller consonant inventories (though this is not true for Ma'di), and raises the (unanswered) question of 'whether the association should be attributed to accidents of survival and spread of particular languages, or can be proposed as reflecting a design feature of language viewed as a whole'. This is typical of the problems which are presented by theoretical explanations for linguistic diversity.

Ma'di is a tone language (WALS-13, Maddieson, 2013), whereas English is not. In a tone language, the pitch or pitch contours on the syllables (i.e. its tone) are used to distinguish one word from another, such that a word has a specific tone pattern. Thus the Ma'di word *sá* with high tone means 'tail', the word *sā* with mid-tone means 'to plant or scour', and the word *sà* with low tone means 'to intervene and bring a fight to the end'; the consonant and vowel is the same in each word, only the tone varies. I now discuss three of the many complexities in the use of tone in Ma'di.

First, while in principle any type of syllable can carry any of the three tones, there are some restrictions: thus in a two-syllable word there are nine possible tonal sequences, but the sequence high-low is associated with words borrowed into the language from another language such as Arabic or English: all borrowed disyllables have this pattern, and all but two words in the language with this pattern are borrowed words. Longer borrowed words also have stereotyped tonal patterns. This illustrates that a language is not uniform in its properties: different types of vocabulary might be subject to different generalizations. A second aspect of tone in Ma'di is that some prefixes or suffixes are just 'floating tones' with no vowel or consonant involved. For example, the past and the non-past (present, future) forms of the verb are distinguished just by adding a low tone to the beginning of the non-past verb.

A third example involving tone demonstrates a case where tonally the spoken form of a word is not the same as its abstract form. Ma'di has a grammatical word *drʊ* meaning something like 'analogous to' which appears with one of two distinct tones, either high tone *dró* or mid-tone *drō*. It has a mid-tone if it follows a word with a high tone, but if it follows a word with a mid- or low tone it has a high tone. Based on what we know about other languages, one possibility is that this is a 'contour' effect which requires contrast between adjacent linguistic elements, so that the tone on the word is different from the preceding tone. However, contour effects of this kind tend to be general within a language and not idiosyncratic to specific words, as is the case here. Blackings and Fabb (2003, p. 62) offer a different explanation, based on the difference between underlying and surface forms. We suggest that the word has the underlying form *HIGH-drō*, that is, that it has two tones, of which the first is an initial floating high tone (annotated *HIGH*) unattached to a vowel and the second is a mid-tone attached to the vowel [o]. This is the form in which the word is stored in the mental lexicon, but it is never pronounced in this way. Instead, it is pronounced in one of

two ways. If the word follows a high-toned vowel, its own initial floating high tone assimilates to the high tone of the preceding vowel, and the mid-tone remains on the word. If the word follows a non-high-toned vowel (i.e. mid or low) the high tone cannot assimilate to the preceding word and instead shifts rightwards to displace the mid-tone on the word, ending up on the vowel [ʊ]. Here again we see a phonological rule in operation which mediates between the abstract underlying form and the surface spoken form. This type of account localizes the effect on the word (so we would not expect it to show up on any other word) but it uses rules and other principles of structure which allow floating tones, assimilation of tones, and the possibility of a high tone displacing a mid-tone: these rules are seen more generally in other aspects of Ma'di, thus justifying their use here. The more generally explanatory an abstract explanation of this kind is, the better the explanation.

Morphology is the shape of a word such as the use of prefixes and suffixes. In Ma'di the past form of the verb is unmarked (it has no special morphology), while the non-past is marked (with special morphology) because it has a prefix (which is a floating low tone). In English the same past vs non-past distinction is made, but in contrast the non-past is unmarked (e.g. *jump*) while it is the past which is marked with a suffix (as in *jumped*). Another morphological difference between the languages relates to the marking of plurality on a noun; in English, most plural nouns have a suffix (or are irregular), while in Ma'di, most kinds of noun are morphologically the same in singular and plural with the exception of nouns of gender, age, kinship and occupation, which are marked for plural by changing the tonal pattern on the word. This restriction of plurality to human nouns is cross-linguistically quite common (WALS-34, Haspelmath, 2013). However, (again unlike English) almost all Ma'di adjectives can be pluralized, where plural is indicated by changing the tone pattern on the adjective. Ma'di has no grammatical gender, in common with more than half the languages surveyed in WALS (WALS-30, 31, 32, Corbett, 2013); English has grammatical gender only in the pronouns, which WALS describes as cross-linguistically rare. Note that deterministic accounts of the relation between language and culture, which are particularly tempting when it comes to meanings relating to gender, would have to steer a careful path through the complexity of these differences, a complexity which is typical of all languages.

Languages can vary in their grammatical words. The English articles *a* and *the* come before the noun; the articles in Ma'di come after the noun. In English, an indefinite singular NP must usually have the indefinite article *a*, but in Ma'di, an equivalent NP can omit the

article. There are several definite articles in Ma'di, one being a low tone suffix added to the noun which is used to indicate that the noun has a unique referent, another is the word *rì* which is used when the NP refers to something which has been earlier mentioned in the discourse (the closest equivalent to English *the*), and another word *nā* used when the referent has very recently been mentioned. The rules for which determiner to use, both in terms of meaning, and also in terms of syntactic context, are very complex in Ma'di. The complexity of the data around these articles in Ma'di is not reflected in WALS, which includes two specific classificatory points about Ma'di, one that (like English) the definite and demonstrative words are different, and the other that it is described as having 'no indefinite but definite article', which is partly true, but must be finessed. This demonstrates that the database necessarily under-represents the complexity of the data, a point which I have made repeatedly in this section and which has significant consequences for the final section of this chapter where I consider economists' uses of this and similar databases.

Pronouns are another class of grammatical words which have drawn the attention of economists, as we will see. Ma'di has distinct pronouns for first person singular and plural (like English *I* and *we*), but also has a third pronoun which can express either 'I and you' (inclusive first and second person) or 'someone' (indefinite third person). Ma'di has distinct pronouns for second person singular and plural (unlike English *you* which is used for both) but this is purely a distinction of number and does not express social relations (hence, unlike *tu* and *vous* in French). In the third person, unlike English, Ma'di tends to use the same pronouns for both, and plurality is instead marked by a distinct word *kí'* or *p̄* (the latter meaning 'and associates'). So the system of pronouns is different from the system in English, along many dimensions. This is further complicated by the fact that the realization of a pronoun depends on the function of the pronoun in the sentence (as in English, where *I* is the subject and *me* the object form); in Ma'di there are three distinct forms of the subject pronoun depending on whether it is the subject of an uninflected (past) verb, of an inflected (non-past) verb, or of a directive verb, and a further distinct form for object pronouns. The pronoun is sometimes realized as a distinct word (or two distinct words if one includes the plural marker), and sometimes as a prefix on the verb.

Any account of the pronominals of Ma'di must make theoretical assumptions, including assumptions about underlying forms which are not necessarily the same as those on the surface. Thus for example there are two forms of the first person singular pronoun

preceding an uninflected (past) verb, one just a prefix *á* and one a longer form *má*. They do not differ significantly in meaning. In Blackings and Fabb (2003, p. 136) we suggest that the longer form is actually a sequence of two pronouns with the same meaning, the default first person pronoun *mā* (also used for object pronouns), preceding the prefix *á*, and both are merged and the high tone replaces the mid-tone (a process seen elsewhere, e.g. in *dró*, discussed above). As we will see later in this chapter, one influential economics article builds a theory by extracting very simplified differences from typological data about pronouns; my goal here is to show that such linguistic data may often be far from simple. The Ma'di system of pronouns is also relevant to the issue of how data is analysed and how it feeds into typological databases. What we identify as a third person pronoun *ká* has been analysed in other work on Ma'di as an auxiliary verb; this is a very significant difference typologically, and both views cannot be right (but someone forming a database must make a choice between these incompatible alternatives, often silently).

Consider now tense and aspect. Tense is a modification of a verb to indicate the relative location of an event in time; in English the verb can have one of two tenses, either as in *ate* or *walked* which are past, or as in *eat* or *walk* which are non-past because they can be used for present or future. Futurity can also be expressed periphrastically by using a modal verb *will* or *shall*. As we will see in Section 1.5, differences in how tense works in a language are taken to be significant for economics by Chen (2013). Aspect is a modification of the verb to represent the internal temporal constituency of the event, with perfective aspect representing the event as a single unit, and imperfective aspect representing the event as internally granular, and interruptable. In English there is no clear grammaticalization of this distinction but imperfective is expressed periphrastically. A periphrastic expression of a meaning uses two or more words, and thus differs from a grammaticalized expression which uses one word (including its internal morphology). The periphrastic expression of imperfective in English uses the progressive form as in the sentence *I am eating*. If not progressive, an English verb is usually interpreted as perfective. Thus the sentence *I ate the sandwich when he entered the room* is best interpreted by treating the two verbs (perfectively) as representing single whole units and ordered one after another, while the sentence *I was eating the sandwich when he entered the room* is interpreted as the second (perfective) event coming in the middle of the first (imperfective) event. In Ma'di, tense and aspect are expressed not only by modification of the verb, but also by major differences in sentence structure. This is illustrated below. The primary distinction is between past and non-

past, and the distinction of aspect between perfective and imperfective is parasitic on this (with complications, Blackings and Fabb, 2003, p. 172).

(14) ̄-pā gbándà

he-eat cassava

‘he ate cassava’ (past, and perfective)

(15) ká gbándà `-pā

he cassava nonpast-eat

‘he is eating cassava’ (or ‘he eats cassava’) (non-past, and imperfective)

The past verb carries no inflection, while the non-past verb has a prefix added to it which is a floating low tone. In addition, the past verb precedes its object (SVO order) while the non-past verb follows its object (SOV order). And the subject pronouns are different, with a prefix on the past verb and a separate pronominal on the non-past verb. However, when the sentence is negative, the ‘past tense’ version of the syntax and morphology is used for both past and non-past, and the tense distinction is instead expressed entirely by a choice between one of two negation words.

(16) ̄-pā gbándà kōró

he-eat cassava not (past)

‘he did not eat cassava’

(17) ̄-pā gbándà kō

he-eat cassava not (non-past)

‘he does not eat cassava’ (or ‘he is not eating cassava’, or ‘he will not eat cassava’)

I know of no published theoretical explanation of why these various differences – inflection of the verb, pronominal, and word order – all align, and why the differences disappear when the sentence is negated. I outline briefly a possible solution now, noting the relation between this problem and the problems around verb position and ‘verb second’ described in Section 1.2. I start by proposing that the two syntactic structures are underlyingly the same, that the underlying word order is SVO, and that tense is expressed abstractly at the right-hand end of the sentence. The specific rule is that when tense is non-past, some word which can express tense must be in this position. When a negation word occupies this position it picks up the non-past tense; if there is no negation then the non-past tense must be carried by something else and so the verb moves (rightwards past the object) to the tense position and picks up the tense as an inflection, thus producing the surface order. The subject pronoun would be realized as a separate word when no longer adjacent to the verb. This type of account hypothesizes abstract underlying word orders (and pronominal expression, etc.) which are not the same as those on the surface. It also introduces a theoretical claim which goes against one of the current cross-linguistic generalizations in generative linguistics, which is the ‘final-over-final constraint’ (Biberauer et al., 2007): this generalization predicts that a verb which precedes its object should not be moveable to a position which follows its sentence, as here. This means either that this explanation is incorrect or that the principle is incorrect, or that there is some other complicating factor: in this way, linguistic theory develops. Ma’di is classified by WALS as having no dominant word order (i.e. neither SVO or SOV), but a more abstract analysis which properly explains the patterns in the language might in fact find that it does have a dominant SVO word order with the other derived from it (Dryer, 2013 devotes a discussion in WALS-144 to Ma’di negation and word order, noting that only five described languages, all from the same area, show this pattern).

As a last example of a variation found in Ma’di, note that while (18) below is a grammatical sentence, (19) is not.

(18) ̄-pā áđ̄ín̄

he-eat yesterday

‘he ate yesterday’

(19) * ̄-nā

he-eat

‘he ate’

Sentence (19) is ungrammatical, as indicated by the asterisk preceding it. One of the important devices of theoretical linguistics which is not always reflected in descriptive grammars is the notion of ungrammaticality: speakers are able to distinguish between possible and impossible utterances in their language. My co-author Mairi Blackings and I visited a group of expatriate Ma’di speakers to discuss their intuitions of the language. They agreed that they could say (18) but not (19) and thought nothing of it; I have striking memories of their amusement when I pointed out that when they spoke English they had no such distinction between the two perfectly acceptable sentences *He ate yesterday* and *He ate*. They were surprised by this observation about the difference between two languages, both of which they spoke, and this neatly illustrates that judgements about grammaticality in a language are generally unconscious. No one taught them the fact about Ma’di that the uninflected (‘past’) verb cannot be the last word in a sentence; it must be followed by something else, which is here the word for ‘yesterday’ but could equally be other words. There is no published explanation for this and indeed it is not picked up in WALS and may perhaps be unique as a surface characteristic of a language. However, a theoretical linguist would ask whether it is the surface result of underlying patterns and rules which are found elsewhere but here producing a unique surface result due to the rules operating in a unique combination.

In this section I have indicated some of the ways in which English and Ma’di differ; my intention has been to show some of the complexity of the data presented by any language, many of which remain unexplained and demand theoretical linguistic study. We have seen that though these differences can be represented to some extent in the WALS project, it can not really represent the complexity of the data or the possibility that the variation on the surface masks underlying similarities. As linguists, the authors of WALS are fully aware of this: it is an inevitable result of the simplifying process needed to produce the patterns in the ‘big data’. However, this may not be recognized by non-linguists who draw on the simplified

version in WALS, particularly in order to produce binarities which can be correlated with social or economic behaviour, as we will see in Section 1.5.

1.4 Theories of linguistic diversity

The forms of languages vary, but within limits: it is possible to imagine kinds of language which do not exist. Ma'di and English have certain forms in common, as demonstrated by the fact that they can be described by similar theoretical terminologies. When they vary from one another they vary in specific ways, such that they fit into bigger but still limited patterns of how languages can vary. In this section, I summarize different views on why languages have certain forms in common, and why they vary. I begin with the current version of generative linguistics, which is a very widely used linguistic theory. I then consider alternative accounts of linguistic form which argue that form is determined in part by external factors.

1.4.1 Chomsky, universal grammar, and the theory of principles and parameters

A form of the generative linguistic theory introduced by Chomsky in *Syntactic Structures* is the theory of 'principles and parameters'. This theory formulates a notion of universal grammar as a set of principles and parameters which govern how language is structured, and which is available as a cognitive capacity to all humans as a genetic inheritance. This is both a theory of linguistic form and a theory of the psychology of language. Rizzi (2013) offers an overview of the theory and introduces a collection of articles which discuss various aspects of it, including Cinque (2013) on typology. Like all theories of linguistic diversity, this remains a hypothesis, with many adherents but also with many competitors.

The psychological part of the theory proposes that all humans have an innate language faculty. This faculty enables the learning of language and hence determines what the possible forms of a language are. For this reason, all languages are predicted to conform to certain principles. Where there are variations between languages, some of these variations arise from determinate possibilities of variation which are set by the language faculty as 'parameters' which allow for one of various options to be selected. Thus for example, a parameter may provide options: the choice of a specific option in a parameter determines that an article precedes the noun (as in English) and the choice of a different option in the same parameter determines that an article follows the noun (as in Ma'di). The effects of parameter settings are

likely to be indirect and interact with other parameters (i.e. my previous sentence oversimplifies: there is unlikely to be a parameter directly determining article position, but article position may be determined by the parameter setting interacting with other parameter settings, along with innate rules of the language system). Other parameters might be set to determine whether the language has 'verb second', whether it has an SOV or SVO order, whether it has long distance reflexives or not (but noting as for long distance reflexives that these parameters might be quite abstract, and have these as surface effects).

Parameter-setting is how a language is learned. When exposed to a language spoken around it, the child learns that language by making choices from the parameters, fixing a set of interacting variables to produce that specific language. Chomsky offers an argument of 'poverty of stimulus', that the data to which the child is exposed does not offer enough information on its own to enable the child to learn the language; instead the child must already 'know' certain aspects of the language and what its possible forms might be as part of his or her innate language faculty. The notion of universal grammar, which is the basis of the theory of principles and parameters, is a radical one: that all languages conform to certain basic principles, and that certain differences between them are based on the selection of specific pre-determined variants ('parameters').

1.4.2 Cultural evolution and linguistic diversity

Evans and Levinson (2009, p. 429) suggest that languages can in principle vary in any way at all, and that the forms of languages which currently exist do so as a combination of historical accident and other forces, but do not involve any language-specific faculty of the kind proposed by Chomsky: 'although there are significant recurrent patterns in organization, these are better explained as stable engineering solutions satisfying multiple design constraints, reflecting both cultural-historical factors and the constraints of human cognition'. They offer evidence for this claim by citing specific kinds of variation which they suggest cannot be reduced to underlying universals, though it should be noted that generativists who have responded to this article disagree with the linguistic evidence offered or its interpretation, and suggest that underlying universals can in fact be found. Evans and Levinson's proposal is that languages change and diverge in parallel with the changing and diverging cultures of their speakers. The reasons for similarities between languages is in part the same reason that there are similarities between cultures: languages and cultures have split

apart over time, but there has not been enough time for major divergences to emerge. Another reason for similarities between languages is that there are external pressures, in part from general principles of cognition and in part from the environment, which limit variation. They take a slightly ‘Whorfian’ position here about causal relations between general cognition and language (Evans and Levinson, 2009, p. 436), citing earlier work by Levinson (2003) proposing that spatial cognition is causally related to the grammaticalization of spatial reference in a language (argued against by Li and Gleitman, 2002 and others, as noted in the next section). Evans and Levinson make a claim about the species-specificity of human language which is opposed, at a philosophical level, to that of Chomsky. Whereas Chomsky proposes that what distinguishes us as a species is that all of our languages are fundamentally alike, Evans and Levinson propose that we are distinguished as a species because our communication systems are fundamentally diverse.

1.4.3 Dediu and Ladd

Dediu and Ladd (2007) develop an account of the diversification of languages based on genetic discoveries by others, including Bruce Lahn’s lab at the University of Chicago. They suggest that there is a correlation between the genetic difference and whether the populations differentiated genetically in these ways have a tone language or not. This is not an individual-level finding: in principle, any human (i.e. with any genetic make-up) can learn any human language (i.e. with any variety of linguistic form). However, Dediu and Ladd suggest that genetic factors can form a slight bias in what can be learned and how it is learned, and that over a population and over time, a collection of slight biases might lead to a population speaking a language with certain formal characteristics. They focus specifically on the learning of tone languages, and suggest that there is a genetic factor in some populations which makes a tone language easier for members of that population to learn. Ma’di, the language discussed earlier, is a tone language, and tone languages are quite common in certain areas of the world (e.g. Sub-Saharan Africa, South East Asia, Central America) and quite rare in others (e.g. Europe, North Africa, Australia). There are some languages (e.g. Japanese, Basque) with intermediate status, and dialects of a language can differ in whether they are tonal (Dediu and Ladd, 2007, p. 10945). They focus on two previously discovered alternative forms of genes (alleles), which are ASPM-D and MCPH-D, which emerged in some populations at an estimated 5.8 thousand years and 37 thousand years ago respectively: ‘those areas of the world where the new alleles are relatively rare also tend to be the areas

where tone languages are common' (ibid.). They propose that there is a causal relation between genetics and language, such that the genetic structure of a population can exert an influence on the language spoken. They propose that ASPM-D and MCPH-D have an effect on the brain areas involved in linguistic tone. This may produce a bias depending on whether one has these alleles, possibly by their making non-tone languages easier to learn. They note that there are many other contributing factors and that their findings do not support a racial or deterministic interpretation. The evolutionary suggestion is that, at some earlier stage, all languages may have been tone languages, but populations emerged with the new alleles which made it harder to learn tone languages, and so non-tone languages emerged. Dediu and Ladd's proposal has been widely discussed, because it offers a rare argument that genetic differences in human populations might be causally connected with language variation.

1.4.4 Linguistic theory and language diversity

Berwick et al. (2011, p. 3) suggest that there are four interacting factors which can determine why languages are different from one another. The first set of factors are innate and domain-specific (specific to language); these are the abstract elements of linguistic form as described for example by principles and parameters theory. Generative linguistics has always fundamentally concerned itself with these factors; opponents of this theory such as Evans and Levinson argue that these factors do not exist (i.e. that there is no innate language faculty). The second set of factors are innate and domain-general. These might include general aspects of perception, memory or other aspects of cognition which might have causal effects on the forms of language, and allow for or determine variations in languages; Dediu and Ladd's proposal stands here, in addition to the very different 'Whorfian' proposals that language has a causal relation with thought. The third set of factors are external stimuli, including exposure to language: Evans and Levinson (2009) think that the cultural environment plays a major role in determining linguistic factors. The fourth set of factors involve natural laws including computational efficiency: it may be that language takes the forms it does, and varies within certain limits or in certain ways, for reasons of computational efficiency.

A proponent of principles and parameters theory might allow all four types of factor to contribute to the shape of any specific language; however, a crucial component of this theory is that innate factors play an important role in constraining the effects of the other factors, and limiting overall variation. Other theorists such as Evans and Levinson exclude

the possibility of innate factors. The balance between external and internal factors, and between domain-specific (to language) and domain-general factors, is a matter of theoretical debate, based on the analysis of patterns and generalizations in the linguistic data (as shown in the previous two sections). It also depends on what one accepts as linguistic form. The key claim by Evans and Levinson is that surface linguistic forms are too diverse to be accommodated to universal principles as found in a faculty of language; the main response by generativists is that it is not at the level of surface forms but at the level of abstract forms (from which the surface is derived) that the underlying uniformities can be discovered. The debate around linguistic theory and language diversity is thus fundamentally a debate about whether there can be certain kinds of abstract linguistic form. This has relevance for the next section of this chapter, in which I explore the ‘Whorfian’ view that linguistic form has a causal relation with thought and behaviour, a view which has a following in the economics literature.

1.5 Whorfian psychology and economics: causal relations between language and thought

In this section I explore proposals that specific linguistic forms have a correlation with thought, and the possibility in particular that language causes thought, such that the language one speaks leads one to think or behave in certain ways. If true, these claims might suggest that linguistic diversity might have a causal relation with cultural diversity. This approach requires a psychological mechanism by which language causes thought, and a mechanism of historical change by which languages and kinds of thought change over time such that the claimed psychological causation can create and sustain correlations between linguistic form and thought over time. This is called a ‘Whorfian’ approach to language and thought. Projects seeking causal relations along these lines have recently been pursued by economists, and I discuss some of their arguments here.

The notion that language has a causal relation with thought and behaviour is particularly associated with the writings of Edward Sapir (1884–1939) and Benjamin Lee Whorf (1897–1941), and is sometimes called the ‘Sapir–Whorf hypothesis’ though here I call it ‘Whorfian’. Surveys of Whorfian ideas include the favourable account by Hill and Mannheim (1992), the account by Lucy (1997), and the hostile account by Gleitman and Papafragou (2005). Whorfianism has been of interest to psychologists and to economists, as

well as others studying language and cognition in society, culture or business. Psychologists construct experiments to test whether language determines observable aspects of cognition. Both pro- and anti-Whorfian psycholinguistic findings exist, and there is no final agreement on this. Economists (and sociologists) propose causal relations between values for some linguistic variable derived from linguistic typology and values for social variables associated with the countries in which the languages are spoken; all the correlational studies which I discuss later in this section propose a causal link (possibly in the distant past) and so affirm a Whorfian hypothesis. If there is a causal link, this must be mediated through a causal relation between language and individual psychology, which is why it is relevant to consider the psycholinguistic evidence for Whorfianism.

Most theoretical linguists tend to be hostile to Whorfianism, whose early arguments, including Whorf's account of the expression of time in the American language Hopi, and claims about the vocabulary of colour relative to colour perception, did not survive fuller scrutiny of the data. However, there are many data-specific Whorfian arguments which claim that language causes thought, and each argument needs to be examined on its merits. Most of the rest of this section looks at specific arguments, and casts doubt in particular on those arguments which have been developed by economists. There are two fundamental bases from which theoretical linguists criticize Whorfian arguments. First, linguistic data is very complex; Whorfian arguments often extract binarities from simplified typological data which is a very attenuated version of the complexity of actual data. Second, what we know when we know a language may include very abstract representations, rather different from what we see on the surface. The idea which underlies much linguistic theory and particularly generative linguistics is that languages are much more alike abstractly than they are on the surface; hence there is not as much cognitively relevant linguistic variety as appears from the Whorfian adoption of surface typological variation. Gleitman and Papafragou (2005, p. 654) make this point when they say that 'much discussion about the relationship between language and thought has been colored by an underlying disagreement about the nature of language itself'.

I now discuss three sets of psychological experiments which test Whorfian ideas. Each of these involves an initial claim that Whorfianism is demonstrated, followed by one or more rebuttals. They indicate the potential fragility of Whorfian arguments.

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- (i) Bloom (1981) noted a difference between English and Chinese (Mandarin) in how they expressed counterfactuals (the statement of something which might but need not be the case). In English, the subjunctive form of the verb can be used, such as *were* in *If she were to come, she would be here by now*. In Chinese, counterfactuality is not expressed on the morphology of the verb, but is expressed pariphrastically (using the arrangement of words in the sentence), as e.g. ‘if X then Y’. Bloom claimed that the direct expression of counterfactuality on the verb enabled monolingual English speakers to formulate better counterfactual interpretations of a story, as demonstrated by an experiment he conducted. However, Au (1983) showed that this effect could not be experimentally reproduced, argued that it was an artefact of how the experiment was constructed, and that different ways of setting up the experiment had results in which Chinese speakers were better at constructing counterfactuals, hence offering no evidence for Whorfianism.
- (ii) In some languages, position is described allocentrically (relative to the person) and in others, deictically (e.g. relative to a compass point), so that in the latter type of language someone might say ‘the spoon is to the north of the coffee cup’. Levinson (1996, 1997) describes experiments in which the spatial reasoning of subjects is affected by which of these types of language they speak, and this is cited as one of the functionalist arguments in Evans and Levinson (2009). However, Li and Gleitman (2002) and Li et al. (2011) argue against the validity of these experiments, on the basis of their own experiments and alternative explanations. They argue that the difference in experimental results comes from environmental and contextual factors impinging on the subjects, not from the differences in language. They say that ‘ambient spatial circumstances’ may be independently a factor both in the language used and in the spatial reasoning, but there is no independent causal relation between language and spatial reasoning. Thus Li et al. (2011, p. 51) claim that ‘spatial reasoning is flexible and largely independent of the implied dictates of linguistic encoding’. They emphasize the experimental subject’s reasoning about intentions and communication in the situation of being in an experiment, and suggest that this explains some of the effects reported by Levinson. Again, if these counter-arguments are right, this Whorfian argument fails.
- (iii) A third argument relates to languages in which temporal sequence can be expressed vertically so that April is described as ‘up’ relative to May which is ‘down’. Chinese (Mandarin) is such a language, while English is not. Boroditsky (2001, p. 18) conducted experiments which presented horizontal and vertical visual primes before asking for judgements about temporal sequence and concluded that ‘Mandarin speakers relied on a “Mandarin” way of thinking about time even when they were thinking about English sentences. Mandarin speakers were more likely to think about time vertically when deciding whether “March comes *earlier* than April”’. It is important to note that Boroditsky shows that this effect can be altered very quickly by training English speakers to use vertical terms to talk about time, and then testing them, in which case their behaviours are similar to speakers of Mandarin. These proposed Whorfian effects of language are thus not deep-rooted in thought, but seem to be highly manipulable in the experimental situation. However, January and Kako (2007), Chen (2007) and Bender et al. (2010), all separately re-ran the experiments and were unable to reproduce the findings. Chen concludes that ‘Chinese speakers do not conceptualize time differently than English speakers’ (2007 p. 436). Again, there is no clear evidence for Whorfianism here.

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These are three attempts to demonstrate Whorfian effects experimentally for three different aspects of a language. In each case, there are arguments for and arguments against. The debate continues, involving these and other aspects of linguistic form. The best conclusion for now is that there is no general agreement in psychology and psycholinguistics that specific forms of language cause specific forms of thought.

In the remainder of this section, I examine papers by economists which claim correlations between features of language and cultural values, and more specifically claim that language causes thought, or that thought (and perception) causes language to take on specific forms. Gay et al. (2013, p. 32) say:

since grammatical features often force us to encode certain aspects of reality to the exclusion of other aspects, it follows that applying an evolutionary perspective to grammar formation could well reveal selective pressures to codify the most relevant or salient aspects of our ancestors' reality, including culture and past economic specialization.

I interpret this to mean that the cultural values of a group of people (ancestors) caused linguistic forms to come into existence, perhaps in a situation where the linguistic system offers alternatives, and selection of the chosen alternative is biased by cultural values. This is opposite from the causal direction explored by psycholinguists, and is of course very speculative as it involves unobservable past processes. However, it is probably true to say that most of the economics articles also assume that causation is in the other direction, that language causes cultural values; here a comparison with relevant psycholinguistic experiments is useful.

1.5.1 Grammatical gender and biological sex

In many languages, nouns are grouped into classes called 'genders', where class membership is manifested as agreement, where the features of one word affect or determine the features of an article or other word (Corbett, 1991). Thus for example in the West African language Fula, *jiiwa* 'elephant' belongs to a gender (along with other large animals and the word for 'field') which takes the article *ba*, i.e. *jiiwa ba* 'the elephant', while *debbɔ* 'woman' belongs to a gender (along with other nouns including both male and female humans) which takes the article *ɗa*. In this Fula linguistic classification, biological sex has little connection to the

classification of nouns, but it is still called 'gender'. In other languages, including those discussed here, there is a substantial correlation between biological sex and gender, such that nouns for men may be classified as in one gender, and nouns for women as in another gender.

Does grammatical gender have a causal influence on cognition? The main focus of psychological research has been on how grammatical gender affects thinking about non-sexed objects which have grammatical genders (such as tables and chairs), in languages including Spanish and German. Boroditsky et al. (2003) summarize experiments whose results suggest that the grammatical gender of (non-sexed) objects affects how people think about those objects. These objects (without natural gender or sex) have conceptual gender associated with the grammatical gender assigned to them in a language: 'differences in grammar, with no concomitant differences in culture, are enough to influence how people think about objects' (ibid., p. 72). They suggest that it is because objects are grouped into categories by grammatical gender that other similarities are assigned to them as a group. It is significant that this arises even for an invented language with grammatical genders taught to English speakers, who immediately associate other gendered characteristics with the objects (ibid., p. 71). As in Boroditsky (2001) cited above, Boroditsky et al. (2003) show that it is possible to undo the influence of language on the subject very easily, suggesting that there is not a deep relation between one's language and one's psychology. Accounts of many similar experiments have been published, all involving the assignment (or not) of gendered characteristics to non-sexed objects (e.g. Vigliocco et al., 2005; Cubelli et al., 2011; Boutonnet et al., 2012). For example, Imai et al. (2014) examine German and suggest that biological sex-related properties are projected onto the articles which mark gender, and that it is via this projection that the classificatory similarities between items which share the same grammatical gender arise: grammatical gender does not affect the conceptual representations or inferences about the associated concepts. Bassetti (2014) suggests that grammatical gender effects on the non-sexed objects are mitigated when a speaker knows two languages with different gender assignments, which 'may increase awareness of the arbitrariness of language, thus reducing language-induced biases in mental representations of the world'. This incidentally again suggests that any causal effect of grammatical gender on cognition can be relatively easily interfered with, and so does not run deep. The easy manipulation of Whorfian effects is an important lesson from the experimental work which significantly problematizes the view expressed in Whorfian economics that language deeply embeds cultural values.

Economists have used Boroditsky et al. (2003) as evidence for Whorfianism; thus Santacreu-Vasut et al. (2014, p. 1) write that ‘grammar, according to cognitive science research (Boroditsky et al., 2003), impacts a speaker’s cognitive framework and mental representation of social reality’. But Boroditsky et al. (2003, p. 76) actually conclude that it is premature to ‘conclude that grammatical gender definitely does affect people’s nonlinguistic representations’. Further, Boroditsky et al.’s article relates not to how grammatical gender affects social reality, but to whether grammatical gender affects the categorization and assigned properties of non-gendered objects. Thus there is no support from the cited psycholinguistic work for the economists’ claims that grammatical gender has a causal relation with social thinking about men and women, claims which I now examine.

I begin with Mavisakalyan (2011), for whom ‘gender systems in language promote gender inequalities’. This is demonstrated by choosing a set of languages which are identified as those spoken at home in a set of countries, and for each country identifying a majority language. The countries are assigned gender-based values. The languages are classified as ‘strongly gendered’ (gender marked in first and second persons), ‘mildly gendered’ (gender marked only in third person) and ‘gender-neutral’ (no gender marked in pronouns). Mavisakalyan says that the relative percentages of women in the labour force correlates with whether the majority language of the country is strongly gendered (there are 4.4 percentage point less women in the labour force than in gender-neutral languages), mildly gendered (there are 2.3 percentage point less women in the labour force than in gender neutral neutral languages), or gender neutral. I illustrate how this maps on to countries shortly.

Gay et al. (2013) differentiate five levels of gender intensity (GII = gender intensity index, from 0 to 4) which a language may fall into, with the highest gender-intensity language having a combination of the properties of (i) a sex-based gender system, (ii) with exactly two genders, (iii) in which only male entities are assigned male gender, and (iv) there is a gender distinction in first and/or second person pronouns. A language with all four properties is called a GII4 language. Lower gender intensities from GII3 to GII0 correlate with fewer of these gender properties. Spanish, Hebrew and Arabic are all classified as GII4. Gay et al. (2013, p. 41) write that

at both the country and the individual level, women who speak in a language – or who live in countries with a dominant language – that marks gender more

intensively are less likely to participate in economic and political life and more likely to face formal and informal barriers when seeking to access credit and land.

Santacreu-Vasut et al. (2013, 2014) repeat essentially the same argument as Gay et al., concluding that ‘the average percentage of female presence on boards and committees is higher in countries with low gender marking than in those with high marking’ (Santacreu-Vasut et al., 2014, p. 5).

Prewitt-Freilino et al. (2012) develop a similar argument (but in a different discipline, apparently not aware of the economists’ arguments). They divide languages into three groups, of ‘gendered’, ‘genderless’ and ‘natural’. Gendered languages have masculine and feminine gender assigned to nouns (sometimes other genders). Genderless languages have no grammatical gender in nouns or pronouns. Natural gender languages have grammatical gender only in pronouns. They find that ‘countries that speak gendered languages evidence less gender equality than countries that speak natural gender or genderless languages’, and ‘countries that speak natural gender languages may be even more apt to exhibit gender equality – especially in the form of women’s greater access to political empowerment – than in countries where gendered or genderless languages are spoken’.

These three research projects each find that a classification of languages (in terms of gender on pronouns) correlates with a classification of cultures (in terms of the position of women). In Table 1.2, I summarize the results for a selection of the languages they discuss, to illustrate how the same languages are differently ranked by different approaches. I have taken a subset of the discussed language which allows for comparison, and I have crudely aligned them as ‘worst for women’, ‘best for women’ and ‘middling’ (these terms are not used by the original articles).

Languages are sorted into kinds differently by the approaches of the different articles, as Table 1.2 shows. So, for example, while Spanish, Hebrew and Arabic are placed by all three articles in the most gendered category, English is sometimes least gendered and sometimes in the middle, while Hindi is most gendered for Prewitt-Freilino et al. (2012), has a gender intensity of 3 (out of a maximal 4) for Gay et al. (2013) but is least gendered for Mavisakalyan (2011); German and French similarly are sometimes grouped together and sometimes separated in how gendered they are, depending on criteria. It is not necessarily a problem that there is no consistent way of classifying how gendered a language is, since it is

possible (in this type of argument) that different types of disadvantage for women correlate with different ways in which a language might be gendered, but it makes the arguments less grounded in objective linguistic reality. Recall also that there is no good evidence from psychology for any causal effects.

Before leaving this example, I want to note briefly the extent to which the typology ignores major differences between languages. Consider one component of Gay's gender intensity, which is whether first and second pronouns are gender marked; Hebrew and Spanish are said to have the same value, but this is so simplified as to be probably wrong. Hebrew gender marks all the first and second person pronouns. But European Spanish marks for gender only first and second person plural. The first person plural form which is used for a group of women is *nosotras* (sometimes informally used when the majority in a meeting are women), while *nosotros* is meant to be used when all are men or in a mixed group. Second person plural, specifically in the 'familiar' form, when all are women is *vosotras* and *vosotros* when all are men; the 'non-familiar' form has *ustedes* for both genders. In South American Spanish, the gender distinction disappears in second person plural because *ustedes* is the only form used (for both familiar and non-familiar). Finally, *nosotros* and *nosotras* and *vosotros* and *vosotras* can probably be treated as compounds, sharing the same ungendered pronouns *nos* 'we' and *vos* 'you' combined with a gender-sensitive suffix *otros* and *otras* (Harley and Ritter, 2002). So gender may not be really marked at all on the pronouns in Spanish. In all these ways, gender is marked in a very different way from Hebrew (and less intensively), but this is lost entirely in the typological simplification; furthermore South American Spanish is less gendered than European Spanish.

1.5.2 Person and subject pronouns

Kashima and Kashima (1998, 2005) correlate aspects of the 'major language used in a country' with cultural dimensions associated with that country such as individualism and uncertainty avoidance. For example, they say that a language allows 'pronoun drop' if first and second person pronouns can be omitted in conversations, and say that Spanish, Italian and Greek allow pronoun drop, while English, French and German do not. Countries are divided into those whose major languages allow pronoun drop and those which do not, and individualism scores are assigned to those countries. They find that 'languages licensing pronoun drop are associated with lower levels of individualism than those that require the

obligatory use of personal pronouns such as *I* or *you* as a subject of a sentence' (1998, p. 477). What reason is there to think that this correlation might arise from causation? Kashima and Kashima claim that the possibility of omission enables a speaker 'to manipulate the presence of the self and other in discourse' because omission of the first or second person subject reduces attention to the distinction between the self and the other, thus favouring a contextualized approach to the self and other rather than an individualistic one. This claim lacks psycholinguistic support.

Licht et al. (2007, p. 673) refer to the research reported in Kashima and Kashima (1998) and interpret it as follows: 'the license to drop pronouns, particularly to omit *I*, reduces the conceptual differentiation between person and context. It should therefore occur more frequently in societies whose cultures emphasize the contextualization of persons more and their uniqueness less'. Kashima and Kashima's argument is also used by Tabellini (2008) to argue that specific cultural values (e.g. that the individual is entitled to certain basic rights) will causally influence good government. He wants to show that certain values are embedded in a culture over a long time, and because language tends to change slowly, and is associated with a culture, he looks to language to provide long-lasting correlates of cultural values. He describes language as 'an instrument ... correlated with the random evolution of ideas in the distant past' and that the grammatical rules are 'correlated with distant cultural traditions', thus explicitly taking on a Whorfian position. Tabellini (2008, p. 274) claims correlations are based on two values, as follows. First, languages in which the first person must be expressed by a pronoun positively correlate with indicators of generalized morality, 'trust' and 'respect' (leading to good government). The second value relates to T-V languages. These are languages which have differentiated second person pronouns; e.g. French has 'tu' and 'vous', differentiated both for singular vs plural but also differentiated for social relations. These T-V languages are claimed by Tabellini to correlate negatively with 'trust' and 'respect'. Thus for example, English has the two linguistic values which would make it a language correlating with trust and respect; Italian has neither. He concludes (2008, p. 278) that 'languages forbidding pronoun drop or that do not differentiate between T-V are associated with better government (the correlation here is mainly with the pronoun drop rule)'.

A linguist might make several objections to Kashima and Kashima's use of linguistic evidence, and here I list four. A first objection (which can be made for all the Whorfian economics articles) relates to whether the complexity of the data has been properly

acknowledged. English – classified as a no-pronoun-drop language associated with individualism – actually does allow pronoun drop in various personal and public styles or registers, including newspaper headlines and diary writing (Haegeman and Ihsane, 2001). This problematizes the data underlying the study but also raises a question: if there is a causal relation between dropping the subject and non-individualism, does this mean that diaries express individualism less than other English genres? A second objection relates to how first and second person are expressed linguistically in English (no pronoun drop) vs Italian (pronoun drop). Both languages express first and second person; English does so only on the subject pronoun, while Italian does so on the verbal morphology and optionally also on the subject pronoun. It is not at all clear why one type of expression (on the verbal morphology as in Italian) should have a weaker causal effect than another (on a pronoun). In many Whorfian arguments, expression of a meaning as part of the verbal morphology is considered to have a greater causal effect than periphrastic expression, the opposite of what we have here. A third objection relates to how freely omissible a pronoun is; whether the subject person is expressed by a pronoun or not is often determined by syntactic or other contextual factors (this is true in Ma'di for example) such as discourse conditions or the need to focus the pronoun. These linguistic contextual factors can determine the choice of pronouns, so that choice is not free; this can over-ride the functional effects claimed by Kashima and Kashima.

A fourth objection comes from the very extensive theoretical linguistic work on the distinctions between what linguists call 'pro-drop' languages (those in which the subject pronoun can be omitted) and non-pro-drop languages. Pro-drop languages are diverse in kind (as Kashima and Kashima acknowledge); for example, in some such as Italian the verbal morphology provides information about the missing subject, while in others such as Chinese there is no relevant verbal morphology. Linguistic theorists seek to discover what underlying properties these languages have, which group them in certain ways: for example, most forms of English have no pro-drop and have a very small amount of partial verbal agreement with the subject, while Italian has pro-drop and uniformly full verbal agreement with the subject and Chinese has pro-drop and uniformly absent verbal agreement. Huang (1989) has argued that a pro-drop language must have uniform properties for agreement, either all present or all absent, hence grouping Italian and Chinese against English. In English the subject can be omitted only in a subordinate clause which has uniformly absent verbal morphology as in *I want [__ to leave]* where the subordinate verb 'leave' has a missing first person subject as marked by the line. Huang notes that the possibility of omitting the subject in a subordinate

clause in English (uniformly without agreement) is analogous to omitting the subject in a main clause in Chinese (uniformly without agreement). Linguists also note that pro-drop is correlated with other properties in a language. Thus Romance languages like Italian which can omit the subject can also invert the subject as in the grammatical sentence *Ha mangiato Giovanni* ('Giovanni ate'); linguists seek a consistent explanation for this and for the possibility of a missing subject. In summary, linguists treat the possibility of having a missing subject as one piece in a complex puzzle, which is solved differently for the diverse ways in which it manifests in different languages, and which also is based on underlying similarities between languages. The simple typologies based on surface properties, which are the basis for Kashima and Kashima's paper, may not represent what people actually know when they know a language.

1.5.3 Tense

Chen (2013) proposes that 'languages with obligatory future-time reference lead their speakers to engage in less future-oriented behaviour', and that this is manifested in behaviours relating to savings and health. Chen divides languages into strong FTR ('future time reference') languages which are associated with this 'less future-oriented behaviour' and weak FTR languages. A strong FTR language such as English requires 'future events to be grammatically marked when making predictions', so that in English we must say *It will rain tomorrow*, grammatically marking the future with *will*, and we cannot say *It rains tomorrow*. A weak FTR language such as German allows *Morgen regnet es*, literally 'tomorrow rains it', with no grammatical marking of the future. Strong FTR languages (the ones which are 'worse' in how they affect economic planning) include Hebrew, French, Russian, Spanish, Korean, (European) Portuguese and English. Weak FTR languages (the ones which are 'better' in how they affect economic planning) are listed as: Norwegian, Danish, Swedish, Dutch, German, Finnish, Estonian, Chinese (Mandarin), Japanese and Brazilian Portuguese.

Chen is explicit about causation, which is good since it makes the mechanisms by which language affects thinking more open to analysis, but also reveals problems in the words which he chooses to describe the psychological processes. Thus Chen (2013, p. 695) says that 'language may affect future choices by changing how different future events feel', and in the next sentence says that using this language might 'lead weak-FTR speakers to perceive future events as less distant'. Though feeling and perception are different kinds of

cognition, Chen has shifted from one to another. At various points in his article, Chen variously describes the kinds of cognition caused by linguistic forms as ‘feeling’ or having specific ‘feels’ (e.g. of vividness), ‘perception’ and ‘distinguishing’ (possibly related to perception), ‘willingness (to behave)’, ‘belief’, ‘remembering’ and ‘making (some outcome) more attractive’. This terminological variety leaves psychological aspects of causation undefined.

The linguist Östen Dahl’s theoretical and descriptive work on tense is a key source for Chen, and **Dahl has responded negatively to a pre-publication version of Chen’s article in a blog post (<http://dlc.hypotheses.org/360>)**. I now summarize two of Dahl’s objections.

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- (i) Chen uses a single criterion for deciding whether a grammar must distinguish ‘prediction-based future time reference’. By this criterion, Finnish and Estonian have hardly any future marking connected to the verb and so for Chen are weak FTR languages, while Russian is treated as a strong FTR language. However, once a wider range of relevant grammatical facts are examined, the distinction into two types of language is not clear. Thus Finnish and Estonian mark the object of the verb differently in a sentence referring to the future (and thus might have been re-analysed as strong FTR). In Russian, perfective verbs have no special future form; rather, the present is normally interpreted as referring to the future, and this difference from other ways in which ‘strong FTR’ emerges in a language makes it less clear that Russian can be classified as ‘strong FTR’. Many of the Whorfian economics articles identify some criterion for classifying languages into two kinds, here strong and weak FTR, but the complex ways in which languages differ work against such dichotomies, as they do here, where Dahl argues that there is a continuum, even when it comes to the specific matter of how weather predictions are expressed.
- (ii) Chen distinguishes two types of language based on a single way of talking about the future, exemplified by whether the future must be used in weather forecasts. Dahl looks at a wider range of data which complicates this significantly (showing for example that future time reference is not fully grammaticalized in the Romance languages called strong FTR by Chen) and suggests that ‘arguably, it should be the total set of patterns a language provides for speaking of the future that influences how we think of it rather than just the use of future tenses in prediction-based contexts’.

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1.5.4 Whorfian linguistic economics

All the ‘Whorfian economics’ articles discussed here identify languages as having specific values for specific linguistic features, usually drawn from typological databases such as WALS. I now note some problems with using WALS in this way, drawing on criticisms by Dahl, and by Roberts and Winters (2012, 2013).

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(i) Dahl (2013) says: ‘when preparing the WALS map “The Future Tense” we decided to refrain from classifying futures in any other way than by whether they were expressed morphologically or not, since we found that the information in grammars was usually not sufficient for anything else’. Simplified data may be misused for correlations, concealing the true complexity of actual language data. In his co-authored article in WALS, he has this to say:

Tense and aspect are notoriously difficult categories to describe adequately, and the treatment in grammars is often problematic, especially if one wants to use it for cross-linguistic comparison. As far as possible, we have tried to apply consistent criteria in classifying tense-aspect phenomena. For this reason, our interpretations sometimes differ from those found in grammars. The reader should thus not be surprised if a language is classified in an unexpected way. (Dahl and Velupillai, 2013)

(ii) Roberts and Winters (2012, 2013) offer a general discussion of the problems associated with using WALS or other large databases of linguistic features as the primary or sole source of evidence for formulating large-scale correlations of the kind seen in the economics articles. Their article more generally discusses, critically, the use of what they call nomothetic studies (statistical analyses of large-scale cross-cultural data). One of their concerns is that these databases are only as reliable as the sources – grammars and other descriptions – on which they are based, but these sources vary greatly in their reliability. This is because for some languages there is just one account by one analyst, and the reliability of the data depends on the analyst’s skill, classificatory decisions and theoretical assumptions.

(iii) Dahl as well as Roberts and Winters note that cultural phenomena may be bundled with each other without any causal relation between them. Dahl notes for example that ‘all the nine full member countries of the International Cricket Council also have left-hand driving’, but there is no causal relation between these; instead, the countries have co-developed for historical reasons, resulting in their sharing certain features. Two historically related languages may similarly share some language-internal correlation between linguistic features, but for reasons of historical development rather than for any underlying principle. Some of the correlations between linguistic features and non-linguistic features similarly are ‘bundles’ which have co-developed historically but with no causal relation between them, and no general principle underlying the correlation.

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In this section I have described various economics and psychology articles which propose that some aspect of linguistic form in a language can cause its speakers to think and behave in ways which are realized in the culture. There are two general reasons for being cautious about the conclusions drawn in these articles. First, there are concerns which theoretical and descriptive linguists might raise regarding the representations in these articles of the linguistic data, that its simplifications are no longer recognizable representations of the

linguistic facts, and do not recognize the potential abstractness of the data. At a minimum, economists who wish to pursue causal arguments involving linguistic data might want to discuss more extensively with theoretical linguists.

The second major problem relates to causation. Causation of this kind is necessarily difficult to demonstrate; there is no general background agreement amongst psycholinguists that specific Whorfian effects exist, and what evidence has been cited usually shows that Whorfian effects are very shallow and can be easily reversed experimentally. Whorfian economics thus needs to demonstrate a more rigorous theory of causation which is compatible with experimental work on language and thought (including the full range of evidence and counter-evidence), and which would support the correlations claimed.

1.6 Non-Whorfian proposals that language influences thought

Whorfian approaches to the causal influence of language on thought (or vice versa) are focused on the differences between languages and how those differences might cause differences in the way speakers of those languages think and behave. In this section I look at how a choice between options within a single language may have effects on how the speakers think. This is non-Whorfian because it does not involve claims that different languages have language-specific causal effects on thought or behaviour.

The British sociologist Basil Bernstein (1971) influentially argued that English is differentially accessed or used by different social classes, claiming that upper-middle-class children speak in an elaborated code (which he saw as a fuller use of the possibilities of the language) while working-class children speak in a restricted code (which he saw as an impoverished use of the possibilities of the language). Bernstein's work has been controversial (particularly amongst sociolinguists) but it has had significant influence in education, given the importance in educational theory of overcoming class-correlated disadvantage.

Stylistic choices might influence thought and behaviour. For example, a language may offer alternative ways of phrasing the same proposition (or asking the same question). A well known account of this is Tversky and Kahneman's (1981) study of how two different ways of phrasing the same options in a question can lead to significantly different responses:

they show that ‘seemingly inconsequential changes in the formulation of choice problems caused significant shifts of preference’ (1981, p. 457). The claim that stylistic choices can influence thought and behaviour is also important in critical discourse analysis, widely used in the social sciences while having little to do with the Whorfian question of whether the distinct forms of a language have the potential to influence thought. Critical discourse analysis is best understood as a methodology in social science; it has little relation to linguistic theory.

Psychological experiments have demonstrated that how a text is written can affect aspects of the psychology of the reader or hearer. These are on-line effects driven by stylistic choices within a single language, not Whorfian effects by which the language as a whole system shapes a culture’s thinking. For example, Hasher et al. (1977, p. 111) showed that repetition of a statement ‘increases a person’s belief in the referential validity or truth of that statement’. This is a well-established finding which McGlone and Tofiqbakhsh (2000) adapted to demonstrate experimentally that aphorisms which rhyme are judged to be truer than aphorisms which do not. In both cases, repetition (including rhyme as a type of repetition) increases the fluency of processing, and that fluent processing leads the hearer to attribute greater truth and even familiarity to the content of what is being processed (and they like it more). Psycholinguistic experiments have similarly shown weak effects on thought, judgement and behaviour which are determined by stylistic choices in a stimulus text. Here, we are in the domain of neuroeconomics, and it may be that relevant experiments might show stylistic effects on economically relevant decision making.

1.7 Conclusion

This chapter has illustrated some of the ways in which languages have diverse forms and has illustrated how linguistic diversity is explained by one of the dominant types of theoretical linguistics, generative linguistics. This discussion was the context for the part of the chapter in which I looked at a number of articles by economists and others, where the diverse forms of languages are said to have a causal connection with the diverse forms, particularly the values, of cultures. I have argued that it is premature to come to these conclusions. Languages vary in much more complex and detailed ways than is accommodated by the binary divisions favoured in the Whorfian articles. The Whorfian claim that language causes thought is not well established: it is still widely contested. And, finally, linguistic theory offers a vision of

linguistic form which makes Whorfian causation less plausible in general, given the linguistic theoretical commitment to abstract form and how this explains linguistic variation. Any future work in Whorfian economics will need to take these considerations more fully into account.

1.8 References

T. Au (1983) 'Chinese and English Counterfactuals: The Sapir–Whorf Hypothesis Revisited', *Cognition*, 15, 155–187.

B. Bassetti (2014) 'Is Grammatical Gender Considered Arbitrary or Semantically Motivated? Evidence from Young Adult Monolinguals, Second Language Learners, and Early Bilinguals', *British Journal of Psychology*, 105, 273–294.

A. Bender, S. Beller and G. Bennardo (2010) 'Temporal Frames of Reference: Conceptual Analysis and Empirical Evidence from German, English, Mandarin Chinese, and Tongan', *Journal of Cognition and Culture*, 10, 283–307.

B. Bernstein (1971) *Class, Codes and Control. Volume 1: Theoretical Studies towards a Sociology of language* (London: Routledge and Kegan Paul).

R. Berwick, P. Pietroski, B. Yankama and N. Chomsky (2011) 'Poverty of the Stimulus Revisited', *Cognitive Science*, 1–36.

H. den Besten (1983) 'On the Interaction of Root Transformations and Lexical Deletive Rules', revised version of a paper in *Studies in West Germanic Syntax, Dissertatie Tilburg*, 1989, 20, 14–100.

T. Biberauer, A. Holmberg and I. Roberts (2007) 'Disharmonic Word-order Systems and the Final-over-Final-Constraint (FOFC)' In A. Bisetto and F. Barbieri (eds) *Proceedings of XXXIII Incontro di Grammatica Generativa*. Available at http://amsacta.cib.unibo.it/archive/00002397/01/PROCEEDINGS_IGG.pdf.

- M. Blackings and N. Fabb (2003) *A Grammar of Ma'di* (Berlin: Mouton).
- A. Bloom (1981) *The Linguistic Shaping of Thought: A Study in the Impact of Language on Thinking in China and the West* (Hillsdale: Erlbaum Associates).
- L. Boroditsky (2001) 'Does Language Shape Thought? Mandarin and English Speakers' Conceptions of Time', *Cognitive Psychology*, 43, 1–22.
- L. Boroditsky, L. Schmidt and W. Phillips (2003) 'Sex, Syntax, and Semantics' In D. Gentner and S. Goldin-Meadow (eds) *Language in Mind: Advances in the Study of Language and Cognition* (Cambridge, MA: MIT Press).
- B. Boutonnet, P. Athanasopoulos and G. Thierry (2012) 'Unconscious Effects of Grammatical Gender during Object Categorisation', *Brain Research*, 1479, 72–79.
- J.-Y. Chen (2007) 'Do Chinese and English Speakers Think about Time Differently? Failure of Replicating Boroditsky (2001)', *Cognition*, 104, 427–436.
- M. Chen (2013) 'The Effect of Language on Economic Behavior: Evidence from Savings Rates, Health Behaviors, and Retirement Assets', *The American Economic Review*, 103, 690–731.
- N. Chomsky (1957) *Syntactic Structures* (The Hague: Mouton).
- N. Chomsky (1965) *Aspects of the Theory of Syntax* (Cambridge MA: MIT Press).
- N. Chomsky (1981) *Lectures on Government and Binding* (Dordrecht: Foris).
- N. Chomsky (1995) *The Minimalist Program* (Cambridge MA: MIT Press).
- N. Chomsky and M. Halle (1968) *The Sound Pattern of English* (New York: Harper & Row).
- G. Cinque (2013) 'Cognition, Universal Grammar, and Typological Generalizations', *Lingua*, 130, 50–65.

P. Cole, G. Hermon and L-M. Sung (1990) 'Principles and Parameters of Long-Distance Reflexives', *Linguistic Inquiry*, 21, 1-22.

G. Corbett (1991) *Gender* (Cambridge: Cambridge University Press).

G. Corbett (2013) "'30 Number of Genders", "31 Sex-based and Non-sex-based Gender Systems", "32 Systems of Gender Assignment" In M. Dryer and M. Haspelmath (eds) *The World Atlas of Language Structures Online* (Leipzig: Max Planck Institute for Evolutionary Anthropology).

R. Cubelli, D. Paolieri, L. Lotto and R. Job (2011) 'The Effect of Grammatical Gender on Object Categorization', *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 37, 449-460.

Ö. Dahl and V. Velupillai (2013) 'Tense and Aspect' In Matthew S. Dryer and M. Haspelmath (eds) *The World Atlas of Language Structures Online* (Leipzig: Max Planck Institute for Evolutionary Anthropology). Available online at <http://wals.info/chapter/s7> (Accessed on 2014-06-16).

D. Dediu and D. R. Ladd (2007) 'Linguistic Tone is Related to the Population Frequency of the Adaptive Haplogroups of Two Brain Size Genes, ASPM and Microcephalin', *Proceedings of the National Academy of Sciences*, 104, 10944-10949.

M. Dryer (2013) '144 Position of Negative Morpheme With Respect to Subject, Object, and Verb' In M. Dryer and M. Haspelmath (eds) *The World Atlas of Language Structures Online* (Leipzig: Max Planck Institute for Evolutionary Anthropology).

N. Evans and S. Levinson (2009) 'The Myth of Language Universals: Language Diversity and its Importance for Cognitive Science', *Behavioral and Brain Sciences*, 32, 429-492.

V. Gay, E. Santacreu-Vasut, and A. Shoham (2013) 'The Grammatical Origins of Gender Roles', BEHL Working Paper.

- L. Gleitman and A. Papafragou (2005) 'Language and Thought' In K. Holyoak and R. Morrison (eds) *Cambridge Handbook of Thinking and Reasoning* (Cambridge: Cambridge University Press).
- L. Haegeman and T. Ihsane (2001) 'Adult Null Subjects in the Non-pro-drop Languages: Two Diary Dialects', *Language Acquisition*, 9, 329–346.
- H. Harley and E. Ritter (2002) 'Person and Number in Pronouns: A Feature-Geometric Analysis', *Language*, 78, 482–526
- L. Hasher, D. Goldstein and T. Toppino (1977) 'Frequency and the Conference of Referential Validity', *Journal of Verbal Learning and Verbal Behavior*, 16, 107–112
- M. Haspelmath (2013) '34 Occurrence of Nominal Plurality' In M. Dryer and M. Haspelmath (eds) *The World Atlas of Language Structures Online* (Leipzig: Max Planck Institute for Evolutionary Anthropology).
- J. Hill and B. Mannheim (1992) 'Language and World View', *Annual Review of Anthropology*, 21, 381–406.
- C-T. J. Huang (1989) 'Pro Drop in Chinese: a Generalized Control Approach' In O. Jaeggli and K. Safir (eds) *The Null Subject Parameter* (Dordrecht: D. Reidel).
- M. Imai, L. Schalk, H. Saalbach and H. Okada (2014) 'All Giraffes Have Female-Specific Properties: Influence of Grammatical Gender on Deductive Reasoning About Sex-Specific Properties in German Speakers', *Cognitive Science*, 38, 514–536.
- D. January and E. Kako (2007) 'Re-evaluating Evidence for Linguistic Relativity: Reply to Boroditsky (2001)', *Cognition*, 104, 417–426.
- E. Kashima and Y. Kashima (1998) 'Culture and Language: The Case of Cultural Dimensions and Personal Pronoun Use', *Journal of Cross-Cultural Psychology*, 29, 461–487.

- E. Kashima and Y. Kashima (2005) 'Erratum to Kashima and Kashima (1998) and Reiteration', *Journal of Cross-Cultural Psychology*, 36, 396–400.
- S. Levinson (1996) 'Frames of Reference and Molyneux's Question: Crosslinguistic Evidence' In P. Bloom, M. Peterson, L. Nadel and M. Garrett (eds) *Language and Space* (Cambridge, MA: MIT Press).
- S. Levinson (1997) 'From Outer to Inner Space: Linguistic Categories and Non-linguistic Thinking' In J. Nuyts and E. Pederson (eds) *Language and Conceptualization* (Cambridge: Cambridge University Press).
- S. Levinson (2003) *Space in Language and Cognition: Explorations in Cognitive diversity* (Cambridge: Cambridge University Press).
- P. Li, L. Abarbanell, L. Gleitman and A. Papafragou (2011) 'Spatial Reasoning in Tenejapan Mayans', *Cognition*, 120, 33–53.
- P. Li and L. Gleitman (2002) 'Turning the Tables: Language and Spatial Reasoning', *Cognition*, 83, 265–294.
- A. Licht, C. Goldschmidt and S. Schwartz (2007) 'Culture Rules: The Foundations of the Rule of Law and other Norms of Governance', *Journal of Comparative Economics*, 35, 659–688.
- J. Lucy (1997) 'Linguistic Relativity', *Annual Review of Anthropology*, 26, 291–312.
- I. Maddieson (2013) '1 Consonant Inventories', '2 Vowel Quality Inventories', '7 Glottalized Consonants', '12 Syllable Structure', '13 Tone', '19 Presence of Uncommon Consonants' In M. Dryer and M. Haspelmath (eds) *The World Atlas of Language Structures Online*. (Leipzig: Max Planck Institute for Evolutionary Anthropology).

- A. Mavisakalyan (2011) 'Gender in Language and Gender in Employment', ANUCBE School of Economics Working Paper.
- M. McGlone and J. Tofiqbakhsh (2000) 'Birds of a Feather Flock Conjointly (?): Rhyme as Reason in Aphorisms', *Psychological Science*, 11, 424–8
- J. Nichols (2012) 'Monogenesis or Polygenesis: A Single Ancestral Language for all Humanity?' In M. Tallerman and K. Gibson (eds) *The Oxford Handbook of Language Evolution* (Oxford: Oxford University Press).
- J. Prewitt-Freilino, T. Caswell, and E. Laakso (2012) 'The Gendering of Language: A Comparison of Gender Equality in Countries with Gendered, Natural Gender, and Genderless Languages', *Sex Roles*, 66, 268–281.
- L. Rizzi (2013) 'Introduction: Core Computational Principles in Natural Language Syntax', *Lingua*, 130, 1–13.
- S. Roberts and J. Winters (2012) 'Social Structure and Language Structure: The New Nomothetic Approach', *Psychology of Language and Communication*, 16, 89–112.
- S. Roberts and J. Winters (2013) 'Linguistic Diversity and Traffic Accidents: Lessons from Statistical Studies of Cultural Traits', *PLOS* August 14, 2013 DOI: 10.1371/journal.pone.0070902
- E. Santacreu-Vasut, A. Shoham and V. Gay (2013) 'Do Female/Male Distinctions in Language Matter? Evidence from Gender Political Quotas', *Applied Economics Letters*, 20, 495–498.
- E. Santacreu-Vasut, O. Shenkar and A. Shoham (2014) 'Linguistic Gender Marking and its International Business Ramifications', *Journal of International Business Studies*, 47, 1–9.

G. Tabellini (2008) 'Institutions and Culture' *Journal of the European Economic Association*, 6, 255–294.

A. Tversky, and D. Kahneman (1981) 'The Framing of Decisions and the Psychology of Choice', *Science*, 211, 453–458.

G. Vigliocco, D. Vinson, F. Paganelli and K. Dworzynski (2005) 'Grammatical Gender Effects on Cognition: Implication for Language Learning and Language Use', *Journal of Experimental Psychology: General*, 134, 501–520.

Websites

<http://www.replicatedtypo.com>. This is a blog on evolutionary linguistics, which has involved extensive critical discussion of correlations between social and linguistic factors, including some of the work in economics.

<http://wals.info>. The World Atlas of Language Structures (WALS). The largest database of typological linguistic information, freely available online.

<http://sswl.railsplayground.net>. Syntactic Structures of the World's Languages (SSWL): another freely available online typological database, strongly influenced by generative linguistics.

<http://www.ethnologue.com>. A catalogue of over 7,000 languages of the world.

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Index terms

1. Index items likely to be specific to this chapter

generative grammar

Whorfian

Sapir–Whorf hypothesis (see also ‘Whorfian’)

pronouns

gender

tense and time

phonology

syntax

morphology

verb order

Ma’di

South Sudan

universal grammar

communication theory

critical discourse analysis

spatial reasoning

counterfactuals

WALS

2. Index items likely to be referred to by other authors

dialect

historical change

German

Chinese (Mandarin)

genetics

allele

Table 1.1 Profane and Profanity

Underlying representations	prof \bar{a} n	prof \bar{a} n + ity	Underlying vowel is long \bar{a} (same for unsuffixed and suffixed form)
Stress assignment	prof \bar{a} n	prof \bar{a} n + ity	Stress is assigned (indicated by underlining)
Shortening rule	prof \bar{a} n	prof \bar{a} n + ity	Antepenultimate vowel is shortened: affects 'profanity' only
Diphthongization rule	prof \bar{a} yn	prof \bar{a} n + ity	Long vowels are diphthongized: affects 'profane' only
Vowel shift rule	prof \bar{e} yn	prof \bar{a} n + ity	Stressed long vowels are altered in quality, e.g. [æ] moves up to become [e]: affects 'profane' only
Surface representations	prof \bar{e} yn	prof \bar{a} nity	Different surface vowels

Table 1.2 Gender and Language

Mavisakalyan (2011)

Worst for women	Strongly gendered	Arabic, Hebrew, Spanish
Middling	Mildly gendered	Chinese (Mandarin), Dutch, English, French, German, Greek, Italian, Lithuanian, Norwegian, Polish, Portuguese, Russian, Romanian, Swedish
Best for women	Gender-neutral	Azerbaijani, Chichewa, Estonian, Finnish, Hindi, Hungarian, Khmer, Malay, Mongolian (Khalkha), Thai, Turkish, Vietnamese

Gay et al. (2013)

Worst for women	GI14	Arabic, Hebrew, Spanish
	GI13	French, Hindi
Middling	GI12	German, Greek, Icelandic, Italian, Lithuanian, Portuguese Russian
	GI11	Chichewa, Dutch, English, Norwegian, Polish, Romanian, Swedish
Best for women	GI10	Azerbaijani, Khmer, Chinese (Mandarin), Estonian, Finnish, Hungarian, Indonesian, Korean, Malay, Mongolian (Khalkha), Thai, Turkish, Vietnamese

Prewitt-Freilino et al. (2012)

Worst for women	Gendered	Arabic, Dutch, French, German, Greek, Hebrew, Hindi, Irish, Italian, Korean, Portuguese, Polish, Romanian, Russian, Spanish, Tamil
Middling	Genderless	Azerbaijani, Chichewa, Chinese (Mandarin), Khmer, Estonian, Finnish, Hungarian, Indonesian, Malay, Lithuanian, Mongolian (Khalkha), Thai, Turkish, Vietnamese
Best for women	Natural	English, Icelandic, Norwegian, Swedish

Figure 1.1 His mother loves John ('his' can be interpreted as 'John')

Figure 1.2 He loves John ('he' cannot be interpreted as 'John')

Figure 1.3 That he is hot Bothers John ('he' can be interpreted as 'John')

Figure 1.4 C-Command

Figure 1.5 Government and binding theory