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The Code Talker Paradox

DEEP MYSTERIES OF LANGUAGE are illustrated by an incident that occurred in 1943, when the Japanese military was firmly entrenched around the Bismarck Archipelago. American pilots had nicknamed the harbor of Rabaul "Dead End" because so many of them were shot down by antiaircraft guns placed in the surrounding hills. It became apparent that the Japanese could easily decode Allied messages and thus were forewarned about the time and place of each attack.

The Marine Corps responded by calling in one of their most effective secret weapons: eleven Navajo Indians. These were members of the famous Code Talkers, whose native language was the one cipher the Japanese cryptographers were never able to break. The Navajos quickly provided secure communications, and the area was soon taken with minimal further losses. Such incidents were repeated throughout the Pacific theater in World War II. Years after the end of the war, a U.S. president commended the Navajo Code Talkers with the following words: "Their resourcefulness, tenacity, integrity and courage saved the lives of countless men and women and sped the realization of peace for war-torn lands." But it was not only their resourcefulness, tenacity, integrity, and courage that made possible their remarkable contribution: It was also their language.

This incident vividly illustrates the fundamental puzzle of linguistics. On the one hand, Navajo must be extremely different from Eng-

lish (and Japanese), or the men listening to the Code Talkers' transmissions would eventually have been able to figure out what they were saying. On the other hand, Navajo must be extremely similar to English (and Japanese), or the Code Talkers could not have transmitted with precision the messages formulated by their English-speaking commanders. Navajo was effective as a code because it had both of these properties. But this seems like a contradiction: How can two languages be simultaneously so similar and so different? This paradox has beset the comparative study of human languages for centuries. Linguists are beginning to understand how the paradox can be dissolved, making it possible for the first time to chart out precisely the ways in which human languages can differ from one another and the ways in which they are all the same.

Let us first consider more carefully the evidence that languages can be radically different. The Japanese readily solved the various artificial codes dreamed up by Allied cryptographers. Translating a message from English to Navajo evidently involves transforming it in ways that are more far-reaching than could be imagined by the most clever engineers or mathematicians of that era. This seems more remarkable if one knows something about the codes in use in World War II, which were markedly more sophisticated than any used before that time. In this respect, an ordinary human language goes far beyond the bounds of what can reasonably be called a code. If the differences between Navajo and English were only a matter of replacing words like *man* with Navajo-sounding vocabulary like *hastiin*, or putting the words in a slightly different order, decoding Navajo would not have been so difficult. It is clear that the characteristics one might expect to see emphasized in the first few pages of a grammar book barely scratch the surface of the complexity of a truly foreign language.

Other signs of the complexity and diversity of human languages are closer to our everyday experience. Consider, for example, your personal computer. It is vastly smaller and more powerful than any-

thing the inventors of the computer imagined back in the 1950s. Nevertheless, it falls far short of the early computer scientists' expectations in its ability to speak English. Since the beginning of the computer age, founders of artificial intelligence such as Alan Turing and Marvin Minsky have foreseen a time in which people and computers would interact in a natural human language, just as two people might talk to each other on a telephone. This expectation was communicated vividly to the world at large through the 1968 movie *2001: A Space Odyssey*, in which the computer HAL understood and spoke grammatically perfect (if somewhat condescending) English. Indeed, natural language was not even considered one of the "hard" problems of computer engineering in the 1960s; the academic leaders thought that it would more or less take care of itself once people got around to it. Thirty-five years and billions of research dollars later, their confidence has proved unwarranted. It is now 2001, and though HAL's switches and indicator lights look hopelessly out-of-date, his language skills are still in the indefinite future. Progress is being made: We only recently achieved the pleasure of listening to weather reports and phone solicitations generated by computers. But computer-generated speech still sounds quite strange, and one would not mistake it for the human-generated variety for long. Moreover, these systems are incapable of improvising away from their set scripts concerning barometric pressures and the advantages of a new vacuum cleaner.

This poor record contrasts with scientists' much greater success in programming computers to play chess. Another of HAL's accomplishments in *2001* was beating the human crew members at chess—a prediction that has turned out to be entirely realistic. We usually think of chess as a quintessentially intellectual activity that can be mastered only by the best and brightest. Any ordinary person, in contrast, can talk your ear off in understandable English without necessarily being regarded as intelligent for doing so. Yet although computer programs can now beat the best chess players in the world, no artificial system exists that can match an average five-year-old at speaking and understanding English. The ability to speak and un-

derstand a human language is thus much more complex in objective terms than the tasks we usually consider to require great intelligence. We simply tend to take language for granted because it comes so quickly and automatically to us. Just as Navajo proved harder than other codes during World War II, so English proves harder than the Nimzowitsch variation of the French defense in chess.

The experience of computer science confirms not only that human languages are extremely complex but that they differ in their complexities. Another major goal of artificial intelligence since the 1960s has been machine translation—the creation of systems that will take a text in one language and render the same text in another language. In this domain the ideal is set not by HAL but by *Star Trek*: All crew members have a “universal translator” implanted in their ears that miraculously transforms the very first alien sentence it hears into perfect English. Again, real machine translation projects have proven more difficult. Some programs can take on tasks like converting the English abstracts of engineering articles into Japanese or providing a working draft of a historical text from German in English or translating a page on the World Wide Web. But the products of these systems are very rough and used only in situations where an imperfect aid is desired. Indeed, sometimes they make embarrassingly funny mistakes. Harvey Newquist reports an apocryphal story about an early English-Russian system that translated the biblical quotation “The spirit is willing, but the flesh is weak” into Russian as “The vodka is strong, but the meat is spoiled.” Performance has improved since the 1960s, but not as much as one might imagine. Here is a quotation from the biblical book of Ecclesiastes (9:11 RSV):

Again I saw that under the sun the race is not to the swift, nor the battle to the strong, nor bread to the wise, nor riches to the intelligent, nor favor to the men of skill, but time and chance happen to them all.

Here is the same passage after it has been translated into Russian and back again by a randomly selected Web-based machine translation program:

Afresh I beheld such under the sun the race am no near the fast, no bread near the profound, no affluence near the clever, no favor near the body [yjîêâ]) against art, alone fardel ampersand accident become near their all.

It is fair to say that something is lost in this translation. My friend who translates banking documents from English to French need not look for other work just yet.

Moreover, the best systems so far work on an ad hoc basis, taking advantage of whatever special properties they can find in the two languages they deal with. When good systems are finally up and running for Russian-English translations, they certainly will not be any good at Navajo or Swahili or Turkish. Adapting the program to these languages will not be a matter of adjusting a few settings. Rather, programmers will have to start almost from scratch to create comparable systems for these languages.

Lest we be tempted to look down on computers and Japanese cryptographers, we should take stock of our own experiences in learning foreign languages. Having been deeply moved by stories of John Henry and the steam engine as a youth, I have a fondness for stories about what machines cannot do. American patriots might feel smug about how easily Japanese intelligence was duped by the clever Marine Corps. But what about us? With the right kind of exposure to a language and plenty of hard work, adults can achieve a reasonable degree of fluency in a new language. But very few, even after years of living in another country, ever learn a foreign language so well that they could pass as a native speaker. Most of us never even make it up to the level of full fluency. For example, I took five years of Spanish in an American high school. I aced most of the grammar tests, but no Spaniard will ever mistake me for one of his own. And even after living in Montreal for twelve years I find it embarrassingly difficult to follow a hockey game in French without visual aids. And French, Spanish, and English are all closely related by global standards: For a native English speaker, learning Chinese or Arabic or Turkish is harder still. Only a handful of white people have ever

learned Navajo with any degree of fluency. Americans should be thankful that the Japanese empire had no aboriginal languages of its own to press into service.

What was it about Navajo that made it so difficult to decode? As far as I know, no one has investigated what strategies the cryptographers tried and precisely why those strategies failed. But if one knows a little bit about Navajo, it is not hard to guess some of the reasons. Much of the difficulty in coming to grips with an unfamiliar language is that there are many layers of difference. Each layer might be understandable enough in its own terms, but the differences magnify each other until the total effect is overwhelming.

First, of course, there is the fact that the Navajos (to adapt an old Steve Martin joke about French) have a different word for everything. When an English speaker would say *girl*, a Navajo speaker would say *at'ééd*; for English *boy*, a Navajo would use *ashkii*; for English *horse*, Navajo has *lį́į́*, and so on. Moreover, the things that English has specific words for and the things that Navajo has specific words for do not always match perfectly. For example, English is unusually rich in words for various modes of thought and feeling. In English, we can believe, know, wonder, opine, suppose, assume, presume, surmise, consider, maintain, and reckon. We can be furious, irritated, incensed, indignant, irate, mad, wrathful, cross, upset, infuriated, or enraged. In many other languages, this domain of meaning is covered with only two words, 'to think' and 'to be angry.' Navajo, for its part, has at least ten different verbs for different kinds of carrying, which depend on the shape and physical properties of the thing being carried: '*Aah* means to carry a solid roundish object, such as a ball, a rock, or a bottle; *kaah* means to carry an open container with its contents, such as a pot of soup or a basket of fruit; *lé* means to carry a slender flexible object like a belt, a snake, or a rope; and so on. For this reason, finding the right words to use in a translation to or from Navajo involves much more than simply substitut-

ing one string of letters for another. The "Replace All" command on your word processor will never be able to do it properly.

Second, there are important differences in the sounds that make up words in Navajo. As you surely noticed, the Navajo words listed above contain some strange-looking symbols: *l*'s with bars through them, vowels with accents over them and hooks under them, apostrophes in the middle of words. This reflects that the Navajo language is built around a different set of basic sounds than English is. For example, the *l* stands for a sound that is rather like that of the English *l* but made "whispering," without vibration of the vocal cords. (The same sound is indicated by the double *ll* in Welsh words like *Lloyd*.) Hooks under the vowels indicate that these sounds are pronounced nasally, with air passing through the nose as well as the mouth. The Navajo word *sá* 'old age' is pronounced much like the French word *sans* 'without.' To complicate matters further, the specific qualities of these sounds adjust in complex ways to the sounds around them. For example, Navajo has a prefix *bí-* that attaches to nouns and means 'his' or 'hers.' Thus, *gab* means 'rabbit' and *bigab* means 'his/her rabbit.' When this prefix attaches to certain words that begin with *s*, that *s* changes to a *z* sound. Thus, *séi* means 'sand,' but *bizéi* means 'his/her sand.' In the same context, the whispered *l* sound undergoes a similar change to become plain *l*: *lį́į́* is 'horse,' and *bilį́į́* is 'his/her horse.' These differences in sound are significant because it is notoriously difficult for people to recognize sounds that do not exist in their own languages. Japanese speakers have a terrible time distinguishing English *l* versus *r*, whereas English speakers have trouble recognizing the four different *t* sounds in Hindi. When added together, the many sound differences give Navajo speech a very distinctive, almost unearthly quality that speakers of Eurasian languages find difficult to grasp or remember.

Words in Navajo also change their form depending on their context in various ways. One of the most remarkable aspects of Navajo is its system of prefixes. Indeed, simple, invariant words are rare in Navajo. We just saw that a prefix can attach to a noun to show that the noun is possessed. The prefix system for verbs is even more elab-

orate. There are between 100 and 200 different prefixes that attach to Navajo verb stems, depending on the exact analysis. Even the simplest verbs in Navajo must take at least three prefixes, five or six are common, and a verb can have up to ten or twelve at one time. The total number of forms a Navajo verb can take is staggering. Nor can the language learner afford simply to overlook these prefixes and hope for the best. The subject of the sentence, for example, is often hidden inside the prefixes. 'The girl is crying' in Navajo is a fairly normal-looking combination of the word for 'girl' and (one form of) the word for 'cry.'

At'ééd	yicha.
Girl	crying

But 'I am crying' is expressed by a verb standing alone. That I am crying, not you or they, is expressed by a prefix *sh-* found before the verb root but after other prefixes.

Yishcha.	(yi + sh + cha)
'I am crying.'	

(This ability of some languages to express subjects as changes on the verb plays a major role in my discussion in Chapter 4.) Other Navajo prefixes elaborate on the basic meaning of the verb root in intricate ways. For example, the simple root *dlaad*, meaning 'to tear,' combines with six different prefixes to make the following word, meaning 'I am again plowing.'

Ninááhwiishdlaad.	(ni + náá + ho + hi + sh + l + dlaad)
'I am again plowing.'	

These aspects of Navajo pose a major challenge to that great institution of Western civilization, the dictionary. Since Navajo has so many prefixes, the primary lexical meaning is rarely carried in the first part of a word. Thus, the basic idea of listing words in alphabetical order

is not so practical for this language. Looking up a word in Navajo requires first identifying the prefixes, undoing the sound changes that they cause, and deleting them. Only then can one find the basic root of the word and calculate the changes in meaning caused by the prefixes. Dictionaries of Navajo do exist, but successfully using one is a major intellectual achievement—the way you prove you have mastered Navajo, not the way you learn it.

Navajo also has complexities at the level of syntax, how its words are put together to make phrases and sentences. The simplest subject-verb combinations, like 'the girl is crying' shown above, look innocent enough: The subject noun phrase comes first, as in English, and the verb that expresses the predicate comes second. But differences appear in more complex sentences. For example, consider a transitive sentence, one that contains a direct object noun phrase as well as a subject. In Navajo the direct object always comes before the verb, not after it as in English:

Ashkii	at'ééd	yiyiiltsá.
Boy	girl	saw
'The boy saw the girl.'		

*Ashkii	yiyiiltsá	at'ééd.
Boy	saw	girl

(Linguists put an asterisk in front of an example to show that the way of combining words is impossible in the language under discussion. I use this convention frequently.) Other phrases have a distinctive word order, too. Whereas in English one says 'change into your clothes,' the Navajo would say the equivalent of 'clothes into change.' Whereas in English one says 'John believes that he is lying,' in Navajo one would say the equivalent of 'John he lying-is believes.' In fact, there is a systematic pattern to these Navajo word orders, a topic I discuss in detail in Chapter 3. But systematic or no, it is confusing to an English speaker.

If the Japanese cryptographers had got this far, they might have breathed a sigh of relief at this point, because these word order patterns are actually the same as in Japanese. But their newfound confidence would have evaporated when they came across sentences like this:

Ashkii	at'ééd	biilstá.
Boy	girl	saw

This sentence has almost the same words arranged in the same order as the one we saw above, and so we might reasonably guess that it has the same meaning: 'The boy saw the girl.' In fact, this sentence means the opposite, that the girl saw the boy. The crucial hint is once again in the prefixes attached to the verb: Here the verb starts with *bi-*, whereas the verb in the previous sentence started with *yi-*. This small difference indicates a large difference in sentence structure. *Bi-* tells the Navajo speaker roughly that the direct object of the sentence comes before the subject, rather than the other way around. Nor is it always easy to find these prefixes: Like any others in Navajo, they can be buried under other prefixes and disguised by sound changes. Furthermore, this option of choosing a sentence with *yi-* or a sentence with *bi-* is used in a culturally specific way in Navajo. The noun phrase that refers to a higher being always comes before a noun phrase that refers to a lower being, regardless of which is the subject and which is the object. (In the Navajo conception, humans count as higher than large and intelligent animals, which count as higher than smaller animals, which in turn count as higher than plants and inanimate objects.) Sentence structure and word structure thus are interdependent in Navajo, and both are influenced by the distinctive Navajo typology of creatures, which puts hawks below wildcats but on the same level as foxes. Not only is Navajo different from English at many levels, from single sounds to the arrangement of words in sentences, but those different levels interact with each other in various ways. There is a combinatorial explosion of difference, and it seems as if one cannot understand anything until one understands everything. The poor Japanese cryptographers didn't stand a chance.

These striking differences between Navajo and English illustrate only one side of the fundamental puzzle of language. The other half of the Code Talker paradox is that Navajo and English are so similar.

The Code Talkers bore witness to this similarity by their ability to translate messages back and forth between Navajo and English. Originally, the U.S. Marine officials doubted whether this would be possible and were reluctant to pursue the project. Pilot studies, however, proved that the Indians could accomplish the task with great accuracy. You are probably familiar with the game of Telephone, in which a message gets garbled beyond recognition as it is whispered from one child to another. Encoding the message into Navajo and decoding it back into English did not significantly increase this garbling. On the contrary, officials were pleasantly surprised at how well even precise technical information was preserved. More than that, the Code Talkers were *fast*. They could translate a message to and from Navajo almost instantaneously, in a fraction of the time it took to encrypt it by conventional means. This made them invaluable in battle situations, in which circumstances could change rapidly, and seconds counted.

The Code Talkers' performance tells against extreme versions of one common view about language differences. Some people believe languages are so different because they are reflections of human cultures that have developed over time in diverse environments and in relative isolation. Different languages thus represent incommensurable ways of thinking about the world. If that were so, the early suspicions of the marine brass should have been borne out: The Code Talkers' translations should have been laborious and inaccurate, if they were possible at all. Certainly nothing in the Navajos' pastoral lifestyle in the Arizona deserts would have helped them conceive of high-tech warfare in the jungles of the Pacific Islands. Yet they did their task with remarkably little training. Apparently English and Navajo—or any other two languages—are not products of incommensurable worldviews after all. They must have some accessible common denominator.

Again, this conclusion is reinforced by our mundane experience, which tells us that translation between two languages is a commonplace experience. Although the limitations of machine translation projects show that translation is hard, the everyday successes of professional human translators prove that it is possible. It is stylish to disparage translations, saying that they are (like mistresses, I am told) either ugly or faithless. But these complaints are generally raised in a literary context. When translating Dante or Shakespeare, one wants to preserve not only the literal meaning of the text but also its meter and rhyme scheme, its connotations and cultural allusions, its puns and wordplay, and the ingenious resonances between sound and meaning that give rise to great poetry. That task is often impossible, simply because there are too many conflicting demands. Away from the domain of high art, however, the idea of translation becomes much less problematic. My friend translates internal banking documents from English to French, and she does a good job. At least the money goes to the right places. To take another example, probably more non-European languages have been first learned by Westerners out of a desire to translate the Bible into the local tongue than for any other reason. The people on both ends of these spiritually motivated translation projects have often felt that something real was being done.

Finally, consider Philip Johnston, the man who first conceived of the Code Talkers project. He was one of the small handful of white people who could speak Navajo fluently. He managed this without being ethnically Navajo himself; nor did he have the education and resources of the Japanese cryptographers when he broke the Navajo code. What was his secret? Simply this: as the son of Christian missionaries, he grew up playing with Navajo-speaking children and so learned the language as a child. Although it is very rare for an adult to learn a foreign language perfectly, this achievement is commonplace for a child raised in the right environment. This phenomenon is seen over and over again in this age of migrations. For example, many East Asian immigrants in New Jersey make their way through life with labored and broken English, but their children's English is indistinguishable from that of a Smith or a Jones.

The more one thinks about this commonplace achievement, the more remarkable it seems. A language is one of the most complex systems of knowledge that a human being ever acquires. Learning one far outstrips such feats as memorizing the capitals of every nation of the world or learning the rules for proper capitalization. Yet children, without graduate training, government funding, or even adequate secretarial help, manage in five years what computer scientists and linguists have been wrestling with unsuccessfully for fifty. And unlike academics, the children don't even have the advantage of already knowing a human language as a basis for comparison when they set out to learn the one spoken around them. Nor are we talking about a few prodigies here, but about every normal, healthy child.

How is this amazing feat accomplished? Linguists and other cognitive scientists conclude, not without some envy, that the children must have a huge head start. By their very nature, children seem to be specially equipped for language learning. No one yet knows exactly what this special equipment consists of. It probably involves knowledge of what human languages are like and of what kinds of sounds and structures they might contain, together with strategies for recognizing those sounds and structures. Linguists call this innate head start "universal grammar," an idea popularized by Steven Pinker as the "language instinct."

This has implications for our questions about linguistic diversity because whatever this universal grammar is, it must equip children to learn any of the myriad of possible human languages. Prior knowledge of the special properties of English might help a human child growing up in Spooner, Wisconsin, but it would only hinder a child learning Mapuche in Junín de los Andes, Argentina. It is conceivable that children could begin life with prior knowledge not just of one human language but of some 10,000 different ones. Then their task would not be to *learn* the complexities of the language being spoken around them but merely to *recognize* which language it is and forget the rest—presumably an easier project. But this scenario is hardly plausible. The idea of an inborn knowledge of grammar is already incredible enough; to have many such inborn systems existing side by

side would be uneconomical in the extreme. Nobody believes that we all have innate knowledge of Ancient Akkadian. The expectations children bring to language learning must be substantial enough to help them master the complexities of language with relative ease yet general enough to be applicable to any human language they come into contact with. This implies that all human languages must be more similar than they appear. Since all are equally within the grasp of a healthy human child to learn through ordinary, informal exposure, they must, with all their distinguishing intricacies, be fundamentally commensurable. This conceptual argument from language learning, even more than the phenomenon of intertranslatability, convinces linguists that at some level all languages must be the same.

Can even languages as different as English and Navajo be cut from the same cloth? Yes. We have already surveyed some of the salient features of Navajo, focusing on the differences. But even in that discussion there were signs of similarity as well. Some of the basic sounds of Navajo are different from English, but others are the same: Both languages have *p, t, m, n, w, y, a, e, i,* and *o*. Even the sounds that are different, such as *ł*, can be described as being like an English sound with one feature of the pronunciation changed—in this case, the vibrating of the vocal cords. In both languages sounds adjust to their environments in comparable ways. For example, *s*'s turn into *z*'s in English, too, as you can see by listening carefully to yourself pronounce the word *dogs* (one actually says "dogz"). Like Navajo, English verbs also inflect to show tense and subject; compare the verb in *They walk* with *They walked* and *Chris walks*. It is true that Modern English has only a few of these inflections, and they are suffixes rather than prefixes. Its inflections are like a Ford Escort compared to Navajo's Lamborgini. Nevertheless, it has the rudiments of the kind of system that is so highly developed in Navajo. Direct objects come before the verb in Navajo and after the verb in English, but both languages have direct objects and verbs. More than that, they are similar in that in basic sentences the direct object appears right

next to the verb, whereas the subject need not. In Navajo the object comes between the subject and the verb, whereas in English adverbs and tense auxiliaries can separate the two (e.g., *Chris will soon find a quarter*). This similarity foreshadows a very significant universal feature of human language important in subsequent chapters.

Perhaps the single most distinctive property of Navajo is that its word order changes when the verb contains the prefix *bi-* rather than *yi-*.

Ashkii	at'ééd	biłstá.	At'ééd	ashkii	yiyiłtsá.
Boy	girl	saw	Girl	boy	saw
'The girl saw the boy.'			'The girl saw the boy.'		

This is indeed a capstone of Navajo grammar and an endless source of fascination and controversy among the people who study this language and its relatives. Nevertheless, English does have something somewhat similar. In English, too, it is possible to permute the basic phrases of a sentence together with a change in the form of the verb. The English permutation is known as the passive voice:

The girl saw the boy.
The boy was seen by the girl.

It would be underestimating the Navajo *yi-/bi-* alternation to say that it is exactly like the English passive. There are as many differences as similarities. For example, the agent of the passive verb in English, marked by the preposition *by*, can be left out of the sentence altogether:

The boy was last seen at the market.

This sentence means that somebody saw the boy but does not say who. In contrast, the repositioned subject in Navajo *bi-* sentences has no special trappings and cannot be omitted:

*Ashkii biilstá.

Boy saw

Bad as: 'Somebody saw the boy.' (OK only as: 'The boy saw him/her.')

Yet even here, where the languages seem most different, there is a suggestive point of similarity.

So is Navajo very different from English? Yes. Or are the languages similar? Also yes. This is the Code Talker paradox again, seen closer up. Just when linguists convince themselves that two languages are incomparable, they come across a striking analogy between them. Then again, just when linguists think they have discovered a single theory that works for both, they are ambushed by a surprising distinction between the two. These issues arise whenever one compares two languages that are not close neighbors geographically and historically. The fundamental challenge of comparative linguistics is to find a way of doing justice to both the similarities and the differences without contradiction, without empty compromise, and without sacrificing one truth to the other. Linguists have recently found a new way of thinking about these problems that has the promise of finally meeting this challenge.

Our glance at Navajo makes it clear that the paradoxes about similarity and difference arise at many levels, from individual sounds to the interrelationships of whole sentences. It would be bewildering, however, to try to focus equally on all of these levels in a book of this nature. Nor is it necessary, because the conceptual issues seem to be essentially the same at each level. Therefore, this book concentrates primarily on syntax, together with those aspects of the form of words that are related to syntactic issues. Thus, I lead you into more detail about topics such as word order, pronoun omission, and the *yi-/bi-* alternation, while putting aside questions of whispered *l* sounds and how they change when a prefix is added. This latter domain—called phonology—is no less instructive. But syntax is a large subfield of linguistics and perhaps the one most closely connected with ques-

tions about thought and culture. It is also the area that first inspired the conceptual innovations I go on to discuss. Finally, it happens to be the area where I am best qualified to act as a guide.

Before beginning the exploration in earnest, it is fair to pause and ask the immortal question: "Why should I care?"

For better or worse, people do care passionately about languages and the distinctions among them. There may be areas of the United States where it is possible to overlook this fact, simply because most people are monolingual. But such areas are uncommon in the world as a whole. The impression that language differences don't matter can be cured by talking to the Mohawk Indians who feel their language threatened by the French Québécois majority around them, who in turn feel their language threatened by the English Canadian majority around them. Or one can go to certain African countries where the language spoken by the chair of the Linguistics Department at the country's flagship university is a source of political conflict and even violence. Or one can visit parts of the United States where English-only legislation is controversial and divisive.

The reason for this passion, of course, is that language is intimately tied to culture, and the question of the commensurability of languages is related to the question of the commensurability of cultures. Many scholars and many ordinary people believe intuitively that much of our higher thought processes as well as our culture is intertwined with our language. Just what these interrelationships are is very difficult to tease apart, but there is no doubt that much of our conscious thought and cultural knowledge is framed in the medium of language. The same tensions between similarity and difference arise in these other domains. Are two cultures basically variations on a common theme, or do they represent deeply different ways of perceiving and thinking about the world? If the latter, then are they incommensurable and hence incapable of truly understanding each other? These questions are the cultural equivalent of the Code Talker paradox, and again the evidence points both ways, with clear disci-

plinary biases. Anthropologists thinking about culture tend to emphasize difference, whereas cognitive psychologists thinking about thought tend to emphasize similarity. One of the charms of linguistics is that it stands at the crossroads of these two intellectual traditions, where neither emphasis can easily be ignored.

Of the human triumvirate of culture, thought, and language, language is the most accessible to rigorous intellectual study. Your tape recorder can give you an objective portrayal of what I say but not of my thoughts or my cultural understanding. If there is hope of solving the Code Talker paradox and thus achieving a more mature understanding of linguistic diversity, we will gain a useful metaphor for thinking about cultural and mental diversity as well. This could powerfully influence how we understand human nature and how we cope with life in a pluralistic world—whether we dread it, are defeated by it, or are able to relish it.

2

The Discovery of Atoms

THE KEY TO RESOLVING A PARADOX often lies in the imagination. In a paradox where some experience points to one conclusion and other experience seems to point to its opposite, what is needed is not simply more experience. Truth is not a democratic matter to be decided by simple majorities. Rather, what is needed is some new idea that can widen the space of hypotheses. Then the conflicting evidence that seemed to lead to contradictory conclusions can be seen to converge on this new possibility.

So it is with the Code Talker paradox. To do justice both to the facts that show that languages are very different from one another and those that show they are similar, we need a new concept. Linguists call their new concept the *parameter*.

Since linguistics is a relatively young and unfamiliar science, I introduce the history of the idea of a parameter by comparing linguistics to an older and more familiar discipline, namely, chemistry. Just as chemistry learned to address the paradoxical properties of physical substances and their transformations in terms of atoms, so linguistics addresses the paradoxical properties of languages in terms of parameters. We may think of parameters as the atoms of linguistic diversity.