Thinking about the Optimal Number of Languages

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THE MULTILINGUAL MIND AND MULTILINGUAL SOCIETIES: IN SEARCH OF NEUROPSYCHOLOGICAL EXPLANATIONS OF THE SPATIAL BEHAVIOR OF ETHNO-LINGUISTIC GROUPS

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Abstract. **Languages are territorial. They tend to occupy homogeneous, well bounded areas. When they do not, they lessen their chances of survival, especially if they are languages of minority groups. Reaching beyond the usual sociological causes of this phenomenon, this article searches the neurophysiological and the psychological literature for explanation of the tendency of closed, equalitarian systems with a high density of communication to move toward unilingualism. The search is guided by the questions: are bilinguals less brain-lateralized than unilinguals? Are different languages stored in different "containers" in the bilingual memory? Are the reaction times for coding and encoding slower in a second language than in a dominant language, slower in multilingual compared to unilingual settings? What are the psychological costs and benefits of bilingualism?**

The hypothesis that the bilingual brain is different from the unilingual brain is not supported by the literature, but some fascinating studies keep the question open. Only two sets of findings emerge to offer likely explanations of language territoriality: the findings that measure the declining level of performance in a second as compared to a first language when the complexity of the task is increased, and the findings that show multilingual communication to be less efficient, due to interferences and delayed reaction times, than the same communication in a single language.

Languages are territorial. By concentrating "their" speakers in physical space, languages increase their chances of surviving, prospering, and assimilating the competitors that enter their midst (Weinreich, 1968; Laponce, 1984). This concentration can be explained by a variety of cultural and political factors that range from ethnic bonding (van den Berghe, 1981) to language planning à la Belgium or Switzerland (McRae, 1964, 1984), and more simply and obviously, to the desire to be well understood by one's doctor, grocer, politician, or clergyman. One may need to communicate at any time, and this communication may be vital; hence the understandable tendency to settle among neighbors who speak the tongue one speaks best. These and other social factors, such as the cost of learning a second language, are sufficient to explain the territorial groupishness of languages. Why not then follow Durkheim's advice and be satisfied that the social explain the social; why search for additional psychological and neurophysiological explanations? Not only, I hope, because trespassing on the ground of other disciplines is, among social sciences, a distinguishing feature of both political science and sociology (Laponce, 1980), but also because of the advantages that result from securing the biological anchors of human behavior. The biological explanation is more likely than the social to offer us the constants, the universal effects that can be used to measure the strength of the cultural factors that either reinforce or contradict them. For this last reason I will survey the recent literature on the bilingual brain and on the bilingual mind, in the hope that it will provide, or at least indicate, these constants.

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Going Beyond the Whorf/Sapir Hypothesis

Is there a cultural difference between monolinguals and bilinguals? At the most obvious level of understanding of the question, the answer is "Yes, of course." The bilingual and the polyglot differ from the unilingual by the mere fact that they have access either to different languages that express different roles (diglossia) or to different symbolic systems that express the same roles by means of compound or coordinate multilingualism.[1] Different languages give access to different corpora of signifiers, hence, nearly always, to different images and different associations of ideas. But, at a deeper level of understanding, the question of cultural difference is not as easily answered. Sapir and Whorf (Sapir, 1949; Whorf, 1956) hypothesized that the bilingual cannot translate thoughts, hence attitudes, from one language into another without introducing a bias imposed by the language in which he or she thinks, speaks, or writes. That hypothesis remains controversial.

Although language does not lend itself to the disentangling of the cultural from the biological, let us go beyond the Whorf/Sapir hypothesis and pose the questions: are bilinguals different from unilinguals, neurophysiologically as well as psychologically, and, if so, are there political consequences? The review of the literature will not provide us with firm answers, merely some circumstantial evidence indicating that the mind does not operate as effectively if it has to shift from one language to another, than if it operates in a single linguistic system. Neuropsychology may thus be part of the explanation of the tendency of language groups to occupy homogeneous territorial areas and to protect themselves by means of enveloping spatial boundaries.

The Bilingual Brain: The Neuropsychological Evidence

When, in a different context, I posed the question: are left-handers socially and politically different from right-handers (Laponce, 1975, 1981), it made sense to find out whether there were differences of a genetic nature between them. In the case of language, it is likely that genetic differences explain why some people acquire second languages more easily than others (Hatch, 1983), but there is no reason to believe that these genetic differences are not evenly distributed across cultures. They will not concern us here. If we become bilingual it is not because of an urge to speak more than one tongue to oneself (for examples of pathological exceptions, see Steyn, 1922); it is because we want or need to communicate with other people who happen not to speak our own language. From my political point of view, the interesting question is, thus, not whether biology helps us to understand differences in the ability of individuals to acquire second languages and to shift from one language to another,[2] but rather to find out whether the brain is so structured that it does not store, retrieve, and use two languages as effectively as one, or, at least, does not store, retrieve, and use two languages equally well. If this could be established, it would then follow that the governments that seek to promote policies of bilingualism at the individual level by mixing languages territorially, would pursue policies that are dysfunctional, if not socially, then at least neuropsychologically. If, on the other hand, the evidence points in the opposite direction, then these same governments would be right in promoting a bilingualism by superposition at the individual level rather than by the juxtaposition of different ethnolinguistic groups, each with its own territorial niche.

The Bilingual Memory

The asymmetry of the human body, that is, the visible asymmetries of the hands, and to a lesser extent of the legs and the eyes, has long been noted and used by both science and religion to explain man and the cosmos. Knowledge of the asymmetry between the left and right brain, however, is recent knowledge, dating back little more than a hundred years. Although neurologists do not agree among themselves on the significance of that asymmetry, they agree, whether they are locationists or not, that in the normal individual the left brain is that which dominates in the performing of analytical functions and, particularly, in producing the sequential ordering of concepts required by verbal or written communication in any given language, whether natural or artificial.

This widespread interest in the comparison of the two hemispheres of the brain has led to the question: If the normal unilingual (typically a right-hander) is left brain dominant as far as language is concerned, what of the bilingual or the polyglot? Are the latter similarly lateralized?

Are Bilinguals Less Lateralized Than Unilinguals?

Albert and Obler (1978) hypothesized, on the basis of the limited evidence at their disposal, that the brain of the bilingual was more bilateral[3] than that of the unilingual. Subsequent studies showed the hypothesis to be, at best, only partially correct. In his review of those studies, Bermy Shanon (1982) distinguishes two major possible interpretations of the original assumption. The first leads one to expect that the two languages of a bilingual are less lateralized than that of a unilingual. That interpreta-

tion finds practically no support in the literature. The second states that the bilingual is less lateralized in the non-native language. That interpretation is partially supported by the literature (see for example Walters and Zatorre, 1978), but calls for distinctions that require the introduction of two intervening factors: a) the age at which the second language was acquired, and; b) the way in which it was acquired. A model built by Vaid and Genesee (1980:432) from the studies that used these factors,[4] assumes: "Right hemisphere involvement is more likely in the initial stages of second language acquisition, the younger the learner, and less likely the older the learner, insofar as adults, relative to children, are more likely to use a formal mode of processing language." The studies from which Vaid and Genesee derived this assumption used a variety of techniques, ranging from EEG measurements (Rogers, TenHouten et al., 1977) to the more common tests of responses to stimuli presented to the right and to the left visual fields (Bentin, 1981, for example), or to the left and right ears (Gordon and Zatorre, 1981; Galloway, 1982). More powerful tests involving penetration of the body, such as the Wada test that paralyzes one side at a time by injection of sodium armytal in the carotid artery, have, for obvious reasons, hardly ever been used. One such test was made by Rapport and Tan (1983) on four Chinese-English dextral polyglots who suffered from cerebral disorders and who were fluent, in varying degrees, in English and/or Hokkien, Cantonese, and Mandarin. The Wada test, as well as a cortical stimulation test, led the authors to conclude that they had found no evidence to support the theory that people who speak Chinese, or polyglots in general, have an increased participation of the right hemisphere in their language functions. However, the number of subjects was very small and the number of uncontrolled factors high, since the subjects had not been selected for the experiments; they were patients treated for markedly different degrees of brain disorder.

If the hypothesis that bilinguals, at least some types of bilinguals, are not as lateralized as unilinguals is still very much alive, that hypothesis has not yet generated the data that would enable us to tell whether unilinguals and bilinguals differ in their brain functions to a degree that matters. We may nevertheless ask ourselves, at this point, what likely social and political consequences might be attributed to the asymmetrical models of Albert and Obler (1978) or Vaid and Genesee (1980), should they be verified. In so doing, let us consider some fascinating yet unconfirmed studies which suggest the possibility that different languages are processed differently by the brain because of their specific visual and/or auditive qualities.

Are Some Languages Differently Lateralized?

The studies by Rogers and TenHouten (1977) and by Tsunoda (1978) are guided by the hypothesis that the difference in lateralization is not so much between unilinguals and bilinguals as among languages. Rogers and TenHouten's study of Hopi-English bilinguals notes that Hopi is more appositional, English more propositional, i.e., that Hopi puts the speaker in a natural context while English abstracts the speaker from the environment in order to analyze the latter. The authors use this semantic difference to explain the variations they recorded when measuring the alpha waves on the right side of the brain of subjects listening to stories told either in Hopi or in English. The study has been criticized for the lack of controls on such factors as degree of attention paid to the teacher reciting the stories (Vaid and Genesee, 1980) but has not thus far been invalidated by retests.

Tsunoda's experiment shows a similar type of difference in brain lateralization, this time between Japanese and English subjects. The differences in this case, however, were apparently related to the native speakers' pronunciation rather than to the semantics of the language concerned. Tsunoda notes that his Japanese subjects process natural sounds such as the rustling of leaves or the rolling of waves in their left brain, while Westerners process these same sounds on the right side. He explains the difference by the fact that Japanese is (with Polynesian) the only language to use the steady vowel sound to signify that which requires the use of vowels and consonants in other languages. It is as if their very language had trained the Japanese (and Polynesians) to process some natural sounds in the left brain. Still according to Tsunoda, this difference in brain processes would contribute to explaining why the Japanese experience particular difficulties in learning a Western language, a language that would be, to them, excessively analytical.[5]

If confirmed, the Rogers/TenHouten and Tsunoda findings would give a very specific biological underpinning to the Whorf/Sapir hypothesis that languages, at least some of them, are culture specific, hence not fully translatable. It would, at least, provide an additional explanation of the resistance to shift from one language to another.

In short, the hypothesis of a difference in brain lateralization between unilinguals and bilinguals, as well as in the brain lateralization of different languages, although denied by a large segment of the literature, is still very much alive. At the moment, however, it would be premature to infer from the neurophysiological evidence available on the brain sidedness of bilinguals an explanation of the ten-

dency of closed and well integrated social systems to move toward unilingualism rather than in the opposite direction.

One or Two Containers; Single or Multiple Switches?

In addition to the Broca area of the brain, which is involved in the production of synthetic and morphological structures, and the Wernicke area, which processes messages received through the auditory channels (Hatch, 1983; Geschwind, 1979), the current models of the "speaking" or "writing" brain involve many other areas in the coding, storing, and encoding of a language, e.g., the cerebellum, the function of which is to "smooth out," to put a kind of finishing touch to the complicated sequence of motor activities required by writing or speaking. But the details of the how and where of language storing remain, for unilinguals as for polyglots, a near mystery. Where in one's memory is the word 'cat' and the image of a cat, where is the word 'chat' and the image of a 'chat' stored? How do we gain access to the right codes? Some neurophysiologists and psychologists have theorized that languages, no matter how many, are stored in a single "container." Others have proposed explanations based on the assumption of more or less separate containers for different languages. If—as hypothesized by Penfield and Roberts in 1959—access to the two languages of a bilingual is controlled by a single switch that blocks one language out while the other is processed, then the two languages of a bilingual, in whatever area of the brain they are located, would not interfere with one another. Bilingualism would not have an interference cost in addition to those for acquisition and storage. The languages would be juxtaposed rather than mixed, and the brain would thus be a kind of Switzerland rather than a kind of Finland (Laponce 1975, 1984a). The single switch theory fails, however, to account for the fact that the two languages of a "balanced" (near perfect) bilingual typically interfere with each other. The experimental evidence produced since Penfield and Roberts formulated their single-switch theory, has led to another explanation of the bilingual memory, the tag theory, according to which the codes are grouped primarily by meaning and "tagged" by descriptors that define their commonality and their individual specificity. The code *cat* would thus have, among its many tags, one that would express its belonging to the English language while *chat* would have a French tag. Reviewing the literature on the bilingual memory, Barnett (1977) found only 5 studies supporting the single-switch theory while 13 supported the tag theory and 3 proposed a compromise, according to which the bilingual memory is organized primarily according to meaning and secondarily according to language. The tag theory and its modified varieties account better for the fact that the two languages of a bilingual interfere with each other at the level of vocabulary as well as that of syntax. Furthermore, even if the single-switch theory were to make a comeback (which seems unlikely on the basis of contemporary evidence), the shifting from one language to another would still not be free of cost. Experiments by Kolers (1966), Macnamara (1968), and Marsh and Maki (1976) show that a language shift in mid-communication causes delays, as does the non-congruence between the language of encoding and that of decoding. Generally, unilingual coding and encoding, hence unilingual social settings, offer quicker, more effective means of communication.

The Hierarchy of Effectiveness of a Bilingual's Languages

Can one possibly be a perfect bilingual? In theory this is possible and would be more likely if the single-switch theory were to be verified. In practice, bilingualism remains an ideal that a few, very few, come close to reaching but from which most people remain markedly distant, even those considered perfect by the less proficient. It is normally very easy to distinguish the dominant from the second language of a subject: a series of simple experiments by Dornic (1975) show that the reaction time of bilinguals, asked to resolve problems of increasing complexity, does not produce parallel curves; the greater the difficulty, the greater the magnitude of the difference in reaction time between the first and the second language. Those who had appeared to be almost perfect bilinguals on simple tasks, were, on complex problems, at a marked disadvantage in their second language. This explains the apparently paradoxical fact that the people most frustrated by bilingual situations are often those who appear to have an excellent command of their second language rather than those who do not. Those most frustrated are those who experience a sharp decline in efficiency as tasks become more difficult, while the less proficient experience and expect that lesser efficiency from the very start. The Dornic experiment explains also why linguistic conflicts are so often elite conflicts. The linguistic demands made on an upper-echelon civil servant or corporate executive are not of the same nature as those that confront a hotel-porter or a customer at a local market. A slight hesitation, a lack of words by which to qualify a statement, a lesser fluency that discourages active participation in a complicated debate have, for the former, consequences not contemplated by nor visited on the latter.

The Cost Benefit Approach to the Study of Bilingualism

Obviously, learning two languages is more costly than learning only one, costly in terms of time and energy. But the cost cannot be measured with any precision, possibly because of the wide variety of individual linguistic abilities, social settings, and linguistic thresholds, which, once reached, satisfy the individual learner and those with whom that learner interacts.[6] But, even if we cannot say how long it takes to learn a foreign language any more than we can say how long it takes to become a pianist, we know that the time and the energy costs are high even when the two languages are learned by the child in a bilingual family where each parent speaks a different language. The cost of learning to speak is much reduced by the one parent-one language system, but the cost of learning to read and write remains high. One does not learn a language easily; there is, even for the most gifted, a considerable learning time that rests in the unavoidable constraints that our neurophysiology puts in the way of polyglotism. Indeed, for most people, language acquisition is among the most complex tasks one will ever perform. Whether it takes six months, one year, two years or more to learn a foreign language, the neurophysiological "wiring" and "rewiring" required are a considerable obstacle to interlanguage mobility.

The benefits we derive from multilingualism are primarily social, and derive from interactions that would not have been possible otherwise. But, are there, in addition, advantages of a non-social kind? The literature on the subject identifies one such major advantage, studied in detail by Leopold (1939-49) and verified by subsequent experiments (for example: Landry, 1972; Skutnabb-Kangas, 1976; Bain and Yu, 1978; Okoh, 1980): bilingualism facilitates the dissociation of the signified from the signifier (divergent thinking). The Peal and Lambert study of 1962 and its numerous replications have also shown that bilingual children taught in their second language in immersion schools did not suffer academically, as was generally assumed in the 1920s and 30s. On the contrary, possibly because of the Leopold effect—the dissociation of signifier and signified—they were often analytically ahead of the monolingual control groups. But this psychological advantage is a biproduct of bilingual learning rather than a cause of it. It would violate common sense to expect that we learn other languages for the sake of detaching the word from the idea, the thing, the person, or the animal it stands for.

In short, does the neuropsychological literature give us any secure underpinnings that would enable us to build a series of explanations leading from the biological to the psychological and from the latter to the geographical and the political? Let us return to our original questions. Is there evidence that the bilingual brain is different from the unilingual? Findings are inconclusive, but have produced some fascinating hypotheses that keep the question open. Does the mind operate as effectively with two as with one linguistic code? The answer must be qualified. Learning a second language appears to facilitate the development, in the child, of his or her analytical abilities, but the use of a second rather than the dominant language puts one at a disadvantage because of interferences and delayed reaction times. Could one write the equation giving the summation of these pluses and minuses? Not out of a specific context; even in context it would be remarkably difficult. However, among the findings encountered in our search for neuropsychological explanations of the tendency of language groups to form compact territorial niches, two stand out as likely links between the neuropsychological and the sociological: first, the Dornic, Kolers, Macnamara, Marsh, and Maki types of experiment, which show subjects to be increasingly inefficient in their second language as the tasks become more complicated; second, the experiments showing that a language shift in mid-communication causes delays in reaction time. Communicating less efficiently is better than not communicating at all, but communicating efficiently should be expected to be preferred.

The Geographical and Political Consequences

If using a second language is inefficient as well as high in learning cost, it should follow that people will want to dispense with that language. Their behavior indicates that this is precisely what they do. A few individuals will, of course, acquire foreign languages, even in the absence of economic or social benefits, for the sole pleasure of reaching and penetrating a foreign culture. They are like solitary explorers, and are the exception. Most people have no particular desire to face the hardships of second language learning. The many daily choices of individuals who prefer living among their own linguistic kind result in societies organizing themselves in such a way as to form unilingual homogeneous areas. But, if the cost and the inefficiency of bilingualism push toward monolingualism, other forces, economic and political in particular, often lead in the other direction. As a result of these contradictory pulls, societies seek a balance point, that of minimum bilingualism. That minimum is obtained, typically, in two major ways: by specializing bilingual communication—through an elite or a group of professional translators for example—and by asymmetrical bilingualism, whereby the dominant group typically remains unilingual, while the ethnic groups

of lower status and power assume the learning costs of bilingualism.

When two languages come into social and geographical contact, one of three major outcomes will prevail: (a) The languages coexist throughout the population, are known by all, but are segregated by individual and social roles (diglossia); (b) The languages cover all social roles (bilingualism without diglossia) but separate themselves territorially (bilingualism by juxtaposition of unilingual areas), and; (c) The languages, as in *(b)*, cover all social roles but are mixed territorially. In this case, either of two solutions will emerge: either the two languages will merge into a single new language (creole) or one language will establish its dominance, relegating bilingualism to the dominated group, and, at longer term, eliminating the weaker language altogether.

a) Diglossia. A common example of diglossia is in the coexistence within a given society of a "high" and a "low" variety of the language, such as in Germany, Luxemburg, Switzerland, and the Alsace. The two languages often have some resemblance to each other, a resemblance due to common historical roots, but they may have diverged so as not to be mutually understandable, or at least not easily comprehensible. Typically, the high language is standardized and written and covers a wide geographical area, while the low form is non-standardized, non-written, and specific to a small geographical entity. One is the language of high-culture and official communication, the other the language of the family, the village, and even, sometimes, of local political institutions. This bilingualism by role-segregation is relatively stable over time. Its cost finds its justification in the desire of a group to maintain its distinctiveness and identity by means of linguistic markers. Interference is reduced by the fact that the languages in contact, not having the same social functions, are not used in the same social situations. But stable as it may be, this form of language coexistence does not escape the effect of the tendency to simplify and improve communication by means of unilingualism. The amount of communication occurring in either of the two languages and the hierarchy of the roles to which the languages are attached (the relative importance of work and family for example) explain an evolution which is, in an industrial, highly mobile society, favorable to the standardized language rather than to the local dialect.

b) Bilingualism by territorial segregation. If two languages cover all social roles, if what could be expressed in one language can also be expressed in the other, the two languages are redundant. That is the case of French and English in Canada, Afrikaans and English in South Africa, Finnish and Swedish in Finland. Since we can assume, from the studies of bilingual communication and problem solving mentioned above, that nearly every bilingual has a dominant language, the redundancy is not, however, absolute. If one's second language is used in communication, one is put at a disadvantage. The inequality between languages thus becomes translated into social and political hierarchies; the choice of language is an affirmation of one's power. To avoid these hierarchical conflicts, one may seek to reduce the number of times communication will occur among individuals who do not have the same dominant language. In pre-industrial societies, when life is centered on villages isolated from one another, though relatively close geographically, the territorial mixing of languages can be as intricate as the mixing of religions in Lebanon. In industrial societies, however, separating bilingual communities according to their dominant language means, in effect, the juxtaposition of linguistic groups that each have distinct geographical core areas where the need for bilingualism is reduced, where the distance between the dominant and the second language is increased, where, in short, each language is territorially secure. The result of such territorial segregation is to reduce the need for individual bilingualism. Typically, bilingualism is concentrated, then, at the elite level while the masses remain or become unilingual. Such is the case in Belgium and Switzerland where the existing territorial segregation of the languages in contact is reinforced by legislation.

c1) The merger of languages. Simplification by the merger of two or more languages into a new language that evolves as a kind of compromise is evident not only in recently created creoles such as those spoken in Haiti or Papua-New Guinea, but in all major standardized languages, such as those born from the encounter of Latin and Frankish dialects. When the contact is between spoken rather than written languages, the merger will occur more rapidly since, even after the advent of the tape recorder, the sound of a language is not as easily regulated as its written form. But when two written languages come into contact—as more languages have become standardized, the number of such occurrences has increased in the last century—the solution of simplification by merger becomes more difficult and less likely to be achieved. In such cases the solution is more likely to be of the *b)* or *c2)* variety.

c2) Asymmetrical bilingualism. If populations of a modern state speaking two different languages are mixed territorially, bilingualism is likely to be widespread. Redundancy is unavoidable unless the two populations are socially segregated. But, since redundancy is costly in learning time and since it is less effective to use a lesser known language, the dominant group will typically shift the cost of additional language learning to the less powerful ethnic

group. English Canadians are less likely to know French than French Canadians to know English; Japanese businessmen are more likely to know English than their American counterparts to know Japanese; and, in the Cameroon, the anglophone minority is more likely to know French than the francophone dominant group to know English. South Africa may seem to be an exception, since the politically dominated group is less likely to know the language of the politically dominant ethnicity than vice versa. This apparent exception can however by explained by the fact that the two official languages —Afrikaans and English—do not have the same power of international communication and also by the fact that the ethnic group which now dominates the political system achieved that dominance little more than one generation ago. It is by means of asymmetrical bilingualism that multilingual Western societies such as France have become unilingual; it is also by such means that the Soviet Union, much more slowly, moves in the same direction.

Conclusion

In summary, the neuropsychological evidence on the bilingual brain, inconclusive as yet in pinpointing biological differences between the bilingual and the unilingual, occasionally reinforces (in its findings on learning costs, interferences, and differences in reaction time) what common observation tells us. The costs of learning, storing, maintaining, and using two languages contribute to the tendency of language groups to form cohesive territorial units: a geographical phenomenon of fundamental political importance since the ethno-linguistic communities so bounded in space often want to control the boundaries that separate them.

Notes

1. For the distinction between compound and coordinate bilingualism, see among others Fergusson (1950), and Fishman (1967). In a coordinate system each term refers to its own signified; in a compound system, two signifiers refer to the same signified. In a coordinate system the two languages are not truly synonymous, each term having its own distinctive context and association of ideas, hence its own meaning—in the Osgood sense of 'meaning' (Osgood, 1957).

2. The age at which a language is learned was, however, found to be a significant variable.

3. To avoid repetition I shall henceforth say "bilingual" where I should say "bilingual and multilingual."

4. They also tested the factor "proficiency" that appeared unrelated to the explanation.

5. Along similar lines, see studies of the laterality effect of pictorial and nonpictorial languages; for example Nguy et al. (1980) and Endo et al. (1981).

6. According to the Foreign Service Institute of the U.S. Department of State, elementary proficiency (the ability to satisfy routine travel requests and minimum courtesy requirements) in an easy language (such as French for an anglophone) requires 220 hours of training while the next level (limited work requirement) requires 700 hours.

THINKING ABOUT THE OPTIMAL NUMBER OF LANGUAGES

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When we think back over the imaginative and persuasive argument that Jean Laponce has made for the high costs of keeping several languages in one brain or in one society, we are tempted to ask ourselves a useful question: Why should there be more than one language in the world? If you were fortunate enough to be engineering a new world, complete with people and computers of your own design, would you want to outfit that world with more than a single language? Should the new world's people have the capability of using more than one language? Should their computers be programmable in more than one language?

Pros and Cons of Linguistic Multiplicity

We can start by extracting from Laponce's discussion some benefits and costs of linguistic multiplicity. A multiplicity of languages within the same territory or brain—or both—is beneficial because:

1. it facilitates analytical thinking, and

2. it helps groups maintain distinctiveness from other groups.

On the other hand, linguistic multiplicity is detrimental because:

1. it decreases the probability of mutual intelligibility;

2. it attaches high learning costs to the achievement of mutual intelligibility;

3. it requires, under some conditions, switching between languages, which slows thinking and communication;

4. it requires, under some conditions, the use of a language one does not know well, which impairs performance and satisfaction; and

5. it helps groups exercise power over other groups.

Just listing the pros and cons this way makes it obvious that one engineer's benefit is another's cost, and that I have arbitrarily assumed that: (1) you want a world in which people can divide themselves into distinct groups but cannot use language to exploit other groups; (2) you want to minimize learning costs; (3) you want to maximize cognitive and communicative efficiency; and (4) you want to promote analytical thinking.

If these assumptions are valid, it looks as if the reasons against linguistic multiplicity far outweigh those favoring it, at least if each reason is worth the same amount of consideration. So presumably you should design your world, its people, and their computers to be unilingual.

Or should you? It's time to reveal a secret: Laponce hasn't given us all the benefits and costs. That is eminently excusable, since I am asking a somewhat different question from Laponce, and in any case no one can enumerate all the effects of a variable. But precisely for this reason we might ask ourselves whether there are any *important* pros and cons Laponce has omitted that it would be interesting to take into account. In this commentary I shall try to rectify what I see as an imbalance in Laponce's article by confining myself to omitted considerations that *favor* linguistic multiplicity.

Omitted Consideration 1

It takes work to maintain linguistic uniformity once it has been created. Languages maintain their homogeneity only with shared use. If (to use a minimal case) persons A, B, C, and D all use a language to communicate among themselves and then A and B split off from C and D, eventually the language used by A and B will be mutually unintelligible with the one used by C and D. Languages naturally and continually change, both within and across generations. Within broad limits presumably imposed by biology and the facts of the world, changes in languages can be assumed to be a random walk. The probability of the two halves of a split language changing in the same ways in the absence of coordination is negligible.

The work required to keep the A-B language mutually intelligible with the C-D language is a cost of linguistic uniformity. If A and B never communicate with C and D, this cost yields no return. But even if some communication does take place between A or B and C or D, the benefit of mutual intelligibility is not necessarily worth the cost of keeping the languages alike. As Laponce suggests, language learning and translation are alternatives. Their costs (including the burdens imposed by use of a non-native language) may be lower than the cost of uniformity maintenance.

Omitted Consideration 2

Different languages are better for different purposes. Once we decide to view languages instrumentally, it is naïve to assume that languages are used to achieve one, and only one, homogeneous purpose, such as "thinking/communicating." We might as well assume that surgical instruments serve the single purpose of "operating." Instruments which do everything don't do any one thing as well as specialized instruments, and this principle holds for languages as much as for anything else, even though its applicability to languages is not widely recognized. The better someone knows two languages, the less likely he is to claim that anything can be said equally well in both of them. As Skvorecky (1985) puts it, "Every language is rich, but rich in its own way."

Those of us who communicate with computers should appreciate the benefits of linguistic multiplicity for efficient purposive action. A language well suited to telling a computer to perform matrix algebra operations is not the same as one well suited for telling a computer to format a manuscript. Even within one of these categories there are grounds for maintaining specialized languages. In one kind of word-processing language (such as that used to typeset *Politics and the Life Sciences*), a formatting instruction is given by including a special character sequence in the text. In another (such as the one I am using to compose this comment), a formatting instruction is given (typically) by pointing on a video

screen to the passage to be affected and then to a label describing the action to be performed on that passage. These languages have different comparative advantages. One is better for global search-and-replace operations and for composing plain text. The other is better for frequent review of what has already been composed and for mixing text and graphics. A third language, one combining all the capabilities of both of the first two, would be more versatile, but it would also be more expensive in its use of the computer's resources and would take longer for the user to learn and for the computer to obey instructions in.

Persons who want to do something that requires using a language need to choose a language. If it is true that languages have specialized utility, then there may be a "best" language for what these persons want to do. But they may not yet know that language. Should they learn it? If they acquire an appropriate amount of competence in it and use it often enough, their learning cost may be more than repaid with the increased effectiveness with which their new language achieves their purpose, even taking into account the difficulty they have using it relative to what would have been the case if it had been their native language. Likewise, if you know only BASIC and you want to write artificial-intelligence programs, you may decide that you are better off investing some time to learn LISP than plowing ahead in BASIC.

As of yet, we know little about which natural languages are best for what. Some have argued that French is a good language for diplomacy, English for democratic thought, and Hopi for theorization in physics. It is obvious, however, that the lexicons of languages are extremely varied in the topics for which they contain specialized vocabularies. Because of this, it is a common phenomenon for a native speaker of language X to find, after being schooled through the medium of language Y, that it is impossible to talk, or even to learn to talk, in his own native language about the subjects he has studied. For any single individual, the cost of providing his native language with a vocabulary for discussing a given subject may exceed the cost of learning another language that already has such a vocabulary.

In conversations between persons who both know the same two languages, the practice of "code switching" is often observed. Laponce's discussion would not seem to lead us to expect such alternation between languages within the same conversation and even within the same sentence. Why does it take place? Among the available explanations for code switching are reselection of the most effective language as the purpose changes during the conversation, and a taste for linguistic variety or surprise (analogous, perhaps, to the custom in some languages for speakers to use synonyms rather than repeat a word shortly after its first use). Laponce mentions experiments showing that people react more quickly in single-language conversations than in conversations requiring language alternation. But alternation could be expected to enhance some other purpose that people may have in mind when they converse, such as precision, secrecy, or humor.

Omitted Consideration 3

Language learning can be selective. While it is often convenient to make the simplifying assumption that language learning is binary—that a person either knows or doesn't know a language—this assumption is clearly untrue, and using it can lead to false behavioral predictions. People can learn bits and pieces of a language, rather than "the whole thing," and they can begin using it shortly after they know the first few bits. In fact, there are millions of persons who know just a few words, phrases, and rules of a language: people who know only how to wait in a restaurant, beg, ask where the cathedral is, or read journal abstracts on hydraulic biology. The cost of acquiring selective semi-competence in a language will typically be substantially lower than the cost of generalized learning. The optimizing learner can be assumed to begin with the pieces for which he has the greatest use and continue learning progressively less useful pieces until the utility of the next piece equals its learning cost.

Thus we should expect to find, and we do find throughout the world, people who know how to do certain things with certain languages. Laponce describes situations of functional specialization of languages, but he does not, I think, make it clear that when a language is used by a given speaker for only a particular purpose the cost that speaker incurred to learn that language may have been correspondingly low.

Omitted Consideration 4

The costs of language learning are interactive. We normally assume, as does Laponce, that it costs more to learn more languages. This assumption may be false. It is well known that an investment in learning how to learn can, under some conditions, more than repay itself in the increased learning effectiveness that it produces. One of the chief methods of learning how to learn, however, is to learn a purposively selected instance of the kind of competence that one wants to learn how to learn. Two common names for this kind of learning investment are the case method and simulation learning. By learning how to analyze an actual case in a law or business school, a student may learn how to analyze later cases so well that the time spent on the study

case and the real cases together is less than the real cases would have taken in the absence of the case study. Similar reasoning applies to simulated medical diagnosis, simulated airplane piloting, etc.

In the arena of language learning, there is reason to believe that learning a "preparatory" language, under some conditions, constitutes a profitable investment in learning how to learn languages. As such, it makes the learning of some or all subsequent languages less costly. Research at the Institut für Kybernetische Pädagogik at Paderborn, Federal Republic of Germany, has produced tentative evidence that the subsequent payoff may be great enough to return, within as little as 3-4 years, the entire cost of learning the first "case study" language (Pool, 1981). If this is true, then under some conditions learning two languages can actually be less costly than learning the second of them without the first.

Omitted Consideration 5

The rate of increase in second-language disadvantage as task difficulty rises is language-specific. Laponce notes that the disadvantage suffered by persons using their second language rises as the communicative task they are performing becomes more difficult. He uses this finding, with remarkable insight, to explain the fact that as second-language competence rises, frustration with second-language use also rises. The phenomenon he describes depends, however, on the characteristics of the languages involved. If we can find a measure for the "output" of language learning, i.e., how much one is able to do with the competence one has acquired in the language, then we shall find that the ratio of output to input (learning effort) rises and falls as learning progresses, but it rises and falls at different rates for different languages. Undoubtedly, the course of this ratio depends on the languages already known, the language being learned, and various learner characteristics.

It is exactly this rate of change in the output-input ratio that differentiates, more than any other efficiency-related attribute, natural and non-natural languages as ideal types. Natural languages, that is, languages that are maintained by bodies of native speakers, are almost impossible for non-native speakers, at least in adult age, to learn to use indistingishably from educated native speakers. Non-natural languages, that is languages that do not have native speakers, can be learned to the existing standard of perfection, because that standard is maintained by the community of persons who have in fact achieved it as second-language learners. Thus, when the speakers of language X and the speakers of language Y use a non-natural language Z for those purposes that require communication across the X-Y boundary, the effect on costs and satisfaction may be much better than what it is when they use language X or Y for this purpose. This is especially true if satisfaction is directly related to the equality of the communicators' competence in the language of communication.

Non-natural languages used in communication among humans fall into the categories of classical languages, pidgins, and artificial languages (Stewart, 1968). From the scanty evidence to date, at least some artificial languages have been designed whose learning cost per unit of output rises much less steeply, or falls much more steeply, than the unit learning cost of a typical natural language. Thus the cost to learn an artificial language well enough to read a newspaper article has been reported to be in the neighborhood of one-fifth as great as the cost to acquire the equivalent competence in a natural language. But the cost to learn an artificial language well enough to write an article for a professional journal has been estimated at about one-thirtieth as great as the cost to reach that level in a second natural language (Pool, 1981).

Conclusion

If one gets the impression from Laponce that analytical intelligence and group identity are the only advantages individuals can reap from living in communities where several languages are used, then that impression is premature. It is premature first because Laponce does not in fact make that claim (although he might appear to do so from a quick reading), and second because a number of phenomena other than those discussed by Laponce open that view to serious doubt.

Laponce's discussion makes an important contribution to the debate about how governments should treat languages and their speakers. His essential message appears to be that linguistic segregation may be beneficial and may be the only reasonable alternative to a battle unto death among languages. My reply is that there may be yet other viable alternatives that have not been seriously considered. These include specialized second-language use, selective language learning, language learning enhancement through the study of "case study" languages, and the use of artificial or other non-natural languages for communication among the speakers of different native languages. We have much to learn before we conclude that the unilingual organization of territories, populations, and occupations is the optimal way to deal with communication barriers in a multilingual world.

Jonathan Pool asks a series of challenging questions that invite me to depart, even more so than in answering Mackey, from my original intention not to consider social costs and benefits. I shall do so by adding a few illustrations to his perceptive comments.

The institutional cost of obtaining or maintaining the uniformity of a language likely to diverge into segments because of the low density of communication among its speakers is illustrated by the policies of states such as France and Quebec, policies alluded to by Mackey. The French Academy, created in the 17th century, the Office and the Conseil de la langue française created in Quebec a few years ago, the French practice of assigning school teachers irrespective of their region of origin, have the conscious purpose, at varying social and individual costs, of homogenizing a nation linguistically.

The comparison among artificial, computer, and natural languages is rich in rewards. Pool has done some fascinating work on the subject. However, one study (as far as I know) still remains to be done: the study of interferences among the various computer languages used by programmers working either under normal conditions or under stress. If interferences have neurophysiological underpinnings, we should note them among artificial as well as natural languages. It would be particularly interesting to test whether such interferences are due to uneven use and memory accessibility, as suggested by Mackey, or whether, under stress, there is a tendency to resort to the symbolic system first learned.

Each computer program has its own function, and is best adapted to some specific purpose; BASIC is not ALGOL. The same is true of the two languages used in situations of diglossia. There is a major difference however. For an Egyptian Moslem, English is unacceptable for prayer, and Arabic inadequate for physics or chemistry. The inability of those two natural languages to perform equally well in all domains is not due, however, to an inherent weakness of the languages qua language; it is due rather to social and cultural causes, to the fact that some languages have not been allowed to evolve, to adapt to certain usages. In such cases, I agree with Pool, effectiveness requires that one should shift from one language to another, or say from Arabic to English or French, as one moves from say politics to science. But, if the experimental evidence I mentioned is to be trusted, that shift has a cost. We say, sometimes, that English is what Latin used to be. Not quite. The French, the Germans, and the Polish scientists who debated in Latin in the 16th and 17th century were not competing with colleagues for whom Latin was an L_1 across all their roles. The French, the Germans, and the Poles who now compete with their English colleagues, compete with an L_2 against an L_1.

I do, of course, agree with Pool that knowing a language is not a case of either-or. Measuring knowledge requires that one know the needs, the language needs, of the individual or of the group to be assessed. But, what matters to me is that people, especially when their language needs are high and when communication is dense, tend to group themselves geographically according to their L_1. If they do not do so, or if their territorial niche is penetrated by the language of a more powerful ethnic group—as in the case of German fragmenting Romanche in Switzerland, or English penetrating French in Manitoba—then the language, assuming it is a minority language, has lesser chances of survival (Weinrech, 1968; Castonguay, 1979; Laponce, 1984a, 1984b).

—Jean A. Laponce

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