

Loglan

This logical language is now being synthesized on modern linguistic principles, largely to examine the hypothesis that the world view of the members of a culture is determined by the structure of their language

by James Cooke Brown

In the closing decades of the 17th century the philosopher-mathematician Gottfried Wilhelm von Leibniz proposed the development of a "universal symbolism" that would speed the growth of scientific thought in the same dramatic way that the development of mathematics was then advancing the art of scientific computation. As a mathematician, Leibniz was doubtless aware that mathematical methods are limited to tracing the deductive consequences of quantitatively stated premises. As a philosopher, he was certainly aware that scientific thinking consists of more than deduction alone. He knew that inductive, or generalizing, operations are also involved, and he would have argued that hypothesis formation, or "creative imagination," is decisive in the development of science. Thus Leibniz intended his universal symbolism to embrace mathematics and imitate its "ratiocinative power," but he meant it to go far beyond mathematics, to encompass the whole of scientific, indeed of all rational, thought. By this means, he predicted, the rational powers of man would be marvelously extended.

In the intervening centuries little progress has been made toward the realization of Leibniz's vision. It is true that the period has seen the development of modern logic, and the extension of mathematics itself in non-numerical domains. The theory of games and of statistical inference appear to have

broadened the scope of formal reasoning in precisely the direction anticipated by Leibniz's proposal. But the universal symbolism, in the sense of an all-encompassing scientific language, has yet to come. The Western scientist, like the man in the street, still does his reasoning largely in the familiar Indo-European languages, and so within the confines of the grammatical rules and metaphysical categories they carry over from the past. If ratiocinative power has increased, it has not been in the universal sense that Leibniz proposed.

The central notion underlying Leibniz's vision may be stated in a question. Is it true that the "rational power" of the human animal is in any significant measure determined by the formal properties of the linguistic game it has been taught to play? A whole school of anthropologically oriented linguists, following the late Benjamin Lee Whorf of Hartford, Conn., believe they have found compelling evidence that the answer to this question is yes. These investigators, arguing largely from the astonishing differences to be found among the grammars and lexicons of preliterate peoples, and between these languages and our own, believe that the structure of the language spoken by a people determines their world view; that is, it sets limits beyond which that world view cannot go. Thus the native speaker of any language is fated to see reality, and to think about it, exclusively on the terms and by

the rules laid down for him by that language—unless he learns a new one.

Other linguists and psychologists have found reason to doubt the Whorfian thesis of linguistic determinism. They feel that, in principle at least, all languages are mutually intertranslatable; that they can all be most fruitfully regarded as dealing with the same "reality"; that "thought," scientific or otherwise, is somehow independent of the specific character of the linguistic machinery in which it is expressed. The biologically oriented psychologist would argue further that any such attribute as "intelligence," "rationality," "problem-solving ability" and so on is a property of the behavior of the individual organism, resulting from its hereditary endowment on the one hand and its particular history of reinforcement on the other.

But Whorf's doctrine, that human thought is largely determined by the formal properties of the pre-existent social forms embedded in the structure of language, is slowly gaining experimental attention. Whorf does not explicitly embrace Leibniz's program of a universal symbolism. Yet implicit in his view of the nature of language is just this possibility. For if language is a human artifact, the power of the human mind need not be restrained by existing languages; the possibility that the inventive human animal will create still more powerful linguistic instruments is certainly

very real. In this sense we may speak of the new linguistic doctrine and the older philosophical hope as expressions of the same hypothesis. That hypothesis has apparently been similarly presupposed in an engaging activity of Western philologists: the construction of international auxiliary tongues.

Until recently, however, a thoroughgoing empirical test of what we will now call the Leibniz-Whorf hypothesis has not been possible. The necessary experimental apparatus has simply not existed. The languages (and their speakers) available to the linguistic experimenter are either the natural languages, with their vast traditions and structural irregularities, or artificial languages such as Esperanto, Interlingua and Novial, which have been created primarily in the interests of international communication. Unfortunately these artificial languages are all modeled so closely on the European plan that they offer little advantage to the experimenter over the natural languages themselves. In either case, the formal properties of these linguistic systems are not, and cannot be, deliberately controlled.

It was to supply an instrument for experimental investigation of the Leibniz-Whorf hypothesis that we undertook our work on Loglan in 1955. Loglan was to be an artificial language, but one especially designed to test the thesis that the structure of language determines the forms of thought. It was to have a small, easily learned vocabulary derived from the word stock of as many of the major natural languages as proved feasible (though it was not intended to be an auxiliary international language). Its rules of grammar and syntax were to be as few and regular as possible. It was to utilize a short list of speech sounds (phonemes) common to the natural languages [see table on opposite page], and it was to be phonetically spelled.

But most important, Loglan was to incorporate as many of the notational devices of modern logic and mathematics as could be adapted to its use. Our Whorfian assumption here was that these powerful calculi carry in their structures precisely those psychosocial devices that give their human practitioners their rational power; our only problem was to tease them out. Lacking the very knowledge needed to assess the "power" of a symbolic device, we have invoked insight and speculative hypothesis to pack the structure of Loglan with the formal properties that seemed most suitable to its experimental purpose. We cannot be sure that this imitative borrowing from

mathematics and logic has maximized Loglan's "ratiocinative power." But we have at least succeeded in achieving a high degree of imitation. It would be surprising if, with such formidable models, Loglan were not superior to any of the natural languages in its ability to facilitate thought, if indeed thought is liable to such facilitation.

Of the many criteria that guided us in the construction of Loglan, the easiest to satisfy was that of the "learnability" of its vocabulary. We do not yet know if the language as a whole will prove learnable with satisfactory speed under experimental conditions. But the vocabulary at least should prove remarkably easy to master, whether the subject's native language is English or Chinese. One of our objectives was to provide an instrument that would be useful in experiments with subjects of different language backgrounds. It would not do, for example, to allow the vocabulary to imitate the English lexicon exclusively. Not only would this limit the range of any cross-cultural investigations we might later wish to make, but we could never be sure that it was Loglan and not English that was producing our experimental results. We have therefore taken great pains to construct a vocabu-

lary that is international in both its concepts and its roots.

To satisfy this requirement we happily hit upon a simple word-finding process. Well over two thirds of the world's present inhabitants speak one or more of just eight of its several hundred natural languages, either as a native or as a second tongue. Counting both their native speakers and secondary speakers who are not native speakers of any of the other seven, these eight languages, in the approximate descending order of the number of their speakers, are: English, Mandarin Chinese, Hindi, Russian, Spanish, Japanese, French and German. The ninth language is Arabic, but the addition of languages below the rank of eight geometrically increases the etymological labor of finding common roots, and only negligibly increases the total population. Now if one regards the 1,700 million speakers of the eight major languages as the target population of Loglan research, the relative statistical importance of each of them may be defined as the proportion of their speakers in the whole. On this basis the relative importance of English is approximately .28; Chinese, .25; Hindi, .11; Russian, .10; and so on down through German, with .05. If these figures are even approximately correct, English and Chinese are over-

BLANU	ALL OF ENGLISH BLUE [BLU]	$1 \times .28 = .28$
BLANU	ALL OF CHINESE LAN	$1 \times .25 = .25$
BLANU	1/2 OF HINDI NILA	$.5 \times .11 = .06$
BLANU	2/7 OF RUSSIAN GALUBOI	$.3 \times .10 = .03$
BLANU	1/2 OF SPANISH AZUL [ASUL]	$.5 \times .09 = .05$
BLANU	NO COUNTABLE PORTION OF JAPANESE AO OR KON	$0 \times .06 = .00$
BLANU	2/3 OF FRENCH BLEU [BLÜ]	$.7 \times .06 = .04$
BLANU	ALL OF GERMAN BLAU	$1 \times .05 = .05$

TOTAL LEARNABILITY SCORE = .76

THE WORD FOR "BLUE" in Loglan is *blanu*. In the "finding" of this word, words of corresponding meaning from the eight natural languages were respelled in Loglan phonemics. Trial words (including *blula* and *lablu* as well as *blanu*) were then assembled from the phonemes in these words, and each was scored according to the system illustrated here. Only the phonemes common to and occurring in the same order in both the Loglan and the natural word are counted. Since *blanu* incorporates all of English "blu," it is given the maximum rating of 1 (top right); since 28 per cent of the target population speaks English, *blanu* receives a score of .28 on the English line. Addition of the scores for all eight languages gave *blanu* the highest "total learnability" score of .76. This expresses the probability that a person will learn the word from association with a familiar natural word.

whelmingly the most "important" modern languages; their speakers constitute 53 per cent of the target population.

We then make a simplifying assumption. We assume that the probability of learning a new word in a second language on first, or very few, exposures is well approximated by the proportion of the phonemes in the corresponding native word that one finds in it. This is, of course, an extension of the familiar practice of studying "cognate roots" in second-language learning. The problem of finding the most learnable Loglan word—and Loglan words are found, not made—is thus reduced to finding a permissible sequence of Loglan phonemes that maximizes the proportion of the target population who will find matching phoneme sequences in related words of their native tongues. Thus the Loglan word *blanu* (English: blue), on the basis of its phoneme-match to words for blue in the eight major languages, has a learnability of .76. The score of .76 is obtained for *blanu* in the following way. The proportion of the phonemes in *blanu* that matches the phonemes in the most similar natural word of corresponding meaning is first computed for each language [see table on preceding page]. This proportion we assume to be a best estimate of the ease with which the speakers of that language will learn the word *blanu*. We then multiply that proportion by the proportion of speakers in the target population who speak that language. The product of these two proportions is nothing but the joint probability of two events: first, that a subject drawn at random will be a Frenchman, say; and second, that he will recognize his own word *bleu* in the Loglan *blanu*. The probability of the first event is only .06; of the second, by our assumption, .67; and of their joint occurrence, therefore, .04. The sum of the resulting probabilities over all eight languages is the probability that some one of these eight alternative joint events will happen: that a subject drawn at random will either be a Frenchman and learn *blanu* through *bleu*, or that he will be a German and learn it through *blau*, or that he will be a Hindi-speaking Indian and learn it through *nila*, or that he will be a Japanese and not learn it (immediately) at all, and so on. Thus the probability that anyone in this vast polyglot population will (easily) learn *blanu* is .76. The nearest competitor for the job of representing the concept "blue" is *blula*; a somewhat handsomer word from the standpoint of the English-trained ear. But the learnability score of *blula* is only

.67. Since no other word obtains a score equal to or greater than .76, *blanu* is the Loglan word.

Many Loglan words score 1 in at least one language; that is, they contain all the phonemes for the corresponding word in that language [see top table at right]. These words, however, had to survive the test of learnability in other languages and achieve a high total learnability. Loglan distributes such favors impartially, giving the speakers of each of the languages, in proportion to their numbers, easy cognate routes into its polyglot vocabulary [see bottom table at right].

We have discovered over 1,000 Loglan words by this means. They comprise the most frequent empirical terms (words for phenomena, say) in any language, and the ones least likely to be affected by direct interlanguage borrowing. Yet the average of their learnability scores is surprisingly high; about half of them have scores above .5, and the range of scores is from about .3 to .9. These figures indicate that our technique is not entirely arbitrary, and preliminary tests on English-speaking subjects suggest that the theoretical ratings tend, if anything, to underestimate the real learnability of the Loglan vocabulary. The figures also suggest that there is more phonetic similarity among the world's languages, even historically divergent ones, than is commonly supposed. The possibility of a universal human tongue may not be so remote after all.

Another feature of the Loglan vocabulary that should make it easy to learn is that each part of speech has its own phonetic form or forms. It is no accident that words like *blanu*, as in the tables at right, are all five-letter words. They all possess, in fact, either of two similar consonant-vowel patterns. *Blanu* has the *ccv'cv*-form (that is, "consonant-consonant-stressed-vowel-consonant-vowel"). Words like *bakso* and *cabro* (pronounced "bahk'-soh" and "shah'-broh"), on the other hand, exhibit the pattern *cv'ccv*. These two five-letter forms are the only permissible forms of what we have called the simple Loglan predicate, a grammatical category that roughly corresponds to the combined class of English common nouns, adjectives and verbs [see table on page 58]. Loglan makes no fixed distinctions between these well-defined Indo-European categories. By avoiding them it also avoids making the metaphysical distinctions between "processes" and "things" and between "substances" and "attri-

ENGLISH-CONTAINING WORDS

BAKSO	[BAHK'SOH]	BAKSO	BOX
BATLA	[BAHT'LAH]	BATLA	BOTTLE
CLIFE	[SHLEE'FEH]	CLIFE	LEAF
DZEGO	[DZEH'GOH]	DZEGO	EGG
FORMA	[FORMAH]	FORMA	FORM
GROCA	[GROH'SHAH]	GROCA	GROW
GRUPA	[GROO'PAH]	GRUPA	GROUP
KAPRE	[KAHP'REH]	KAPRE	COPPER
KETLI	[KET'LEE]	KETLI	KETTLE
LAKSO	[LAHK'SOH]	LAKSO	LOCK
KRUMA	[KROO'MAH]	KRUMA	ROOM
NARMI	[NAR'MEE]	NARMI	ARMY
NIGRO	[NEEG'ROH]	NIGRO	NEGRO/BI
PROZA	[PROH'ZAH]	PROZA	PROSE
RIZNU	[REEZ'NOO]	RIZNU	REASON
SAZNO	[SAHZ'NOH]	SAZNO	KNOW
SEDBO	[SED'BOH]	SEDBO	SAID/SAY
TRATI	[TRAH'TEE]	TRATI	
TRUCI	[TROO'SHEE]	TRUCI	TRUE
TITCA	[TEET'SHA]	TITCA	TEACH

LEARNABLE WORDS in Loglan for speakers of three of the eight languages of the target population incorporate all of the phonemes of the corresponding word in the natural language and in the same order

LOGLAN	ENGLISH
	.28
MATMA [MOTHER]	MOM MAM
SUPTA [SOUP]	SOUP SUP
BLANU [BLUE]	BLUE BLU
RISMI [RICE]	RAIS
DERTU [EARTH, SOIL]	DIRT DRT
TRELU [RAIL]	RAIL REL
VITCU [SEE]	VIEW VIU
PLUCI [PLEASE]	PLEASE PLIZ
FORLI [STRONG]	FORT FORT
SORLU [EAR]	AURAL ORL
KLESI [CLASS]	CLASS KLAS
GRODA [BIG]	GROSS GROS

MOST-LEARNABLE WORDS in Loglan have high "total learnability" scores measured in terms of the phonemes that compose the corresponding words in all of the eight natural languages. Each natural word

BOSNI	[BOHS'NEE]	BOSNI	OS [BONE]	CABRO	[SHAH'BROH]	CABRO	SHAO [BURN]
BRIKI	[BREE'KEE]	BRIKI	BRIQUE [BRICK]	DUNZO	[DOON'ZOH]	DUNZO	DZO [DO]
CEFLI	[SHEP'LEE]	CEFLI	CHEF [CHIEF]	DZORU	[DZOH'ROO]	DZORU	DZOU [WALK]
FLAMI	[FLAH'MEE]	FLAMI	FLAMME [FLAME]	FLETI	[FLEH'TEE]	FLETI	LEI [TIRED]
GLIDA	[GLEE'DAH]	GLIDA	GUIDE [GUIDE]	DJILE	[JEE'LEH]	DJILE	JIE [NOUN RING]
FEKTO	[FEK'TOH]	FEKTO	FAIT [FACT]	DJORI	[JOH'REE]	DJORI	JI [ORDER]
GRISI	[GREE'SEE]	GRISI	GRIS [GRAY]	LALDO	[LAHL'DOH]	LALDO	LAO [OLD]
GUSTO	[GOOST'OH]	GUSTO	GOUT[ER] [TASTE]	LILFA	[LEEL'FAH]	LILFA	FA [LAW, LEGAL]
KORLO	[KOR'LOH]	KORLO	CORPS [BODY]	MANDU	[MAHN'DOO]	MANDU	MAN [DECEIVE]
KROKU	[KROH'KOO]	KROKU	CROC [HOOK]	MATCI	[MAHT'SHEE]	MATCI	CHI [MACHINE]
LAVDO	[LAHV'DOH]	LAVDO	LAV[ER] [WASH]	METRI	[MET'REE]	METRI	MEI [SISTER]
MLEKO	[MLEH'KOH]	MLEKO	LAIT [MILK]	MUBRE	[MOO'BREH]	MUBRE	MU [WOOD]
MORTI	[MOR'TEE]	MORTI	MORT [DEAD]	NUMCU	[NOOM'SHOO]	NUMCU	SHU [NUMBER]
PORKO	[PORK'OH]	PORKO	PORC [HOG]	PETRI	[PET'REE]	PETRI	PEI [DISTRIBUTE]
PUDRU	[POOD'ROO]	PUDRU	POUDRE [POWDER]	PRANO	[PRAH'NOH]	PRANO	PAO [RUN]
SUVI	[SLEE'VEE]	SLIVI	VIE [LIFE]	RETCA	[RET'SHAH]	RETCA	CHA [DIFFERENT]
TABLI	[TAHB'LEE]	TABLI	TABLE [TABLE]	SANRE	[SAHN'REH]	SANRE	SAN [UMBRELLA]
TCELA	[CHEH'LAH]	TCELA	AILE [WING]	STISI	[STEE'SEE]	STISI	TI I [SENTENCE]
TCENA	[CHEH'NAH]	TCENA	CHAÎNE [CHAIN]	TIRNE	[TEER'NEH]	TIRNE	TIE [IRON]
VEGRI	[VEG'REE]	VEGRI	VERT [GREEN]	TOSKU	[TOH'SKOO]	TOSKU	TOU [HEAD]

in which they occur in that word. Thus, according to the assumptions of the Loglan word-finding system, the 20 words at left should prove to be immediately learnable by speakers of English. The Loglan words appear in the first column; their pronunciations in English phonetics, in the second column; the phonemes

common to the Loglan and the English word, in bold-face type in the third column. But these words had to score in other languages as well to be accepted in the Loglan lexicon. Similar lists can be drawn up for other major languages and represent the Loglan words that their speakers would learn most easily.

CHINESE	HINDI	RUSSIAN	SPANISH	JAPANESE	FRENCH	GERMAN	SCORE
.25	.11	.10	.09	.06	.06	.05	1.00
MA MA	MATA MATA	MAT MAT	MAMA MAMA	OKOSAMA OKOSAMA	MAMAN MAMA	MUTTER MUTR	.94
TANG TAN			SOPA SOPA	SUPU SUPU	SOUPE SUP	SUPPE ZUPA	.76
LAN LAN	NILA NILA	GALUBOI GALUBOI	AZUL ASUL		BLEU BLU	BLAU BLAU	.76
MI MI		RIS RIS	ARROZ AROS		RIZ RIS	REIS RAIS	.71
TU TU	DHARTI DARTI		TIERRA TIERA		TERRE TER	ERDE ERDA	.71
TIE LU TIE LU	REL REL	RIELS RIELS	BARRERA BARERA	RERU RERU	RALE RAL	RELING RELIN	.71
CHOU TCOU		VID[IET] VID-	VI VI		VISION VIZIO		.67
SHI CI	KHUSH KUC		PLAC[ER] PLAS-	TANOSHIMI TANOCIMI	PLAI[RE] PLE-	LUST LUST	.65
LI LI			FORTE FORTE		FORT FOR	FORT FOR	.65
RH GU RGU		SLUH SLU	OREJA OREHA		OREILLE OREI	OHR OR	.65
LEI LEI		KLASS KLAS	CLASE KLASE		CLASSE KLAS		.65
DA DA		SHCHI- ROK[IO] CTCIROK-	GRAND[E] GRAND-		GROS GRO	GROSS GROS	.65

is respelled in letters representing Loglan speech sounds, with the letters in bold face indicating the speech sounds shared with the Loglan word. As this table indicates, the common features of English, Spanish, French and German, which are spoken by 52 per cent of the target population, predominate in the determination of

these high-scoring Loglan words. Because of its great number of speakers and its typically short words, Chinese also makes a contribution. Russian and Japanese show up with the smallest frequency. Hindi, with its short, consonant-rich words, is intermediate despite its slight similarity to the other Indo-European languages.

21 LOGLAN PHONEMES		ENGLISH	CHINESE	HINDI	RUSSIAN	SPANISH	JAPANESE	FRENCH	GERM
5 VOWELS	A FATHER	✓	✓	✓	✓	✓	✓	✓	✓
	E MET	✓	✓	✓	✓	✓	✓	✓	✓
	I MACHINE; ALSO, BEFORE VOWELS, Y AS IN YET	✓	✓	✓	✓	✓	✓	✓	✓
	O NOTE; ALSO, BEFORE R, O AS IN OR	✓	✓	✓	G ONLY	✓	✓	✓	✓
	U LUTE; ALSO, BEFORE VOWELS, W AS IN WOE	✓	✓	✓	✓	✓	✓	✓	✓
16 CONSONANTS	B BOY	✓	✓	✓	✓	✓	✓	✓	✓
	C SHE	✓	✓	✓	✓	IN TC ONLY	✓	✓	✓
	D DOG	✓	✓	✓	✓	✓	✓	✓	✓
	F FAT	✓	✓	✓	✓	✓	✓	✓	✓
	G GO	✓	✓	✓	✓	✓	✓	✓	✓
	J AZURE [FRENCH JEAN]	✓	IN DJ ONLY	IN DJ ONLY	✓	IN DJ ONLY	IN DJ ONLY	✓	✓
	K COAL	✓	✓	✓	✓	✓	✓	✓	✓
	L LATE; ABLE	✓	✓	✓	✓	✓	NO	✓	✓
	M MAN	✓	✓	✓	✓	✓	✓	✓	✓
	N NO	✓	✓	✓	✓	✓	✓	✓	✓
	P PET	✓	✓	✓	✓	✓	✓	✓	✓
	R RAIN; BROTHER	✓	✓	✓	✓	✓	✓	✓	✓
	S SEW	✓	✓	✓	✓	✓	✓	✓	✓
	T TON	✓	✓	✓	✓	✓	✓	✓	✓
	V VERY	✓	NO	✓	✓	✓	NO	✓	✓
	Z ZEPHYR	✓	✓	✓	✓	NO	✓	✓	✓

LOGLAN SPEECH SOUNDS comprise the five vowels and 16 consonants most widely distributed among the eight languages spoken by the 1,700 million people of the "target population." A check mark indicates that some similar version of the Loglan sound occurs in the natural language. Only *l*, *v* and *z* are not common to

all eight languages. In the languages *c* ("sh") and *j* ("zh") occur only in the combinations *tc* ("ch" of "chum") and *dj* ("j" of "jam"), obliging a speaker of one of those languages to separate the Loglan sound out of the psychologically unitary native sound. Loglan words are spelled phonetically.

butes" that have long troubled Western thought. It turns out that these distinctions are nonessential in a logical grammar. We wish to impose as little metaphysics as possible upon the speakers of Loglan; therefore we have avoided them.

Not all Loglan predicates are of this five-letter form. Complex terms may be compounded of two or more elementary roots; for example, the word *rizdonsu* means "to reason" (literally "give reasons"), from *rizna* (reason) and *donsu* (give). Such terms have characteristic eight- or 11-letter forms. This arrangement conforms to the mechanism found in natural languages which interrelates the frequency of use of any word, its length and the number of other words of that length in the vocabulary. The late George Kingsley Zipf of Harvard University and other investigators have shown not only that the most frequently used words in any natural vocabulary are the shortest words, but also that there are much fewer short words than long ones. Conversely, the infrequently used words of a language tend not only to be numerous but also to be long. This empirical finding has been carefully worked into the formal structure of the Loglan vocabulary. Whether they be simple five-letter or complex eight- and even 11-letter terms, all of the Loglan predicates are instantly identifiable by their phonetic forms.

The other classes of Loglan words, as shown in the table at the right, have correspondingly recognizable phonetic forms, and they equally reflect the results of modern logical analysis of grammar. In collapsing the conventional European categories of noun, verb, adverb and adjective, the Loglan predicate embodies the realization that all such words may be treated alike for logical purposes. They share the distinguishing property of extralinguistic reference. They are the descriptive terms for the multitude of empirically distinguishable objects, actions, qualities and so on with which any language must deal. But formally considered, they are the interchangeable counters of the linguistic transactions with which logic is concerned. Ignoring the distinctions between nouns, verbs, adjectives and adverbs, Loglan draws other distinctions that conventional grammar either does not draw or draws faintly. Thus all the emotive or attitudinal elements of Loglan speech form a single phonetically distinct class. Such elements are called indicators. They do not refer;

they only indicate the attitude of the speaker toward what he says, and form a category that embraces such expressions as "yes," "no," "please," "hello," "ouch" and diverse others. Similarly, all the logical elements of speech are formally distinguished in Loglan. These are the words, or parts of words, in any language that relate other words to one another. Their reference is intralinguistic; in short, they impart to speech its structure. In Loglan these logical elements occupy several phonetic categories: most numerous are the operators, of which there are several subtypes; then there are the five connectives, the conjunctions of ordinary grammar.

The phonetic distinctions among the form-classes both transcend and reinforce the logico-grammatical distinctions among them. No matter how Loglan words are combined into sentences, their distinctive character remains. Thus all predicates, and only predicates, have adjacent multiple consonants; all indicators and sentential operators, and only these words, contain vowel diphthongs. On the other hand, all Loglan words except proper nouns end in vowels.

These regularities not only serve the purposes of grammatical distinction; they lead to a second interesting result. No matter how words of any of these classes are ordered in the flow of speech, their lexical separateness and their grammatical identity may be rapidly resolved [see table on page 61]. The reader is challenged to find a combination of permissible word-forms that does not resolve. This remarkable property of Loglan contributes in turn to what may ultimately be one of its most useful characteristics: its audiovisual isomorphism. But more of this important matter later.

We have said that logic and mathematics were our models. Therefore one might expect Loglan to be terse, explicit and symbolically compact, and that the logical structure of its sentences would be plainly apparent. In large measure the formal separation of empirical content from logical structure achieves this result. Thus the logically manipulable aspect of any statement in Loglan is expressed by its 90 operators and connectives together with a handful of attitude indicators. These 112 tiny words [see table on page 60] carry the entire burden of Loglan grammar and syntax, and are always immediately recognizable for what they are. Many of them are represented by distinctive symbols

in the written form. In consequence we expect the thinker in Loglan to find it easy to concentrate on the formal structure of his ideas, because the grammatical apparatus of the language will always leave that structure starkly revealed.

This is not all. Loglan not only separates the logical from the empirical and attitudinal components of speech, but Loglan grammar itself is nothing but a linguistic extension of symbolic logic. Under logical analysis the English sen-

LOGLAN WORD-CLASS	PHONETIC FORM
CONNECTIVES	V
INDICATORS	VV
SIMPLE OPERATORS	CV
OPERATORS SENTENTIAL OPERATORS	CVV
COMPOUND OPERATORS	CV'CV
SIMPLE PREDICATES	CV'C/ OR CCV'/CV
COMPLEX PREDICATES [TWO-TERM]	CV'C}/CV'C/CV CV'C}/CCV'/CV
PREDICATES COMPLEX PREDICATES [THREE-TERM]	CV'C}/CV'C}/CV CV'C}/CCV'/CV CV'C}/CCV'/CV
PROPER NAMES	LU -C

LOGLAN WORD-CLASSES reflect the syntactical concepts incorporated in the grammar of the language from symbolic logic and are readily identified by their characteristic phonetic forms (second column from left). Thus any one-letter word is a logical "connective" and is recognizable as

tence "He is a man" comes apart into two elements: the so-called propositional function "is a man," written $f(x)$; and the variable "he," written x . The complete scheme for this kind of sentence may then be written $f(x)$. The corresponding Loglan sentence form is xP , where x is any variable and P is any predicate. Thus "He is a man" would be written "*da mreni*" in Loglan, for no coupling operation between variable and predicate is necessary. Consequently Loglan predicates turn out to be nothing

more nor less than the propositional functions of symbolic logic. The predicate *mreni* does not really have the same meaning as the English noun "man"; it carries with it the force of an assertion "... is a man" or "... is manlike" and so corresponds to $f(x)$. (So also the meaning of *blanu* is best captured by the expression "... is blue" or "... is a blue object"). Similarly the five free Loglan pronouns (*da, de, di, do, du*) are precisely equivalent to the variables of logic; they do not really correspond to

English pronouns, with their limiting inflections of number, gender and case, but are more appropriately interpreted as the x, y and z of the mathematician.

The English sentence "All men are rational" may serve to illustrate the logical function of other crucial little words in Loglan. The sentence in Loglan reads: "*Radaku da mreni u da rizdonsu.*" Here the operation of quantification ("all") is performed by the special expression "*radaku*," which may be rendered "for any x ..." The little word u performs

EXAMPLE	ENGLISH WORD-CLASSES REPRESENTED	MAXIMUM SIZE OF CLASS	PROBABLE SIZE OF CLASS	PROBABLE FREQUENCY RANGE
I [EE] AND	THE MAJOR CONJUNCTIONS	5	5	WITHIN FIRST 500
IA [YAH] YES	EXPLETIVES, MANY ATTITUDINAL EXPRESSIONS	25	22	
DA [DAH] HE, SHE, IT	ALL PRONOUNS, NUMBERS, TENSE FLEXIONS, MINOR CONJUNCTIONS, MATHEMATICAL SYMBOLS, NAMES OF LETTERS, PUNCTUATION MARKS; MOST ADVERBS AND SOME PREPOSITIONS	80	80	WITHIN FIRST 1,000
SOI [SOY] SO, THEREFORE		550	100	
FACI [FAH'/SHEE] SOON		6,400	20	
BORSI [BOR'/SEE] BOY GROCA [GRO'/SHAH] GROW	ALL COMMON NOUNS, ADJECTIVES, AND VERBS; SOME ADVERBS AND MOST PREPOSITIONS	86,400	8,000	WITHIN FIRST 10,000
GROMAKSO [GRO'/MAHK/SO] CULTIVATE FROM GROCA = GROW, MAKSO = MAKE		103,296,000	?	?
GROMAKSENSI [GRO'/MAHK/SEN/SEE] AGRONOMY FROM GROCA = GROW, MAKSO = MAKE, SENSI = SCIENCE		VERY LARGE	?	?
LU TAM [LOO TAHM] = TOM LU MISISIPIS [LOO MEESESEEPES] = THE MISSISSIPPI	ALL PROPER NOUNS	VERY LARGE	?	ENTIRE FREQUENCY RANGE

a vowel preceded by a glottal stop (\cdot v). Any vowel diphthong (\cdot vv) is an "indicator" of the attitude of the speaker toward what he says. Any open monosyllable, that is, of a vowel followed by a vowel or diphthong (cv or \cdot cv), or series of such syllables (cv'cv) is an "operator," a formal logical, mathematical or grammatical element of the statement in which it occurs. Any five-, eight- or 11-letter word containing a multiple consonant and ending in a vowel is a "pred-

icate," a class of words that takes in the nouns, adjectives, verbs and adverbs of familiar grammars. Proper names may have any length and name operator *lu*, must end in a consonant and must not include *lu* preceded by a consonant. As the columns at right indicate, the use (frequency range) of these words is roughly proportional to their length and is inverse to the number in each class.

the logical operation of implication (If . . . , then . . .) and is one of the five connectives that express the principal logical relations between propositions [see tables below and on next page]. The Loglan sentence thus corresponds faithfully to the symbolic form of the state-

ment: $(x) [f(x) g(x)]$, which may be read "For any x , if x is a man, then x is rational."

Multi-place predicates are handled in Loglan precisely as they are in symbolic logic, that is, by arranging the

predicates in meaningful sequence. For example, the direct and indirect objects of the verb "to give" in "x gives y to z" are written in logic as $g(x,y,z)$ and in Loglan *da donsu de di*. Loglan uses no prepositions, but establishes the meaning of the places in its multi-place predicates by

SOUNDS	SIGNS	APPROXIMATE ENGLISH EQUIVALENTS
5 CONNECTIVES		
A E I O U	↔ . . . o →	MEANS, AND, [FULL STOP], OR, IMPLIES
77 OPERATORS		
DA DE DI DO DU MI MA MU TU TI TA	X Y W H Q	IT ₁ , IT ₂ . . . , IT _z [ALSO HE, HIM, SHE, HER, ETC.] I, WE [HE AND I], WE [YOU AND I], YOU THIS, THAT
LE LI LA LU VI VA VU		THE-, THIS-, THAT-, THE ONE NAMED- HERE, THERE, FAR AWAY
PA NA FA GA CI CA		BEFORE, NOW, AFTER, DURING NEAR [TIME], FAR [TIME]
NO NU [NIU]	~ ← [←]	NON- [ALSO NOT], UN- [ALSO PASSIVE VOICE OF TWO-PLACE PREDICATES]
PE PO PU		OF, -ING [ALSO TO-], -NESS
RA RE RI RO RU SU BO SO CO JO LO GO		ALL, MOST, MANY, SOME, FEW, ENOUGH BECAUSE, SO THAT, FOR, WITH [ALSO BY], LIKE, ACCORDING TO
NI NE TO TE FO FE SI SE VO VE MO	0 1 2 3 4 5 6 7 8 9 ∅	ZERO [ALSO NO], ONE [ALSO A/AN], TWO, THREE, FOUR- FIVE, SIX, SEVEN, EIGHT, NINE, -THOUSAND
ZA ZE ZI ZO ZU BI FI FU SA PI CE CU BE BA BU	× ' - + / = < > . . , √ ! ()	TIMES, TO THE -TH POWER, MINUS, PLUS, OVER EQUALS, IS LESS THAN, IS GREATER THAN -TH, POINT, SUB-, THE -TH ROOT OF FACTOREAL, PARENTHESIS, CLOSE PARENTHESIS
KA KE KI KO KU JA JE JI JU	" . : -	QUOTE, WHO/WHICH, [COMMA], THAT [ALSO COLON], [DASH] [CAPITALIZE], [INDENT], [UNDERLINE], [CENTER LINE]
22 INDICATORS		
IO IU		HELLO, GOODBYE
IA IE II AI AE AO		CERTAINLY, PROBABLY, MAYBE I WILL, I WANT, I HOPE
EA EI EO EU OA OE OI OU		WHAT? IS THAT SO? PLEASE. SUPPOSE. MUST, SHOULD, MAY, IT DOESN'T MATTER.
UA UE UI UO UU AU		WHAT! WELL! HOW NICE! THANKS! SORRY! OUCH!
9 SENTENTIAL OPERATORS		
TUI TUE TAI KAI NIE NIO PIU SOI NIU		IN GENERAL, MOREOVER, ABOVE ALL, SUMMING UP HOWEVER, IN ANY CASE, IN PARTICULAR, THEREFORE UN- [ALSO PASSIVE VOICE OF THREE-PLACE PREDICATES]

ONE HUNDRED TWELVE "LITTLE" WORDS carry the whole burden of Loglan logic and grammar. Once these words have been learned, the student will have acquired mastery over the entire grammatical apparatus of the language, together with the many logical and mathematical devices which have been built into that grammar. The words as sounded, or spelled, are listed in the column at left. The logically more significant words have formal "signs," shown in the middle column, which adapt them for written manipulation in the algebra of symbolic logic. Some of these signed words correspond to punctuation marks, which are spoken as well as written in Loglan. The English equivalents of all the words are approximated in the column at right. There are four classes of these "little" words. Each is identified by its characteristic phonetic pattern. The connectives are the five vowel sounds;

they include not only the familiar connectives "or" and "and" but the specialized logical concepts of equivalence and implication. The operators are all consonant-vowel words. This large class includes concepts represented in familiar languages by numbers, pronouns, prepositions, verb endings, the most common adjectives and adverbs, mathematical signs and of course punctuation marks. Nonetheless all the operators have a common function: to facilitate inference, cross reference, manipulation and transformation within the flow of speech. They may be joined together to express compound operations; for example, *rada* ("all of these"). The indicators are vowel diphthongs, and relate the attitude of the speaker to what he says. The sentential operators are all composed of a consonant followed by a vowel diphthong; they serve various rhetorical functions in the context of sustained speech.

syntactical rules. Many problems of conventional grammar are solved at one stroke by this device. Thus the comparative adjective "shorter than" is rendered without confusion in Loglan by the same word as the absolute adjective "short." Thus, *da cortu* (pronounced "short too")

means "He is short," while the same word *cortu* means "is shorter than" in the context of *da cortu de*. Similarly, *da farfu* ("He is a father") employs the same predicate in one-place form that is used with two places in *da farfu de* ("X is the father of y").

From its logical syntax Loglan gains great simplicity and rigor; yet it is still capable of reproducing—if one insists—all of the conventional grammatical distinctions. Unmodified, the predicate *prano* means "runs" or, alternatively, "is a runner," and so serves as a verb or a

<p><i>a</i></p> <p>THE CHIEF OF THE GROUP OF ARMY GUIDES SAID THAT HE WAS PLEASED TO SAY THAT HE HAD KNOWN THE FACTS FOR A LONG TIME. "THEY CERTAINLY DID NOT DECEIVE ME," HE SAID FORCEFULLY, "EVEN THOUGH THEY TRIED"; AND ORDERED SEVEN HUNDRED OF THEM LOCKED UP IN THEIR ROOMS.</p>	<p><i>g</i></p> <p>CV CVCCV CCVCV CCVCV CVCCV CV CVCCV CV CV CV CV CV CCVCV CV CVCCV CV CV CV CV CVCCV CV CV CVCCV VCV VV'CVCV CVCCV CV CV CV CV CVCCV CVCCV CVCCV'V. CVCV CCVCV CV.VCV CCVCV CV CV CV CV CV CVCCV CV CV CV CCVCV CV CV</p>
<p><i>b</i></p> <p>LE NARMI GLIDA GRUPA CEFLI PA SEDBO KOKO DA PA NU PLUCI PO SEDBO KO DA PAPACA SAZNO LE RI FEKTO ... KA IA NO DE MANDU MI KA DA PA FORLI SEDBO KA NU NIE DE PA TRATI KA E PA DJORI SENINI DE NU LAKSO VI LE RU KRUMA PE DE</p>	<p><i>h</i></p> <p>..... V CV VV' CV CV CV CV CVV CV CV CV V CV</p>
<p><i>c</i></p> <p>LENA'RMIGLI'DAGRU'PACE'FLI.PASE'DBOKOKO.DAPANU PLU'CI.POSE'DBOKO.DAPAPACASA'ZNO.LERIFE'KTO.IKA IA'NODEMA'NDUMI.KADAPAFOR'RLISE'DBO.KANUNIE. DEPATRATIKA.EPADJO'RISE'NINIDE.NULA'KSOVILE RUKRU'MAPEDE</p>	<p><i>i</i></p> <p>LE NARMI GLIDA GRUPA CEFLI PA SEDBO KO KO DA PA NU PLUCI PO SEDBO KO DA PA PA CA SAZNO LE RI FEKTO I KA IA NO DE MANDU MI KA DA PA FORLI SEDBO KA NU NIE DE PA TRATI KA E PA DJORI SE NI NI DE NU LAKSO VI LE RU KRUMA PE DE</p>
<p><i>d</i></p> <p>CVCV'CCVCCV'CVCCV'CVCV'CCV.CVCV'CCVCVCV.CVCVCV'CCV'CV.CVCV'CCVCV.CVCVCV'CCV.CVCVCV'CCV.VCV VV'CVCV'CCVCV.CVCVCV'CCV'CCV'CCV'CCV.CVCVCV'CCV.CVCVCV'CCV.CVCVCV'CCV.VCVCCV'CVCV.VCVCCV'CVCV'CVCVCV.CVCV'CCVCVCV CVCCV'CVCVCV</p>	<p><i>j</i></p> <p>LE NARMI GLIDA GRUPA CEFLI PA SEDBO KOKO.DA PA NU PLUCI PO SEDBO KO DA PAPACA SAZNO LE RI FEKTO ... KA IA NO DE MANDU MI KA DA PA FORLI SEDBO KA NU NIE DE PA TRATI KA E PA DJORI SENINI DE NU LAKSO VI LE RU KRUMA PE DE</p>
<p><i>e</i></p> <p>CVCV'CCVCCV'CVCCV'CVCV'CCV.CVCV'CCVCVCV.CVCVCV'CCV'CV.CVCV'CCVCV.CVCVCV'CCV.CVCVCV'CCV.VCV VV'CVCV'CCVCV.CVCVCV'CCV'CCV'CCV'CCV.CVCVCV'CCV.CVCVCV'CCV.CVCVCV'CCV.VCVCCV'CVCV.VCVCCV'CVCV'CVCVCV.CVCV'CCVCVCV CVCCV'CVCVCV</p>	<p><i>k</i></p> <p>LE NARMI GLIDA GRUPA CEFLI PA SEDBO: X PA +PLUCI PO SEDBO: X PAPACA SAZNO LE RI FEKTO ... "IA— Y MANDU MI" X PA FORLI SEDBO "+NIE Y PA TRATI" PA DJORI 700Y +LAKSO VI LE RU KRUMA PE Y</p>
<p><i>f</i></p> <p>CV CVCCV CCVCV CCVCV CVCCV CV CVCCV CVCV.CVCVCV' CCVCV CV CVCCV CV.CVCVCVCV CVCCV CVCV CVCCV VCV VV'CVCV CVCCV CV.CVCVCV CVCCV CVCCV CVCVCV. CVCV CCVCV CV.VCV CCVCV CV'CVCVCV.CV CVCCV CVCV CV CCVCV CVCV</p>	<p><i>l</i></p> <p>LE NGRIC PS: X P-P PO S. X PPCSA LE RI F... "IA— Y M MI" X PFOS "+NIE Y PT" PD 700Y +L VI LE RU K PE Y</p>

WRITTEN AND SPOKEN LOGLAN may be resolved easily into each other and reduced to purely symbolic expression. In *a* at upper left is an English sentence constructed of words whose Loglan equivalents are shown in other tables. The passage is translated into written Loglan in *b*, and in *c* is transcribed as it might sound if read rapidly with word identity lost but with a natural pattern of stresses (') and pauses (.). The spoken transcript is then resolved in *d* into its consonant-vowel (cv) pattern, with stresses and pauses and the occurrence of semivowels (v) noted. The adjacent consonants that identify predicates appear in bold-face in *e*. Since pairs of consonants preceding a stressed vowel (ccv') always begin a predicate, and pairs of consonants that follow a stressed vowel (v'cc) always occur in the middle of a predicate, and since predicates have only limited numbers of phonemes,

the predicates may be resolved as in *f*. Most of the unresolved sequences consist of consonant-vowel alternations; these can only be operators, and they are resolved in *g*. The remainder of the passage is now easily resolved (*h*) into connectives (vowels preceded by a glottal stop, or .v), indicators (diphthongs, or rv) and sentential operators (cvv). With the spoken passage thus resolved into words, it is restored to full phonemic form (*i*), and the compound operators and full-stop are identified in *j* to restore the passage to original written form. The punctuation may be carried a step further (*k*) with translation of the connectives and certain operators into their conventional signs as shown in the chart on opposite page. The passage may then be completely mathematized, with predicates reduced to abbreviations and most operators represented by signs, to expose its logical structure (*l*).

"VERB" FORMS	
DA DONSU DA DONSU DE DA DONSU DE DI	HE GIVES. HE GIVES IT. HE ₁ GIVES IT TO HIM ₂ .
DA NU DONSU ETC. DA NIU DONSU ETC.	IT IS A GIFT. HE IS A RECIPIENT.
DA NA DONSU DA PA DONSU DA FA DONSU	HE NOW GIVES. HE GAVE. HE WILL GIVE.
DA PAPA DONSU DA PANA DONSU DA PAPA DONSU ETC.	HE HAD GIVEN. HE HAS GIVEN. HE WILL HAVE GIVEN.
DA NAGA DONSU ETC. DA PAGANA DONSU ETC.	HE IS NOW GIVING. HE HAS BEEN GIVING.

"ADVERB" FORMS	
DA RANA DONSU DA RENA DONSU DA RINA DONSU ETC.	HE ALWAYS GIVES. HE USUALLY GIVES. HE OFTEN GIVES.
DA PACI DONSU DA PACA DONSU DA FACI DONSU ETC.	HE RECENTLY GAVE. HE GAVE LONG AGO. HE WILL SOON GIVE.
DA VI DONSU DA VA DONSU DA VU DONSU	HE GIVES HERE. HE GIVES THERE. HE GIVES FAR AWAY.
DA RAVI DONSU ETC.	HE GIVES EVERYWHERE.
DA PACAGAVI FACI DONSU ETC.	SOON HE WILL HAVE BEEN GIVING HERE FOR A LONG TIME.

NEGATIVES	
DA NO DONSU NO DA DONSU NI DA DONSU	HE IS A NON-GIVER. HE DOES NOT GIVE. NONE OF THEM GIVES.

"NOUN" FORMS	
LE MRENI LI MRENI LA MRENI	THE MAN THIS MAN THAT MAN
RA MRENI RE MRENI RI MRENI ETC.	ALL MEN MOST MEN MANY MEN
NI MRENI NE MRENI TO MRENI ETC.	NO MEN A MAN, ONE MAN TWO MEN
LE TE MRENI RA LE TE MRENI ETC.	THE THREE MEN ALL OF THE THREE MEN

ABSTRACT "NOUNS"	
LE PO DONSU LE PO PRANO	THE GIVING THE RUN
LE PU DONSU LE PU MRENI	THE GENEROSITY THE MANLINESS

"ADJECTIVE" FORMS	
NE LALDO MRENI NE DONSU MRENI	AN OLD MAN A GENEROUS MAN

NE LALDO DONSU MRENI NE DONSU LALDO MRENI	A TRADITIONALLY [?] GENEROUS MAN A GENEROUSLY [?] OLD MAN
NE MRENI KE LALDO NE MRENI KE DONSU NE MRENI KE DONSU E LALDO	A MAN WHO IS OLD A MAN WHO IS GENEROUS A MAN WHO IS GENEROUS AND OLD
NE MRENI KE DONSU DE NE MRENI KE DONSU DE DI	A MAN WHO GIVES IT A MAN WHO GIVES IT TO HIM
LE LALDO MRENI KE PA DONSU TE DA LI SE PRANO ETC.	THE OLD MAN WHO GAVE THREE OF THEM TO THESE SEVEN RUNNERS

IDENTITIES	
DA BI LU DJAN DA BI LE MRENI DA BI LE LALDO MRENI KE PA DONSU TE DE LI SE PRANO ETC.	HE IS JOHN. HE IS THE MAN. HE IS THE OLD MAN WHO GAVE THREE OF THEM TO THESE SEVEN RUNNERS.

COMPOUND FORMS	
DA PRANO O DZORU DA PRANO E DZORU ETC. DA O DE PRANO DA E DE PRANO ETC. DA PRANO O DE DZORU DA PRANO I DE DZORU DA PRANO U DE DZORU DA PRANO A DE DZORU	HE RUNS OR WALKS. HE RUNS AND WALKS. HE ₁ OR HE ₂ RUNS. HE ₁ AND HE ₂ RUNS. HE ₁ RUNS OR HE ₂ WALKS. HE ₁ RUNS AND HE ₂ WALKS. IF HE ₁ RUNS THEN HE ₂ WALKS. HE ₁ RUNS IF AND ONLY IF HE ₂ WALKS.

DA PRANO BO DE DZORU DA PRANO LO DE DZORU ETC.	HE ₁ RUNS BECAUSE HE ₂ WALKS. HE ₁ RUNS LIKE HE ₂ WALKS.
BO DE DZORU KI DA PRANO ETC.	BECAUSE HE ₂ WALKS, HE ₁ RUNS.
DA PRANO NA DE DZORU DA PRANO PA DE DZORU DA PRANO VI DE DZORU ETC. NA DE DZORU KI DA PRANO ETC.	HE ₁ RUNS WHEN HE ₂ WALKS. HE ₁ RUNS AFTER HE ₂ WALKS. HE ₁ RUNS WHERE HE ₂ WALKS. WHEN HE ₂ WALKS HE ₁ RUNS.

UNIVERSALS	
RADAKU DA PRANO U DZORU RANAKU DA PRANO NA DE DZORU RAVIKU DA PRANO VI DE DZORU RADARODEKU DA DONSU U DA DONSU DE	ANYONE WHO RUNS CAN WALK. HE ₁ RUNS WHENEVER HE ₂ WALKS. HE ₁ RUNS WHEREVER HE ₂ WALKS. EVERYONE WHO GIVES GIVES SOMETHING.

ATTITUDINAL FORMS	
UA DA PRANO UE DA PRANO UI DA PRANO ETC.	WHAT! HE RUNS? [ANGER] WELL! SO HE RUNS. [SURPRISE] HOW NICE THAT HE RUNS! [PLEASURE]
EI DA PRANO EA DA PRANO DA PRANO EA DE ETC.	DOES HE RUN? WHO RUNS? WHERE DOES HE RUN?
IA DA PRANO IE DA PRANO II DA PRANO IA NO DA PRANO ETC.	YES; HE RUNS. HE PROBABLY RUNS. PERHAPS HE RUNS. NO; HE DOESN'T RUN.
AI MI FA PRANO AE MI FA PRANO AO MI FA PRANO AI NO MI FA PRANO ETC.	YES; I WILL RUN. I WANT TO RUN. I HOPE TO RUN. NO; I WON'T RUN.
OA MI FA PRANO ETC.	I MUST RUN.

LOGLAN GRAMMAR derives great flexibility and variety from manipulation of the 112 "little words" that do all of its work. These words are defined and their functions explained in the table on page 60. As demonstrated here, it is the little words that determine whether a predicate—a term of extralinguistic reference, such as *donsu* and *prano*—is to serve in a given statement as a noun, verb, adjective or adverb, as in more familiar grammars. Thus *pa* (before), *na* (now) and *fa* (after) give the predicate *donsu* (give) the function of verb (upper left) and "conjugate" it through the future, present and past tense. Compound forms of

these operators yield the compound tenses; for example, *papa* (before-before) indicates the pluperfect tense. In such combinations they not only duplicate all of the familiar grammatical forms but go far beyond to express relationships that can be only clumsily approximated in the natural languages, as is indicated by the translation of the compound operator *pacagavi faci* at center left. The flexibility of the system is suggested further by the transformations of *donsu* (in this table "give," "giver," "gift," "generous," "generously," "generosity" and so on) in accord with its association with operators and connectives or its place in a multiple predicate.

noun [see table on opposite page]. But should anyone wish explicitly to differentiate these meanings, it can easily be done. Thus *da na prano* means "He is now running," for *na* is the tense-operator of present time. This expression clearly communicates the sense of verbal action, and leaves the simpler expression *da prano* ("He is a runner") with the categorical, timeless sense of the predicate which we would associate with the English noun. Similarly "He talked" is *da pa takla*, for *pa* is the operator of past time. In exactly the same way predicates that we would consider adjectives can be given time specification. Thus *da pa blanu* means "It was blue" and *da fa blanu* means "It will be blue" in senses that now involve explicit use of the English verb, while *da na blanu* expresses the clearly verbal property of being only temporarily blue, as might be said of a flashing light.

The three tense-operators *pa*, *na* and *fa* constitute the elements out of which the whole system of Loglan verb tenses is constructed. Here again word order plays a decisive role. Thus *da panu kamla* means "He has come" (literally "He before-now comes"), *da papa kamla* means "He had come" ("He before-before comes") and *da pafa kamla* means "He will have come" ("He before-after comes"). On the other hand, *da fapa kamla* ("He after-before comes") precisely expresses a compound tense only approximately suggested by the past progressive "He was going to come".

Loglan is, of course, an analytical language. Its predicates are never inflected, and are free to be combined in any order. Thus the serial predicate *venri cortu mreni* means ". . . is a very short man." Each modifier qualifies the meaning of the immediately subsequent word exactly as in English. But unlike the corresponding English words—one of which is an adverb, the other an adjective and the third a noun—it is possible to recombine the Loglan words in any order without doing violence to their essential meanings. Thus *da venri mreni cortu* means "X is a very manlike short-thing," in which *venri* modifies *mreni*, and *mreni* modifies *cortu*. *Da mreni cortu venri*, on the other hand, means "X is a masculinely short extreme thing," and *da cortu venri mreni* means "X is a shortly extreme man." These clumsy English sentences only approximately convey the three quite different perceptions that are expressed by simple rearrangement of the serial predicate in Loglan. With the free range of imaginative permutation available in its permis-

sive syntax, we expect Loglan to be a metaphor-rich language, more similar to Chinese in this respect than to the structurally more confining European tongues. The formal property of metaphor facilitation has a service to render to the exercise of "creative imagination," whether in science or poetry.

Another feature of Loglan that we hope will interest linguists and psychologists—and perhaps computer engineers as well—is that the spoken and written forms of the language are isomorphic. That is, each element of the spoken utterance stands in one-to-one correspondence with some element in the written form. This is saying a good deal more than that Loglan is written phonetically; in addition, all the "punctuation marks" of Loglan are spoken, and even the spaces between its written words, its paragraphing, indentation, italicizing and the like have formal analogs in the structure of the spoken form [see tables on pages 60 and 61]. No other symbolism of which we know has this audiovisual isomorphism; no natural language approaches it, and the symbolisms of mathematics and logic do not even attempt it (as is indicated by the almost total lack of parallelism between the way logical expressions are written and the way they are read). Perhaps the most nearly isomorphic of existing symbolic systems is the notation of musical composition: a symbolism that is not meant to be rendered into human speech at all. In this sense Loglan's isomorphism is a unique linguistic property that we think will have some interesting experimental consequences.

It is a surprising feature of the history of the natural languages that the forms of speech and the forms of writing have had little effect on each other until comparatively recent times. Speech is an activity shared by all members of any society; writing, when it exists at all, by the few. As a consequence the forms of writing tend to be remote from the forms of "vulgar" speech. It is only recently, in our own highly literate societies, that writing has come to adopt the forms of audible speech. Even "literary" sentences are now shorter; dialogue in the hands of modern writers tends more and more clearly to imitate audible forms. But a process of reciprocal influence also seems to be well under way. Speakers are more and more often heard to use devices that formerly belonged exclusively to the written form. Consider the still somewhat slangy use of the spoken word "period" to indicate the unquali-

fied nature of an assertion, or the even more frequent use of the spoken words "quote" and "unquote" in precise speech. Thus as writing and reading approach speaking and listening as universal arts, we should expect their forms to grow more similar if not actually to coalesce.

Loglan experimentally pushes this historical tendency to its extreme. In Loglan the formal structure of writing is identical with that of speech. This formal property in no way guarantees, however, strict isomorphism of behavior. It should be interesting to observe its effects upon the actual speaking and writing of the learners of the Loglan game. It is especially tempting to consider how children might respond; the growth of capacity to read and write might closely parallel that of speech itself, with interesting consequences for the early development of the rational powers. Finally, the audiovisual isomorphism of Loglan should permit its spoken form to be mechanically and correctly recorded in writing and conversely should permit its written form to be reproduced mechanically in intelligible speech. In short, the isomorphism of Loglan, while unprecedented and therefore unguageable, may yet prove to be one of its most fruitful properties.

At present Loglan has a tested grammar; a core vocabulary of nearly 1,000 elementary terms has been constructed, and complex terms based on these elements are rapidly accumulating. Our object is to test the adequacy of this list of elementary predicates by constructing from them the first 4,000 most frequent concepts of the European languages before publishing a dictionary. If so much can be demonstrated, it is our hope that the remainder of a vocabulary of any desirable size and specificity can be easily generated in use. The model language is thus very nearly finished. While there are as yet no speakers, we are hopeful that Loglan primers and laboratory manuals will soon be available.

Loglan is already "alive," however, in the interesting sense that those of us who have been closely associated with it have begun to sense the parsimony of its metaphysics, its liberating style of metaphor, its incisive modes of thought. We are by no means certain yet that Loglan is a thinkable language, let alone a thought-facilitating one. But there is some prospect that this instrument will facilitate experimental investigation into the distinguishing human faculty of symbolic communication.