corresponding to Old English fūl. Consequently these cases are scored as non-correspondences. On the other hand, normal phonetic changes (e.g., belg to belly) and structural modifications (e.g., the use of a new affix, as in cenizos) are disregarded. Applying this procedure to the entire test list, the agreement between Old and modern English was found to be 85 per cent. Between modern Spanish and classical Latin, the correspondence was 70 per cent. The elapsed time period in the first case was about 1,000 years, in the second case 2,000 years. Now, if after 1,000 years 85 per cent of the original vocabulary still remains in the same function, then in a second thousand years a similar retention rate would give 85 per cent of the 85 per cent still existing at the beginning of this second period. In other words, 2,000 years at the English rate would leave 72 per cent, a little more than the Spanish retention after such a period. The Spanish retention corresponds to a rate of a little less than 84 per cent per 1,000 years. The rate of retention is thus practically identical in these two cases.

In order to determine whether the rate of retention is always constant, it is necessary to examine a number of cases where the vocabularies of two periods of the same language are known and the elapsed time is also known. A number of suitable instances are available for study. Since the time intervals are generally not simple multiples of each other, it is convenient to use logarithms to reduce all the cases to a standardized time period such as 1,000 years. The mathematics can be expressed by the formula:

$$\log r = \log c \div t.$$

That is, logarithm of the retention per 1,000 years in per cent equals logarithm of common vocabulary per cent divided by number of time periods.

Tests of rate of retention have been made for several languages by different scholars with the following results.[14]

	% per 1,000 years
Middle Egyptian 2100-1700 B.C. to Coptic 300–500 A.D. (C. Baer) (calculated as 23 centuries)	76
Classic Latin 50 B.C. to present-day Romanian (E. Cross)	77
Old High German 850 A.D. to present-day German (G. J. Metcalf and R. D. Lees)	78
Classic Chinese 950 A.D. to modern colloquial North Chinese (C. Y. Fang)	79
Latin of Plautus 200 B.C. to French of Molière 1650 A.D. (D. A. Griffin)	79
Dominica Carib of 1650 to present-day (D. Taylor and M. Swadesh)	80
Classic Latin 50 B.C. to present-day Portuguese (E. Cross)	82
Koiné to present-day Cypriote (E. Hamp)	83
Koiné to present-day Athenian (E. Hamp)	84
Classic Latin 50 B.C. to present-day Italian (E. Cross)	85
Old English 950 A.D. to present-day English (M. Swadesh)	85
Latin of Plautus 200 B.C. to Spanish of 1600 A.D. (D. A. Griffin)	85

[14] See Lees, *op cit.*

The reasons for variation in the rate of retention need to be considered in detail, but the amount of variation, from 76 to 85 per cent, is relatively small. For the purposes of studying reasons for variation it would be desirable to obtain the counts for a much larger number of cases, but the number of examples given here is already sufficient to eliminate the possibility of sheer coincidence in the close agreement of the retention indices.

THE TEST VOCABULARY

The lexical test list used for studying rate of change consisted of 215 items of meaning expressed for convenience by English words. In some cases, where the English word is ambiguous or where the English meaning is too broad to be easily matched in other languages, it is necessary to specify which meaning is intended, and this is done by means of parenthetic additions. If it is understood that normal everyday meanings rather than figurative or specialized usages are to be thought of, complicated notes are not necessary. The list, minus 15 items recommended for omission and with one other change, is as follows:

all (of a number), and, animal, ashes, at, back (person's), bad (deleterious or unsuitable), bark (of tree), because, belly, berry (or fruit), big, bird, to bite, black, blood, to blow (of wind), bone, breathe, to burn (intrans.).

child (young person rather than as relationship term), cloud, cold (of weather), to come, to count, to cut, day (opposite of night rather than time measure), to die, to dig, dirty, dog, to drink, dry (substance), dull (knife), dust, ear, earth (soil), to eat, egg, eye.

to fall (drop rather than topple), far, fat (organic substance), father, to fear, feather (larger feathers rather than down), few, to fight, fire, fish, five, to float, to flow, flower, to fly, fog, foot, four, to freeze, to give.

good, grass, green, guts, hair, hand, he, head, to hear, heart, heavy, here, to hit, to hold (in hand), how, to hunt (game), husband, I, ice, if.

in, to kill, to know (facts), lake, to laugh, leaf, left (hand), leg, to lie (on side), to live, liver, long, louse, man (male human), many, meat (flesh), mother, mountain, mouth, name.

narrow, near, neck, new, night, nose, not, old, one, other, person, to play, to pull, to push, to rain, red, right (correct), right (hand), river, road (or trail).

root, rope, rotten (especially log), to rub, salt, sand, to say, to scratch (as with fingernails to relieve itch), sea (ocean), to see, seed, to sew, sharp (as knife), short, to sing, to sit, skin (person's), sky, to sleep, small.

to smell (perceive odor), smoke (of fire), smooth, snake, snow, some, to spit, to split, to squeeze, to stab (or stick), to stand, star, stick (of wood), stone, straight, to suck, sun, to swell, to swim, tail.

that, there, they, thick, thin, to think, this, thou, three, to throw, to tie, tongue, tooth (front rather than molar), tree, to turn (change one's direction), two, to vomit, to walk, warm (of weather), to wash.

water, we, wet, what? when? where? white, who? wide, wife, wind, wing, to wipe, with (accompanying), woman, woods, worm, ye, year, yellow.

Sixteen items used in the studies but which are unsatisfactory for many language groups are: brother, sister, six, seven, eight, nine, ten, twenty, hundred, clothing, to cook, to dance, to shoot, speak, to work, to cry. One item, to speak, has been replaced by a near synonym of higher normal stability, to say; and one word, heavy, has been added to bring the lists to an even 200. There may be reason for questioning some other items in the list, but the more serious defects are probably contained in the seventeen items now recommended for deletion or change. For the time being it is recommended that studies continue either with the original list or with the slightly modified list so that new results will be comparable with those previously obtained. The same applies to possible additions, since any major lengthening of the test vocabulary would require recalculating the index of the constant.

Suitable items for a test list must be universal and non-cultural. That is, they must refer to things found anywhere in the world and familiar to every member of a society, not merely to specialists or learned people. Moreover, they must be easily identifiable broad concepts, which can be matched with simple terms in most languages. Of course, it would be impossible to devise a list which works perfectly for all languages, and it must be expected that difficult questions will sometimes arise. This can, however, be very simply met by omitting the troublesome item when necessary. The rules for filling in the list for each language may be stated as follows: (*a*) Try to find one simple equivalent for each item by disregarding specialized and bound forms and the less common of two equivalents. (*b*) Use a single word or element rather than a phrase, even though the meaning may be broader than that of the test item. (*c*) Where it is impossible to find a single equivalent, omit the form.

It is doubtless possible to devise a better test list than the present one, but from the author's own experiments along these lines it is not too easy. Many notions seem suitable but are difficult to match in some languages because of structural peculiarities; thus the locative relations, like behind, above, beneath, etc. Many promising items turn out to have finely subdivided ranges of meaning in certain cultures, e.g., to work. It is therefore suggested that an objective method may solve the problem. A long list of possible items may be tried for a number of languages chosen for their diversity, and each item scored as to how often it can be easily matched. Only those which can be matched unambiguously in most languages are suitable. The stability of the items also needs to be objectively tested by noting how often and for how long they are retained in a number of historically known situations. A stability score for individual items could be calculated, and this score taken into account in constructing the improved test list. Presumably the variation in the index of retention would be reduced by having a better test list, but we do not know to what extent the present variability can be reduced by such improvements.

An obvious way to improve the test list, if possible is to make it longer. However, once one has two hundred test items, it takes several hundred more to improve the statistical adequacy of the test in any marked degree. Considering the difficulties of finding universally suitable words for a test vocabulary, it can hardly be hoped that a list of more than about three hundred items could be devised. Even this extension would be worthwhile for the purpose of dealing with remote time depths. For instance, where there is only 5 per cent retention, it is distinctly more satisfactory to have fifteen rather than ten actual instances.

DETERMINING TIME INTERVAL

In calculating rate of retention in historic cases, it is important to have correctly dated samples and to be sure that both samples are on the same line of language tradition. In one of our instances