THE DATING GAME:
ONE LAST LOOK AT GLOTTOCHRONOLOGY:
THE CASE OF SOME ARABIC DIALECTS

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Introduction

In a series of seminal articles, Swadesh (1951, 1955) and Lees (1953) developed the theories of lexicostatistics and glottochronology, and detailed the methods for their application. There followed a spate of enthusiastic studies to test and refine those methods, discussed by Hymes (1960) in his lengthy evaluation of the progress of lexicostatistical theory. At that time, Hymes deemed the glottochronological method a potentially useful tool for the dating of language splits, and called for its further refinement. Yet, since Bergsland and Vogt's (1962) scathing and cogent critique of the method, glottochronology has been neglected. Neither defended nor disproven definitively, glottochronology seems to have died a silent death. Our purpose in this paper is to resurrect it once again, to test the method with data from nine modern dialects of Arabic, to examine the problems involved in its application, and to scrutinize the assumptions which underlie the theory.

The Glottochronological Method

Lexicostatistics, as defined by Hymes (1960), is the statistical study of vocabulary for purposes of drawing "historical inference(s)". Glottochronology is thus only one lexicostatistic method among many, although it is perhaps the most controversial. It refers to the study of the rate of change in languages as measured from the rate of replacement of "basic vocabulary" items over time. This rate may, in turn, be used to calculate the approximate time at which two related languages began to diverge in development.

The validity of the glottochronological method rests on several assumptions. First, that certain parts of the vocabulary--the "basic core"-- are less subject to change than other parts. The rate of retention of these basic vocabulary items is held to be constant, not only through time, but across languages. If the percentage of true cognates within the core vocabulary is known for any two languages, then the length of time that has elapsed since the two languages began to diverge from a single parent language can be computed. Alternatively, one can compare

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the basic vocabulary of a single language at two different stages of its development in order to determine the rate of loss or retention (Gudschinsky 1956).

The mechanics of the technique are relatively simple. The researcher collects word lists of the core vocabulary, determines probable cognates within the two lists under comparison and counts the totals. The time depth is then computed according to the formula $t = \log C/2 \log r$, where t is the divergence date in millennia, C is the percentage of cognates, and r is the "glottochronological constant," the percentage of cognates assumed to remain after a thousand years of independent development, based on the thirteen "control cases" studied by Swadesh and Lees (1953)(Jeffers and Lehiste 1979: 134). The value of this constant varies according to the list being used. For Swadesh's 200-word list, the constant is claimed to be 81%; for the 100-word list (the one used in the present study), 86% (Swadesh 1955).

Glottochronological Studies

The glottochronological method, developed by Swadesh (1951, 1955) and Lees (1953) over thirty years ago, has been tested by an impressive variety of scholars, on various languages and language families, with varied results. The most positive results find the technique to be remarkably successful in its calculation of time depths as validated by historic documentation.

For example, in a comparison of Koranic Arabic and the current dialect of Mecca, Satterthwaite (1960) calculated a retention rate of .823, "completely supporting Lees' and Swadesh's estimate".(1) The result was surprisingly close, according to Satterthwaite, since "the daily public recitation of the Qoran in mosques and schools throughout the Islamic world would lead one to expect that its vocabulary would have a higher retention rate than almost any other vocabulary in the world."

Troike's study of six Turkic languages (1969) yielded similarly stunning results: "The internal consistency of dates...as well as the close correspondence of both sets of dates to known historical developments, constitute a strong corroberation of the validity of the Swadesh 100-word list and the .86 retention rate as tools for determining the chronology of language divergence" (Troike 1969:191).

In the followup article to his comprehensive survey "Lexicostatistics So Far" (1960), Hymes discussed a number

of successful glottochronological studies, particularly those of Shirō Hattori on Japanese dialects. Hymes' conclusions at that time were that glottochronology and lexicostatistics enjoyed "a fair amount" of theoretical and empirical support, that further applications could be of value both for their historical and for their methodological implications; but that "a painstaking retesting of the basis of glottochronology" and an equally "painstaking analysis and synthesis" of the problems in its application were "greatly needed" (Hymes 1960a:345). Despite occasional success stories like those of Satterthwaite and, later, Troike, there were, and continue to be, plenty of less than successful applications of the method.

Kroeber (1955) examined the application of lexicostatistics to several Native American language families, and argued for controlled use of the technique on moderate time depths on the order of 500 years, instead of what he saw as outlandish applications. For splits of five thousand years or more, the glottochronological method treads on progressively thinner ice: "Part of it(s results)--six or seven words--might well be fortuitous resemblance, the rest--another six or seven--be due to borrowing, and nothing be left for the supposed genetic kinship" (Kroeber 1955:97). To reduce the ill effects of chance, Kroeber suggested that a thousand-word list be used.(2) Cautioning against the over-zealous application of the method to "languages whose very connection is novel and startling, but tenuous" (104), he advised scholars to refine the technique by restricting it to groups of languages that are obviously related.

Even such restricted applications have not always proven successful. Hale (1958, 1959), after examining seventeen Uto-Aztecan languages and constructing a tree-diagram of groupings based on the results, was left with a "disturbing problem". The Tarahumara dates arrived at by the formula led him to assert that "the premise that different languages lose vocabulary items at the same rate is false" (Hale 1958:107).

Gudschinsky (1955) studied six closely related dialects of Mazatec, language of Southern Mexico, and concluded that "any hope of determining absolute time...seems to have been permanently lost...reborrowing from other dialects following a change in the lines of communication or a shift of cultural and economic dependence can distort the evidence so that it no longer accurately reflects the true historical development"

(Gudschinsky 1955:149). If a language has lost the proto-word and later reborrows it from a related language or dialect, this form will appear to be a retention when, in effect, it is a re-replacement. In lieu of calculating time depths, she proposed a technique for discussing degrees of lexical relationship between dialects in terms of "dips".(3)

Aside from problems with the formula and rate-constant, the word lists themselves have presented significant difficulties. According to Hoijer (1956), "There is, in short, nothing in lexicostatistic theory which enables us, once and for all, to establish a firm test list, translatable...into any language" (Hoijer 1956:53). He goes on to illustrate this point with data from his own attempts at translating the list into Navajo and other Athabaskan languages. The problem of duplication--more than one item on the English list represented by a single Navajo word, or more than one Navajo word to represent a single English item--necessitates a different test list for each language, even among closely related languages, "an obvious handicap to the accurate dating of their separation"(58).

Such limitations are not unique to the Athabaskan data. When O'Grady (1960) applied the 200-word list to a widely scattered group of Australian languages, he had "serious difficulties" and concluded that "no less than 69 of the items are either unsuitable or else need more precise definitions in terms of the Australian environment" (O'Grady 1960:338).

In their highly critical article "On the Validity of Glottochronology" (1962), Bergsland and Vogt came to similar conclusions about the relative untranslatability of the test list: "It is, indeed, often difficult to find one simple equivalent for each test item, the very concept of 'equivalent' being rather vague" (Bergsland and Vogt 1962:116). They discuss a variety of cases including Icelandic, Norwegian, Georgian, Armenian, and Eskimo dialects, each of which illustrates a unique set of circumstances. As in Gudschinsky's study of Mazatec, the comparison of Norwegian Riksmål with Old Norse is complicated by interdialectal borrowings: "In Norwegian Riksmål, two lines from Primitive Norse are blended, one coming directly from Old Norse and the other via Danish; and there is no clear-cut difference between borrowings and cases where the Norwegian word has been partly influenced by the cognate Danish word" (116). The date derived for the Georgian-Mingrelian split is several centuries too

recent, the high percentage of common vocabulary is perhaps due to a long and prestigious Georgian literary tradition (129). As for Icelandic, when the language of 1200 A.D. is compared with that of today, "even the calculation may be dispensed with, the score being 100% retention" (125). These findings, they believe, "clearly disprove the basic assumption of glottochronology 'that fundamental vocabulary changes at a constant rate.'" (125). Bergsland and Vogt suggest a critical examination of the data on which the theory was originally based to determine its validity.

Such a study had already been undertaken four years earlier. Rea (1959) compared Swadesh's time depths for the Romance languages with historical evidence and discovered absurdly inaccurate results: "The Romance languages have been diverging lexically for close to 2.2 millennia, and the figure of 1.08 millennia obtained by the use of lexicostatistics is too far from known facts to indicate that this method of dating linguistic splits has any usefulness or validity even for the languages upon which it is based " (Rea 1958:150). Perhaps, like Georgian, these languages represent a special case, due to their "contiguity... and to a prolonged period of cultural intercommunication" (Rea 1958:147). If so, they should not have been chosen as test-cases for developing a "universal" formula.

Glottochronological Study of Arabic

The dialects of Arabic provide a test-case for the glottochronological method well-suited to Kroeber's specifications; they derive from a common source, and the dates obtained by applying the formula may be cross-checked with historical data to verify their accuracy.

The identity of their common ancestor is something of a puzzle for scholars of Arabic. Many believe the dialects are direct descendents of Classical Arabic, or something close to it. Others, like Ferguson (1959), posit another variety of Arabic (termed by Ferguson the "koiné") that was used "side by side with the Classical language during the early centuries of the Muslim era" (Ferguson 1959:616) and from which the modern spoken dialects developed. It is unfortunate that 25 years after the publication of Ferguson's well-known article, this koiné has yet to be reconstructed (or, at least, such a reconstruction has never been published.)

Nine dialects have been compared to their plausible source, Classical Arabic. For the purposes of the present

study, the lack of a reconstructed koine as a possible ancestor poses no serious problem. If, indeed, the postulated koiné is a more plausible source, the results should point to a more distant date of divergence from the more indirectly related Classical Arabic--an outcome just the opposite of the actual results.

The 100-word list was based on the revised lists of Swadesh (1955) and Rea (1958), with a few initial exceptions due to already-foreseen problems. Not, bark, lie, and path were replaced by she, this(f), where, and olive. Contexts were fixed for words that appeared unclear or problematic at the outset i.e., "weather" for cold and hot, and "student" for good).

Interviews were conducted at the University of Arizona, with consultants who were native speakers from Morocco (Casablanca), Tunisia (Jemmal), Libya (Yefren/Tripoli), Egypt (Cairo), Palestine (Jeruselem), Jordan (Salt), Iraq, (Baghdad), Saudi Arabia (Abqeq), and North Yemen (Sanaa'). The interviews were conducted in a mixture of Arabic and English, in order to obtain the most accurate results possible. Consultants were asked to provide the most common dialectal term for each item and discouraged from lapsing into "Classical" word choices or pronunciations. When two or more synonymous words seemed equally common (as "correct" choices) to the consultant, both were recorded, and tabulated as explained below.

Problems with the Arabic Test-List

Given knowledge of a handful of well-attested sound correspondences among dialects (? for q , ɣ for k, etc), cognate-counting for the Arabic test lists was a relatively straightforward task. As in other studies, the difficulties are in cases where it was not possible to agree on a single "best" form. Several of the test items were represented by two or more synonymous equivalents in Classical Arabic, one or another of which was often retained in the modern dialects. In other instances, a dialect had two or more synonyms for a single test item, one of which was cognate with the Classical Arabic word.

How were these problematic cases to be treated? Swadesh (1952) suggested that such items, "where it is impossible to find a single equivalent" (Swadesh 1952:457) be thrown out and omitted from the count. Each such omission, however, not only reduces the accuracy of the

formula by shrinking the sample (recall Kroeber), but might skew the results in another way if obvious cognates are tossed out with the rest of the synonyms. Gudschinsky (1956) offered another solution: Given "an equal choice of two or more expressions, one should be chosen purely at random (by flipping a coin if necessary)." She argued that for statistical reasons it was essential "that the error be random error, so that the accumulating errors tend to cancel each other out instead of compounding each other" (Gudschinsky 1956: 179). It is hard to see how a method that willfully ignores clear cognates and opts instead for random coin-flips could be construed as statistically sound. But what are the alternatives? Should one choose the "most frequently occurring item" (Satterthwaite)? Or the first item elicited from the consultant? Or the "included, rather than the including, equivalent" (Hymes 1960a)? And what of a percentage rating (suggested by Janda, personal communcation)? If, as in the present study, there are four Classical Arabic synonyms, for example, and a given dialect retains one of them, should it be accorded 25% (1/4) retention? What of a dialect that retains one Classical cognate, but has two other synonyms of its own? Is it to be counted as 1/2? 1/4? 1/3? Clearly the problem presented by such equivalent terms is not easily solved.

Our initial method was to count any cognate from among the synonyms for a given item as signifying a full retention of the item. If a term on the Classical list had a cognate among the terms on a dialect's list, these cognates were recognized as such and scored accordingly. This procedure has been criticized by Hymes in regard to Samarrai's study of three dialects of Arabic whose rate of retention was significantly higher than the Swadesh-Lees estimate. Still, it is the only method that recognizes the presence of cognates despite possible synonyms. For the sake of comparison, a second count was later taken, this time omitting all such problematic forms, as Swadesh had suggested. The results are detailed below.

As has been made clear in previous studies, the application of the "basic vocabulary" list poses different problems for different languages. Questions about the Arabic data, when taken collectively, point to larger theoretical questions about "basic vocabulary."

The 100-word list used in this study breaks down into the following general semantic groupings:

pronouns	4
interrogatives	3
demonstratives	3
quantifiers	4
"people"	3
colors	5
animals	4
body parts and substances	21
verbs	18
"nature" (including the subgroup of _fire_-related items	13
animal parts	3
plant-related	4
foods	3
adjectives	10
miscellaneous	2

These percentages are virtually identical to those constructed by Swadesh (1955), for the four replacement terms (_she_, _this_(f), _where_, and _olive_) each fall into different semantic groupings.

The four pronouns sampled by this list share a 100% retention-rate in all the dialects. The interrogatives are more varied. _Who_ has been replaced in Moroccan and Tunisian, and _what_ in eight of the nine dialects tested. Cadora (1976a) suggests that this replacement, roughly similar in all of the dialects, may have developed from the Classical "?ayyu say? in (yakunu huwa) _Which thing is it_?" (Cadora 1976a:254), but any relic of such a construction would not be scored as cognate with the Classical word(s) for _what_. At first glance, _where_ seems to have been lost in eight of the dialects as well, but the _fin/fen_ and _win/wen_ forms are in fact cognate with the Classical ?aInə, perhaps fused with the conjunction _fa_ and/or _wa_ (_and_) and subsequently altered through various sound changes (Cadora 1976:259). These forms have been scored as cognates in the present study. Other interrogatives (_when_, _why_, _how_), were elicited as additional evidence but not counted as part of the test-list. These also show considerable variation. Interrogatives as a group seem to share a lower retention-rate than pronouns, at least in the case of Arabic.

The demonstratives were retained in each dialect, though Yemeni has synonymous alternates for all three which are derived from Classical forms. The quantifiers yielded rather strange results. "_All_" shows 100% persistence, but

there are six variant forms for "many". Why should many be more subject to replacement than all? It is significant that the three dialects which have retained the Classical form (Egyptian, Palestinian, and Jordanian) are contiguous? Did they reinforce each other? What happened elsewhere?

The item person poses a methodological problem for Arabic. There are four approximately synonymous Classical forms, one or more of which have been retained in all of the modern dialects, save Iraqi, which has substituted a rough equivalent to the Classical someone.(4) The statistical difficulties caused by this variation have been outlined above, and two separate solutions will be discussed in a later section of this paper.

Color terms were almost universally persistent, as were animal terms, except for bird. Classical Arabic has two forms that translate into the English bird, although one can refer to a large class of bird-like "flying things", and the other is the literal word for sparrow, though it is generally used to refer to small birds of all kinds. All the modern dialects have one or the other of these, if not both, but the meanings are not strictly synonymous. Which is the "birdiest" bird?(5) For the purposes of this study, a retention of either form is deemed a retention, but this rather arbitrary choice obscures the more interesting facts of the situation, a situation of superficially similar forms with subtly shifting semantic features. The glottochronological method, working at the lexical level, is too clumsy a tool for examining processes within individual lexemes.

Most body-part and bodily-substance terms have remained constant, although without good contextual information, there could be confusion about belly (e.g., "inside" or "outside"? human or animal? Tunisian has three possibilities) and tooth (i.e., any old tooth, or a molar?). There is a good deal of variation in the terms for mouth and nose (four different forms for each) though reasons for this are open to speculation.

There are six instances of verbs which have more than one Classical form. The forms for give all begin with a glottal stop/vowel, or a pharyngeal, end with a vowel, and have a dental or alveolar stop in between. A cursory examination would lead the researcher ignorant of the dialects and their history to single out the Iraqi ʔinteI as the only possible non-cognate; but in fact the Iraqi form is a retention and the Egyptian and Yemeni forms, though superficially similar, actually derive from a root

other than the Classical one (Qafisheh, personal communication). In such cases, apparent cognates can be separated from true ones only after careful reconstruction, a situation that argues against applying the glottochronological method to languages lacking a reconstructed proto-language.

As noted by Ferguson (1959) and Cadora (1976a), all of the modern dialects(6) share a common form for <u>see</u> that is not cognate with the Classical word.(7) This fact is one piece of evidence pointing to the existence of the postulated koiné.

The two Classical forms for <u>stand</u> emphasize different senses of the single English word: one means "stand" in the sense of "stop" (found in eight modern dialects), the other in the sense of "wake up" or "get up" (found in two dialects). Is one more "basic" than the other?

The "nature" words show an all but perfect 100% retention-rate, as do the "animal part" words--except for <u>tail</u> which has five variants, although seven of the modern dialects retain one or both of the Classical forms of the plant-related terms, <u>leaf</u>, <u>root</u> (one of two forms) and <u>tree</u> are retained, but <u>seed</u> has five variants. All of these are derived from Classical roots, whose original referents were not synonymous. One is related to the noun and verb <u>plant</u>; another refers not only to seeds, but to pieces or bits of other things as well. Though the forms that do not stem from Classical words for <u>seed</u> and seed alone are not scored as cognates, this kind of semantic drift, a qualitatively different matter from wholesale borrowing, has theoretical and practical implications for the glottochronological formula.

<u>Grease</u> seems a particularly bad word for the Arabic test-list. There are two Classical forms, one for the fat on an animal or its meat, and the other for cooking fat, or shortening. The modern dialects add to these distinctions a third possible referent, the grease used for lubricating machinery. Is Swadesh's <u>grease</u> the grease of the kitchen or the grease of the car? Clearly a context is necessary to assure some uniformity of response. Yet even given a cooking context (the one applicable to all cultures, while the automotive context is not), the choice of one or the other Classical term will skew the results, for some dialects have retained one and others another, and their collective semantic features have shifted around as well. Either must count as cognate if their obvious retention is to be reflected.

A similar problem occurs with hot and dry, both of which have two Classical forms, the specific contexts of which vary across dialects. Do we want the word for hot food or hot weather? dry clothes or a dry season? Most of the dialects have both forms for both words (Yemeni has yet a third for hot), but when used, the terms crisscross, intersect and vary. Again, the question is not loss or retention, but subtle shift of reference.

Good offers a total of nine variants across these dialects, all in the lone context of "_____ student". A fuller account of the possible goods in Arabic would stymie the most sophisticated calculator's attempts to score it by means of the glottochronological formula. Perhaps good is an unwise choice for the Arabic test-list. If such a basic word does not display the properties alleged to define the "basic list", the claim of a constant retention-rate is open to question.

If good is bad, not is even worse. As remarked by Samarrai (1959), not "cannot be translated properly into Arabic independently of the context of the sentence" (Samarrai 1959:69). Classical Arabic negates verbs in different tenses in different ways, so which not are we after? The negative copula laIsə is used in equational sentences, while verbs in the imperfect are negated with the negative particle læ. Verbs in the perfect are negated either with the negative particle mæ: or by using the negative particle lǽm followed by the jussive mood of the imperfect. If a specific sentence were chosen for context, the results of the comparison would be determined by that choice, so not has been eliminated from the list.

General Problems with the Test-List

The difficulties of constructing a workable test-list have been debated since the earliest applications of the glottochronological method. Hoijer criticized Swadesh's original contention that the list should be not only "universal", but "non-cultural": "What cannot be avoided is the particular patterning of categories and types that a language and the culture to which it belongs impose upon lexicon and vocabulary--a patterning which affects all of the lexicon and vocabulary, that which is culture-bound and tied to the environment, as well as that which is not so bound" (Hoijer 1956:60). There is no such thing as a "non-cultural" list because of the inextricability of language and culture. Hoijer's position echoes the linguistic relativity of Sapir's assertion that "the worlds in which societies live are distinct worlds, not merely the

same world with different labels attached" (Sapir 1929:209).

Agreeing that "all of language, including vocabulary, is a part of culture," Hymes argued that the term "non-cultural" was simply an unfortunate misnomer, that we "should drop the usage altogether, and speak of 'basic' and 'non-basic' vocabulary" (Hymes 1960a:5). Yet, nomenclature aside, how are we to determine the properties of such a list and go about devising it? Hymes proposed three criteria of "basicness"--frequency, universality, and persistence. These variables intersect in various ways to produce a list of "basic" items. For example, while not all of the test-items are among the most frequent, "a strong majority is", which "indicates a strong positive correlation between frequency and the basic vocabulary" (7) tested by the list. The criterion of universality is "far from easily met," but it is "possible to meet it approximately in a way that permits the method to be used" (8). The procedure here is to throw out problem cases and make substitutions, to adapt the list to specific test-case. The attribute of persistence is based on the assumption that some types of vocabulary are less likely to be replaced than others, an assumption that "seems borne out by every investigation and is commonly assumed" (9). These three criteria interact to define not individual words, but groups of basic vocabulary items: "In different languages, different items may equally well satisfy one or more of these criteria" (Hymes 1960a:11). Different, but "equally valid" lists, then, may be constructed for different language families.

Once these groups of basic items have been isolated, however, there is the problem of differential retention-rates for different semantic groups. As noted above, the Arabic interrogatives seem substantially less persistent than the pronouns, and individual words like many and good show still lower rates of retention. Clearly, the percentage of items drawn from groups of varying persistence will affect the final tally. How are these percentages to be reconciled in the construction of a list with an overall constant retention rate?

Even if these difficulties could be resolved and an adequate test-list devised for a particular language, the problems of cognate-counting and "equivalency" remain. Certainly a context is necessary for the controlled elicitation of each test item, but even a clear context will not assure, and may even obscure, the equivalency of an item from one list to another. The "meaning" of a word

does not derive from its use in a single context. In response to Hymes (1960a), Cohen (1960a) wrote: "lexical items in a language are not ideas per se, but symbols which usually refer not to one idea but to several...These various idea-referents of lexical items change through time and vary from language to language. That is to say, words in one language often have meanings which their closest equivalents in other languages do not have" (Hymes 1960b:340). In effect, no two words are equivalent from one language to another.

While absolute equivalents are difficult, if not impossible to find, a working definition of "equivalence" is necessary if the method is to be applied at all. Perhaps the test items should be broken down into component semantic features, and correspondences be sought among the most salient of these. But how are "major" features to be distinguished from "minor" ones? Again, the definition of equivalency becomes arbitrary but the distinctions are finer and one might hope, more accurate. The tabulation of feature-bundles would vastly complicate mathematical matters, but semantic shifts like those discussed in the Arabic data must be accounted for in some way. "The neglect of semantic factors," as argued by O'Grady (1960), "could introduce marked skewing of final cognate percentages" (Hymes 1960b:339). The accuracy of these percentages--the numbers used in the formula--is crucial to the results of the entire procedure. Until a more precise method of counting cognates is devised, the results of any glottochronological study are bound to be sketchy at best.

Application of the Glottochronological Formula to Arabic

As we have seen, many problems arise when one applies the glottochronological method to a number of diverse languages. These problems demonstrate the naivete of supposing that all languages exhibit a one-to-one correspondance between divisions within their semantic fields. However, even if one assumes that a core-vocabulary word-list could be devised that was translatable into any language, the question remains whether there is enough evidence to confirm the hypothesis that morphemes are lost from that core at a constant rate. In the following sections, we will report the results of applying the method to various Arabic dialects and discuss the extent to which these results confirm or disprove the contention that there is a rate of retention for "basic" vocabulary which is the same for all languages.

In applying the glottochronological method to language data, two distinct situations are possible. On the one hand, the languages being compared may be different historical stages on a single line of development. This is a so-called "control case" for which the time separating the two stages is known, as in the percentage of core vocabulary that the later stage has retained from the earlier stage. The formula used in this case merely allows the researcher to translate the retention percentage into a figure per one thousand years to allow for comparison with retention figures arrived at in other control cases. On the other hand, the languages compared may be two contemporaneous languages known to be related and to have diverged at some time in the past. This situation constitutes an "application" of the glottochronological method. The time-depth separating the two languages from their common source is unknown, but can be ascertained given the percentage of cognate pairs retained in the two languages and the assumption that languages lose morphemes in their basic vocabulary at a constant rate as determined by the control cases mentioned above. Clearly, the validity of the application of the method depends on the validity of the assumption of a constant rate of retention in core vocabulary, and on the extent to which the control cases accurately measure that constant.

We will consider the data collected from nine Arabic dialects first, in terms of "control cases" and second, as an "application" of the method to establish internal relationships among these dialects. Arabic data have been used before, with somewhat conflicting results, in control cases to establish the value of the retention-constant. We will attempt to compare the results of our research with previous studies and demonstrate how different methodological decisions can lead to widely disparate results. Arabic data have not been used to compare contemporaneous dialects, so we have no other research for comparison, only historical facts about the migration patterns of Arabic-speaking communities.

Arabic as a "Control Case"

To calculate the percent of retention in each of the dialects of Arabic, the earlier stage used for comparison was the Classical written langauge. As has been noted, a methodological problem arises since for eighteen(8) of the words on the test-list, there are two or three synonyms in the Classical langauge. We chose to consider an occurrence of any single synonym as a full retention and ignore the fact that one or more of the synonyms had not survived as

such in the dialect. Furthermore, if a dialect retained a word cognate with one in Classical Arabic but the consultant indicated the existence of another equally common non-cognate form used for the item, this also was considered as a full retention. Table 1 shows the retention rate per millenium (r) obtained by solving for r in the formula log C/log r = t, where t = 1.25 millennia(9) and C is the percent of cognates retained in the dialect from the Classical language.

Table 1

Dialect	C	r
Moroccan	86	88.6
Tunisian	86	88.6
Libyan	93	94.3
Egyptian	93	94.3
Palestinian	92	93.6
Jordanian	93	94.3
Iraqi	94	95.0
Saudi	93	94.3
Yemeni	94	95.0

At first glance, it is apparent that these retention rates are, on the average, higher than those reported by Swadesh for the 100-word list. This seems to confirm the results obtained by Samarrai (1959) who concluded, based on investigation of the Egyptian, Iraqi and Jordanian dialects using the 200-word list that the rate of retention of core vocabulary in the Semitic language family is generally higher than for those thirteen control languages originally studied by Swadesh. It should be noted that eleven of the original thirteen control languages belong to the Indo-European language family, a sample which can hardly be considered representative of the languages of the world.

At this point, it may be useful to look more closely at how the "constant" of retention was first calculated by Swadesh (1955). Swadesh himself was the first to point out that "what has been called the 'constant', but might be better called the 'index' of lexical retention" (Swadesh 1955:122) is based on extremely limited data. The original thirteen languages used as control cases to test the 200-word list had to be reduced to seven for the 100-word list because of a methodological problem of "overlapping histories". Thus, the final "constant" was calculated as the arithmetic mean of the retention rates exhibited by Swedish (94.4%). German (90.0%), English (86.2%), Rumanian (85.6%), French (85.1%), Athenian

(84.8%), and Chinese (81.5%). The range of retention rates within the control cases spans a full thirteen percentage points. Swadesh suggests, however, that the rate for Swedish (94.4%), which is four percentage points higher than the next highest rate, should perhaps be discounted because of evidence that it was overestimated. He calculates a mean retention rate for the control languages including Swedish (86.4%) and without it (85.4%). This dual calculation gave rise to a rather confusing situation, since both 85% and 86% were reported in subsequent literature as the constant to be used for r with the 100-word list.

It seems, then, that Swadesh himself was bothered by the inconsistency of making claims of a constant rate of retention when one of the control cases had a retention rate a full eight percentage points above the mean. It would be convenient to have a clearcut guideline as to what range in the rate of retention in control cases should be treated as statistically allowable variation. However, the only guidelines found in the literature on glottochronology are as vague as: "All we desire is that the ks (constants) be _sufficiently_ close together so that our assumption that they are equal will not introduce an intolerable error into future calculations" (Lees 1953:121, emphasis added), or: "It is of course true that even if control cases should differ _markedly_ in rate of change an average rate of change and its standard deviation would still permit estimates of time depth. But, if the deviation is _very_ great, the usefulness of the estimate for historical anthropology will be little or nil. Therefore, it is hoped that further studies will confirm the degree of agreement so far found" (Hymes 19670a:14, emphasis added).

The question remains, then, do the results obtained here for the Arabic data (ranging from 88.6% to 95.0%, with an arithmetic mean value of 93.11%) constitute sufficient deviation from the results of the original control cases to bring into question the validity of the assumption that all languages have the same rate of retention in their core vocabulary? Lacking clear guidelines to answer this question on the basis of statistical principles, one can still assume that the answer is yes, given 1) Swadesh's own uneasiness about retention rates in the low-to-mid 90s, and 2) the attempts to discredit previous studies done on Arabic showing similarly high retention rates.

As mentioned above, Samarrai's studies of core vocabulary retention in three Arabic dialects using the 200-word list showed a higher rate than was found in the control cases. He reported retention rates of 89.2%, 91.2% and 92.7% in Egyptian, Iraqi and Jordanian, respectively, as compared to the expected mean value of 81% retention based on the control cases. Samarrai treated cognates of any one of the synonyms in the Classical language as retentions of the item as a whole as we have done here. Hymes (1960a) criticizes this methodology, arguing this gives each item a double chance of being retained and each dialect retains one or the other equivalent for almost every item in the group (Hymes 1960a:13). Twenty-two words on the 200-word list had synonymous equivalents in the Classical language. Following Swadesh's and Lees' original procedure of dropping such problematic items from the list, Hymes then reports that "this procedure would give a somewhat lower retention rate for Egyptian, Iraqi and Jordanian, but still a high one" (13). If we delete from our count the 18 "problematic" items which have synonyms in Classical Arabic, then the rates of retention, based on a list of 82 words are as follows, compared with previous rates:

Table 2

Dialect	r'	r
Moroccan	91.1	88.6
Tunisian	91.1	88.6
Libyan	93.1	94.3
Egyptian	94.1	94.3
Palestinian	95.1	93.6
Jordanian	95.1	94.3
Iraqi	96.1	95.0
Saudi	95.1	94.3
Yemeni	95.1	95.0

Interestingly, recalculation of the rates of retention after elimination of the 18 problematic items actually resulted in an increase in the rate for seven of the dialects, and a decrease of 1% and .2% in Libyan and Egyptian, respectively. Despite the fact that double or, in some cases, triple counting of Classical Arabic synonyms within the 18 words would lead one to expect them to have a disproportionately low number of non-cognates, the opposite is the case. In general, the proportion of non-cognates within the group of 18 was higher than for the test-list as a whole, although the difference is not significant. Recalculation resulted in rates of 91.1%

compared to 88.6% for Moroccan and Tunisian, which were initially the closest to the 86.4% mean calculated by Swadesh. The new mean value for the rate of retention is 93.98% compared to the previous 93.11%. Clearly, recalculation based on recommendations of the originators of the method makes the figures less supportive of the idea of a constant rate of retention for all languages.

Since elimination of the problematic cases in Samarrai's study of Arabic did not reduce the rates enough to bring them into line with the expected 81% for the 200-word list, Hymes suggests "that the best alternative in such cases is to choose one equivalent for each item by some explicit criterion--if necessary, by chance. If either the first listed equivalent for each item, or the second, is arbitrarily chosen from Samarrai's list, the result is to bring the retention rates for each of the three Arabic dialects toward the higher values obtained by Lees" (Hymes 1960:13). It is hardly surprising that by choosing a procedure that essentially guarantees non-cognates 50% of the time, the rate of retention will be reduced, given that the rate of retention in the test language is clearly greater than fifty percent.

Hymes goes on to support his contention that Arabic dialects do not have high rates of retention once "procedural errors" have been corrected by citing the results obtained by Satterthwaite (1960) in a "well-documented control-case study of Meccan Arabic". Satterthwaite used a test-list of 88 words taken from the original 100-word list. He does not say why twelve had to be omitted. Satterthwaite used a rather unique approach in getting around the problem of synonyms in the Classical language. He chose to count as cognate only that synonym with the greatest frequency of occurrence in the Qoran, the scripture of the religion of Islam. The results of this procedure are nothing short of absurd. For example, the word <u>sabiyl</u> was chosen as the classical equivalent for <u>road</u>, although it is used in the Qoran in the religious sense of 'the true way to God'. It is small wonder that none of the three Meccan consultants retained this word as the dialectal equivalent for the more common meaning of <u>road</u>. The word <u>jaa?</u> (<u>come</u>) was counted as non-cognate despite the fact that it occurs enough times in the Qoran to require 10 1/2 columns in a Qoranic concordance to list all its occurrences. It just happens that the synonym <u>?ataa</u> requires 15 columns. Other examples of his treatment of "good" Arabic words as non-cognate include ʕsrif (<u>know</u>), ʕayn (<u>eye</u>), <u>nassif</u> (<u>dry</u>), <u>ramla</u> (<u>sand</u>), and <u>jalas</u> (<u>sit</u>)

Even a rudimentary knowledge of Arabic is sufficient to realize the inaccuracy of treating these words as replacements of the proto-items.

To the extent that there exists any stylistic difference between the two synonyms in Classical Arabic, Satterthwaite has guaranteed that he will be using the more formal of the synonyms by using frequency in the Qoran as a criterion for choosing between them. The formal synonym is also the least likely to appear in colloquial speech. In most cases, the Meccan consulants, instructed to give the common, colloquial word equivalent, did not give the synonym occurring most frequently in the stylized written verses of the holy scriptures. Indeed, if one espouses the theory that there existed, even in the earliest stages of the Muslim era, a spoken dialect distinct from the written language, it seems likely that the colloquial equivalent would _not_ be the most frequently occurring item in written forms. In view of the bias of the methodological procedures used by Satterthwaite, his claim that the Meccan Arabic retention rate of 82.3% "completely" supports Lees' and Swadesh's estimates is clearly erroneous.

The question remains, then, of what to do about the problem of synonyms in Arabic. Ignoring retention of a word attested as an equivalent in the early stage hardly seems reasonable. The problem exists because the method does not recognize the possibility that an earlier language-state tolerated synonyms in its core vocabulary. Rather, it presupposes that all languages will have one and only one item corresponding to each item on the test-list. This presupposition is certainly not valid for Arabic, where synonyms occur in the core vocabulary of the proto-form and also in all of the daughter-languages. Nonetheless, given that the rate of retention among the nine modern dialects for the 82 words (excluding the problematic synonym cases) shows a mean value of 93.98%, it seems safe to say that, even ignoring the problematic synonyms, Arabic dialects have a higher rate of core vocabulary retenton than did the original control languages. This falsifies, or at least casts serious doubt on, the hypothesis that the rate of retention is the same for all languages.

By eliminating the 18 problematic cases on the word-list, we have reduced our sample size from 100 to 82 words. While it is true that a smaller sample size reduces statistical accuracy, the current reduction is not a serious flaw in the analysis. In discussions of sample-size for application of the glottochronological formula,

the fact that the "population" itself, the core vocabulary, is fairly small is often overlooked. Suggestions of using up to 1000 words on the test-list ignore the fact that in doing so, the researcher moves out of the realm of "core" vocabulary and into areas of the lexicon in which individual items are not resistant to replacement and therefore, by definition, do not constitute part of the "basic" core. There is thus a kind of trade-off. A larger sample-size can result in greater statistical accuracy, but it can also result in listing items which are not part of the universal, or even language-specific, core vocabulary. Given the small size of the core vocabulary, 82 items would seem to be a statistically sufficient sample-size.

It is rather curious that so much attention has been given to the importance of a large number of test-items in order to get a reliable figure for the rate of retention in a particular language, since that constant retention-rate was originally calculated with only seven of the world's languages, five of them from one language family. Swadesh did recommend that the retention-rate be calculated for at least 100 control cases to ensure that the figure being used for the constant in "applications" was correct. But the possibility that a large number of control cases was needed to test the assumption of a constant rate was not seriously considered. The existence of a constant was considered a given on the basis of initial control-case results and the only question was thought to be what that constant was.

Before looking at results obtained when the data were treated as an "application" of the glottochronological method rather than as a "control case", we need to mention one final methodological issue: what should be used as the proto-language for the Arabic dialects? Practically speaking, there is no choice, since no reconstruction has yet been made of a proto-spoken-language different from the written language as attested in the Qoran and other early Islamic literature. The written form is the only available one to use as the proto for purposes of determining retention of original words. As a result of using the written form as a proto-one, any difference that may have existed at the time divergence began will be interpreted as being caused by the divergence. For example, the occurrence of the form sæ:f (see) in all of the dialects but not in the written language suggests that this item existed in the proto spoken dialect. Since use of the written form as the proto will result in treating such possible cognates as non-cognates, the number of cognates will, if anything, be understated by the procedure. On the other hand, it

seems unlikely that such skewing could occur in the other direction, since this would mean an item in the written language which did not exist in the spoken proto-language was subsequently re-adopted independently by all the dialects.

Arabic as an "Application Case"

The glottochronological formula

$$t = \log C / 2 \log r$$

is used in applying the glottochronological method to related contemporaneous languages. The formula is used to determine the interrelationships among these languages, specifically, the degree of relatedness and the chronological order in which various language communities split off from the parent- or proto-language community. In the formula, C is the percentage of proto items still found in both daughter languages, and r is the constant rate of retention (86% for the 100-word list). Again, in counting cognates, the 18 problematic cases for which synonyms existed in the proto-language were discounted, and therefore the percentages are based on a sample of 82 items.

Given the relatively high rate of retention in the Arabic dialects, one would expect the time-depths from the formula to be less than the actual time-depths separating the modern dialects from the proto-language. Our purpose here, however, is to see if the formula can tell us something about degrees of relatedness, regardless of the actual number of years of separation involved. Shared cognate percentages were calculated for all the possible pairs of languages in the study. The number of non-cognates, as a percentage of 82 (C), and the time-depths yielded by the formula are shown below in Tables 3, 4 and 5, respectively. Column and row headings are the first letters of the names of the various dialects.

Table 3

	M	T	L	E	P	J	I	S	Y
M	N.A.								
T	12	N.A.							
L	12	10	N.A.						
E	13	11	10	N.A.					
P	12	10	9	7	N.A.				
J	12	11	9	8	7	N.A.			
I	11	9	8	7	6	6	N.A.		
S	12	10	7	8	7	6	5	N.A.	
Y	13	10	10	9	9	9	7	8	N.A.

Table 4

	M	T	L	E	P	J	I	S	Y
M	N.A.								
T	85.4	N.A.							
L	84.4	87.8	N.A.						
E	84.1	86.6	87.8	N.A.					
P	85.4	87.8	89.0	91.5	N.A.				
J	85.4	86.6	89.0	90.2	91.5	N.A.			
I	86.6	89.0	90.2	91.5	92.7	92.7	N.A.		
S	85.4	87.8	91.5	90.2	91.5	92.7	93.9	N.A.	
Y	84.1	87.8	87.8	89.0	89.0	89.0	91.5	90.2	N.A.

Table 5

	M	T	L	E	P	J	I	S	Y
M	N.A.								
T	523	N.A.							
L	523	430	N.A.						
E	573	477	430	N.A.					
P	523	430	387	295	N.A.				
J	523	477	387	341	295	N.A.			
I	477	387	341	295	252	252	N.A.		
S	523	430	295	341	295	252	209	N.A.	
Y	573	430	430	387	387	387	295	341	N.A.

As anticipated, the absolute values for the time-depths are much lower than the actual number of years during which the dialects developed. Swadesh states that "in a set of indicated time depths, the greatest is most likely to correspond to the actual time (elapsed) since the common period" (Swadesh 1955:123). Yet even the largest time-depths, for Moroccan/Egyptian and Moroccan/Yemeni, of 573 years(10) are less than half the 1250 years that have elapsed since the last of the Islamic conquests which established Arabic-speaking communities from Yemen in the East to Morocco in the West.

Other cases where languages have retained more of their core vocabulary than would be predicted by the glottochronological method have led to certain qualifications concerning the interpretation of time-depths. Gudschinsky (1956) states as one of the basic assumptions of the method, "if the percentage of true cognates within the core is known for any pair of languages, the length of time that has elapsed since the two languages began to diverge from a single parent can be computed PROVIDED THAT THERE ARE NO INTERFERING FACTORS THROUGH MIGRATIONS, CONQUESTS OR OTHER SOCIAL CONTACTS WHICH SLOWED OR SPEEDED DIVERGENCE" (Gudschinsky 1956:178, emphasis added.) Swadesh says "the simple relation between cognate percent and time applies under full or undiminished divergence, that is, when there are no contact influences between the two diverging dialects to keep their lexicons from going their separate ways. To the extent that there is contact, the rate of divergence will be slowed." (Swadesh 1955:123). He suggests a modification of the formula by including the variables (the average "degree of separation") as follows:

$$t = \log C/s\ 2 \log r$$

(The value of s is always less than 1.) Swadesh adds that the new equation is valuable only in helping conceptualize the effect of contact on the formula, since the value of s cannot be known unless the actual time elapsed since the common period is known and the formula yields a number of years less than the actual one. Obviously, it is of little value to have a formula which computes the time of divergence from the common source, but which presupposes a knowledge of that same time in order to know one of the variables within the formula.

Presumably, then, those who would accept this ideal of an "undiminished divergence" would argue that the reason Arabic dialects show a relatively high rate of retention of

core vocabulary is that they have not experienced "undiminished" divergence. Continued social contact and a common prestige language have undoubtedly contributed to the high rate of retention. Superficially, this seems to "explain" why Arabic dialects have relatively high retention-rates. But a closer examination of the logic involved reveals a fundamental flaw in the argument for a constant rate of retention. The argument states that the rate is constant only when those variable factors of historical development which influence the rate are constant! In fact, such a claim is an empty one. The interesting historical-linguistic question here is what factors, social and otherwise, in the historical development of a language affect the rate at which core vocabulary changes, and how is this effect realized? It is hard to see how anything can be learned in an investigation of language change that forces languages into a strict mold which ignores the inevitably variable context of their development. Furthermore, since the glottochronological method was designed to be applied to languages of pre-history, where the social contacts are, by definition, unknown, the method seems ineffectual.

As far as the interrelationships between the various dialects go, the glottochronological method again appears to offer not insight, but only confusing results. One would expect a relatively close time-depth figure for geographically-closer dialects. Thus, for instance, Moroccan and Tunisian should show a shorter time-depth than Moroccan and Saudi or Yemeni. As can be seen from Table 5, however, this is not the case. In fact the time-depths for Moroccan and Tunisian, Libyan, Palestinian, Jordanian and Saudi are all the same, 523 years. The time-depths for Moroccan and the other dialects are also very close. The results for the remaining dialects are equally unrevealing.

Conclusion

A preponderance of evidence points to the conclusion that there is no rate of morpheme loss in core vocabulary that is constant through time for all languages. The original claim was based on too small a sample size to be statistically reliable and, despite a few "success" stories, subsequent studies did not confirm the claim. We have seen that even studies of Arabic initially used as evidence to support the claim actually refute it upon closer examination of their methodology.

During the 1920s, the dating technique of dendrochronology (tree-ring dating) was developed. It was hoped that

this technique would supply anthropologists with precise dates for events in prehistory which before could only be roughly estimated. Linguists were excited by, and perhaps too ready to believe, the prospect that language might provide another such scientifically precise dating tool in the form of morpheme decay in core vocabulary. Languages do have "basic" vocabulary that is more resistant to change than other parts of the lexicon. However, it does not follow that the retention rate is constant over time for all languages. In fact, intuitively, it seems unlikely that this would be so. If there did exist a "constant" rate to which all languages conformed, it is hard to imagine how this constant would be effected by speakers of the languages. The speakers of any given language would presumably need to have some kind of "mental" constraint on replacement of core items, based on a knowledge of how many items had already been replaced since the time of divergence, to know how many replacements were "allowed" during the life cycle of the individual speaker.

It seems more in line with our understanding of language change to say that the tendency to resist replacement of core items is just that a tendency. That tendency, furthermore, can be either weakened or reinforced by historical variables influencing the speakers of a language. These variables include contact with other more presitigous languages, continued interaction between speakers of diverging languages, existence of a common literary form, and any number of other possible social factors. These factors, rather than "interfering" with the application of glottochronology, are the key to understanding the dynamics of language change. If anything can be learned from the misguided attempt to force language into a simple mathematical formula, it is that the factors influencing language change are still largely unknown. It is certain that there is no convenient "invisible hand" of constant morpheme decay in basic vocabulary.

Acknowledgements

Notes

1. Because he used the 100-word list, Satterthwaite's 82% is less than "completely" supportive of Swadesh's 86% estimate, but the result is at least in the ballpark.

2. In view of the difficulty of compiling even a 200-word list, the prospects are bleak for coming up with 1000 items of "basic vocabulary" that fit the specifications to be discussed below.

3. See Gudschinsky (1953) for a discussion of dips and the formula used to calculate them.

4. While Cadora (1976a) lists a different form from his Baghdadi consultant, mine contends that this form is possible, but has a Classical ("formal") feel. I have therefore chosen the more everyday form, as Swadesh suggested.

5. To complicate matters, there is a third Classical form, which refers not only to small or young birds, but to small or young animals of many kinds, including snakes. This form has been retained and shifted to refer only to birds in two of the dialects, but its presence has not affected the cognate-count in either direction since its Classicl meaning is not applicable to the list, and since both dialects retain one or the other cognates.

6. Except Yemeni, which retains a rare alternant of the Classical see.

7. Though Cadora mentions the presence of this form in Classical, with the meaning polish.

8. The words on the list with synonyms in Classical Arabic are marked with two asterisks by their number for quick identification.

9. It is assumed that Arabic became spoken in the countries included in the current study after the Islamic conquest (about 1.25 millennia).

10. In order to see if our figure for the time of separation is within the allowable range of error the following calculation can be made for the maximum time-depth of 573 years (with 84.1% common cognates):

$$\sigma = \sqrt{\frac{C(1-C)}{n}} = \sqrt{\frac{.841\ (1-.841)}{82}} = 2.66$$

σ @ 90% confidence level is 2.66 x 1.645 = 4.38%

Time depth result for C = 84.1% + 4.38% = 405 years
Allowable range in years = 168 (573-405)

In other words, there is a 90% chance that the actual time depth falls within the range of 573 ∓ 168 years. Even the greatest of these time depths (741 years) is far from the known time depth of 1.25 millennia.

11. The phonetic symbols and diacritics used in the transcription of the data are, for the most part, standard IPA ones. The one exception to this is the use of a . under a symbol to indicate velarization of certain consonants and adjacent vowels in Arabic. In IPA, this diacritic stands for a retroflex sound. However, since there are no retroflex sounds in Arabic to cause confusion we have chosen to follow the long-standing tradition of using the dot to represent velarization.

REFERENCES

Bergsland, Knut and Hans Vogt
    1962   "On the Validity of Glottochronology".
              Current Anthropology 3:115-53.

Cadora, Fredric J.
    1970   "Some Linquistic Concommitants of Contactual
              Features of Urbanization". Anthropological
              Linguisitics 12:1-19.

    1976   "Lexical Relationships among Arabic Dialects
              and the Swadesh List". Anthropological
              Linguistics 18:237-60.

    1976   "Contrastive Compatability in Some Arabic
              Dialects and Their Classification". Anthropo-
              logical Linguistics 18:393-407.

Fairbanks, G.H.
    1959   "A Note on Glottochronology" IJAL 21:116-20.

Ferguson, L.
    1959   "The Arabic Koiné". Language 35:616-630.

Gudschinsky, Sarah C.
    1956   "The ABC's of Lexicostatistics (Glottochrono-
              logy)". Word 12:175-210.

    1955   Lexico-Statistical Skewing from Dialect
              Borrowing". IJAL 21:138-49.

Hale, K.
    1958   "Internal Diversity in Uto-Aztecan I". IJAL
              24:101-108.

    1958   "Internal Diversity in Uto-Aztecan II". IJAL
              25:144-122.

Hymes, D.H.
    1960   "Lexicostatistics So Far". Current Anthropo-
              logy 1:3-44.

    1960   "More on Lexicostatistics". Current Anthropo-
              logy 1:338-345.

Hoijer, Harry
    1956   "Lexicostatistics: A Critique". <u>Language</u>
                32:49-60.

Jeffers, Robert J. and Ilse Lehiste
    1982   <u>Principles and Methods for Historical Linguis-
                tics</u>. Cambridge: MIT Press, pp. 133-137.

Kroeber, A.L.
    1955   "Linguistic Time Depth Results So Far and
                Their Meaning". <u>IJAL</u> 21:91-104.

Lees, Robert B.
    1953   "The Basis of Glottochronology". <u>Language</u>
                29:113-127.

Lehmann, Winfred P.
    1973   <u>Historical Linguistics   An Introduction</u>,
                Second Edition, New York: Holt, Rinehart and
                Winston, Inc., Chapter 7.

Rea, John A.
    1958   "Concerning the Validity of Lexicostatis-
                tics". <u>IJAL</u> 24:145-150.

Sapir, E.
    1929   "The Status of Linguistics as a Science".
                <u>Languages</u> 5:207-214.

Samarrai, Alauddin Ismail
    1959   "Rate of Morphemic Decay in Arabic". <u>IJAL</u>
                25:68-70.

Satterthwaite, Arnold C.
    1960   "Rate of Morphemic Decay in Meccan Arabic".
                <u>IJAL</u> 26:256-261.

Swadesh, George M.
    1951   "Diffusional Cumulation and Archaic Residual
                as Historical Explanation". <u>Southwestern
                Journal of Anthropology</u> 7:1-21.

    1955   "Towards Greater Accuracy in Lexicostatistical
                Dating". <u>IJAL</u> 21:21-137.

Troike, Rudolph C.
    1969   "The Glottochronology of Six Turkic Lan-
                guages". <u>IJAL</u> 35:183-91.