Explorations in the Origins of the Japanese Language

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1. Language and the past

Edward Sapir speculated in 1921 that some form of language must have existed since hominids made their first stone tools. This we now know to date back over 2 million years. To fashion a diverse assemblage of tools out of material as hard as stone is a development unique to human evolution. It required a mental instrument that can manipulate imagery to a degree of precision and complexity greater than that achieved by any other species.

Taking cue from what we know of primate societies today, it is reasonable to believe that the communicative repertoires of bands of *Homo erectus* were at least as great, and that varieties of prelanguage were in use. The repertoires probably included both visual signals in terms of facial expressions and bodily gestures, and acoustic signals coded in modulations of prosodic features, i.e., the pitch, intensity, and quality of the voice. Indeed, all peoples still gesture during speech, though to different degrees, and all languages use intonation.

The first major threshold toward language was crossed when some early hominid realized that these signals produced consistent consequences in the hearer even though the physical properties of the signals and the consequences are not causally related. We may refer to this threshold as symbolization. Vocal signals are more effective than gestural signals since they do not require visual contact and hands and feet can be doing other things.

Prosodic features used in primate calls are few in number, and they carry very low information content per unit time. The next major threshold prelanguage crossed was the organization of acoustic signals into chains of syllables, which is the invention of segmental phonology. Crossing this threshold eventually achieved two critical advantages. One is that it greatly expanded the number of unit signals in the repertoire—up to many dozens of distinct segments found in some modern languages. This allowed the construction of large vocabularies—to include up to thousands of words. The other advantage has to do with the rapid rate at which the segments can be emitted, sometimes as many as a dozen segments per second. These two advantages allowed prelanguage to transcend the limitations of our short term memory, and laid the foundation of syntactic organi-

zation.

Since words are emitted one after another in time, the last threshold is to invest order with a hierarchic function so that the sequence of words can achieve a systematic set of relationships among themselves. As Herbert Simon (1962) observed, hierarchic organization is to be expected with all systems that pass a certain level of complexity, and language is no exception. True language emerged with the invention of syntax (Wang 1997).

Speaking in strictly probabilistic terms, it is much more likely that language emerged at many different sites, that is, by polygenesis rather than monogenesis (Freedman & Wang 1996). This does not preclude the scenario, of course, that at some early stage of human evolution all the ancient languages were eliminated except for one, and this one language, Proto-Sapiens, is ancestral to all modern languages. Indeed, the Out-of-Africa hypothesis of *Homo sapiens* currently investigated by anthropologists and geneticists may provide such a scenario. Recent studies with mtDNA and the Y-chromosome all suggest dates under 200,000 years BP.

Recent anatomical findings by Kay et al. (1998) show that hypoglossal canals comparable in size to those of modern humans appear in Neanderthals, early *Homo sapiens* and Homo specimens, while *Australopithecus africanus* possesses hypoglossal canals in the same relative size range as those of chimps. This suggests that fine neurological control over the vocal tract necessary for spoken language emerged during a time of major revolutions in hominid adaptive patterns around 500,000 to 100,000 years BP.

Other recent evidence suggests that the size of hominid brains increased dramatically during that period. We may assume that language was not what made modern humans successful, and the critical issue is how language was elaborated. Chances are that over these numerous millennia there were many false starts which vanished without a trace, and that contact among the early hominid tribes both stimulated and enriched the processes of language emergence.

Cavalli-Sforza et al. (1989) analyzed 120 non-DNA polymorphisms in 42 indigenous populations around the world. The phylogenetic tree constructed for these populations shows the first migration to originate from Africa. When they compared this tree with a phylogenetic tree of the world's languages, they find considerable parallelism between genetic and linguistic evolution. Charles Darwin was perhaps the first to connect our biological heritage to language when he wrote the following in chapter 14 of his *Origin of Species*:

> "If we possessed a perfect pedigree of mankind, a genealogical arrangement of the races of man would afford the best classification of the various

languages now throughout the world."

Given that typically people do pass on both their genes and their language to their offspring, we should expect a strong correlation between the two phylogenetic systems. However, various factors significantly complicate the picture. It appears that a language can transmit any linguistic feature to its neighbors if the contact is intense and prolonged enough. Such horizontal transmission can produce words which are highly hybridized, such that it becomes impossible to identify their ancestral lineage. It is necessary to sort out similarities due to vertical transmission and those due to horizontal transmission.

The method of biology and linguistics converge in the use of tree diagrams. The first person who suggested the tree as a logically conceivable way of representing the relationships among animal species was the German naturalist Peter Simon Pallas in a book published in 1766. As regards the linguistic tree, Rasmus Rask first showed a branching diagram of the so-called Thracian languages group in an article in 1819 (Percival 1987). The most influential linguist in this area, however, was August Schleicher, who corresponded with Charles Darwin on evolutionary matters. Schleicher's idea of phylogenetic trees was remarkable in that they were intended to be additive—that the branch lengths are significant, even though he had no recourse to the computational methods to implement the idea. This can be seen clearly in his words published in 1876, as quoted in Percival (1987, p.8).

> "Die länge der linien deutet die zeitdauer an, die entfernung der selben von einander den verwantschaftsgrad." [The length of the lines indicates the amount of time which had elapsed and the distance between them degrees of relationship.]

Shortly after Schleicher published his family tree for the Indo-European languages, which accounted for only vertical transmission of linguistic traits, critical voices came to the fore, most notably from J. Schmidt and H. Schuchardt. The emphasis of these scholars was on the horizontal transmission. Indeed, the conceptual basis is very much like that of the isolation-by-distance model that geneticists have quantified. This method has been successfully applied to a chain of Micronesian islands for estimating linguistic affinity (Cavalli-Sforza & Wang 1986). Nonetheless, the family tree diagram has remained the dominant model in most phylogenetic work both in linguistics and in biology.

Glottochronology was developed by Morris Swadesh, who was inspired by the method of carbon 14 dating that was invented in chemistry. The fundamental idea in glottochronology is that the time depth separating two genetically related languages can be estimated by the degree to which they share commonly inherited words. However, it is limited in that it deals with languages one pair at a

time, thereby missing out on information which can be provided by the large number of subgroups in any group. The numerical methods developed in biology are much more powerful, such as those by Cavalli-Sforza and Edwards (1967), Fitch & Margoliash (1967), and especially Saitou & Nei (1987). Rather than pairwise comparisons, these latter methods yield phylogenetic trees which comprise the entire group of languages at once, where the branch lengths are additive (Wang 1993).

The evidence for the genetic affiliation of languages should be cumulative rather than any single trait. It is well known that any linguistic trait can be borrowed from one language to another, therefore no single linguistic trait can be sufficiently diagnostic of the lineage of languages. Wang (1998a) discusses six types of linguistic data: (i) writing, (ii) typological similarity, (iii) vocabulary, (iv) sound correspondence, (v) morphology, and (vi) basic words. Of the six types of linguistic data, basic words are clearly the most useful. They can be used quantitatively as well for dating language divergence. In the next sections, we will investigate the origins of Japanese by evaluating the correspondences of the basic words of Japanese with Altaic and Austronesian, using the numerical methods which produce additive trees.

2. The genetic affiliation of Japanese

The problem of the genetic affinity of the Japanese peoples has fascinated many for a long time, experts as well as laymen. The intrigue of origins is no doubt stimulated in part by the relative remoteness of the island nation. The nearest point to the Asian mainland is from northern Kyushu, across a span of one hundred some miles of sea to Korea, with two stepping-stone islands in between. This distance proved a formidable barrier as late as the 13th century, when several expeditions by the Chinese navy failed in their attempt to conquer.

But water is only there to keep Japan apart during epochs when the planet is warm. In early times, when water was locked in icebergs and the seas were low, the long archipelago that stretches from Sakhalin in the north to Taiwan in the south was merely the eastern coastline of the Asian mainland. In sharp contrast with islands of the South Pacific, where settlement is very recent, the islands of Japan show early human activity.

The earliest dates of human habitation is very much in dispute, with claims of 500,000 BP for stone tools from Kami-Takamori; see Figure 3.8 in Imamuras useful overview (1996, p. 28). But 30,000 BP is the date that Imamura chooses to "denote the boundary and differences between problematic earlier sites and sites of the established 'Late Paleolithic'" (1996, p. 26).

Furthermore, carbon 14 methods point to very early dates for Japanese

stone tools and pottery. The emergence of pottery may go back earlier than 12,000 BP, perhaps the earliest in the world. Over this wide panorama of time, numerous waves of migration must have taken place, with the peoples sometimes replacing one another and other times amalgamating into each other.

Imamura provides a chronology of the prehistory of Japan, noting of course that exact dates will differ from region to region. The Paleolithic in Japan ended around 12,000 years ago with the production of pottery, ushering in the Jomon period. The name comes from the highly distinctive cord [Jo-] marking [-mon] found on the pottery. Agriculture began around 5th century B.C.E., ushering in the Yayoi period with sites of wet-rice paddy-fields, and variety of agricultural tools. Here the name comes from the location in Tokyo, where a new type of pottery was first discovered in 1889; see Figure 2.3 in Imamura (1996, p. 14). The Yayoi culture did not reach Hokkaido, where Jomon culture persisted till around the 7th century.

This is also the time when Japan first appeared in Chinese history books. The Hanshu, which is a history of the Early Han Dynasty [206 B.C.E. − 23 C.E.], refers to Japan as being divided into more than 100 polities. In the year 57 C.E., Emperor Guangwu of the Late Han dynasty bestowed a gold seal to one of the polities in Japan, bearing the inscription "Han Wa Na King", that was discovered in Fukuoka accidentally in 1784; see Figure 14.5 in Imamura (1996, p. 186).

The next period is the Kofun, starting around 3rd century of the common era. The name means ancient [Ko-] tombs [-fun]. These keyhole shaped tombs are found within large mounds distributed all over Japan, but less in Tohoku and not in Hokkaido. One of the oldest kofuns, found in the Yamato Basic, is also one of the largest, measuring almost 1000 ft long. There is remarkable uniformity among these tombs, both in their architecture and in the furnished goods.[iv] This uniformity and wide distribution of kofuns lead archeologists to conclude that Japan had achieved some stage of state formation by that time.

The Kofun period ends in the 7th century, with the first historical annals of Japan being recorded in Chinese characters. At around the same time, Hokkaido entered a period called Satsumon, which literally means "brushed marks". It is generally believed that the Satsumon culture of the northeast is ancestral to that of the Ainus. It was noted by Yamada, for instance, that many place names in northern Tohoku probably originate from the Ainu language (1974). Any research into the origins of the languages and peoples of Japan must take into serious consideration the fact that Hokkaido in the north and the Ryukyus in the south did not merge into the Japanese polity until around the 17th century.

Popular accounts of Japan often note that "the origins of their language are one of the most disputed questions of linguistics"; see for instance Diamond

(1998, p. 86). The writing system clearly originated in China, as is shown in the term kanji, which means Han characters. According to historical annals, Japanese contact with China does not appear to go back more than 2,200 years. The two spoken languages are strikingly different in structure, so that very complicated syntactic rules had to be devised for reading early Japanese documents written in Chinese characters; see Rabinovitch (1996).

It is well-known that the Japanese vocabulary consists of numerous words of Chinese origins, perhaps as much as one-half, having entered the language in several chronological strata. Some of these words entered the language either so early or via other Altaic languages that it is difficult to find large sets of sound correspondences. This is the case, for instance, with the /n:r/ correspondence. Possible examples for this pair are Japanese "soroban" [=abacus] from Chinese "suanpan"; Japanese "sara" [=plate] from Chinese "zhan". Another set of examples involve the sound /s/, such as in "miso" [=flavoring] from Chinese "wei4"; "nashi" [=pear] from Chinese "nai4"; and "tsushi" [=facing, as in the island name, Tsushima] from Chinese "dui4"; see Norman (1982, p.243). In these latter examples, the /s/ has been palatalized into "sh" in some Japanese words; in Chinese, the effect of the /s/ is seen in the 4th tone in Chinese.

Other words show a correspondence with Chinese that is more transparent. Thus the Cantonese word for "writing instrument", /pat/ correlates with both Japanese /fude/ and /hitsu/,[v] with the former having entered Japanese earlier, before /t/ had evolved into /ts/. Similarly, Chinese words which begins with /m/ frequently have both m-pronunciations and b-pronunciations, depending on the time and place of the borrowing event; e.g., eyebrow is /bi/ and /mi/, rice is /bei/ and /mai/, seedling is /byo/ and /myo/, blind is /bo/ and /mo/, and so on. For further examples of correspondence, see Wang (1998a, p. 254).

However, these words are almost all cultural vocabulary. If we look at the basic vocabulary of 100 words, the words of Chinese origin number only six. Because of the large quantity, many rules of sound correspondence can be discovered correlating them to Chinese forms. The earlier in time we go, of course, the fewer words can be discovered to have Chinese origins; see Kamei (1954) and Miyake (1997) for a handful of examples.

Oftentimes these "kango", literally Han words, exist side by side with a deeper stratum of native words, called "wago", though with different shades of meaning. Shibatani illustrates this with data reproduced in the following table (1987, p. 133):

Table 1 Words of different strata in Japanese vocabulary

Gloss	Wago	Kango	European
inn	yadoya	ryokan	hoteru
idea	omoitsuki	chakuso	aidea
acrobat	karuwaza	kyokugei	akurobatto
detour	mawarimichi	ukairo	baipasu
cancellation	torikesi	kaiyaku	kyanseru

There have been more than half a dozen theories connecting Japanese variously with Altaic languages, Austronesian languages, Austroasiatic languages, Uralic languages, Dravidian languages, etc. The question is not which of these languages are related to Japanese, since it may turn out to be the case that all modern languages trace back to a single ancestor, according to the Out-of-African hypothesis. Rather, the question is to discover the hierarchy of monophyletic units to which the Japanese language belongs.

Currently, at one end, there are those who continue to regard the Japanese language as an isolate, with no close relatives to speak of. At the other end, Joseph Greenberg of Stanford University, an eminent linguist, recently includes Japanese in his far-flung Eurasiatic family, which also includes Ainu, Korean and Altaic as well as Indo-European, Uralic, Eskimo, etc..[vi] We will consider the relations of Ainu and Korean to Japanese later in our discussion. The two competing proposals with the most notable literature are those connecting Japanese with Altaic and Austronesian. For a survey of the earlier work on the Japanese-Altaic or the Japanese-Austronesian connection, see Murayama (1979).

The work has been done on the Japanese-Altaic relationship by Martin (1966), Miller (1971, 1981), and more recently Whitman (1990) and Vovin (1994 a, 1994b, 1997). Whitman (1990) accounts for the loss of certain consonants when these occurred between vowels in pre-Old Japanese. Vovin (1994a, b) argues against Benedict's Austronesian hypotheses and presents the 100-word Swadesh-list for Proto-Japanese [PJ] with all possible Altaic etymologies, and Vovin (1997) accounts for the development of the so-called "pitch accent" in Japanese.

Benedict (1990) attempts to establish the Austronesian theory, though he is by no means the first to make the attempt. Murayama (1979) advocates the theory of a mixed Altaic-Austronesian origin for Japanese, though he uses the term Austronesian substratum. Kawamoto (1978) also believes a mixed Altaic-Austronesian origin, but he thinks Altaic traits form a substratum. Sakiyama (1996) has also presented some lexical evidence showing Austronesian contact from the south.

Benedict (1990) tries to demonstrate regular phonological correspondences between 235 Japanese and Austronesian etymologies, but he does not refer to most of the earlier works on the Austsronesian- or Altaic- comparative studies. In his review articles (1994a, 1994b), Vovin criticizes Benedict for leaving aside Japanese connections with Altaic, and disproves particular etymologies proposed by Benedict because of the lack of regularity in phonetic correspondences, the abundance of ad hoc reconstructions, existence of lexical ghosts, vague approach to semantics, etc.

Vovin compiles the 100-word Swadesh-list for PJ and provides it with all possible Altaic etymologies based on the regularity of phonetic correspondences and identical semantics, and Austronesian etymologies from Benedict's book as shown in Appendix A.[vii] If a parallel does not occur in one branch of Altaic or Austronesian, or in both, the branch is marked with a dash. Vovin gives the reconstructions of the corresponding protolanguages, since he believes that the development of languages often obscures important phonetic correspondences. He disproves the Austronesian etymologies for blood, dog, eye, fire, foot, hair, I, tree, water, white provided by Benedict.

Vovin criticizes Benedict on the basis of regular phonetic correspondences and identical semantics. Vovin does not take semantic change into account, which we think is misleading. There are natural tendencies of semantic change, and one can search for cognates from the meaning side (Wilkins 1996). But in the present study, we adopt both of Benedict's and Vovin's proposals for these etymologies at face value, with the lists regarded as showing the maximum that the two advocates feel able to claim, and assume that Proto-Japanese [PJ], Proto-Altaic [PA] and Proto-Austronesian [PAN] are cognates in these words. The correspondences with Austronesian and with Altaic, to the extent that both are valid, need to be evaluated and placed in relation to each other.

3. Analysis by bootstrap

From a list in Appendix A, Vovin states that there are considerably more Altaic parallels than Austronesian. We can make the following table. In this table, Proto-Altaic [PA] and Proto-Austronesian [PAN] cognates mean that a single Proto-Japanese item is compared to PA by Vovin and to PAN by Benedict.

Table 2 Comparison of the basic lexicon

PA cognates only	48	46.6%
PAN cognates only	8	7.8%
PA, PAN cognates	37	35.9%
missing altogether	10	9.7%
total	103	100%

In this section, based on the data in Appendix A, we would like to evaluate the correspondences of PJ with PA and with PAN, whether Japanese is Altaic or Austronesian, whether Japanese chose one as integrated and the other as borrowed, or whether Japanese is one of the cases having in its past a break in normal genetic transmission, by the Neighbor Joining method and the recently introduced statistical technique, the bootstrap. We hope that this analysis will give some conclusive evidence for what seems likely to remain in one way or another a controversial affiliation.

Glottochronology, developed by Swadesh in the 1950's, is the method to estimate the time depth separating two genetically related languages by the degree to which they share commonly inherited words. One of the problems with glottochronology is that the method assumes a uniform rate of change for all languages. Languages can be expected to evolve at different rates depending on such parameters as density of communication and amount of contact with other languages.

The pair-wise comparisons used by Swadesh are being replaced by computational methods advanced in molecular genetics, using phylogenetic trees for grouping sets of languages. The trees are additive in the sense that the evolutionary distance between any pair of languages is directly represented by the path length between them, in a way that is consistent with the distances of all other languages in the set. These methods have the advantages that they integrate the pair-wise data to arrive at an overall phylogenetic hypothesis, and that they allow members of the same set to have different rates of evolution. One such method that is gaining wide currency in biological systematics is the Neighbor Joining method (Saitou & Nei 1987), which we will apply to the basic lexicon for PJ, PA and PAN.

Table 3 shows a matrix which specifies the distance between every pair of PJ, PA and PAN. This distance matrix is calculated by subtracting each percentage of similarity from 1.[viii]

Table 3 Distance matrix for PJ, PA and PAN

	PJ	PA
PA	0.17	
PAN	0.56	0.63

This input matrix is analyzed into an unrooted binary tree with the Neighbor Joining method. Then the location of the root of this tree is determined. A common procedure for doing this is to take the midpoint of the longest path. The resultant tree is shown in Figure 1. The numbers along the branches indicate the distances between the nearest nodes, and the number in parentheses indicates the bootstrap estimate (see below).

If we can sort out the effects of the two fundamental reasons for similarity: inheritance and borrowing, we can model exchanges between branches and evaluate them. In biological evolution, new populations are assumed to have emerged by gene migration, i.e., admixture between two neighbors, and subsequently evolved independently. To detect potential admixtures, the bootstrap is applied to the tree because mixed populations often tend to be attached to different clusters in different bootstrap trees. The instability of attachment of a population to its cluster under bootstrapping is especially noticeable for popula-

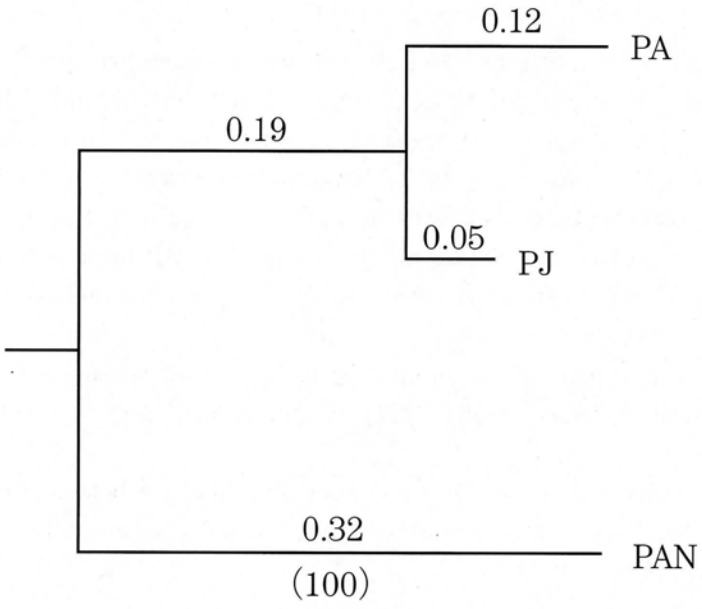

Fig. 1 Rooted tree of PJ, PA and PAN

tions in which admixture is substantial. The tendency of a population to leave its cluster and join another in different bootstrap trees gives some clues on the clusters contributing to the admixture (Cavalli-Sforza, Menozzi & Piazza 1994, Chap.1).

We applied this method to the subgrouping of the 8 Germanic languages, where there is a consensus on most aspects of their history, to present a valid test. We found that there is a clear correlation between the number of the borrowings and the instability of the structure (Ogura & Wang 1998a).

We apply the bootstrap to the data for PJ, PA and PAN in Appendix A to test the reproducibility of the splits in the tree shown in Figure 1 and to detect borrowings. Bowcock et al. (1991) and Cavalli-Sforza et al. (1994) state that a branch to a population resulting from admixture tends to be shorter than other branches. But we find that the branch length of English which results from admixtures is long in Germanic tree (Ogura & Wang 1998a) and admixtures occur in the dialects with long branches in Chinese lexicon data (Ogura 1996). Thus, though the branch length between PAN and PJ in Figure 1 is long, there is a possibility of admixture between them. The basic idea of the bootstrap involves resampling points from one's own data, with replacement, to create a series of bootstrap samples of the same size as the original data. The bootstrap procedure is most useful when we either do not know the distribution of the data points, or when some method of statistical estimation is so complicated that its standard error is difficult to compute (Efron 1979, Efron & Gong 1983).

In biological evolution, genes are randomly sampled with replacement, generating a new matrix of genes x populations with the same number of genes as the original, but in which some genes are missing and others are repeated. In linguistic evolution, words correspond to genes and languages to populations in biological evolution.

We have generated by the program in PHYLIP 100 bootstrap samples, in each of which 103 basic words (see note vii) are randomly sampled with replacement, generating a new matrix of 103 words x 3 protolanguages with the same number of words as the original, but in which some words are missing and others are repeated. For each of the 100 bootstrap samples, dissimilarity numbers which reflect distance are calculated between all pairs for the 3 protolanguages and from each matrix a bootstrap tree is constructed by the Neighbor Joining method.

We find that all the 100 bootstrap trees separate PAN from the cluster of PJ and PA. Felsenstein (1985) suggests that if a group shows up 95% of the time or more of the bootstrap trees, the evidence for it is taken to be significant. From the results, we may assume that Japanese is genetically affiliated to Altaic. We

do not find any bootstrap tree which separates PA from the cluster of PJ and PAN. If Japanese emerged by admixture between Altaic and Austronesian, PJ would be attached to PAN in different bootstrap trees.

4. Comments on competing hypotheses

Murayama (1979) proposes that Japanese is a mixed language of Altaic and Austronesian, because Japanese not only has a large number of loan words from Austronesian but also its morphology involves stems deriving from Austronesian and the inflectional endings from Altaic. In Murayama's view, forms such as watari (<wata-ri)'to ford-adverbial', watara (<wata-ra)'fordirrealis', wataru (wata-ru<*wata-rjum<*wata-ri-wu-m<*wata-ri-bu-m)'to ford-conclusive' are mixed morphology. He believes that the Austronesian contribution is not a simple case of lexical borrowing or of an inert substratum; rather, the Austronesian elements had a far more active participation.

As we have shown in the bootstraps, there is not a statistically significant number of the basic lexicon from Austronesian. Furthermore, Thomason & Kaufman (1988, Chap.3) state, typically, though not always, the borrowed words are treated as stems in the borrowing language, that is, the borrowing language speakers take the usual affixes for the appropriate stem-class. In fact, grammatical morphemes are much more resistant to borrowing than lexical ones. So we find numerous Japanese words composed of the stems deriving from Chinese and the inflectional endings from native Japanese alongside with words where both stems and the inflectional endings are native Japanese. Table 4 gives some examples with the suffix "suru".

Table 4 Hybrid words in Japanese

Chinese-Japanese	Japanese-Japanese
kansatsusuru 'to observe'	torihiki-suru 'to transact'
sampo-suru 'to stroll'	toode-suru 'to go on an excursion'
inshoku-suru 'to eat and drink'	hirune-suru 'to take a nap'
kyukei-suru 'to take a rest'	deiri-suru 'to go in and out'

Similarly, numerous English words composed of the stems deriving from French and the affixes from native English alongside with words where both stems and the affixes are native English. Table 5 gives some examples of these, taken from Marchand (1960).

Table 5 Hybrid words in English

Suffix	French-English	English-English
-ful	joyful	careful
-dom	dukedom	kingdom
-ing	browsing	bathing
-ed	joined	feathered
-ly	stately	friendly

We expect such examples of hybrid words are easy to find in all languages, since language contact is a ubiquitous phenomenon. If hybrid words are a sufficient condition for defining mixed languages, then most, if not all, languages of the world must be defined as mixed languages. Clearly, this would not be a proper use of the term.

In these cases hybridization was actuated externally by extensive borrowing, but is now being implemented internally. A speaker may not be conscious of all the historical distinctions in his vocabulary, and Wang & Lien (1993) refer to the process as bidirectional diffusion. Thus what Murayama believes characterizes the formation of Japanese as a mixed language is a common situation in lexical borrowing actuated externally and implemented internally.

Kawamoto (1978) also believes that Japanese is an Austronesian-Altaic mixed language, but he thinks that the Altaic traits form a substratum. His reasoning is based on his observation that, while a strong language forming a superstratum tends to impose its vocabulary on a weaker, subjugated language; in the case of Japanese there are not as many Altaic words as expected from a theory incorporating an Altaic superstratum. But his reasoning is not supported by the data in Appendix A and the bootstraps.

Thomason & Kaufman (1988, Chap.3) divide contact-induced change into two categories, depending on whether the speakers of a given language A, exposed to contact with B, selectively incorporate foreign features from B or abandon A altogether for an imperfect, A-colored variety of B. In the former case the effect is light to moderate borrowing of non-basic vocabulary from B into A; under conditions of intense contact, with many speakers of A bilingual in B, there may be pervasive lexical borrowing and considerable structural borrowing as well, especially of phonology and syntax.

In cases of shift (a notion roughly equivalent to the traditional substratum influence), however, the most basic effects are structural rather than lexical; Small numbers of A speakers who adopt B, after learning it well, are not likely to make any permanent imprint on their new language; but a large shifting popula-

tion with imperfect control of B will typically retain and transmit phonological and syntactic features of A even after the transition to B is complete. Often B adopts few words from A. If speakers' goal is to give up their native language and speak some other language instead, vocabulary is the first part of B they will need, so it is the first part they will learn. They will probably keep their own native-language words only for things B has no words for: foods and other cultural items, and, if B speakers are invaders from elsewhere, names for local animals, plants, and so forth (Thomason & Kaufman 1988, Chap.3).

Actual instances are not hard to find. Thomason & Kaufman cite the example of Vedic Sanskrit, which almost certainly owes its retroflex consonants to Dravidian influence, despite the rarity of Dravidian loanwords in early Indic.

English developed from the fusion of several Germanic languages of the invaders. From the middle of the 5th century, the Jutes, Angles, Saxons and Frisians who left their north German homelands invaded England. Many Celts who lived in England were pushed to the west and north by the invading Anglo-Saxons. Groups of Celts remained scattered throughout England. Those Celts who remained would have been gradually absorbed through intermarriage into the Anglo-Saxons. And the Celtic language became displaced by the languages of the invaders. The Anglo-Saxons adopted few words except the river-names and place-names.

But it seems that English in the north and west retained some phonetic feature such as fronting surviving from a Celtic substratum: the fronting of ME ō to /ɸ: /, the retention of OE ā in Middle English (ME) times, Modern English (ModE) reflex /ai/ of ME ī in the north and west in contrast to /ɑi/ in central England, ModE reflex /ʌ / of ME ō in the southern England around the Welsh border and in Scotland in contrast to /u/ in central England (Ogura 1990, Chaps. 2 & 5).

We may consider the influence of Austronesian within Thomason & Kaufman's framework. The borrowing under conditions of intense contact is refuted by the data in Appendix A and the bootstraps. The hypothesis of an Austronesian substratum is also implausible, because the influence of Austronesian is mainly lexical rather than structural. If we assume contact-induced change by Austronesian, it is moderate borrowing of non-basic vocabulary from Austronesian. It is usually considered that many body part terms came from Austronesian. But this view is no longer tenable, given Vovin's list in Appendix A. Most of the basic body part terms are cognates in PJ, PA and PAN.

Omoto (1995a, 1995b) and Omoto & Saitou (1997) examine, from a perspective of molecular anthropology, the validity of Hanihara's "dual structure model" for the origins of the Japanese. The dual structure model hypothesizes that the

Japanese is genetically affiliated to the South-east Asians who migrated in the late Paleolithic period, and there have been an admixture with the North-east Asians who migrated in the Yayoi period.

Omoto constructs the tree of Hondo-Japanese, Korean, Ainu and Ryukyuan by the Neighbor Joining method, based on the 25 polymorphic loci. The first split separates the cluster of Hondo Japanese and Korean and the cluster of Ainu and Ryukyuan, and this first split shows up in 85% of the bootstraps. Omoto further constructs the tree of the 25 world's populations by the Neighbor Joining Method. It shows that a Japanese-Korean cluster forms a North-east Asian group together with Tibetan and Mongolian, to which the Ainu belongs with a relatively long distance separating it from the rest.

South Chinese, Thai, Negritos, Indonesian, Filipino, Polynesian, Micronesian, Papuan and Australian form a South-east Asian group. The North-east Asian group and the South-east Asian group form a separate cluster in 22% of the bootstraps, which he assumes due to admixture between these groups. From these results, Omoto proposes that the Japanese is genetically affiliated to the North-east Asians, but there remains a possibility of admixture of the North-east Asians and the South-east Asians.

Our bootstrap results of the basic lexicon for PJ, PA and PAN show that Japanese is genetically affiliated to Altaic. This agrees with Omoto's first proposal. We have also suggested a possibility of borrowing of non-basic vocabulary from Austronesian. If there is admixture between the North-east Asians and the South-east Asians, we may assume that borrowing took place by demic migration (i.e., migration of people) and not by cultural migration (i.e., migration of ideas) (Cavalli-Sforza & Feldman 1981).

Regarding the time of migration of Japanese to the Japanese islands, we assume that Japanese may go as far back as the Jomon culture as Miller (1980) believes (see the discussion below). But Vovin (In press) places it in the Kofun period. Following Unger (1990), who considers the implications of Egami's horserider theory for linguistic history, and based on his own investigation of the ten agriculture terminology in which four terms have Altaic origin, and three Austroasiatic origin, Vovin assumes that the Yayoi people were Austroasiatic people who brought rice agriculture to Japan, and Austroasiatic formed a substratum for Japanese. A substratum influence is structural rather than lexical. But we do not find any structural imprint of Austroasiatic.

As to the chronology of the circum-Pacific linguistic colonization, the first stratum is the south-east-interior stratum of Australasia, also echoed in South America. The second is the north-west-coast stratum of Australasia, well represented throughout the New World. At the edge of this second stratum, the

clearly coastal pattern stands out as a third layer. The fourth stratum marks the beginning of north Eurasian linguistic influence on the New World (Nichols 1994). The corresponding times of separation suggested by paleoanthropology are 50,000 years BP for the separation between Asians and Australians, when the humans began their expansion out of the Old World to colonize the Pacific, and 15-35,000 years BP when the New World began to be settled by the multiple colonization (Cavalli-Sforza 1994).

The divergence of PA and PAN occurs in the third stratum, and we may assume that the time of separation is later than 50,000 years BP and earlier than 15-35,000 years BP. By the Neighbor Joining method, all the languages are calibrated against each other on the tree. So once we can determine that the absolute date of split between PA and PAN is later than 50,000 years BP and earlier than 15-35,000 years BP, and the reproducibility of the splits are statistically significant, we can infer from the tree shown in Figure 1 that the split between PA and PJ is later than 7800 years BP and earlier than 2,400-5,500 years BP. This agrees with the Jomon period.

Vovin's investigation of the rice agriculture terms shows that four out of ten terms have Altaic origin. Moreover, the earliest evidence for the cultivation of grains of rice dates to about 900 B.C., and the first definite evidence for charred grains of rice dates to c.600−300 B.C. (Shaw 1994). Some scholars report the plant opal of rice which dates to about 2,500 B.C. (Toyama 1996). Thus we may rather assume that the Jomon people were Altaic people who brought rice agriculture to Japan. According to Omoto (1995b) and Omoto & Saitou (1997), there are similarities of stone-tool cultures and ecology between the Jomon Period and North-east Asia.

We now briefly turn to Ainu, a language that has long been considered a language isolate in linguistic texts. Recently, however, many studies have been made to determine older stages of the language as well as its relative affiliation with Japanese and Korean. Chiri (1952) was an early report which posits the existence of vowel harmony in Old Ainu. Patrie (1982) expresses some reservation with respect to Chiri's study, but instead studies the genetic position of Ainu within a much broader framework.

Patries hypothesis is that Korean and Ainu form a unit which split off earlier from Japanese. He defends his position as follows (1982, p. 121):[ix]

> That Korean and Ainu are more closely related is supported by the fact that these two languages share a greater number of cognates than Ainu does with Japanese. Further, Ainu and Korean have some recurring sound correspondences that are not shared with Japanese. In addition, there is also a

close identity in the numeral systems of Ainu and Korean.

Such a grouping based on linguistic criteria does not agree with that of the geneticist. Omoto and Saitou (1997, p. 440) present several phylogenetic trees based on gene frequency data, using the Neighbor Joining method of analysis. In these trees, Korean is more closely related to Hondo Japanese than it is to Ainu.[×] The two groupings may be represented as follows:

Linguistic grouping: [Ainu, Korean], Japanese
Genetic grouping: Ainu, [Hondo Japanese, Korean]

Discrepancies in results between disciplines are always interesting, and ultimately revealing. While languages and genes often go together in the default case, we know of numerous cases where a people give up their original language for another. A particularly clear case in recent years is that of the Manchus, whose dynasty in China lasted almost 300 years [1644-1911]. Their original language is also a member of the Altaic family. However, while the Manchus have preserved their ethnic identity, and presumably their genetic identity to some extent, there is hardly any left who still speak the Manchu language. Multidisciplinary research is valuable precisely because they can reveal such discrepancies, which can lead us to a deeper understanding when cultural migrations and demic migrations do not completely coincide.

5. Conclusion

We evaluated the correspondences of PJ with PA and PAN in Vovin's list of basic words by the Neighbor Joining method and the bootstrap. We found that all the 100 bootstrap trees separate PAN from the cluster of PJ and PA. This indicates that Japanese is genetically affiliated to Altaic. This result is consistent with earlier work by linguists. This includes the discussion of vowel harmony in Old Japanese (Hattori 1978), sound correspondence in both segmentals and supersegmentals (Whitman 1990 and Vovin 1997), as well as in morphology (Miller 1981). Thus the hypothesis for Altaic origins of the Japanese language is supported by a diversity of cumulative evidence, including the quantitative study reported in the present paper.

We assumed the borrowing of non-basic vocabulary from Austronesian. We refuted the proposal of the mixed Altaic-Austronesian origin and an Austronesian substratum. We have also suggested that the divergence of PA and PJ occurred in the Jomon Period. These results are consistent with genetic and archeological evidence for the origins of the Japanese peoples.

Further examination of the correspondences of Japanese with Altaic and with Austronesian by experts in the fields is necessary. Then the correspondences with Altaic and with Austronesian need to be evaluated and placed in relation to each other in a conclusive way. Furthermore, these results should be verified against diverse forms of evidence: genetic, archeological, historical, cultural, etc. Note however, that the results from different disciplines need not always agree, since as yet we do not know which of the prehistoric migrations were more demic and which were more cultural. Nonetheless, a question as complex as the origins of the languages and peoples of Japan can only be answered adequately from a multi-disciplinary perspective.

Appendix A 100-word Swadesh-list for Proto-Japanese with all possible Altaic etymologies and Austronesian etymologies from Benedict's book(Taken from Vovin 1994a)

gloss	PJ	PA	PAN(Benedict)
all	*múCí-nà	*mu[-]t^{h}V	–
ashes	*pápÍ	–	–
bark(n.)	*kàpà	*k[^{h}]ap^{h}a	Kanakanabu *kaba*
belly	*pàrà	*päl$_1$V	PR *ba[r,ɣ]aŋ
big	*ò̲pò̲-	PMT *amba	–
bird	*tó̲rí	*t^{h}or$_1$V"bird kind"	PTA *taru"bird kind"
bite	*kàm-	*kämV-"gnaw"	*kamkam"hold[in/mouth]"
black	*kùrwò	*k[^{h}]Vr$_1$a	–
blood	*tí	PM *ti	*dz$_2$uɣuq"fluid"
bone	*pone	*p^{h}eñiV	*bani
breast	*ti/*titi	*c^{h}yVjV	*tsitsi
burn	*dák-	*dak-	–
cloud	*kùmù[C]à	PK *kwúlwùm	–
cold	*sàmù-	PMT *saŋu-	*ts$_{123}$əpuq
come	*kò̲-	*gäl$_1$-	–
die	*sín-	*siuun-"die out" "disappear"	Kadai *sin"end"
dog	*ìnù	*ŋinV	*(ʔu)-ʔats$_2$u
drink	*nò̲m-	*l$_1$um-"swallow"	*[q,ʔ]inum
dry	*káw(V)rá-k-	*k[^{h}]awVr$_1$V	–
ear	*mìmì	–	*birbir"edge"
eat	*kup-	*käbi-"chew"	*kupkup"seize"/"hold"
eye	*mà-n	*ña-n	*maCa
feather	*pánÉ	*p^{h}ïñV"down"	*ka(m)pak"wing"
fire	*pò-Ci	*p^{h}ər$_1$	*x$_1$apuy
fish	*(d)íwó	*digV	PI*[q,ʔ]iwak
fly	*tó̲np-	*tepV-"clap"	Kadai *top"clap wings", "fly up"
foot	*pànkì	*pal$_1$ki	*paqi"stalk"
full	*mìt-	*mil$_1$tV	–
give	*ata[-]pa-Ci	–	–
go1	*káywóp-	*keedV	–
go2	*dik-	–	–
good	*dò̲-	*dyoogV	–
grease	*à(n)pùrá	–	–
green1	*àwò	–	*[h]idz$_1$aw
green2	*míntórì	–	–
hair	*ká-Ci	*kïïl$_1$V	*bukas
hand	*tà-Ci	*[i]t^{h}a"five"	PI *taŋan
head1	*tumu-	PMT *tuŋu "top of the head"	–
head2	*kàsìrà	–	–
hear	*kí[-]k-	*k^{h}ïl$_1$V"ear"	–
heart	*kòkòró	*kok^{h}ï-r$_2$V"chest"	–
horn	*tùnwò	PMT *taŋña	*ts$_{123}$uŋu
I	*bàn[u]	*bän	*aku
kill	*kó̲ró̲s-	PM *koro[-]Ga-	–
knee1	*pínsá	–	–
knee2	PR *tubusin	*top[^{h}]V	–
know	*sír-	*seer$_2$-	–
land	*tùtì	*t^{h}oor$_2$V	–
leaf	*pá	–	*paGpaG"leaf"/"wing"
lie	*ná-	*naa-	–

gloss	PJ	PA	PAN(Benedict)
liver	*kímwò	*k^{h}emu"intestines"	–
long	*nànkà-	*ŋoo[l]nV	–
louse	*sìrámí	*sir$_1$V	–
man	*bò	*beye	–
many	*mana-Ci	PK *manV	–
meat	*sìsì	*sil$_2$V	–
moon	*tùkú-	PK *tol[h]	–
mountain	*dàmà	*daba-"cross a mountain", "mountain pass"	–
mouth	*kútú-Ci	MK kwút"hole"	*ŋu[d,dz$_2$]uy
nail	*túmá-Ci	*t^{h}ubV	–
name	*ná	*ner$_1$e	*ajan
new	*àrà-ta-	–	–
night	*dùCà	PMT *dolba	*ɣabi ʔiH"evening"
nose	*páná	*p[^{h}]ĭnV"smell"	–
not	*-an[a]-	*a[a]nV	–
one	*pitō	*pir$_1$V	*pitroŋ"one-eyed"
person	*pítō	PMT *puyte"child"	*Ca ʔu ʔ
rain/sky	*àmâ-Ci	PMT *abVka"sky"	–
red	*áká-	*aaka	–
root	*mōtō	*ŋuuŋte	*(m)bə[t,C]əŋ"belly"
round	*márú/*márō	*mĭr$_1$V	*beLuɣ
sand	*súná	–	*qən[a,ə]y
say	*(d)i[-]p-	PT *te-	–
see	*mì-	PMT *mE-	–
seed	*tàná-Ci	PK *coño"kernel"	–
short	*m-ìnsìkà-	PT *iŋcikä"thin" "narrow"	*pinDik
sit	*bí-	*bui-	–
sleep	*ui-	*ŋĭya	–
small	*tìpìsà-	–	*tipits"thin"
smoke	*kái[-]npúrí	*kei"wind"	–
stand	*tàt-	*c[u]r$_1$[V]	–
star	*pósí	*p^{h}yool$_2$V	*bituqun
stone	*(d)ísò	*tyool$_2$o	–
sun	*pí	PK *pi-s"sun light"	–
swim	*ōyō-	*oyV-	–
tail	*bō	–	*(m)puŋku[r,ɣ]"hind-part"
that	*ká-	–	–
this	*kō-	*k[^{h}]əə	–
tongue	*sìtà	–	–
tooth	*pà	*p[^{h}]al$_1$V"molar"	*(N)Gipən
tree	*kō- <*konor	PMT *xiñee"cherry tree"	*kaS$_2$iw
two	*puta	PK *pVca-k"pair"	PTA *-pusa-"two" (dur. of time only)
warm	*àta-taka-	*oota-	–
water	*mí	*mĭr$_1$i	*bidzuq"juice"
way	*mítí	*mĭr$_1$ĭ	–
we	*bàn[u]	*bän	*aku
what	*nà[-]ní	*ŋya	–
white	*sírà-Cu	*sira	*ts$_{123}$ilaR
who	*tá-	–	*ts$_{123}$ayi
woman	*-mina/*míCá	PK *mìnó "daughter-in-law"	–
yellow	*kú-Ci	–	*kulijaŋ
you[1]	*si/*sō-	*si	–
you[2]	*na	PK *ne	–

References

Benedict, Paul K.

1990. *Japanese/Austro-Tai*. Ann Arbor: Karoma.

Bowcock, Anne M., Judith Kidd, Joanna Mountain, Joan Hebert, Luciano Carotenuto, Kenneth Kidd & L. Luca Cavalli-Sforza.

1991. "Drift, Admixture, and Selection in Human Evolution: A study with DNA polymorphisms". *Proceedings of National Academy of Sciences 88*: 839-843.

Cavalli-Sforza, L. Luca.

1991. "Genes, Peoples and Languages". *Scientific American* November.72-78.

1994. "An Evolutionary View in Linguistics". *In Honor of William S-Y. Wang: Interdisciplinary studies on language and language change* ed. by Matthew Y. Chen & Ovid J-L. Tzeng, 17-28. Taipei: Pyramid Press.

Cavalli-Sforza, L. Luca & A.W.F. Edwards.

1967. "Phylogenetic Analysis: Methods and estimation procedures". *Evolution* 32. 550-570.

Cavalli-Sforza, L. Luca & Marc W. Feldman.

1981. *Cultural Transmission and Evolution*. Princeton: Princeton Univ. Press.

Cavalli-Sforza, L. Luca, Paolo Menozzi & Alberto Piazza.

1994. *The History and Geography of Human Genes*. Princeton: Princeton Univ. Press.

Cavalli-Sforza, L. Luca & William S-Y. Wang

1986. "Spatial Distance and Lexical Replacement". *Language* 62.38-55.

Chiri, Mashiho.

1952. "Ainugo ni Okeru Boin Chowa". *Papers from the Hokkaido University Faculty of Letters* 1.101-118.

Darwin, Charles.

1859. *The Origin of Species*. New York: Mentor Book.

Deacon, Terrence W.

1997. *The Symbolic Species*: *The co-evolution of language and the brain*. New York & London: W. W. Norton.

Diamond, Jared.

1998. "Japanese Roots". *Discover* 19.86-94.

Efron, Bradley.

1979. "The 1977 Rietz Lecture—Bootstrap Method: Another look at the jackknife". *Annals of Statistics* 7:1.1-26.

Efron, Bradley & Gail Gong.

1983. "A Leisurely Look at the Bootstrap, the Jackknife, and Cross-Validation". *American Statistician* 37:1.1-26.

Felsenstein, Joseph.

1985. "Confidence Limits on Phylogenies: An approach using the bootstrap". *Evolution* 39.783 -791.

Fitch, Walter M. & Emanuel Margoliash.

1967. "Construction of Phylogenetic Trees". *Science 155*: 279-284.

Freedman, David A. & William S-Y. Wang.

1996. "Language Phylogenesis: A Probabilistic Model". *Anthropological Science 104*: *2*. 131-138.

Greenberg, Joseph H.

In press. *Indo-European and Its Closest Relatives*. Stanford: Stanford Univ. Press.

Hanihara, Kazuro.

1991. "Dual Structure Model for the Population History of the Japanese". *Japan Review* 2.1-33.

Hattori, Shiro.

1976. "Jodai Nihongo no Boin Taikei to Boin Chowa". *Gengo 5*. 2-14.

1978. "Arutai Shogengo, Chosengo, Nihongo no Boin Chowa". *Gengo 7*. 80-88.

1978-1979. "Nihon Sogo ni Tsuite 1-22". *Gengo*.

Imamura, Keiji.

1996. *Prehistoric Japan*: *New perspectives on insular East Asia*. London: UCL Press.

Jasanoff, Jay H.

1989. "Review of Thomason & Kaufman(1988)". *Language* 65:3.623-628.

Kamei, Takashi.

1954. *Chinese Borrowings in Prehistoric Japan*. Tokyo: Yoshikawa Kobunkan Ltd.

Kawamoto, Takao.

1978. *Minami kara Kita Nihongo*. Tokyo: Kodansha.

Kay, Richard F., Matt Cartmill & Michelle Balow.

1998. "The Hypoglossal Canal and the Origin of Human Vocal Behavior". *Proc. Natl. Acad. Sci*. *95*. 5417-5419.

Koizumi, Tamotsu.

1998. *Jomongo no Hakken*. Seidosha.

Marchand, Hans.

1960, 1969. *The Categories and Types of Present-Day English Word-Formation: A synchronic-diachronic approach.* München: Beck'sche.

Martin, Samuel E.

1966. "Lexical Evidence Relating Korean to Japanese". *Language 42:2*. 185-251.

Miller, Roy A.

1971. *Japanese and the Other Altaic Languages*. Chicago/London: Chicago Univ. Press.

1980. *Origins of the Japanese Language*. Seattle/London: Univ. of Washington Press.

1981. "Altaic Origins of the Japanese Verb Classes". *Bono Hominidonum: Essays in historical linguistics, in memory of J. Alexander Kerns*. ed. by Yoel L. Arbeitman & Allan R. Bomhard, 845-880. Amsterdam: John Benjamins.

Miyake, Marc H.

1997. "Pre-Sino-Korean and Pre-Sino-Japanese: Reexamining an old problem from a modern

perspective". *Japanese-Korean Linguistics* 6.179-212.

Murayama, Shichiro.

1979. *Nihongo no Tanjo.* Tokyo: Chikuma Shoten.

Nichols, Johanna.

1994. "Language at 40,000 BC". Paper read at AAAS Annual Meeting, San Francisco, February 21, 1994.

Norman, Jerry.

1982. "Four Notes on Chinese-Altaic Linguistic Contacts". *Tsing Hua Journal of Chinese Studies 14*. 243-247.

Ogura, Mieko.

1990. *Dynamic Dialectology: A study of language in time and space*. Tokyo: Kenkyusha.

1996. "Borrowings and their Effect on Tree Structures" MS.

Ogura, Mieko & William S-Y. Wang.

1997. "Lexical Diffusion and Evolution Theory". *Language History and Linguistic Modelling: A festschrift for Jacek Fisiak on his 60th birthday* ed. by Raymond Hickey & Stanislav Pappel, 1083-1098. Berlin/New York: Mouton de Gruyter.

1998a. "Evolution Theory and Lexical Diffusion". *English Historical Linguistics 1996: Papers from the 9th International Conference on English Historical Linguistics* ed. by Jacek Fisiak and Marcin Krygier, 315-344. Berlin/New York: Mouton de Gruyter.

1998b. "Parallels in Language Evolution and Biological Evolution". Paper presented at the 10th International Conference on English Historical Linguistics, University of Manchester, August 21-26, 1998.

Omoto, Keiichi.

1995a. "Genetic Diversity and the Origin of the "Mongoloids"". *The Origin and Past of Modern Humans as Viewed from DNA* ed. by Sydney Brenner and Kazuro Hanihara, 92-109. Singapore: World Scientific.

1995b. "Nihonjin no Kigen: Bunshijinruigaku no Tachiba kara". *Anthropological Science 103*: *5*. 414-427.

Omoto, Keiichi & Naruya Saitou.

1997. "Genetic Origins of the Japanese: A partial support for the dual structure hypothesis." *American Journal of Physical Anthropology 102*. 437-446.

Pallas, Peter Simon.

1766. *Elenchus Zoophytorum*. The Hague: Apud Petrum van Cleef.

Patrie, James.

1982. *The Genetic Relationship of the Ainu Language*. University of Hawaii Press.

Percival, W. Keith.

1987. "Biological Analogy in the Study of Language Before the Advent of Comparative Grammar". *Biological Metaphor and Cladistic Classification* ed. by Henry M. Hoenigswald & Linda F. Wiener, 3-38. Pennsylvania: Univ. of Pennsylvania Press.

Rabinovitch, Judith N.

1996. "An Introduction to Hentai Kambun [Variant Chinese], a Hybrid Sinico-Japanese Used by the Male Elite in Pre-modern Japan". *Journal of Chinese Linguistics 24*: 98-110.

Saitou, Naruya & Masatoshi Nei.

1987. "Neighbor-joining Method: A new method for reconstructing phylogenetic trees". *Mol. Biol. Evol. 4:4*. 406-425.

Sakiyama, Osamu.

1996. "Formation of the Japanese Language in Connection with Austronesian Languages". *Prehistoric Mongoloid Dispersals* ed. by T. Akazawa & E.J.E.Szathmary, 349-358. Oxford Science Publications.

Sapir Edward.

1921. *Language*. New York: Harcourt, Brace & World.

Schleicher, August.

1863. *Die Darwinsche Theorie und die Sprachwissenschaft*. Weimar: H. Bohlau.

1876. *Compedium der vergleichenden Grammatik der indogermanischen Sprachen*. 4th ed. Weimar.

Schmidt, Johannes.

1872. *Die Verwandtschaftsverhältnesse der indogermanischen Sprachen*.

Shibatani, Masayoshi.

1987. "Japanese". Chapter in *The Major Languages of East and Southeast Asia* ed. by Bernard Comrie. London: Routledge.

1990. *The Languages of Japan*. Cambridge: Cambridge Univ. Press.

Shaw, Ian.

1994. *Timeline of the Ancient World 3000 BC-AD 500*. London:British Museum Press.

Sidwell, Paul J.

1996. "Review of Vovin (1993)". *Diachronica XIII:1*. 179-186.

Simon, Herbert.

1962. "The Architecture of Complexity". *Proceedings of the American Philosophical Society 106*. 467-482.

Solnit, David B.

1992. "Review of Benedict (1990)". *Language 68:1*. 188-196.

Thomason, Sarah G. & Terrence Kaufman.

1988. *Language Contact, Creolization, and Genetic Linguistics*. Berkeley/Los Angeles/London: Univ. California Press.

Toyama, Shuichi.

1996. "Nihon Retto no Inasaku no Hajimari". *Kokogaku 56*: 39-43.

Unger, J. Marshall.

1990. "Japanese and What Other Altaic Languages". *Linguistic Change and Reconstruction Methodology* ed. by Philip Baldi, 547-561. Berlin/New York: Mouton de Gruyter.

Vovin, Alexander.

1993. *A Reconstruction of Proto-Ainu*. Leiden: E. J. Brill.

1994a. "Long-distance Relationships, Reconstruction Methodology, and the Origins of Japanese". *Diachronica XI:1*. 95-114.

1994b. "Is Japanese Related to Austonesian?" *Oceanic Linguistics 33:2*. 369-390.

1997. "The Origin of Register in Japanese and the Altaic Theory". *Japanese-Korean Linguistics 6*. 113-134.

In press. "Japanese Rice Agriculture Terminology and Linguistic Affiliation of Yayoi Culture". *World Archaeology Congress*. #6.

Wang, William S-Y.

1976. "Language Change". *Origins and Evolution of Language and Speech* (Annals of the New York Academy of Sciences, 280) ed. by Steven R. Harnad et al., 61-72. New York: The New York Academy of Sciences.

1983. *Exploration in Language Evolution*. Hyderabad: Osmania Univ. Press.

1987. "Representing Language Relationships". *Biological Metaphor and Cladistic Classification* ed. by Henry M. Hoenigswald & Linda F. Wiener, 243-256.

1991. *Explorations in Language*. Taipei: Pyramid Press.

1992. Origins of Language. *International Encyclopedia of Linguistics* ed. by William Bright, Vol. 3, 139-141. Oxford: Oxford Univ. Press.

1993. "Glottochronology, Lexicostatistics, and Other Numerical Methods". *Encyclopedia of Language and Linguistics* ed. by R.E.Asher & J.M.Y. Simpson, 1444-1550. Oxford: Pergamon Press.

1997. "Language Emergence and Transmission". Paper presented at the meetings held at the Cold Spring Harbor Laboratory in October 1997 [organized by L. L. Cavalli-Sforza and J. D. Watson], and at the Santa Fe Institute in December 1997 [organized by M. Gell-Mann and M. Ruhlen].

1998a. "Language and the Evolution of Modern Humans". *The Origins and Past of Modern Humans-Towards Reconciliation* ed. by Keiichi Omoto & Phillip V. Tobias, 247-262. Singapore: World Scientific.

1998b. "Three Windows on the Past". *The Bronze Age and Early Iron Age Peoples of Eastern Central Asia* ed.. by Victor Mair. pp 508-534 Washington, D.C. The Institute for the Study of Man.

Wang, William S-Y. (ed.)

1995. *The Ancestry of the Chinese Language. Journal of Chinese Linguistics* Monograph Series Number 8. Berkeley: Journal of Chinese Linguistics.

Wang, William S-Y.& Chinfa Lien.

1993. "Bidirectional Diffusion in Sound Change". *Historical Linguistics: Problems and perspectives* ed. by Charles Jones, 345-400. Harlow, Essex: Longman.

Whitman, John.

1990. "A Rule of Medial *-r- Loss in Pre-Old Japanese". *Linguistic Change and Reconstruction Methodology* ed. by Philip Baldi, 511-545. Berlin/New York: Mouton de Gruyter.

Yamada, Shuzo.

1974. "Ainu Gozoku no Kyoju Hani". *Hoppo no Kodai Bunka* ed. by N. Shinno & S. Yamada. Tokyo: Mainichi Simbunsha.

Yasumoto, Biten & Masahisa Honda.

1978. *Nihongo no Tanjo*. Taishukan Shoten.

Notes

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ii City University of Hong Kong, and University of California at Berkeley.

iii Tsurumi University, Yokohama, and University of California at Berkeley.

iv For instance, bronze mirrors cast with the same mould are found in many kofuns.

v We choose Cantonese for comparison here because this dialect of Chinese is most conservative in its phonological development, and thus can reveal better the similarity with these Japanese forms.

vi These remarks are based on Greenberg's work on Indo-European, soon to be published by Stanford Universisty Press. Greenberg does not propose a subgrouping for his Eurasiatic family, though it is evident that not all branches are intended to be coordinate with each other.

vii Though Vovin states that he compiled the 100-word Swadesh-list for PJ, there are 103 glosses in the data given in Appendix A. Vovin gives two glosses for go, green, head, knee, you. Egg, neck and skin usually included in 100-word Swadesh-list are omitted in Vovin's list, but short usually not included in Swadesh list is given in Vovin's glosses.

viii If a cognate does not occur in one branch of Altaic or Austronesian, it is interpreted to be different from the others. If a cognate does not occur in both Altaic and Austronesian, they are interpreted to be different from Japanese and from each other.

ix Vovin (1993) ventures a hypothesis that Proto-Ainu may be related to Proto-Austroasiatic on the basis of some parallels in the basic vocabulary, the initial clusters and general syllable structure. He assumes that the lexical and grammatical parallels between Proto-Ainu and Altaic are probably due to the centuries of mutual contact, rather than common origin.

x But Figures 1 and 2 in Omoto & Saitou (1997) show that Hondo Japanese is closer to Ainu than it is to Korean.