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Linguistic Mapping and Historical Analyses : Vertical and Horizontal Transmission and Potential GIS Applications

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6. Linguistic Mapping and Historical Analyses: Vertical and Horizontal Transmission and Potential GIS Applications

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Abstract

The Fijian Language GIS Project is a scientific endeavor where we explore how to apply GIS to linguistics analyses and how language data could be processed in geography appropriately. In this chapter, from the viewpoint of historical linguistics, I will review two existing approaches to language change, namely, the Comparative Method and Linguistic Geography, and summarize the differences between them. Based on these observations, I will then assess the results of pilot analyses of Kadavu data in our project. I will also provide a case study focusing on the clarification of the development of the word *icōni* ‘pandanus mat (general)’ in Kadavu dialects. It will be shown that maps with at least three different types of information are necessary for this to be identified. Although these maps are expected to be manually analyzed by a specialist, the breakdown of the process of the analyses is believed to help in the future to establish a computer assisted historical linguistics based on the GIS database.

6.1. Introduction

GIS is “a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data” (University of Wisconsin-Madison Library). It provides a sophisticated tool for presenting data in the form of maps, and has been used in projects focusing on language documentation, locating and organizing information about languages and dialects around the world (Luebbing 2013: 52). One of the products of such projects is the World Atlas of Language Structures (WALS) Online (Dryer and Haspelmath 2013), where maps are used for presenting the distribution of languages and the components of them. Such usage of maps has been popular in linguistics, although obviously, using GIS enables the handling of much larger amount of data, and make data more accessible (e.g. Veselinova 2009).

Major advantages of applying GIS in language/linguistic mapping is said to include: i) customizable (=interactive), ii) accurate locations, and iii) the data can be easily related to non-linguistic information (Dahl and Veselinova 2005). Each of these can be actively

utilized in linguistic analyses. For example, data may be browsed in an interactive manner once incorporated into a GIS. However, language data do not automatically organize themselves and jump into the system. Linguists need someone to collaborate with who is a specialist of geography and who knows how to handle a GIS tool. Another less-commonly known aspect of GIS among linguists is that there are spatial analysis tools that are incorporated in the system which “allow sophisticated and efficient analysis of spatial data by researchers in many fields” (Hoch and Hayes 2010). It has been pointed out that little discussion has been taking place as to how the system could be used for data management and analysis of linguistic datasets (Hoch and Hayes 2010: 23; Luebbering 2013: 41).

Although limited, there are a series of pioneering “historical-linguistic-cultural studies” using GIS and focusing on Tai languages by Luo *et al.* (2000), Luo *et al.* (2007), Luo *et al.* (2010) and Wang *et al.* (2012) (see Luo *et al.* 2018 for a summary). Their method is to calculate phonological similarities of a set of words and map the results to examine how differences in sounds correlate to space-oriented information (Figure 6-1). This is applied to both reflexes of selected reconstructed forms and borrowed forms, and to a wide geographical area. Their method has a potential for application to various linguistic contexts, however, it requires fine tuning.

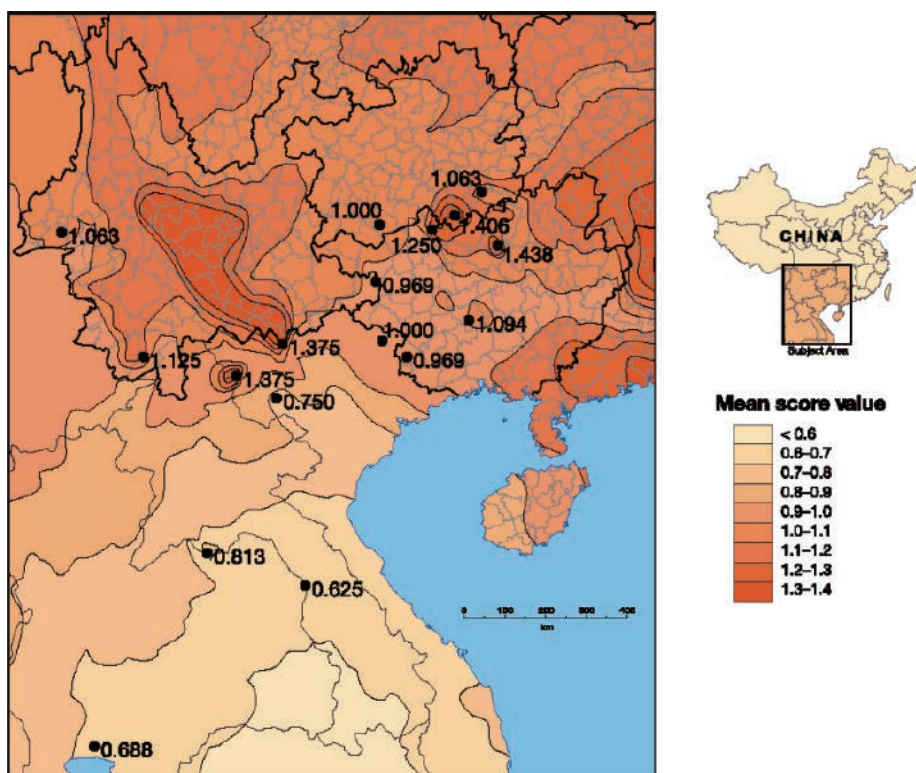


Figure 6-1 Pronunciation similarity presented on a map (Luo *et al.* 2018)

This chapter is the first attempt at developing a methodology for the application of GIS to historical linguistics research. For this purpose, I compare the traditional Comparative Method, where vertical transmission is studied and clarified, and the method used in Linguistic Geography, where contact induced changes, or horizontal transmission, is observed using maps. In Section 6.2, I will point out that there are two different axes for comparing language data used in the two methods; one is the cognacy of the forms, and the other is shared semantic notions. Understanding this fact brings various insights as to how we could best use GIS based data and develop tools for historical linguistics research. In Section 6.3, the results of pilot study on Kadavu data are assessed from this view point, and in Section 6.4, taking up words referring to pandanus mats in Kadavu, a case study is provided to show why and how mapping information combining the two different axes becomes necessary in clarifying the developmental paths of the form *icōni*, which is exclusively used on the island as a general term for pandanus mats. Section 6.5 provides concluding remarks.

6.2. Two Streams in Historical Linguistics

6.2.1. Development of Languages

In their recent proposal of a workshop “Patterns of language contact within and across phylogenies,” de Benito Moreno *et al.* (2018) points out that using two different models in the study of language change results in two separate streams in approaches in historical linguistics. It reads:

A long-standing debate in historical linguistics concerns the question how language change progresses. Two competing models were proposed in the 19th century: the tree model (Schleicher 1853) and the wave model (Schuchardt 1900; Schmidt 1872). Although there are good reasons to regard these models as complementary rather than oppositional, they represented an opposition at the time, and often have been presented as opposed, mutually exclusive models since. This has led to quite separate traditions in historical linguistics that focus on inheritance on the one hand, and contact on the other.

The tree model, which is strongly associated with the Comparative Method, is used to reflect direct splits of languages from a common ancestor. What is implied in the branches is vertical transmission—in other words, direct inheritance passed down from generation to generation. The wave model indicates distribution of a selected component of language, where languages change resulting from a contact relationship is shown and horizontal transmission is considered to be reflected. With the advance of GIS computer software and technology, it is now possible to display the distribution of variations fairly accurately on a map. Such a distribution-oriented analysis of language change is particularly common in sociohistorical linguistics. Another aspect that contrasts these two models is the nature of the group of languages examined. Kikusawa (2015, 2018) argues that the Comparative Method is successful in macro-comparison, or a comparison of languages that are genetically and geographically distant from each other. This is because in macro-comparison, the results of local contact and areal developments are naturally eliminated and only inherited

characteristics can be extracted. In other words, the tree model by its nature does not reflect the results of contact and areal developments that are shared by the languages under examination. On the other hand, the wave model, which is useful for micro-comparison, where languages that are genetically and geographically close to each other are compared, reflects contact and areal developments. Although the relationship between the two models has been long discussed in biology, this unfortunately rarely happened in linguistics.

That the two models are separate does not mean that languages are susceptible to one or the other of the changes. On the contrary, there is no language that contains only inherited characteristics, or those which developed only as a result of contact. A language develops as a sum of both vertical and horizontal changes. When a language develops, it continually undergoes changes resulting from the influence of various factors, such as features that are inherited from its ancestral language, the results of contact, as well as sporadic changes that the language undergoes independently from other languages. Figure 6-2 shows the abstracted developmental paths of Rotuman, spoken in the north of Fiji, based on Schmidt's comparative work (Schmidt 2003). It shows that, having developed from its ancestor language Proto-Oceanic, Rotuman has had influence from various closely related languages, including Nuclear Polynesian languages, East Uvean, Niuafu'ou, Tongan, as well as Pacific Pidgin, Fijian and English. It can be seen that, even among those that are identifiable by examining the forms of lexical items found in the modern languages, layer after layer of influence from other languages can be identified. Such a view, that a language is made up of layers of development led a research area referred to as "linguistic stratigraphy." The point here is that, each language consists of traces of both vertical and horizontal transmission. By developing tools using GIS for identifying each trace and extracting and comparing them, it should become possible for us to identify more details of change of the targeted language family. It should also become possible to understand general mechanisms of the development of language better than we do today. For example, discussion regarding the direct inheritance

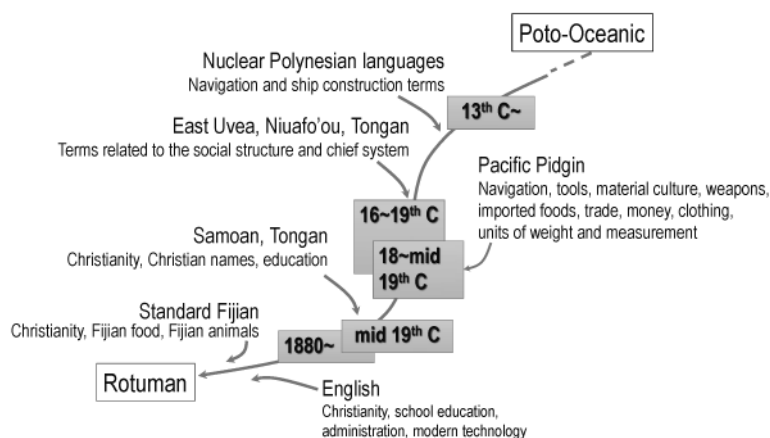


Figure 6-2 The development of Rotuman (compiled by the author, based on Schmidt 2003: 235)

of Fijian languages appears in Geraghty (1983), and the details of the influence of other languages to Fijian in the historical period appears in Geraghty (Chapter 2 in this volume).

In the historical analyses of Fijian communalects, two subgrouping hypotheses have been proposed, namely, a subgrouping hypothesis with a split model (reflecting vertical transmission, Figure 6-3) and one where language linkages (as a result of horizontal transmission, Figure 6-4) are assumed. The latter is somewhat similar to the wave model approach in the sense that it considers the contact situation of Fijian. However, there is no methodology to compare and integrate the two. This is directly or indirectly related to the common problems seen in micro-comparison conducted in historical linguistics, which is becoming common as a result of work focusing on regional varieties in descriptive linguistics (Kikusawa 2018). In the Fijian Language GIS Project, as an attempt to deal with such data, the geographical location of Fijian communalects will be regarded as the intersection of the two types of transmission. To integrate the two, a GIS project will be used. GIS will also be used for examining the correlation between linguistic and non-linguistic information, such as the time of travel and the relationship among settlements. This will capture linguistic change in the context of human activities. In addition, statistic modelling will be applied to evaluate the outcomes of this data-oriented approach and to make the method applicable to other language groups.

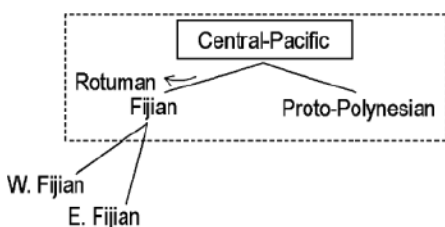


Figure 6-3 Position of Fijian languages shown on a tree model (based on Pawley 1972)

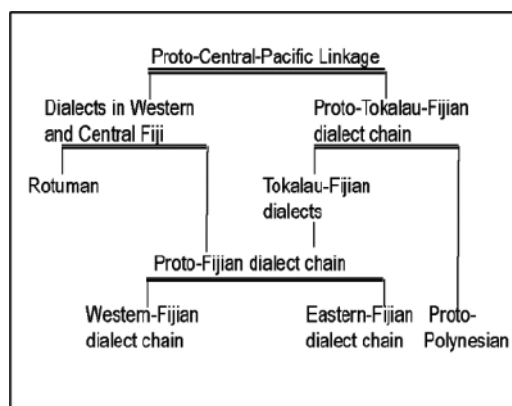


Figure 6-4 Development of Fijian languages shown using dialect linkages (based on Geraghty 1983 and Schmidt 1999)

To clarify the development of languages, it is inevitable that we understand both chronological language change (“vertical transmission”) and the spread of linguistic features (“horizontal transmission”). However, there is no methodology where the different pieces of information are integrated. For example, François (2015) gives a good summary of the characteristics of the two models, and Kalyan and François (2018) proposes Historical Glottometry as a new tool. The model gives a method to calculate the distance relationship among languages and to display it, however, it does not give us the kind of information a tree model does. This may be partially because of the limit of a two-dimensional display

of three- (or four- if we include the time axis) dimensional changes.

6.2.2. Different Axes in the Comparative Method and Geographic Linguistics

It is the Comparative Method that enables us to understand what has been transmitted from the commonly shared ancestor language. The details of how this method is applied to languages with no written records appear in Crowley and Bower (2010). In this method, cognates, that is the forms that are likely to have developed from the same source, are collected, compared and reconstructed. For example, *boŋi*-like forms (see Table 6-1) are collected from genetically related languages, sounds composing the forms are compared to ensure they follow the sound correspondences, which is the sign of direct inheritance from the commonly shared ancestor language, then a form for the proto-languages is reconstructed. Here, it is **boŋi* that is reconstructed for Proto-Oceanic. When we look at the meaning associated with the forms in Table 6-1, however, there is a discrepancy. While most of them indicate ‘night,’ others carry somewhat related meanings, such as ‘morning,’ ‘tomorrow’ and others. In the Comparative Method, since the reconstruction is based on the comparison of the forms, the semantic differences are compared after the form correspondence is established and it is inferred that, for example, the original meaning must have been ‘night’ for the case of **boŋi*, for this is the majority, and that other meanings must have developed from the original meaning because of semantic association with the meaning ‘night.’ The development of the reflexes of a reconstructed form is understood in the context of a family tree diagram, such as the one shown in Figure 6-5.

The wave model is the approach to language change based on geographical distribution and not on the family tree. The area referred to as Linguistic Geography can be characterized as a subfield of linguistics, where “varieties of terms referring to the same notion are plotted on a map, and based on their distribution, developmental paths of the varieties are inferred... Established out of the criticism against the Junggrammatiker (Neogrammarians).” It was

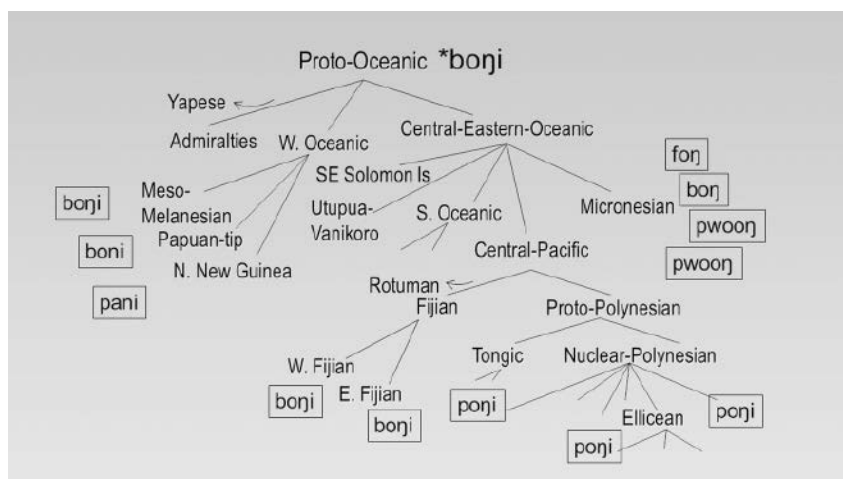


Figure 6-5 The vertical transmission of the reconstructed form **boŋi* (compiled by the author)

Table 6-1 Reflexes of Proto-Oceanic *boŋi in Oceanic languages

| LANGUAGE | FORM | MEANING | LANGUAGE | FORM | MEANING |
|---------------------|--------------------|---------------------------------------|---------------|----------------|--|
| Nauna | <i>puj</i> | night | Nggela | <i>mboŋi</i> | night; a day, as a measure of time (<i>e rua na j mboŋi</i> 'two days'); yesterday; the weather |
| Andra | <i>biŋ</i> | night | Lau | <i>boŋi</i> | night; days, in reckoning time |
| Ponam | <i>biŋ</i> | night | Lau | <i>bo-boŋi</i> | tomorrow |
| Lindrou | <i>ben</i> | night | Lau | <i>ū-boŋi</i> | early morning |
| Seimat | <i>i-poŋ</i> | night | 'Are'āre | <i>poi</i> | evening, after sunset, night; an appointed day |
| Wuvulu | <i>poi</i> | night | Sā'a | <i>poŋi</i> | a time, a season |
| Tolai | <i>boŋ</i> | to cover, obscure, esp. of the clouds | Sā'a | <i>poŋi-ku</i> | my appointed time |
| Arop | <i>boŋ</i> | night | Arosi | <i>boŋi</i> | a night; last night |
| Lusi | <i>bo-boŋi</i> | morning | Gilbertese | <i>boŋ</i> | night |
| Kove | <i>voŋi</i> | morning | Kosraean | <i>foŋ</i> | night |
| Sobei | <i>pai</i> | night | Marshallese | <i>boŋ</i> | night; last night |
| Kayupulau | <i>mponi</i> | night | Pohnpeian | <i>pwohŋ</i> | night |
| Manam | <i>boŋ</i> | day, time | Chuukese | <i>pwooŋ</i> | night (mostly in compounds) |
| Gedaged | <i>boŋ-anip</i> | at the end of night, tomorrow | Puluwat | <i>pwooŋ</i> | night; day of the month; be night |
| Gitua | <i>boŋ</i> | last night | Mota | <i>qoŋ</i> | night; darkness; dark |
| Bunama | <i>boi</i> | yesterday | Lakona | <i>kweŋ</i> | night |
| Motu | <i>(hanua)-boi</i> | night; till night | Laméŋin | <i>mboŋ</i> | night |
| Pokau | <i>voŋi</i> | night | Amblong | <i>mo-bon</i> | night |
| Kilivila | <i>boŋi</i> | night; darkness | Apma | <i>buŋ</i> | night |
| Bwaidoga | <i>boŋi</i> | night | Efate (South) | <i>pog</i> | night |
| Saliba | <i>boni</i> | night | Rotuman | <i>poŋi</i> | night, night-time; be night or evening or late in the day |
| Haku | <i>boŋ</i> | night | Fijian | <i>boŋi</i> | night |
| Petats | <i>boŋ</i> | night | Niue | <i>poŋi</i> | weak, inactive (mentally) |
| Tinutuz | <i>pwèn</i> | night | Samoan | <i>poŋi</i> | blurred, dim (vision) |
| Piva | <i>boŋi</i> | night | Samoan | <i>po-poŋi</i> | (of the night) fall |
| Uruava | <i>boni</i> | night | Tuvaluans | <i>poŋi</i> | bemused (as from a blow on the head) |
| Torau | <i>boni</i> | night | Maori | <i>poŋi</i> | a dark variety of taro |
| Mono-Alu | <i>boi</i> | night, day (indefinite) | Hawaiian | <i>poi</i> | purple; any purple-like color |
| Eddystone/Mandegusu | <i>boŋi</i> | night | | | |
| Bugotu | <i>boŋi</i> | night | | | |
| Bugotu | <i>ke boŋi</i> | by night, at night | | | |

started by G. Wender and established by J. Gilliéron, who is famous for the statement “chaque mot a son histoire (each word has its own history),” which describes the difference in their approach against the idea that sounds change is “exceptionless.”

Figure 6-6 is an example of the examination of the development of two different clause structures in the Swiss-German dialects presented in Stoeckle (2014). The two maps show the distribution of the usage of two prepositions used in Swiss-German to express the same notion “to have a ticket issued.” The red dots in the map on the left shows the frequency of the phrase «für ein Billet (zu) lösen», while the blue dots in the map on the right shows the frequency of the phrase «zum ein Billet (zu) lösen». Looking at the distribution, it can be inferred that the use of the preposition *für* is an influence of the French speaking population, while that of *zum* is one of the characteristics inherited from earlier German.

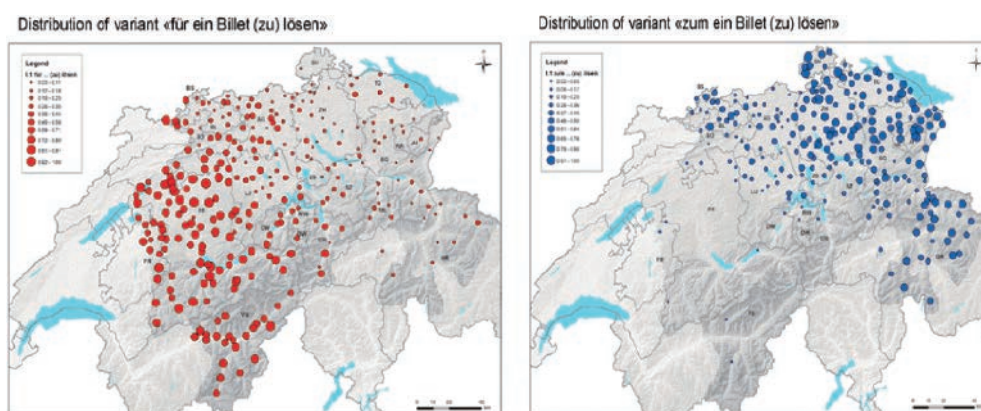


Figure 6-6 Showing the distribution of different sentence structures in Swiss-German dialects (cited from Stoeckle 2014)

Figure 6-7 shows that the combined distribution even makes this hypothesis clearer, that the red started in the southwest and spread toward northeast, while the blue started from the east and spread toward the west.

There have been some hypotheses regarding the relationship between language development and geographical distribution. For example, it has been claimed that old forms are conserved in the periphery, while they are replaced by new forms in the center. This is because new forms are more likely to start in the center and gradually spread outwards. However, as a word is transmitted toward the periphery, it undergoes changes. Therefore, it has been also generalized that the forms in the periphery are new, and those found in the center are old. These two hypotheses appear to be contradictory, however, they refer to two different things. The first is talking about the replacement of the earlier word with a new form, while the second is about the differences in the forms with the same origin.

However, the biggest interest for us here is the difference of the comparative axis of the two methods. In the traditional comparative method, lexical items are organized according to their cognacy. Once the developmental paths of the forms are clarified, then their semantic/

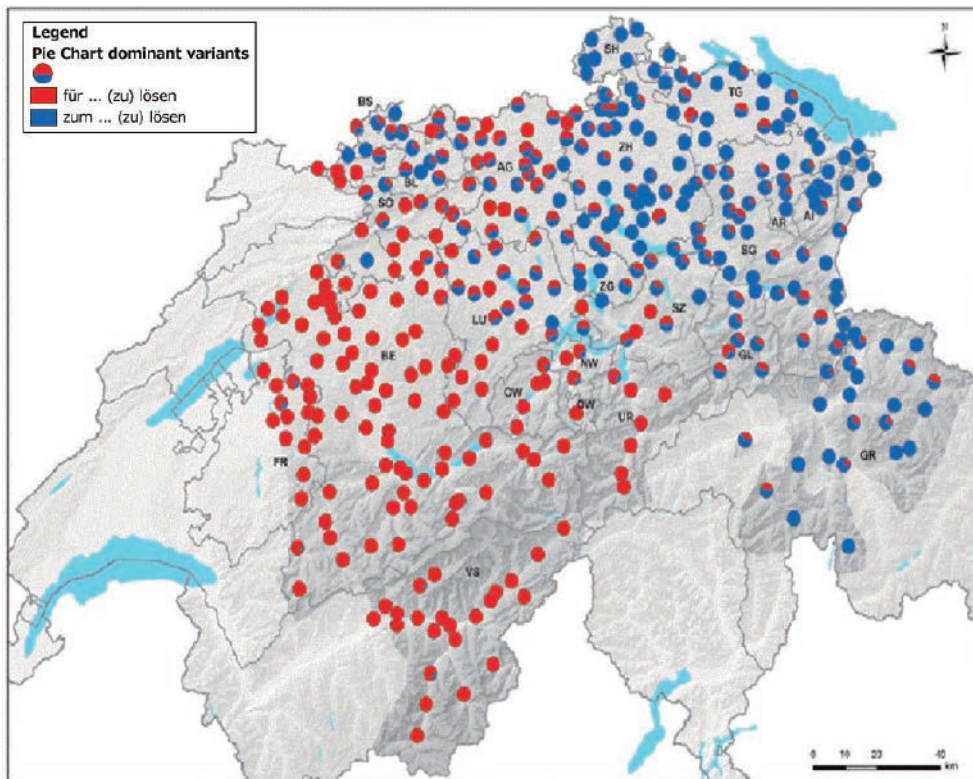


Figure 6-7 Pie charts showing the distribution of frequent variants in Swiss-German dialects (cited from Stoeckle 2014)

functional aspects are examined and reconstructed. In Linguistic Geography, on the other hand, lexical items are geographically organized with their meanings as an axis. Word forms and or expressions indicating the same semantic notions are collected and displayed on the map. The forms may or may not be cognates, and this is one of the biggest differences between the analyses between the one where the Comparative Method is applied and the one where Linguistic Geography is applied. With this view, I will assess the results of a trial geovisualization of Kadavu data in Section 6.3.

6.3. Assessing Geovisualization of Kadavu Data from a Methodological Point-of-View

In this section, results of a pilot study using GIS data of Kadavu Island are introduced and assessed from a linguistic point of view. Although the data processed was limited and contained some errors, the results still help us to explore the potential of the application of GIS to linguistic analyses. Background information about the Kadavu communalects is presented in 6.3.1. Then in 6.3.2, the results of this pilot study are presented and examined.

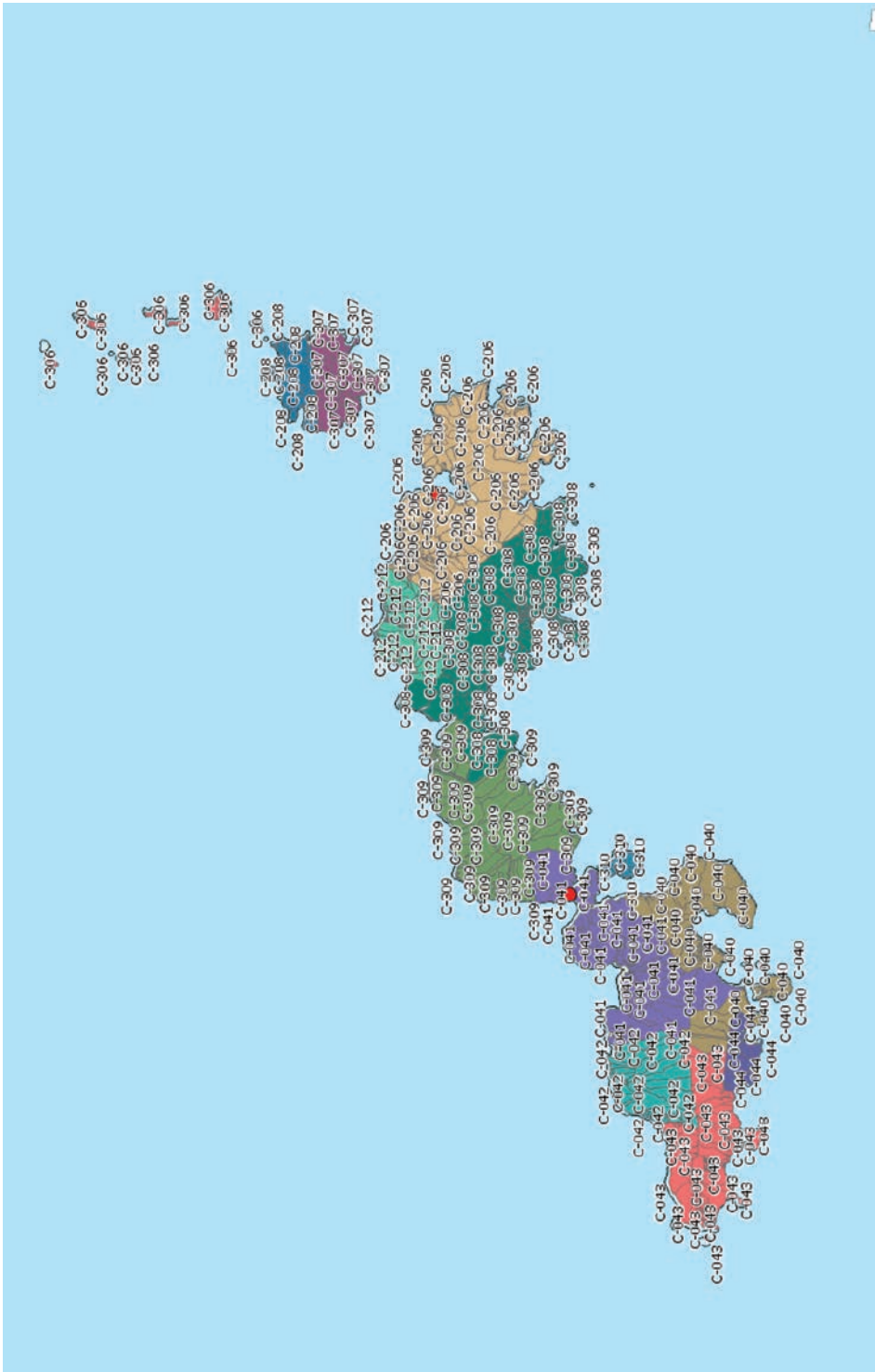


Figure 6-10 A map of Kadavu with different communal areas shown in areas and color-coded (compilation of this project)

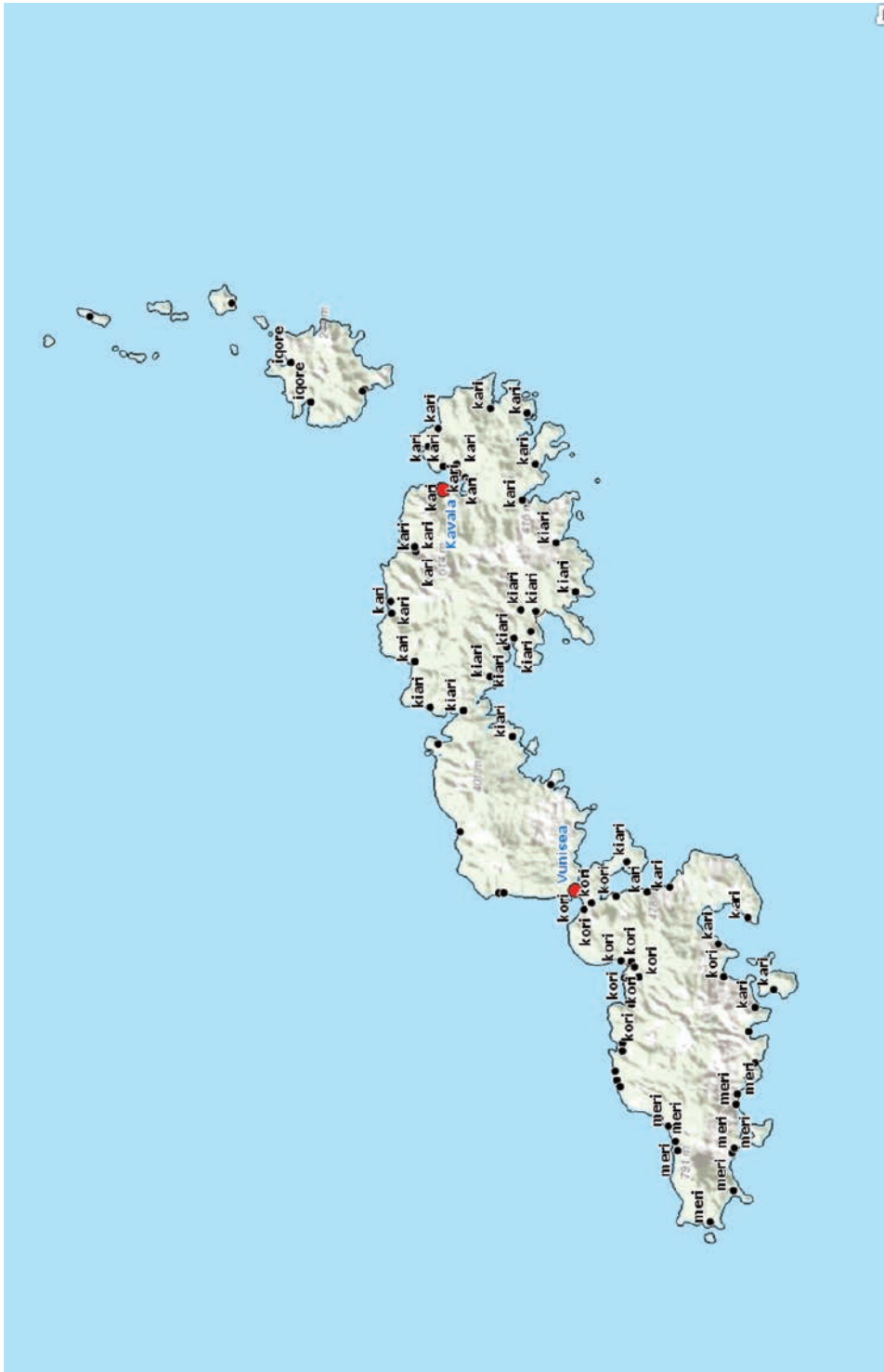


Figure 6-11 A map of Kadavu with forms meaning “that (near addressee)” displayed (compilation of this project)

data by Geraghty, where the “diaphones” are used and pronunciation differences are not reflected (see Section 8.3 in Chapter 8 of this volume). The two red dots in the figures indicate the two points of entry. Vunisea, in the west, is the main town on the island with



Figure 6-12 An aerial photograph showing the space between inhabited areas on the Kadavu Islands with settlements circled with yellow (compiled by the author, based on a screen shot of Google Maps of the Kadavu area)



Figure 6-13 Scenery on the road between inhabited areas on the Kadavu Islands (photo taken in March 2019 in Kadavu by the author)

an administrative complex, hospital and boarding school, with the airfield and also the wharf where the ferry for commuting between Kadavu and Suva exists. Kavala, located in the east, is another point where the ferry stops.

Whether to indicate the positions of the communalects as areas or as points is a difficult matter to decide upon. In real life, it is always an area where a language is spoken and not a point. Originally a decision was made to record the area of each communalect according to the *mataqali* boundary. The *mataqali* boundary shows the land ownership of each village and therefore, it shows the potential edge of the geographical spread of speakers of each village. It is also easy to see as a visual representation when the distribution of languages is demonstrated in areas such as in Figure 6-10. However, in actual linguistic activities, there is no language spoken in vacant land. It is unlikely that substantial contact that causes language change takes place in an area which is not inhabited. Figure 6-12 and Figure 6-13 are presented to show this situation. In Kadavu, the stretch between inhabited areas is clearly uninhabited in most areas. Thus, I consider the distribution and geographical relation between communalects shown in Figure 6-10 is inaccurate and is not suitable for linguistic analyses. It is probably better to have a point-based approach to an area-based approach.

6.3.2. Results of Pilot Geovisualizations and Their Assessments

The area was chosen for initial sample geovisualization. This was because Kadavu province consists of an island group which geographically can be analyzed independently from the other island groups, and also because we found GIS data for this area, including language

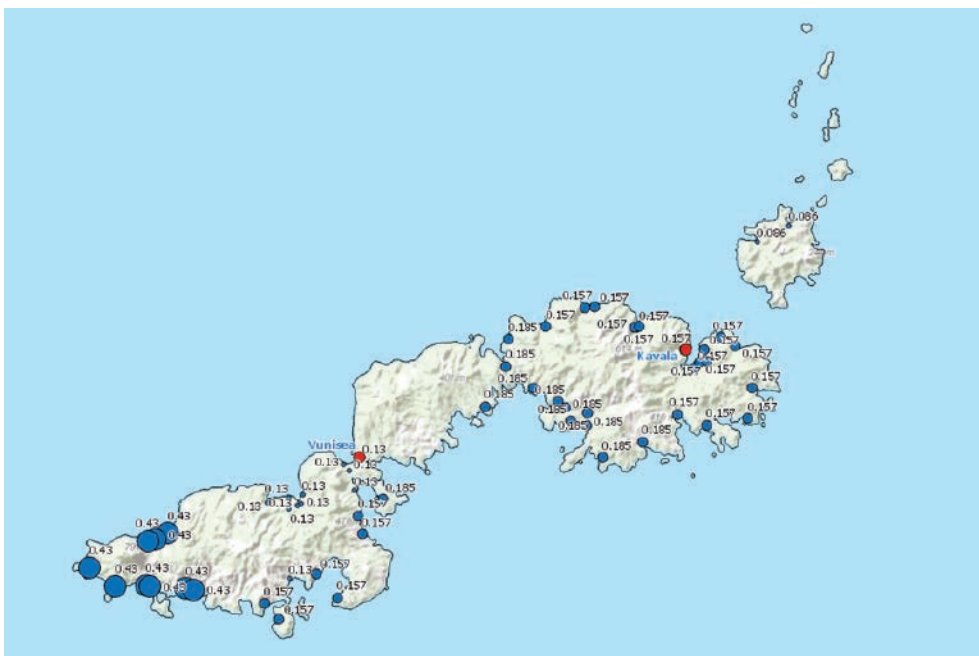


Figure 6-14 Map of Kadavu with distance metrics; Larger symbol indicates greater linguistic “distance” from standard Fijian (compilation of this project)

data, were more manageable than those for the other areas in the early stage of our work. To experiment with this area, a working hypothesis was set as “difference corellates to the distance from standard Fijian in the two ports of entry—Vunisea and Kavala.” As has been mentioned, there are two ports of entry to Kadavu from outside. An assumption was made that forms of standard Fijian may enter as a result of these two ports of entry. As a result, more standard forms may be found in these two ports, and further away from the ports, differences from standard Fijian become larger. Based on this hypothesis, we decided to calculate the correlation between the similarities and differences between forms used in Kadavu and standard Fijian and the distance from the ports of entry. Details of the methodology appear in Chapter 5 of this volume and here I will introduce only the results of the study.

Figure 6-14 shows the map of Kadavu with distance metrics. The numbers (in the background) show the distance, or the degree of difference from standard Fijian. This is reflected in the diameter of the symbols. A larger symbol indicates greater linguistic “distance” from standard Fijian and the smaller the symbol, the difference is not as much. The same information has also been shown in a different manner. Figure 6-15 is a spline spatial interpolation of point values of the same data shown in Figure 6-14. The degree of distance/difference from the standard variety is now visible in the form of gradated areas and not in points.

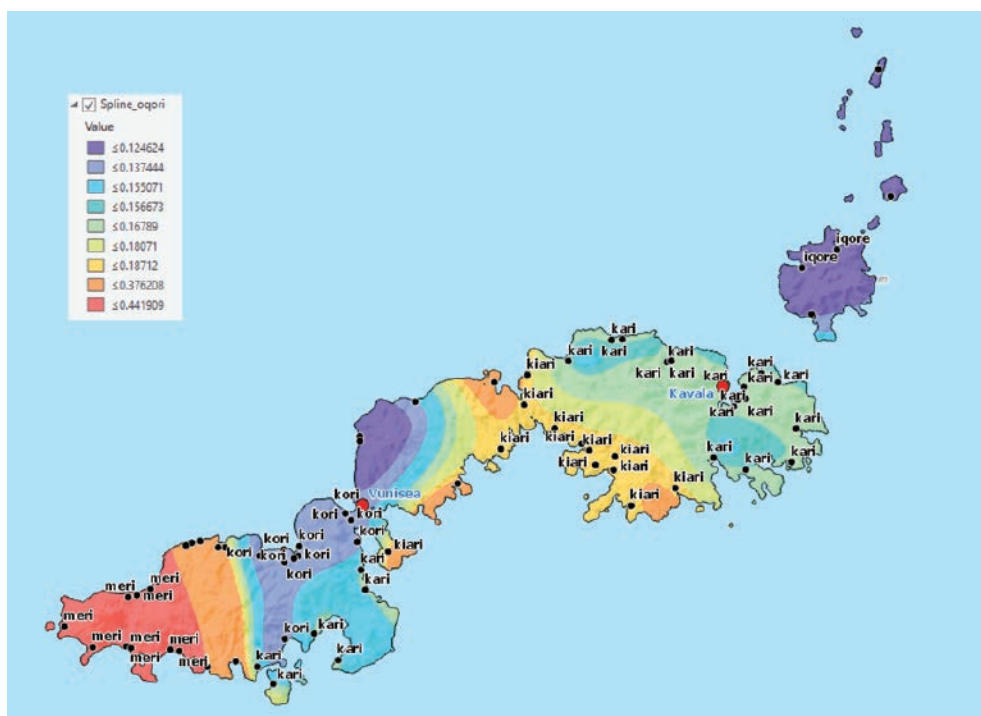


Figure 6-15 Spline spatial interpolation of point values of the forms for “that (near addressee)” shown along with word forms. The lower the colour is located, the bigger the distance. (compilation of this project)

The results shown in Figure 6-14 and Figure 6-15 appears as though they support the hypothesis. However, the pattern differs depending on the forms for which semantic notion one is looking at. In Figure 6-16, it can be seen that the results of the forms for ‘morning’ contradict the hypothesis, while that of the forms in Figure 6-17 for ‘that (distal)’ does not seem to have any pattern in relation to the ports of entry.

When we look at the general distribution of the forms, however, there are some interesting results found in the maps. First, this supports Geraghty’s observation (Figure 6-9, see Figure 2-1 in Chapter 2 in this volume for a bigger map) that Ono Islands (a northward stretch of islands located in the east of Kadavu) are typologically grouped separately from mainland Kadavu, and what is more, the communalects there are far more similar to the standard variety. Second, there is a possibility that by sorting out different patterns that are found in the 100 wordlist, we may be able to identify the developmental paths of forms in conjunction with non-linguistic events. For example, one way to analyze Figures 6-16 and 6-17 is that, the east part of Kadavu is generally similar to the standard variety than the west and there is a variety within the section. In Figure 6-16, it appears that the whole eastern part originally had a similar form as standard Fijian, and subsequently other forms appeared in Kavala (marked with a green arrow) and spread to surrounding areas replacing it. On the other hand, in Figure 6-17, it appears that a new form is emerging in the south of Ono island. This is for the moment no more than speculation, however, by looking at the distribution of other forms, there may be something more solid appearing. In fact, the case study provided later in this Chapter (6.4.), provides one such example.

6.3.3. Assessing the Results of the Pilot Study

This pilot study was conducted on a simple hypothesis for us to capture what can be done applying GIS and how the results could be displayed. Although it was primitive as a trial, there are many clues for our future data processing. I will discuss these taking one of the forms for ‘that,’ the one with no obvious pattern identifiable. In this section, focusing on the result of the analysis of the forms indicating ‘tomorrow,’ I will try to come up with a linguist’s wish list for the GIS project.

Looking at the actual word forms and the distribution, however, questions arise as to data processing.

First is the appropriateness of displaying the results in spline interpretation. When we examine the forms and their distribution, it appears that there are some disjunctions with clear boundaries rather than gradual transition. The boundaries could be drawn for example as in Figure 6-18. The disjunction appears to be indicating the frontline of the replacement of one of the forms by the other. The question here would be, why these forms did not spread beyond these boundaries.

The replacement, if that is in fact what happened, could be hypothesized in various ways based on the information provided on the map. For example, it is possible to speculate that the earlier word for ‘morning’ was *mataka* in eastern Kadavu and *bogibogi* in western Kadavu. The latter, for some reasons, started to replace the former in Kavala indicated by the red arrow in the right and the surrounding areas, thus creating an enclave of the form *bogibogi* in the middle of the *mataka* area. Another possible explanation for the current

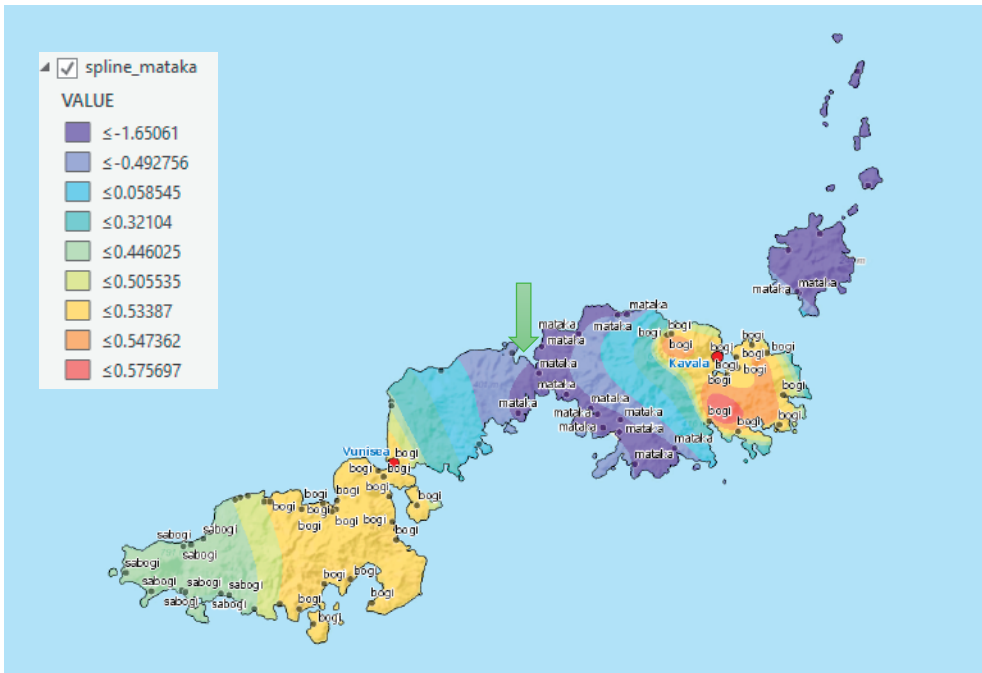


Figure 6-16 Spline spatial interpolation of point values of the forms for ‘morning’ shown along with word forms in Kadavu communalects (compilation of this project)

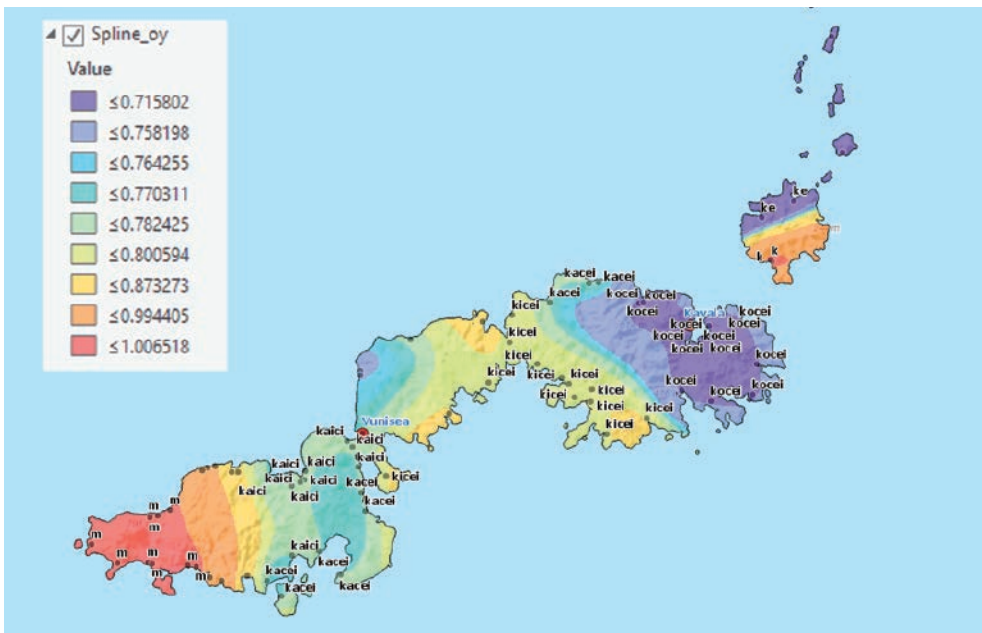


Figure 6-17 Spline spatial interpolation of point values of the forms for ‘that (distal)’ shown along with word forms in Kadavu communalects (compilation of this project)



Figure 6-18 Interpretation of the distribution of the forms for ‘morning’ in Kadavu communalects (compiled by the author)

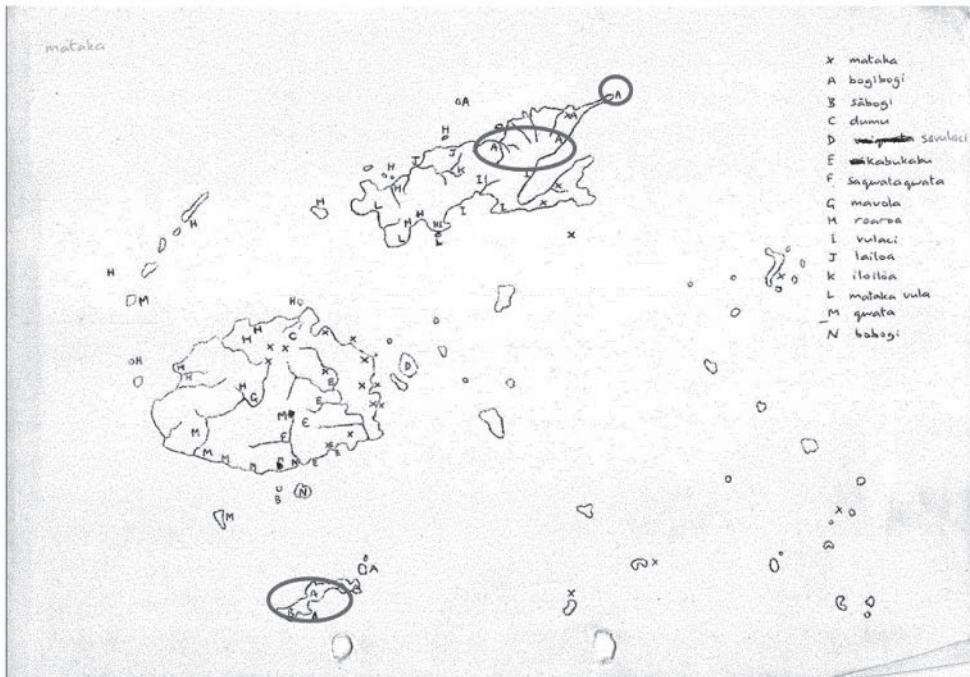


Figure 6-19 Distribution of words for ‘morning’ in Fijian communalects. Circles indicate the area where the form *bogibogi* occurs. (based on a map compiled by Geraghty, modified by the author)

distribution is that, the earlier Kadavu form for morning was *bogibogi*. The form *mataka* was later introduced and spread, not through Kavala nor Vunisea, but probably at the point indicated with an arrow in green in Figure 6-16. What we would like to look at next is whether there are other forms which show a similar distribution and if so, we could examine what the historical event could have been, where such contact and borrowing took place in this area of Kadavu based on what type of forms show such distribution.

Looking at the forms indicating the notion ‘morning’ in Fijian, one thing we would like to know to identify the development of the forms is the etymological source of the two forms. According to Blust and Trussel (n.d.), unfortunately, there is no proto-form reconstructed *bogibogi* nor *mataka*. However, regarding at least *bogibogi*, there are languages in Polynesia where the cognate form is used for the notion ‘morning,’ as in Table 6-2.

Time and space do not allow me to further investigate this case, however, let me mention that i) the form *bogibogi* indicating ‘morning’ is also found in eastern Vanua Levu in Fiji (Figure 6-19); ii) cognates of *bogibogi* are found in various Polynesian languages (which split off after Fijian). The next step thus would be to examine the distribution of cognates of *bogibogi* and *mataka*, then examine the meaning distribution of the two forms. Unfortunately, I could not get enough data to further proceed with the set for ‘morning.’ A case study will be presented in Section 6.3.4 for the forms referring to ‘pandanus mat (general).’

Table 6-2 The occurrence of *bogibogi*-like forms in Polynesian languages

| LANGUAGE | FORM | MEANING |
|----------|----------------------------|---|
| Tongan | <i>poŋi-poŋi</i> | be or become morning; by morning, early in the day; festival of a certain kind held after a wedding or a funeral and on various other occasions |
| Niue | <i>poŋi-poŋi</i> | morning, morrow |
| Samoan | <i>poŋi-poŋi</i> | be dusky, twilight |
| Tuvaluan | <i>poŋi-poŋi</i> | morning (6-8 a.m.) |
| Maori | <i>poŋi-poŋi</i> | dim; dull, stupid |
| Hawaiian | <i>kakahiaka poni-poni</i> | purple morning (before dawn) |

6.4. A Case Study of Linguistics Analyses Based on Distribution of Different Components

In this section, based on the observation provided in 6.3.3, I will propose that to clarify the history of each word, three different components need to be observed. These are i) distribution of different forms referring to the same referent, ii) distribution of each form (and its cognate) regardless of the meanings carried by them, and iii) the distribution of meaning values of the cognate forms. Here breaking down such processes is considered to be the first step toward the future development of a computer assisted tool which can be used for processing multiple data.

In some communalects in Kadavu, the general word referring to pandanus mat is *icōni*. This is different from the standard Fijian form *ibe*.

Figure 6-20 is a map compiled according to the methodology of Linguistic Geography, where varieties of terms referring to the same notion “pandanus mat (general)” are plotted on a map. The next step is to infer the developmental paths of the varieties based on their distribution, however, the information is limited. The standard Fijian form is *ibe*, and it appears in the northeast most part, one may consider that the form *icōni* originated from the west and gradually spread toward the east, however, this is mere speculation.

The distribution of the forms for ‘pandanus mat (general)’ in the whole area of Fiji is shown in Figure 6-21. Of the forms listed on the right-hand side, the form *i conī*, under the symbol “C,” refers to what is described in this chapter as *icōni*, but spelled differently. The symbol “C” is found only in the west of Kadavu, and it appears as though this was a sporadic independent innovation there. Another possible interpretation of this map is that the forms *ō* and *iō* are reduced forms of *icōni*. This hypothesis would have to be assessed based on forms and sound correspondences, but if it in fact is correct, we see that the three related forms occur in the southwest coast of Viti Levu and the western end of Kadavu. These are the areas known for some commonly shared vocabulary and this is not impossible either.

The maps shown so far were all compiled according to the methodology in Linguistic Geography, where varieties of terms referring to the same notion are plotted on a map. Here I will introduce another axis in compiling a new map; that is, to plot varieties of forms that are likely to be cognates regardless of the meaning. Many Fijian languages have multiple words referring to pandanus mat differentiating different kinds of mats. Cognate-like forms



Figure 6-20 Distribution of the forms for ‘pandanus mat (general)’ in Kadavu (compiled by the author)

of *icōni*, such as *ioni* and *iō* are found in a wide area, as shown in Figure 6-22. This gives a completely different picture from what we get based on a map such as Figure 6-21, where the occurrence of the form is limited to Kadavu.

In Figure 6-23, the meaning associated with each form listed in Figure 6-22 is plotted on the map. Green indicates the distribution of the forms for “pandanus mat in general,” while red indicates that the forms meaning “big pandanus mat.” Based on the three sets of information given in the maps shown in Figure 6-21, Figure 6-22 and Figure 6-23, the following can be inferred regarding the development of the word *icōni* in Kadavu. Originally, the *icōni*-like word existed indicating “big mat,” along with the general term *ibe* and others referring to other kinds of mat. In Kadavu and Southwest Viti Levu, this form for “big mat” extended its meaning to become the general term for pandanus mats, eliminating all the other forms referring to pandanus mat in one way or another. In other communalects in Fiji, however, both the earlier form for pandanus mat (general) and the one for “big mat” along with the others were retained to show the current distribution.

Why the word for “big mat” would survive to become a general word for all mats of the kind appear to be puzzling. However, according to Paul Geraghty (pers. comm.), the word *icōni* was/is used in the areas where kinds of pandanus mats are differentiated referring to the “mat which is used to spread over the grass floor of the house.” In traditional house building, dried grass was spread over the foundation of the house to give insulation and cushioning, which was then covered by a pandanus mat. In fact, the word *cō*, which forms



Figure 6-21 Distribution of the forms for ‘pandanus mat (general)’ in Fiji (X: *ibe*, A: *loga*, B: *levulevu*, C: *icōni*, D: *saruta*, E: *yaba*, F: *ō*, G: *iō*, H: *motu*) (compiled by Paul Geraghty)

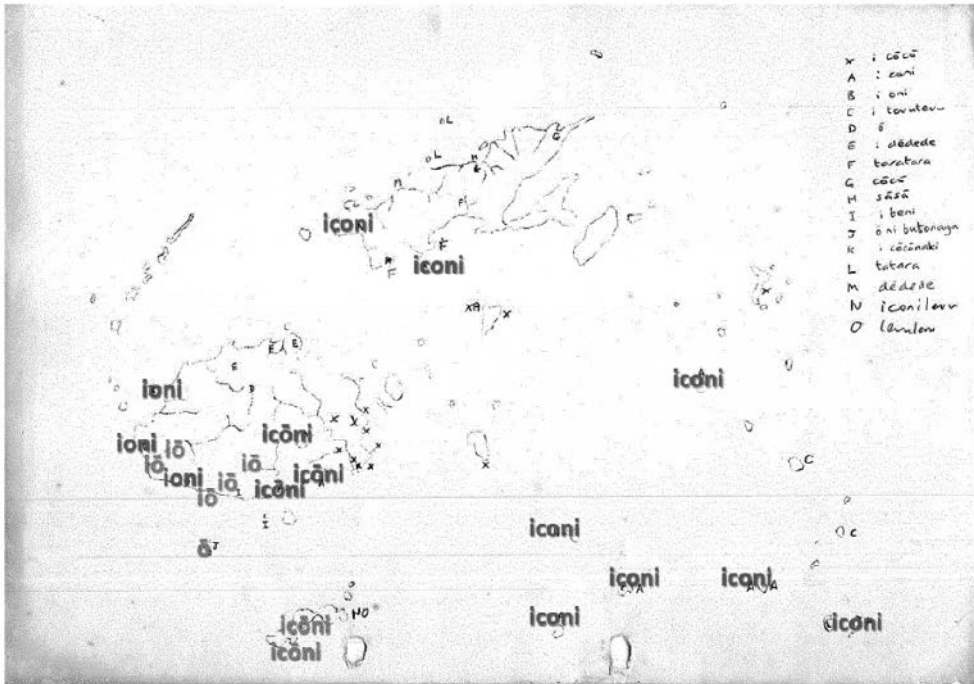


Figure 6-22 Distribution of *icōni* and possibly related forms in Fiji (compiled by the author, based on maps by Paul Geraghty)

part of the word *icōni*, indicates “grass” in many Fijian communalects, including those in Kadavu. This information supports the conclusion reached above by looking at the distribution of the three components, for first, the pandanus map spread over the house floor was one of the biggest of the kind, and second, the pandanus mat is an essential material for house building and therefore this word, referring to the main kind of all, was retained to extend its meaning, rather than any other word.

To sum up the above observation, a GIS system where maps with the following information can be easily switched among one another would make a good tool for historical linguistics analyses.

- (1) System for Manual Historical Linguistics Analyses for Linguists
 - 1) The distribution of the forms referring to the same referent (cf. Figure 6-20).
Helps to identify horizontal development. In the above example, the distribution of the ‘general word for pandanus mat’ in both Kadavu and whole Fiji was first observed.
 - 2) The distribution of the cognates of the (key) form (cf. Figure 6-22).
Helps to identify vertical development and if any part may be horizontally oriented.
 - 3) Semantic value of the cognates in 2) (cf. Figure 6-23).
Helps to identify horizontal development of the semantic value.

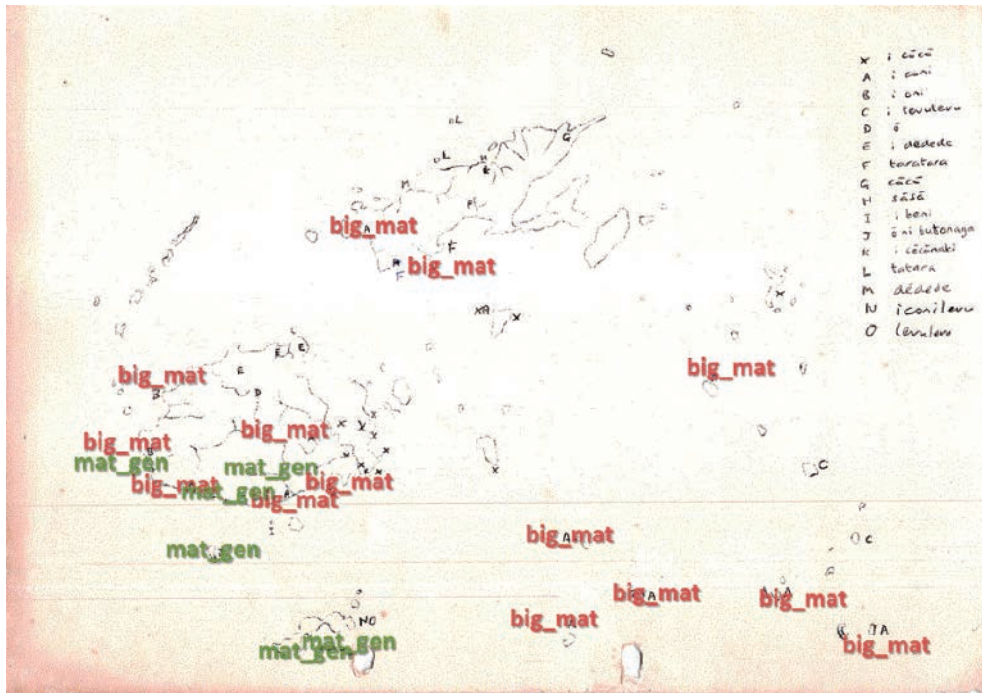


Figure 6-23 Distribution of the meaning of *icōni* and possibly related forms in Fiji (modified by the author, based on maps, compiled by Paul Geraghty)

6.5. Concluding Remarks

In this chapter, I have tried to show that it is necessary to combine the Comparative Method of historical linguistics and Geographic Linguistics. These correspond to vertical transmission and horizontal transmission, both of which are necessary in order to clarify the developmental paths of languages. In particular, I have pointed out that in the former, it is the forms that are used as an axis for comparison and reconstruction, while in the latter, it is the meaning of forms that is used as an axis for the analysis. These different axes are obvious when one is told, however, no one in the past has developed a GIS system that includes them. I have shown in this chapter how this difference plays a role in the clarification of the developmental paths, taking the word for ‘pandanus mat (general)’ as an example.

For further research, a system needs to be developed so that the vertical development is reflected on maps of the GIS system. For this, more thinking is necessary, however, maps where the sound correspondences are made visible and a system is introduced where the distribution of reflex forms could be switched and compared with the distribution of sound correspondences would help.

The method and tools proposed in this chapter may sound rather clumsy and archaic in the era of computer linguistics. It assumes manual operation and analyses by the eyes of a linguist. However, it should be noted that the above observation breaks down what a

linguist does to analyze historical development of words and languages step-by-step. Such an observation, I believe, will eventually lead us to create systems that can be automatized and applies the same method to mass data on the computer to open up new results in historical linguistics.

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