The Lexical Semantics of Athapaskan Anatomical Terms: A Historical-Comparative Study

by

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ABSTRACT

This dissertation synthesizes theoretical developments in linguistics and anthropology in order to tackle questions in lexical semantics and Athapaskan historical linguistics. This dissertation aims at contributing both to theoretical development of diachronic lexical semantics and to provide solid evidence for the classificatory arrangement of Athapaskan languages. In the case of the former, theoretical work carried out within the school of thought calling itself cognitive linguistics is brought together with an epidemiological approach to mental representations in order to construct a theoretical framework in which semantics can be viewed as a source of information for tracing the historical evolution of languages. The data that are brought to bear on these questions are gathered through the application of the lexicological method known as *onomasiology*. The method allows for the comparison of a large sample of Athapaskan languages by investigating what semantic, morphological, and phonological means are employed by each language to encode a pre-determined set of onomasiological concepts. The study proceeds by comparing Athapaskan languages on the basis of sets of terms expressing anatomical concepts. These comparisons allow for the construction of etymologies, for the delineation of semantic structures termed lexicalization patterns, and for the characterization of individual languages as aggregates of semantic and phonological data. These aggregate data were evaluated with techniques drawn from dialectometry in order to classify Athapaskan languages. The results of the research offer add to the growing body of knowledge on typologies of semantic change and present a dialectometric perspective on grouping among Athapaskan languages.

DEDICATION

This is dedicated to my family:

Dorothee, Michael, Michelle, Marlow, and Kian

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1. Theoretical framework and background

1.1 Introduction

> …The bad giant fell backwards into the sea in such a manner that his feet lay in the West and its head rested in our country. His head reached the area around Cold Lake, and it is for this reason the Dènè of these parts call themselves Thi-lan-ottiné, "the people of the end of the head." The giant's body became a huge mountain, stretched out as it was, and, in time, it became the natural route of migration for the caribou. (*The Legend of Otchôpè, the Arctic Giant*, quote from Hoffman-Mercredi and Coutu 2002)

The body of the mythical giant Otchôpè demarcates the traditional lands of the Athapaskan-speaking peoples in the North American subarctic. This is the region where, according to the best current scientific and mythological understanding, Athapaskan-speaking people first formed an ethno-linguistic entity, and from where they spread out to settle across a vast area covering the western half of what is now known as the United States and Canada. The anatomical understanding of ethno-geography suggested by this myth is echoed in this study which proceeds by viewing Athapaskan linguistic relationships through the lense of anatomical nomenclature.

The Athapaskan languages form the most geographically dispersed of the North American Indigenous language families, with both the greatest number of languages and the greatest number of speakers (Mithun 1999: 345). Athapaskan languages are part of the larger phylum Na-Dene (more accurately, Athapaskan-Eyak-Tlingit) and the hypothesized macro-family Dene-Yeniseian. While evidence substantiating the existence of this macro-family is still accumulating, the existence and constituency of the Athapaskan family itself is not in dispute. However, internal relationships among member languages have proved difficult to delineate, with Athapaskan, on the whole, resisting being classified into a phylogenetic tree. For the most part, Athapaskan languages have been loosely grouped based on their geographic distributions. Partial sub-groupings have associated small sets of languages in northern California and interior Canada, but a more fine-grained understanding of sub-grouping of Athapaskan languages has eluded researchers to date. Attempts at classification have encountered difficulties for many reasons, not least of which has been a paucity of data.

The problem of sub-grouping Athapaskan languages is one of the central concerns of this study. However, this work diverges from earlier attempts at the internal classification of Athapaskan languages by exploring the possibilities for classification posed by semantic structure. Such a move contrasts with previous attempts at classification, which have relied on sound correspondences and morphological features (Sapir 1915; Hoijer 1963), as well as with almost all later work in Athapaskan historical linguistics (Krauss 1964, 1965, 1976; Krauss and Leer 1981; Story 1984), which has exhibited a preponderance for phonological research on the basis of the comparative method. While phonology remains important, the patterns of sound change, which have been identified so far, have failed to produce a satisfactory classification of the Athapaskan languages. As detailed below, this failure has led to an attitude of resignation toward questions of phylogeny in Athapaskan and favored the adoption of a grouping-scheme for Athapaskan languages that is based largely on geography. The examination of semantic structures in order to uncover their potential for revealing details of Athapaskan linguistic history is an avenue of research that has mostly been neglected. This study approaches the problem from this unexplored terrain. Far from ignoring phonological data, however, the methodology developed here offers additional perspectives on the classification of Athapaskan languages by integrating phonological and semantic data.

The description of the phonology of Athapaskan languages is well established and transcription can rely on previous work. The treatment of phonology pursued here differs radically from previous research, however. Instead of seeking out individual sound correspondences, the *aggregate* phonological resemblance between Athapaskan languages is examined. This reveals an overall phonological characterization of the languages that can overcome the difficulties posed by cross-cutting sound correspondences. The motivations for taking this approach, drawing heavily on dialectometry, are outlined below in Section 1.4. The implementation of this method is described in Chapter 4. The description of semantic structure, in contrast, is a matter of greater contention within linguistics. What exactly is intended by the term semantic structure in this study, and the means of describing it, require some theoretical elaboration, which is detailed in Chapter 2. The semantic structures occurring in Athapaskan anatomical terminologies, a major concern of this study, are described at length in Chapter 3. These semantic patterns are referred to as characters states following the practice in biological taxonomy (Sneath and Sokal 1973: xii). The shared taxonomic characters here are the bodily referents which the various Athapaskan languages encoded through different semantic structures. These individual semantic structures are treated as states of the same character on the basis of which the taxonomic units, in this case languages, can be measured and compared.

The conclusions reached through this study have implications for those disciplines beyond linguistics that are interested in the prehistory of Athapaskan-speaking peoples, especially archaeology and ethno-history. This dissertation is conceived in a broad inter-disciplinary framework that aims both to open new perspectives on an old and difficult problem in the historical linguistics of Athapaskan languages and to be accessible to researchers from related disciplines. This chapter outlines this framework and provides the historical background to the research question pursued in this study.

1.2 Theoretical framework

> Each point of the present has evolved. What it had been and how it came to be belongs to the past, but the past is still ideationally in it. But only ideationally. Extinct traits and latent characteristics are as if not there at all, if they remain unknown. The searching gaze, the gaze of research is able to resuscitate them, awaken them to new life and throw light into the darkness of the past.[1]
>
> (Droysen 1882: 8)

Languages evolve through time; their structure and content always changing, but almost imperceptibly. Perhaps some speaker's utterance diverges from previous convention or some new purpose drives innovation with the result that new generations learn variations of the languages spoken by their elders. As communication systems distributed over populations of speakers, languages change, and when they do, traces of their previous states-of-being may remain as echoes of the past. These traces are revealed through the application of rigorous methodology. Approaching language with the intent of revealing the linguistic past is the domain of the specialist discipline called historical linguistics. But traces of the linguistic past of a language or family of languages can reveal unique perspectives on the history of its speaker, populations and, as a consequence, historical linguistics stands at the confluence of different fields of inquiry providing information on the past from a source wholly independent of archaeological, genetic, and ethno-historical data. And yet, the wider goal of tracing a people's history and prehistory can be profitably pursued only through the integration of these different disciplines in the hope that the gaps left by the perspectives of one discipline can be filled by the insights provided by another. Historical linguistics can illuminate the particular aspect of the past that regards the relationships among a set of related languages. These relationships have been studied in a sub-field of historical linguistics known as linguistic classification. Linguistic classifications, as the products of historical linguistic inquiry, are among the most useful contributions to the inter-disciplinary research goal of uncovering the prehistoric past. This dissertation

[1] "Jeder Punkt in dieser Gegenwart ist ein gewordener. Was er war und wie er wurde, ist vergangen; aber seine Vergangeheit ist ideel in ihm. Aber nur ideell, erloschene Züge, latente Scheine ungewusst sind sie als wären sie nicht da. Der Forschende Blick, der Blick der Forschung vermag sie zu erwecken, wieder aufleben, in das leere Dunkel der Vergangenheit zurückleuchten zu lassen". [Translation mine.]

approaches the historical linguistic problem of establishing language relationships in a family of languages known as Athapaskan.

The research approach taken in here synthetizes theoretical developments in linguistics and anthropology in order to tackle difficult questions in semantics and historical linguistics. This dissertation aims at contributing both to theoretical development of diachronic lexical semantics and to provide solid evidence for the classificatory arrangement of Athapaskan languages. In the case of the former, theoretical work carried out within the school of thought calling itself cognitive linguistics is brought together with ideas developed by the anthropologist Dan Sperber in order to construct a theoretical framework in which semantics can be viewed as a source of information for tracing the historical evolution of languages. This is achieved primarily by re-thinking the old lexicological method known as *onomasiology* (see below) in the light of the understanding of semantics advocated by cognitive linguistics. For the latter, this study proposes a set of historical relationships among Athapaskan languages with the aim of contributing to the inter-disciplinary study of Athapaskan migrations. The term *historical relationship* is used here in order to indicate that the results should not be uncritically equated with phylogenetic relationships. For reasons discussed more fully below, the Athapaskan languages do not easily lend themselves to phylogenetic classification in the same manner as other language families, such as Indo-European. The approach taken emerges from the conclusions reached by prior Athapaskanist scholarships, which advocated treatment of Athapaskan languages as complexes of dialects, motivating the use of dialectometric methods. The overarching goals of this work are therefore two-fold: to show that semantic data can provide valuable insights that can complement the more traditional historical linguistic work based on phonology alone, and to provide a structured representation of historical relationships among Athapaskan languages that can provide insights on the historical migrations of Athapaskan-speaking peoples.

Linguistic classifications are helpful in the study of migrations because, along with information about the contemporary geographic locations of language communities, they allow for the formulation and exploration of hypotheses about migratory routes, migratory streams, or areas of sustained contact. However, in the ultimate pursuit of questions of migratory history, insights stemming from ethnography, ethno-history, and physical anthropology must be considered along with the primary archaeological research, and the kind of data that historical linguistics can provide. This has long been recognized within archaeological research (see, for example, Ives 1990, Anthony 2007). The idea that the study of lexical semantics itself is deeply intertwined with the concerns of anthropological research, however, is much less well supported, and scant mention of this is to be found in introductory textbooks to the field (for example Riemer 2010, Saeed 2003). An emerging view within linguistics, holds that semantic structures, just like many other cultural phenomena, can be treated as mental representations which, furthermore, are differentially distributed across populations. Thinking in this vein has a deep history in dialectological research which has long traded in such phrases as “every word has its own history”, but treatment of semantic structures as differentially distributed items is still rare (Enfield 2003 is one exception). In this view, the details specific to individual cases take on a theoretical importance which they do not have in more generalizing frameworks like Neo-Grammarian historical linguistics with its emphasis on systemic properties and widespread patterns of change. This is not to invalidate this venerable tradition, but rather to raise the importance of a complementary view which makes weaker axiomatic assumptions: namely that speakers are the hosts of a wide spectrum of linguistic mental representations which, from a certain point of view are perceived as coherent systems (Enfield 2014: 50), but which may, in fact, reveal a substantial degree of heterogeneity. This view is particularly appropriate to the historically oriented study of Athapaskan languages, which have emerged from a cultural situation that is markedly distinct from the situation of Indo-European and Finno-Ugric languages, on the basis of which Neo-Grammarian models of historical linguistics were initially formulated.

The main methodological ideas of this study have been developed against the background of the failures of the Neo-Grammarian Comparative Method to provide a phylogenetic tree of Athapaskan languages — one of the most valuable products that linguistics as a science can contribute to the study of migratory prehistory. The particular difficulty of extracting phylogenetic structures from Athapaskan historical phonology is discussed in detail in Chapter 2, along with the proposed alternative approaches pursued in this study. It may be noted at this point, however, that the failures of the Comparative Method in producing an Athapaskan phylogenetic tree are failures of a method applied to a particular, perhaps unforeseen, linguistic context. More precisely, conceding the failure of the Neo-Grammarian Comparative Method has perhaps occurred too rashly, before the complex intricacies of Athapaskan historical relations where recognized in their full extent. That is to say, the research behind this study is not conceived as working around the ultimate application of the Comparative Method, as a substitute for this method. Rather, the study aims to prepare a complementary analysis based on semantics and distance measurements based on aggregate phonological structure to be used in a more informed re-application of the Comparative Method under the fuller understanding of possible patterns of dialect borrowing, of the semantic shift of individual words, and of the proper intermediate levels for the reconstruction of proto-languages. Measures of aggregate phonology use averages over distances between strings of phonemes to identify linguistics groups and areas of linguistic interaction. This method arises out of dialectometry and was originally proposed to account for dialect proximity and distance. The method is described in Chapter 2 and applied in Chapter 4. Deeper considerations of semantic structures do not have a clear predecessor. The methodology employed in this analysis of semantic structures is described in Chapter 2, but the general framework in which the importance of semantic structures for the study of historical relationships among languages receives due attention needs some prior elaboration. This framework also proposes a theoretical bridge between anthropology and linguistics (Sperber 1996, Enfield 2014) and therefore is well suited to inter-disciplinary research.

A framework acts as a research space in which particular questions can be asked and which leads to the emergence of certain questions and perspectives. Underlying this study is an understanding of language as a system of units that are only loosely held together by the grammars of the systems in which they occur. From this perspective on language, questions between the relationships of individual items to the languages to which they belong can be meaningfully posed. The empirical study of these questions must begin from the individual items themselves and Enfield rightly exhorts the researcher to seek out the item — the "piece and its functional relation to a context" (Enfield 2014: 67) — rather than the system. The primacy of individual structures rather than systemic properties contrasts with the more traditional Neo-Grammarian approach, which places the greatest emphasis on the recurring, systemic differences between languages or between historical stages of a single language. Instead, the methods applied here take the perspective that "each linguistic convention in a community has its own individual history" (ibid.). This does not mean, however, that there should be no search for the systemic properties of lexical systems, but rather that these should be expected to arise from the low-level, immediate, functional contexts in which individual items are encountered. In this view lexical systems are local arrays of functionally related items, such as, for example, the terms for 'upper leg' and 'lower leg' (see Sections 3.4.8-3.4.9). These items are related insofar as each of them is embedded in a partonymic structure of the 'leg', in which they denote adjacent regions. The relationships among these items become evident when a shift in the denotation of the terms for one part leads to changes in the other terms. However, none of the observations of the 'leg' terms provide valid grounds for assuming a systematicity at higher levels, i.e. they cannot answer the question of whether the 'hip' is considered part of this lexical system or not without the support of further evidence. Taking this bottom-up view of linguistic structure has the important theoretical and methodological consequences that systemic properties are inferred on the basis of the behavior of individual items and not vice versa; systemic properties, if there are any, will emerge from the analysis. Thus, intuitively, there appear to be differences between terms denoting solid body parts, like legs, and bodily fluids such as blood. It even appears reasonable to posit a three-way distinction within the anatomical domain. Snoek (2013) proposed the existence of body part, ephemera, and effluvia terms. However, the membership of individual terms in these sub-domains represents a systemic property which is hypothesized to order this lexical field in Athapaskan languages. The adequacy of this hypothesis is tested statistically on the basis of semantic and morphological criteria in Chapter 4.

Concentrating on individual items and their distributions among populations of speakers (and populations of languages) can be viewed as part of the anthropological project of an *epidemiology of representations* formulated by Dan Sperber (1985). Sperber's ideas have been applied to the investigation of semantic patterns in Southeast Asia (Enfield 2003, Enfield 2008). They become important in this study of Athapaskan languages since they provide a framework within which analyses of lexical semantics can be brought to bear on anthropological research interested in the distribution of cultural units — i.e. representations — among groups of speakers. From the perspective of an epidemiology of representations, individual semantic structures are seen as travelling between speakers and speaker groups, from semantic system to semantic system. Sperber develops an approach to studying culture in terms of a metaphorical model drawn from the medical field: epidemiology. He sees the usefulness of adopting this mode of thought because of similarities both between cultural representations and diseases, and the method of studying the spread of disease in human populations:

> Epidemiology is not an independent science studying an autonomous level of reality. Epidemiology studies the distribution of diseases; diseases are characterized by pathology. The distribution of diseases cannot be explained without taking into account the manner in which they affect the organism, that is, without looking at individual pathology and, more generally, at individual psychology. (Sperber 1985: 76)

For Sperber, representations populate the minds of speakers in metaphor reminiscent of medical metaphors in descriptions of viruses and bacteria. Like these organic entities, mental representations can travel from speaker-to-speaker in processes of transmission. This is where the metaphor ends, however, since the aspects of harm identified with pathogens do not transfer to linguistic items. Instead, the epidemiology concerns the manner in which mental representations are distributed and which aspects of the speakers and of the representations cause the distributions we can observe. Sperber combines an interest in cognitive representations and population-level phenomena. It is here that cognitive linguistics, with its detailed attention to the lexical semantics of individual items, and the more anthropological concern with larger cultural patterns, can be fruitfully brought together. Mental representations are traded within and between speaker communities, and they evolve with them. This approach pays full dues to the observation that representations are unevenly distributed over populations, a fact reflected in the level of variation to be found among members of individual cultures. Edward Sapir noted this fact long ago, writing that:

> Every individual is, then, in a very real sense, a representative of at least one sub-culture which may be abstracted from the generalized culture of the group of which he is a member.
> (Sapir 1949: 515)

What anthropologists have identified as culture can therefore be thought of as sets of shared representations, or rather, as densities of shared patterns. Sperber's view is that "cultural phenomena are ecological patterns of psychological phenomena” (Sperber 1985: 76). Individuals have representations in their minds, some of their representations may be limited to the individual in question, but many are, in fact, shared by other individuals in shared socio-cultural environments. The level at which these representations are shared might also differ from culture-to-culture, as some cultures more rigidly enforce conformism to particular sets of values, or conversely exhibit an ethos which promotes individualism over conformity. The representations themselves might have properties that render them more or less likely to be widely distributed. Of particular interest here is that cultural representations need to spread by necessity from individual-to-individual. This makes their distributions interesting for the reconstruction of historical relationships among speakers groups. In linguistic terms, certain representations are learned from the parent in situations of vertical transmission that preserve the linguistic systems of the parent, with changes occurring to natural drift and which are presumably accounted for in a regular and predictable manner. Representations can also be transferred horizontally in cases of dialect borrowing or dialect admixture. It must also be considered that several competing representations exist even with the same close-knit speaker community. For the classification of languages, it is of course particularly important to be able to distinguish which mental representations encountered in a particular language may have arisen due to vertical transfer (or inheritance) from an ancestral language and which are due to horizontal transfer (e.g. borrowing, calquing). A further complication for the analysis of mental representations as classificatory character states is the possibility that the particular form of two mental representations has developed a similarity not through shared ancestry, or borrowing, but through independent innovation. These difficult questions are treated further in Chapter 2 in the discussion of patterns of semantic structure as taxonomic features use din classification.

Returning to the wider framework, it may well be asked what is cultural about representations of the human body and its by-products? It can certainly be said that this lexical domain represents a sort of lower threshold as far as the influence of culture is concerned. This is especially so since the human body is a universal domain within all human society. However, while the human body and its by-products are universal, the manner in which they are talked about is not and the means of talking about them, the anatomical nomenclature, are distinct from language-to-language. These mental representations are minimally affected by other cultural changes speaker groups may undergo in their migratory movements. Yet, anatomical nomenclatures differ and diverge over time. Their manner of divergence must therefore reveal something about the processes of language evolution that affects some all forms, independent of changes caused by adaptations to different environments, or technological developments. Of course this is a simplification, since certain cultural development (modern medical science, ceremonial butchery practices, religious taboo) might indeed cause changes in the anatomical vocabulary. But, by and large, it is possible to say that Athapaskan anatomical nomenclatures have been less affected by their migrations, than have the terms for flora and fauna and other terms more closely tied to means of subsistence and the surrounding environment. Thus, the analysis of regularities in the structure and evolution of mental representations of anatomical terms cannot rely on external factors such as environment or culture and must instead look inward. Sperber notes:

> …formal properties of representations (or at least some of them) can be considered as potential psychological properties. Potential psychological properties are relevant to an epidemiology of representations. (Sperber 1985: 78)

The manner in which anatomy is represented linguistically is tied to the manner in which the speakers think about the human body. An effort must, therefore, be made in outlining the models of the human body that can be assumed to populate the minds of the speakers of Athapaskan languages, since this will illuminate the mental representations pertinent to languages — the linguistic signs themselves. Linguistic signs are prime cases for the kinds of entities an epidemiology of representations is designed to deal with.

The objects of epidemiological analysis here are the semantic structures of anatomical terms in Athapaskan languages. As mental representations with individual distributions, these items can be thought of epidemiologically as entities passing from one language system to another, as evolving in parallel in related systems, or as emerging independently. This individualistic perspective is complemented by studies of the aggregate distributions of these individual representations both in terms of their phonological and their semantic structures leading to a more generalized view of the relationships among Athapaskan languages. These are, in turn, important data for the inter-disciplinary research into Athapaskan prehistory, especially in regard to the population movements that speakers of Athapaskan languages appear to have undertaken. The wider historical context for the present study is described in the next section.

1.3 Athapaskan languages and migration

The Athapaskan languages are spoken in three discontinuous geographical regions across the western half of North America. The largest of these is the domain of the sub-set of Athapaskan languages traditionally referred to as Northern Athapaskan (Krauss and Golla 1981). This region encompasses interior and southern Alaska, the Yukon and Northwest Territories, as well as parts of British Columbia and Alberta. This area was predominantly settled by Athapaskan-speaking groups, but the topography of this vast area makes it likely that not all the groups living there were in constant and equal contact with each other, and consequently the region must certainly contain important linguistic sub-groupings.

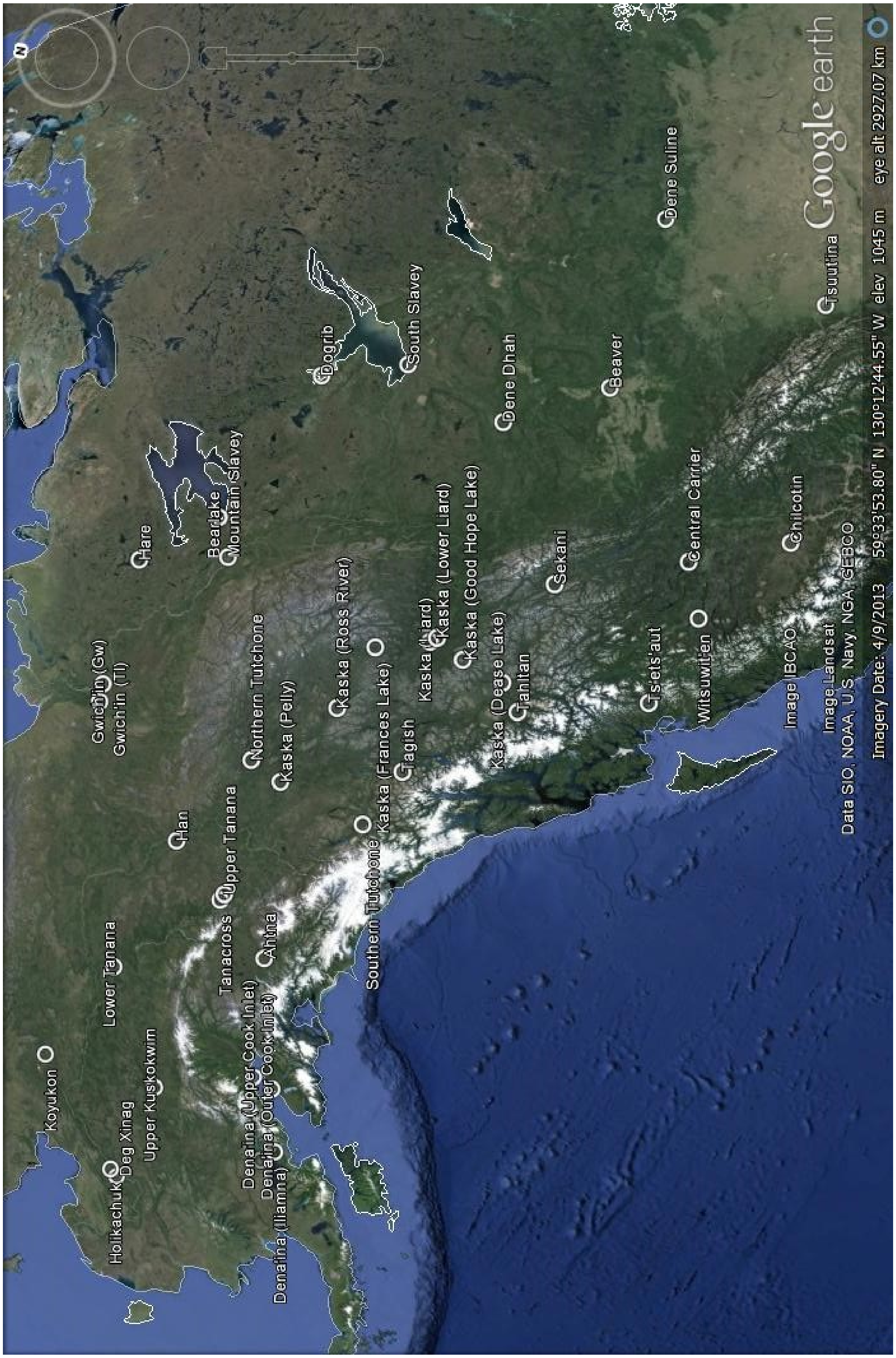


Figure 1. Map of Athapaskan-speaking communities in Alaska and Canada included in the study

Figure 2. Map of Athapaskan-speaking communities in Oregon, California and the American Southwest included in the study

The Athapaskan speaking communities whose languages are included in this study are indicated by circles on the maps of Figures 1 and 2. Figure 1 shows the northern extent of the Athapaskan world, where the environment can generally be described as ranging from taiga to tundra, which allows for a number of different types of subsistence economies. At the southern extent of the Northern Athapaskan area, the Tsuut'ina participated in Plains cultures and modes of production, while at the eastern edge, Dene Sųłiné and Tłįchǫ hunted herds of migrating caribou (Ives 1990: 353). The groups on the interior of this region can be further divided into Arctic and Pacific drainage cultures (Osgood 1936). Greater abundance of resources as well as cultural contact were the likely factors in producing a greater degree of cultural complexity among the Pacific drainage cultures, than among the Arctic drainage cultures (Ives 1990: 14-15). These distinctions have played some role in the classifications of Athapaskan languages along geographic and cultural lines (see Section 1.3.2), and some of these distinctions have been used here to guide the arrangements of languages in the tables of Chapter 3. Northern Athapaskan languages have been grouped under the following regions: Alaska, Yukon, Interior Canada, and British Columbia. These groupings are made only to facilitate the reading of the data in the tables. Categories of regional association are meaningful only to the extent that they emerge from the analyses in Chapter 4. This holds true as well for the languages mapped in Figure 2: the Pacific Coast languages (abbreviated as PCA) once spoken in present-day Washington, Oregon, and California; and the Apachean languages now predominantly restricted to parts of Arizona and New Mexico. These three geographic areas provide coarse-grained reference points for the discussion of Athapaskan languages throughout, but they are not thought of as reflecting linguistic classification, even though there is some linguistic evidence from previous studies indicating close association within these three groups.

The presence of Athapaskan languages in Alaska, Canada, the Pacific Coast, and the American Southwest has long raised question of migratory history. The earliest scholarly indications of connections among northern and southern groups speaking Athapaskan languages date back as far as the work of Horatio Hale and William W. Turner in the mid-19th century, but firmer evidence does not emerge until the study of Navajo myths carried out by Franz Boas just before the turn of the century (Ives 1990: 11-12). In 1915, Boas' student Edward Sapir proposed that Athapaskan languages form part of the phylum Na-Dene (as discussed in Section 1.4). Sapir placed the point of ethnogenisis for Athapaskan-speaking peoples in the north on the basis of criteria of linguistic differentiation:

> Thus, I do not see that the divergence between, say, Carrier and Loucheux[2] is less profound that that which obtains between, say, Chipewyan[3] and Navaho. This being so, it would seem that the historical center of gravity lies rather in the north than in either of the other

[2] An antiquated exonym for Gwich'in-speaking peoples.
[3] A variant name for Dene Sųłiné-speaking peoples.

> two regions and that the occupation of these latter was due to a southward movement of Athabaskan-speaking tribes. (Sapir 1916: 81)

Unfortunately, Sapir does not offer evidence for his conclusions that Carrier and Gwich'in are equally distant from each other than are Dene Sųłiné and Navajo. These conclusions, it may be surmised, are the result of considering various morphological and phonological criteria, but it remains far from clear which exact criteria these may have been. This is not to say that Sapir might not be correct; in fact, most evidence would indicate that he is, and his conclusions are now widely accepted in Athapaskanist circles. But it is worth noting that the strength of the evidence on which Sapir based his conclusions cannot be independently assessed, and while his conclusions are well received in the scholarly community they are, strictly speaking, purely subjective. It is only through the operationalization of variables in publicly available datasets that conclusions such as Sapir's can properly attain scientific rigor. One such means of operationalization and hypothesis testing is carried out in Chapter 4.

There is, however, evidence pointing to a northern origin for Athapaskan-speaking peoples coming from other quarters. Boas thought that Navajo myths contained many elements that were northern in origin (1897: 371), while Sapir provided some internal linguistic evidence (Sapir 1936). More recently, Carmichael and Farrer (2012: 187) recorded origin tales from the knowledgeable Mescalero Apache Elder Bernard Second which indicate that "The Mescalero were made in the Land of Ever Winter, near a lake you cannot see across (*Tuduubitsˀątlidaa,* Water cannot see over) - Great Slave Lake or Lake Athabasca…". This same Elder also retained knowledge of place names for geographic sites far in the north, but in the Mescalero Apache Language (Carmichael and Farrer 2012). Bernard Second reports that his own interactions with Tłı̨chǫ and Slave speakers showed that the mutual ease at understanding each other's languages further indicated a close historical relationship between the Mescalero Apache and the Athapaskan-speaking groups of the Mackenzie drainage. These anecdotes are cited here as an example of the kind of evidence that can and should be marshaled in support of the northern-origins hypothesis of Athapaskan-speaking peoples, but in no way represents an adequate review of the relevant literature. These examples, however, suffice to show that there is good evidence for the hypothesis of a northern Athapaskan point of origin and subsequent migrations to the south. Even if this idea is accepted beyond question in the scholarly research community, it should be taken as a well-supported hypothesis and a source for the construction of testable questions. Even if, as it will also be assumed in the subsequent discussion here, the hypothesis is correct, this does not immediately indicate *where* in the vast northern territories occupied or once occupied by Athapaskan speakers such a point of origin may have lain. What is clear, however, is that Athapaskan peoples migrated, and migrated far.

David W. Anthony has convincingly argued that the types of factors that motivate contemporary migrants could equally have influenced people's decision to migrate in prehistoric times (Anthony 1990). This means that negative *push* factors that drive people away from certain areas as well as positive *pull* factors that make other areas attractive should be important points of consideration in the study of prehistoric migrations. Anthony's complex and enlightening diagram (Anthony 1990: 901) is reproduced in Figure 3, since it provides a helpful background against which the discussion of the results of the linguistic analyses for the study of Athapaskan migratory history presented in Chapter 5 can be assessed.

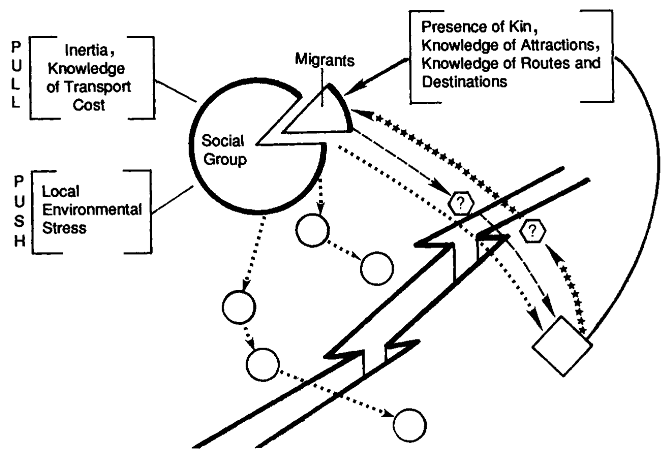


Figure 3. Diagram of the migration process (Anthony 1990: 900)

The diagram conceptualizes the migration process as involving obstacles (geographic terrain, inertia, fear, etc.) to be overcome and summarizes the multiple motivations that underlie the decisions to migrate. At the point of origin, populations may encounter situations, which make a continued residence in a place or area difficult. These could range from the incursion of enemies into the territory to natural phenomena that change the subsistence conditions to such a degree that the present lifestyle can no longer be maintained. These situations are considered push factors. On the other hand, a location removed from the one of current residence may provide attractions tempting people to migrate: the subsistence conditions in the removed location may be better, or less harsh, there may already be relatives living in those locations, or it may provide opportunities that cannot be pursued in the current location. Anthony (1990) emphasizes that there are more conditions to be taken into considerations in migratory processes: the migratory movement could be a gradual expansion in which all the intermediate ground is occupied, as is perhaps most common in a prototypical or folk understanding of migration. But other possibilities also exist. Migratory movements might proceed in streams toward specific locations, that once established, could further the movements of subsequent peoples. The connections between old points of origin and new communities may subsist even after migratory movements have occurred and could be sustained for quite some time, or it the stream could be broken. In fact, different motivations and processes could occur at different temporal and locational points in the migration. In short, migratory movements are complex, temporally extended events, and simplifying perspectives, if not treated with sufficient care and rigor are likely to obscure as much as they reveal.

When considering the Athapaskan case, there is good evidence for push *and* pull factors, in several directions. Pull factors most certainly included subsistence forms. Ives makes a case for the lure of the bison-hunting lifestyle of the Great Plains as a major pull factor that influenced many Aboriginal groups (Ives 1990: 352). The more abundant fishing grounds and rich ceremonial cultures of the Canadian Northwest Coast also provided attractive migratory goals (ibid). Among the push factors however, two cataclysmic events, in particular, stand out. The distributions of certain types of deposits across a large area of Alaska and Northwestern Canada indicate the occurrence of two prehistoric volcanic explosions. The deposits are known as the White River Ash Falls. These are a "bi-lobate formation of volcanic ejecta" (Ives 1990: 42), which means that they are evidence of two separate volcanic eruptions. These eruptions can be dated as having occurred at 100 C.E. (1900 B.P.) and 750 C.E. (1250 B.P.) and are described as "Plinian" (Lerbekmo 2008: 693). The term "Plinian", used for "an exceptionally violent continuous gas blast eruption which ejects pumice copiously" (Walker and Croasdale 1971: 50) is wholly appropriate since White River Ash deposits from the second eruption, the east lobe, have been found as far away as Greenland (Jensen et al. 2014: 875). Figure 4 shows the dispersion of ash for the north lobe (1900 B.P.) and east lobe (1250 B.P.).

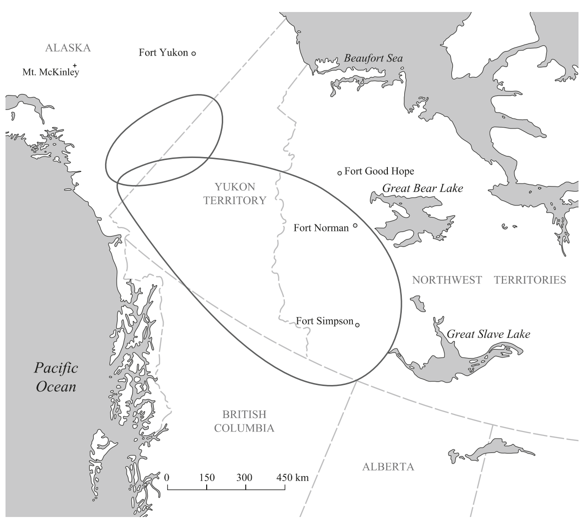


Figure 4. Location map of bi-lobate White River Ash (Lerbekmo 2008: 693)

The thickness of the ash deposits, as well as the wide dispersal, suggest catastrophic consequences for the people living in the affected areas. Besides the toxic ash and gases in themselves being dangerous to humans, the whole ecosystem would have been drastically affected in the short term (Ives 1990: 42). The regions affected are precisely those, which have been suggested as the original areas of habitation of Athapaskan-speaking peoples. With game animals killed by the ash or fleeing the area, and other resources wiped out or inaccessible, hunting and gathering lifestyles as practiced by Athapaskans would have become unsustainable. These volcanic eruptions are therefore primary candidates for push factors prompting the initiation of major population movements.

The distribution of Athapaskan languages in the present day and recent historical record indicate a migratory past. The dominant hypothesis is that Athapaskan migrated from a northern homeland to occupy regions on the northwestern Pacific coast and the American Southwest. To add certainty to these hypotheses, however, requires further evidence. Archaeology can provide models of migratory movements, as well as material evidence of presence in various regions. Furthermore, archaeology can provide one special kind of information that linguistics is still struggling to provide: dates. The importance of this point, and the confusion that surrounds it, require some further comment. Dating in archaeology is a firmly established practice that, with the necessary care, can lead to accurate estimations of the temporal distance between an event whose traces can be discerned from the archaeological record and the present time. In linguistics, similar estimation is not possible at present. In the past, the pioneering work of Morris Swadesh (Swadesh 1950) had made it seem possible that divergence times of languages in the same family could be estimated from lexical data. Subsequent research, however, showed that Swadesh's glottochronological work was lacking both in the methodology and the results it produced (Campbell 2004: 201ff, McMahon and McMahon 2005: 179ff). While Swadesh's work was not entirely without merit, his approach requires a level of refinement that is, perhaps, just beginning to emerge (Holman et al. 2011). This fact has unfortunately not been noticed in archaeological scholarship, where linguistic time estimates derived on the basis of discredited methodologies are still used in support of arguments (Gordon 2012: 306). However, it is exactly in this area that linguistics and archaeology could stand to profit most from each other. In much simplified terms: archaeology can answer the *when*, while linguistics can answer the *who* of migration.

What linguistics can provide, specifically, is a detailed record of the development of lexical items, a record of which groups used these items, and an indication of the relationships between these groups. The present study goes beyond the pursuit of investigating individual items and their provenience, however, and adds to that endeavor the wider, over-arching perspective that can only be supplied by quantitative evaluations of data collections. Through the estimation of language proximity, statements such as the greater diversity of northern than southern languages, the greater affinity between pairs of languages, and the possible ancestry of groups of languages can be questioned, tested, and answered in a transparent and objectively verifiable way. It is especially in this sense that the present study attempts to break new ground, in an endeavor to reduce the speculative element, and to provide the means by which hypotheses can be reliably supported, or finally rejected. In order to demonstrate the reasoning behind the choice of methods used herein to approach these inter-disciplinary questions from the perspective of a linguistic contribution, the state of knowledge of historical linguistics of Athapaskan languages will now be discussed in detail.

1.4 Historical background to Athapaskan language studies

This section presents an overview of the proposed classifications of Athapaskan languages. The present structure of the Athapaskan language family, repeated diligently in the secondary literature on this subject (see for example the Glottolog at http://glottolog.org/resource/languoid/id/atha1245, Multi-Tree at multitree.org, or the Ethnologue http://archive.ethnologue.com/15/show_family.asp?subid=91095), is based on geographic proximity and is therefore not a phylogeny in the sense of Germanic or Indo-European linguistic family trees. As will be described in more detail below, the reasons for this perpetuation lie with a lack of adequate data on the one hand, and the extraordinary complexity of linguistic relationships among Athapaskan languages, on the other. Dialect admixture and a lack of clear language boundaries have been cited as explanations for the failure to establish a phylogenetic tree for Athapaskan languages (Krauss and Golla 1981: 68). It is additionally worth noting, however, that the sources of Athapaskan linguistic data scarcely reach back 150 years or more and, when they do, they are typically in the form of word-lists gathered by non-native speakers. In short, the historical record for Athapaskan linguistic data is very shallow and linguistic history must in general be inferred from contemporary data or information gathered in the relatively recent past. It is important to note, therefore, that when methods developed in the study of languages with a long written historical record, such as Indo-European, are applied to Athapaskan, they are being used against the backdrop of a very different situation, both in terms of the historical setting and in terms of the available resources. This does not invalidate the Comparative Method for use on Athapaskan languages, but the method must be used in the knowledge that certain phonological processes may be wholly invisible to present-day analysis. The Comparative Method has been a key source of information, however, and its basic principles should be briefly outlined before the discussion moves on to historical linguistic findings for Athapaskan that make up the rest of this chapter.

1.3.1 Comparative linguistics, lists, and cognates

When two words can be shown to have originated in a shared ancestral form, they are said to be cognate (cf. Crystal 2008). The term *cognate*, then, is a relational one and cannot be applied to a term in isolation: a word is a cognate of another word in another language. The first indication that a word in some language might be a cognate of a word in some other language is given through similarity in form *and* meaning. Such similarity famously caught the attention of the British legal expert, William Jones, whose insights into the relationships among Greek, Latin, and Sanskrit lie at the outset of one of the most important research projects in historical linguistics (Hock 1999: 556): the discovery and reconstruction of the Indo-European language family. The idea that similarities among words were due to a common origin in an ancient language became the focus of intense research in 19th century philology. Researchers began to find recurring regularities in the patterns of similarities among words. Their success led them to elevate patterns of similarities to laws, hypothesizing that any differences had arisen through change over time according to exception-less changes in sound structure. Working from this idea, they developed a method of reconstructing the ancient forms of words in a hypothetical proto-language and revealing the nature of historical relationships among languages. Their approach to the study of language history is known as the Comparative Method.

Cross-linguistic comparison is the hallmark of the Comparative Method. Linguistic history and especially phylogeny are revealed through the comparison of phonological forms. The Comparative Method and the insights its application has provided are among the greatest achievements of the field of linguistics. The tree diagram of language relationships that represent related languages and language groups on a tree may even have predated this kind of diagram in biology (Atkinson et al. 2005: 517). Despite this considerable scientific and cultural impact, the method has not provided equally bountiful results for all languages to which it has been applied. Even in scholarship on European languages[4], where the method attained its greatest sophistication and greatest results, critical reactions soon followed the proposals of phylogenetic trees. These reactions gave rise to the wave model and subsequent research in the field of dialectology, whose findings belied the neat linguistic demarcations suggested by phylogenetic dendrograms. As will be described in detail below, past research in Athapaskan historical linguistic studies have uncovered a phylogenetic tree that shows the relationship of the Athapaskan languages to Eyak and Tlingit, but they have failed to provide the linguistic grounds for any internal grouping of the Athapaskan languages themselves.

[4] European is intended in the geographical sense here to include comparative studies both in Indo-European and Finno-Ugric.

The fundamental practice in the application of the Comparative Method is the identification of cognate sets: groups of words from different languages with identical (or near identical) meaning. The words are arranged in such a manner that resemblances and differences in the phonemic structures may become apparent. These resemblances are referred to as *correspondences*. Putative cognates are distinguished from true cognates if the relationships that hold between them, that is between their sound-forms, can be shown to be regular across a series of cases. These cases must be numerous enough that positing accidental resemblance lies beyond the realm of plausibility. This has, in fact, been more than problematic in Athapaskan historical linguistics (Krauss 1976: 323, Krauss and Golla 1981: 68). While the identification of putative cognates, or pairs of words that are similar semantically and phonologically, has been relatively easy in comparative Athapaskan, the establishment of recurrent sound correspondences in a manner that would indicate phylogenetic divisions, has proved well-nigh impossible. Examples of correspondences found on the basis of the heuristic that the meanings of terms in the compared languages are similar enough and that the sound correspondences between them are phonetically plausible, are given in Table 1.

Table 1. Two cognate sets exhibiting the same regular sound correspondence (ʦʰ = f = tθ = ʦ) in stem-initial position

TERM	Ahtna	Hare	Dene Sųłiné	Hupa
‘flesh’	ʦʰɛnʔ	fɛ̃́	tθə́n	ʦɪŋʔ
‘head’	ʦʰəʔ	fí	tθí	ʦeʔ

Since the meanings are consistent across the languages and the sound correspondences regular (at least with regard to this sample), the terms in Table 1 can be considered cognates. It is important to note here that both the meaning and the sound structure of cognates *can* vary. Variation in the equivalent position of the sound structure reveals the sound correspondence itself. The recurrence of the sound correspondence across different cases is crucial. If the recurrence has been satisfactorily established, then variations in meaning can be permitted and are even analyzed to lend insights into semantic change. This idea is better demonstrated by an example from the Germanic languages, since most patterns of cognation in Germanic are well understood. German *Tier*, for example, is a cognate of English *deer*. The Modern English deer is a name for “a family (*Cervidæ*) of ruminant quadrupeds” (OED), in contrast to the German term whose meaning corresponds to the Modern English word *animal*. Since the two terms are cognates connected by a regular and recurring sound correspondence, it is possible to discern a narrowing of meaning of the English term. Hence, variation in both the sound and the semantic structure of cognates can be informative for comparative linguistic research. The key strategy in historical-comparative linguistics has been to uncover a wider, recurring pattern by working from sets of cognates to establish sound correspondences and semantic changes.

In the Indo-European case, once patterns of sound correspondence had been established and the ancestral forms reconstructed, it became possible to group languages according to their shared histories: sets of languages which shared particular sets of changes were identified as families and sub-families. This thinking led to the development of a model of language evolution known as the *Stammbaum* or family tree model, attributed to August Schleicher. The tree had a root or ancestral language which split into branches over time, each branch being defined by a set of sound changes or innovations. Established through philological research supported by textual evidence dating back centuries, the family tree model at first accounted well for the languages it was used to represent: the Indo-European languages. The model was challenged, however, as early as 1872, by Schmidt who instead proposed a *Wellentheorie* or wave model. This latter model found support through dialectological studies which found that dialectical differences were not easily represented by the branching structures of the family tree. In particular, it was discovered that sound changes did not easily define geographical areas. Differences in pronunciations did occur forming borders between dialect communities. These borders, however, overlapped, thereby crossing the neat division predicted by the family tree model. There are two understandings of language change enshrined in these models: the family tree model rests on the Neo-Grammarian hypothesis that sound change is exceptionless, while the wave model, at least initially, was postulated with the idea in mind that "each word has its own history" (attributed to Hugo Schuchardt, Campbell 2004: 212). These two models are not actually in competition since they reveal different aspects of language change. As Campbell notes:

> …neither model is sufficient to explain all of linguistic change and all the sorts of relationships that can exist between dialects or related languages. Without accepting the sound change, we would not be able to recognize these dialect forms as exceptions, and without the information from dialectology, our knowledge of how some changes are transmitted would be incomplete. Clearly, both models are needed. (Campbell 2004: 215)

While the family tree model remains a useful tool and aid to historical interpretation (Fox 1995: 142), it too readily suggests that languages in different branches are wholly separate entities, continually diverging after a given split. This is a patently inadequate representation of historical fact in many language families, with Northern Athapaskan being a case in point. Instead of branching into discrete languages or groups of languages, (Northern) Athapaskan has been spoken in an area of sustained mutual contact and exchange for a very long time. Searching for the branching structures suggested by the family tree model in this case has proved nothing short of "disastrous" (Krauss 1976: 323). This is a conclusion arrived at after several attempts to construct family trees, however. These attempts are described in the next section.

1.3.2 Language classification in Athapaskan

It may be remarked at the outset that the discussion of historical linguistic research on Athapaskan languages is made difficult by the absence of a clear overview of reconstructed forms and the data underlying reconstructions. Numerous citations refer to unpublished data. Cognate sets and reconstruction are dispersed over a number of papers, not all of them published. This review will deal almost exclusively with the published record of historical linguistic work on Athapaskan. After briefly considering the deeper historical connections Athapaskan languages have been found to have with Eyak and Tlingit, and the still tentative connections with Yeniseian languages, the review will focus on the history of the internal sub-classifications of Athapaskan languages.

Since Edward Sapir, the Athapaskan languages have been hypothesized to form part of a larger linguistic grouping known as Na-Dene, originally including Haida, along with Tlingit and the Athapaskan languages. However, the evidence that would have conclusively established Na-Dene as a linguistic family has never emerged. In his assessment of Na-Dene as a proposal for a linguistic phylogeny, historical linguist Lyle Campbell assigns a, self-admittedly, personal and subjective probability of 0% to the possibility of Na-Dene representing an actual language family, albeit with a mere 25% confidence (Campbell 1997: 284). This evaluation is motivated partly by the original inclusion of Haida in Na-Dene. Indeed, the status of Haida remains controversial, with scholars arguing both for and against its genetic affiliation with Athapaskan, Eyak, and Tlingit. The potential for an association of Haida with Tlingit goes back at least to Boas, but prior scholars may have speculated on this earlier. The fact that today, a century later, there is still room for debate shows, at the very least, that no fully convincing set of sound correspondences have ever been proposed. Furthermore, the attention invested in these deep links and the full extent of Na-Dene as a language family, while certainly important in their own right, have drawn attention away from the internal classification of the Athapaskan branch of this family.

The debate around the inclusion of Haida in Na-Dene, as well as attempts to link Athapaskan, Eyak, and Tlingit on the basis of sound linguistic criteria has taken up much of the energy in the field of comparative Athapaskan studies. The most recent developments indeed aim at expanding the family even further backwards in time to a link with the Siberian language family, Yeniseian (Vajda 2010). The desire to reach back more deeply into prehistory and uncover the hidden connections between the multitudes of North American Indigenous languages may here have been coupled with the notion of bringing order to the unruly diversity encountered by the first Euro-American scholars of Indigenous languages:

> The enormous linguistic diversity in the Americas aroused a desire for classification, to bring the vast number of distinct languages into manageable genetic categories. As Duponceau put it: "We are arrested in the outset by the unnumbered languages and dialects…But philology comprehends them all, it obliges us to class and compare them with each other. (Campbell 1997: 28)

The same enthusiasm has not been brought to the problem of internal classification of Athapaskan languages, at least not since the work of Harry Hoijer. Perhaps this paucity of publication on internal classification is best understood in light of the formidable situation presented by Athapaskan languages themselves:

> Attempts to accomplish this [internal classification] have been largely disastrous, based largely on two false premises. The first premise is that the Stammbaum model (implying pure divergence, 'campfire'-theory) is adequate to explain relationships. The second false premise is that even if Athapaskan were in fact a group of languages thus related (by pure divergence), the Athapaskan 'languages' as now known … are very largely mythical and arbitrary groupings.
> (Krauss 1976: 323)

The problem of grouping languages under the same name that are in fact mutually unintelligible is a problem that goes back to the work of Cornelius Osgood (1936), whose assessment of the linguistic situation in Athapaskan has never been adequately revised (Krauss 1976: 323). More importantly, Krauss hints at the dialectically complex situation in Athapaskan in which sound correspondences cross-cut each other and fail to coalesce into a neat branching structure. This realization is echoed in most of the subsequent scholarship on Athapaskan language history and presents one of the main motivations for the use of dialectometric methods in this study.

The chapter will outline the proposals for larger linguistic phyla that have included Athapaskan, without going into detailed review of the justifications for these groupings since the focus of interest lies with the lower-level distinctions in Athapaskan itself. A summary overview of the higher-level groupings is pertinent, however.

1.3.3 Athapaskan in classification from the 19th century up to Sapir

The name Athapaskan has quite a long history in North American linguistics (Krauss 1987) dating back to the 19th century and the first overall classification of North American Indigenous languages by Gallantin:

> The name Athapaskan … was introduced in the form Athapascas by Gallantin (1836: 16-20) as an "arbitrary denomination" of the linguistically related Indian groups in the interior of northwestern North America beyond the Churchill River. This was an extension of his usage in a manuscript sent to Alexander von Humboldt, in which he called Sarcee a dialect of Athapescow, his name for Chipewyan. (Gillespie 1981: 168)

One of the earliest to recognize Athapaskan as a family of languages, Gallantin produced the first overall classification of North American Indigenous languages. Gallantin's classification relied predominantly on similarities among lexical items, while taking some grammatical structures into account (Campbell 1997: 43). He found there to be 32 families among the languages north of Mexico. His classification would serve as a starting point for the slightly later and much more influential classification by John Wesley Powell, the first director of the Bureau of American Ethnology. Powell counted 58 stocks (Campbell 1997: 57) in the final version of his classification. This number struck Sapir as so improbable that it is used by him to motivate his own assessment of North American stocks:

> It is clear that the orthodox "Powell" classification of American languages, useful as it has proved itself to be, needs to be superseded by a more inclusive grouping based on an intensive comparative study of morphological features and lexical elements. The recognition of 50 to 60 genetically independent "stocks" north of Mexico alone is tantamount to a historical absurdity.
>
> (Sapir 1921: 408)

In the same paper, Sapir goes on to propose six language families. Already in 1915, Sapir had expanded on the association between Haida and Tlingit noted by Boas (Goddard 1997: 312), by including both languages in a larger stock he called "Na-Dene", a compound made up of the Haida *na* 'to dwell, house', Tlingit *na* 'people', and a generalized or abstracted form of the word for 'person/people' in most Athapaskan languages (Sapir 1915: 558). The three branches of Na-Dene, presented in Figure 5, are discussed by Sapir, but the details of how these conclusions were reached are not presented in the paper being relegated to a more "extensive paper" (Sapir 1915: 534), which was never published and is unfortunately entirely lost to comparative Athapaskan studies (Krauss 1976: 334). Some of Sapir's comparisons and reconstructions are published in papers by his students, Fang-Kuei Li, and especially, Harry Hoijer, whose work will be discussed in more detail below.

Sapir considered an even more far-ranging hypothesis, Na-Dene/Sino-Tibetan, but Franz Boas and Pliny E. Goddard would eventually criticize the Na-Dene proposal heavily, possibly preventing Sapir from ever publishing on this far-ranging historical hypothesis (Krauss 1986: 159). At any rate, no convincing data for this hypothesis have emerged to date, leading Krauss to doubt that any proposal ever existed on paper (Krauss 1976: 334). Furthermore, the tripartite form of Na-Dene suggested by Sapir would prove problematic in the long run, albeit not in the way that Boas or Goddard would have suspected: through the later discovery of Eyak as the closest relative to Athapaskan and through the ever-increasing doubt concerning the membership of Haida in the language family.

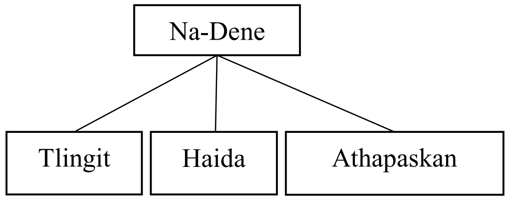


Figure 5. Genetically related Na-Dene languages proposed by Sapir (1915)

While the genetic relationship of Haida to Athapaskan and Tlingit still has some proponents (the work of Hans-Jürgen Pinnow, for example), similarities to Tlingit and Athapaskan are now thought to be due to areal diffusion (Mithun 1999: 308). Tlingit is now considered to be firmly established as being related to Athapaskan, thanks to extensive and detailed work by Krauss and Pinnow (reviewed in considerable depth in Krauss 1976: 333-343). However, the relationship of Athapaskan-Eyak to Tlingit is based to a considerable degree on phonological and morphological resemblance:

> Tlingit, a single language…bears a close resemblance to Athapaskan-Eyak in phonology and grammatical structure but shows little regular correspondence in vocabulary...the nature of the relationship between Athapaskan-Eyak and Tlingit remains an open question.
>
> (Krauss and Golla 1981: 67)

Regular sound correspondences between Athapaskan-Eyak and Tlingit have only been sparsely represented in published work. Krauss and Leer's reconstruction of the Proto-Athapaskan sonorants *w, *n, *y and *ŋ (Krauss and Leer 1981) lists a limited number of correspondences pertaining to the sounds under scrutiny in that study, but patterns of regular correspondence are also documented more substantially in unpublished collections (Mithun 1999: 307)[5].

At the time he proposed Na-Dene as a language family, Sapir was not aware of the existence of Eyak, but he recognized it as another branch of Na-Dene once adequate data on the language became known to him in the 1930s (Krauss 1986: 164). Further work on Eyak, now sadly extinct, has confirmed that languages' historical relationship with Athapaskan. Krauss carried out a lexicostatistic study showing Eyak to be equidistant from all Athapaskan languages. These studies, as well as the judgments of language specialists, have given rise to the now commonly accepted branching structure for Na-Dene given in Figure 6. The name itself is ambiguous however, since it may still evoke a constellation that includes Haida. In order to avoid this misleading conclusion, the name Athapaskan-Eyak-Tlingit (AET) is now gaining acceptance in the more modern literature (for example Mithun 1999).

[5] Of particular note here is the extensive comparative work by Jeff Leer, partially available in a series of unpublished documents (Leer 1996, now available online at the Alaska Native Language Archive). These have not been treated here in respect of the author's explicit wish to await further refinement of the materials (Leer personal communication, 2013).

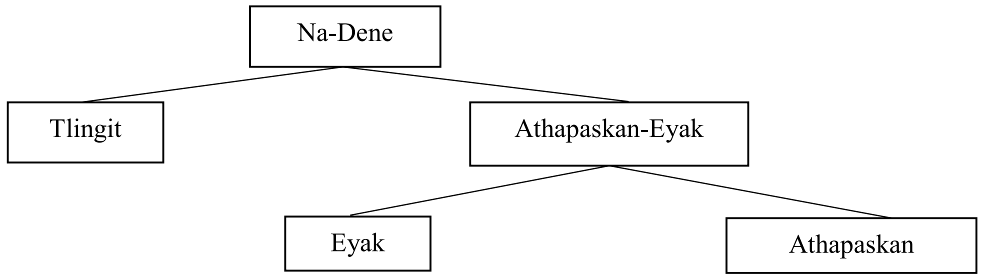


Figure 6. Divisions in Na-Dene (Goddard 1997) or Athapaskan-Eyak-Tlingit (Mithun 1999)

While there has been a string of papers on the problem of relating the higher branches of the family tree, the internal structure of the Athapaskan branch of the language family has received less attention in print. The reasons for this have been alluded to in the introduction, but disparaging comments by Krauss and Golla notwithstanding, the last substantive publications on sub-classifying the Athapaskan languages comes from Sapir's student, Harry Hoijer.

1.3.4 Harry Hoijer's classifications

As his student, Harry Hoijer was able to work with Sapir's data as well as data published in studies by Goddard and Li. To this he added his own expertise on Apachean languages. Hoijer had firmly established Apachean as a sub-group in the paper, *The Southern Athapaskan Languages* (Hoijer 1938). Widening his interest from Apachean to comparative Athapaskan in the late 1950s, Hoijer published two seminal studies on his application of lexicostatistics (Hoijer 1962) and the Comparative Method (Hoijer 1963) to the problem of internal sub-classification in Athapaskan.

Hoijer (1963) sets out from a set of correspondences and reconstructed Proto-Athapaskan phonemes published by Sapir in 1931. He then expands the set of languages to be compared to 38 (Hoijer 1963: 6). Hoijer focuses exclusively on stem-initial consonants, a fact that has been criticized by Krauss who points out that this is a "tiny" set of phylogenetic characteristics on which to base historical inferences, and then goes further to note that the result of Hoijer's study:

> …is interesting from a purely typological point of view, perhaps. But due to the obvious inadequacy of the criteria [for grouping], and what should be an equally obvious inadequacy of the theory based exclusively on divergence (and ignoring all diffusions, convergences, and simple parallel innovations or retentions), and extremely frequent inadequacy of the data and often of the

interpretation of the data, the results are predictably absurd from a genetic point of view.
(Krauss 1976: 324)

This scathing assessment notwithstanding, Hoijer's classification remains the most sophisticated attempt at internal sub-grouping of Athapaskan language at the time, with no single publication matching its breadth and scope. This being the case, Hoijer's classification remains influential even today. Hoijer divides the family into three major groups, along the familiar geographic lines: Northern Athapaskan, Pacific Coast Athapaskan, and Apachean. Hoijer sorted his reconstructed consonants into three groups, shown in (1)[6]:

(1)

I. *s, *z, *dz, *ts, *ts'
II. *ʃ, *ʒ, *dʒ, *tʃ, *tʃ'
III. *x^j, *j, *g^j, *k^j, *k^j'

Apachean, for example, is defined through the shared development of all these consonants, with only one exception: Kiowa Apache differs in the development of the sounds of group III (Hoijer 1963: 6). Hoijer had already established Apachean as a sub-grouping in earlier work (Hoijer 1938), finding cause to divide the sub-stock into Eastern and Western Apachean. In fact, these two branches subdivided further into two branches each: Navajo and the San Carlos group for Western Apachean, and Jicarilla-Lipan and Kiowa Apache for Eastern Apachean (Hoijer 1938: 86). Having considered these "probable" (Hoijer 1938: 86) in 1938, Hoijer makes no further mention of them in his later classification based on the Comparative Method.

Decades later, Hoijer compared his classification on the basis of the Comparative Method with classifications "by the methods of glottochronology" (Hoijer 1962: 192). To prevent any potential confusion, it must be pointed out right away that Hoijer is conflating two methods under the term *glottochronology* that are clearly distinguished in modern quantitative historical linguistics (McMahon and McMahon 2005: 34). The first of these methods is better referred to as *lexicostatistics*, which is the construction of phylogenetic branches in a family on the basis of percentages of shared cognates from a pre-established list. Here the use of Swadesh lists represents perhaps the most well-known application. The second method is the dating of the branchings in a family on the basis of an assumed, constant rate of language change, first proposed by Morris Swadesh (1952). The latter method is widely discredited, while the former is still in use (see discussion in Campbell 2004 and McMahon and McMahon 2005). While Hoijer did use Swadesh lists to date linguistic divergences in Athapaskan (Hoijer 1956) — a truly glottochronological approach — he also used percentages of shared cognates on a Swadesh list to group

[6] Here given in IPA.

Athapaskan languages without reference to chronology. It is the classification arising through this latter application of the method that is contrasted with the shared patterns of innovations and retentions characteristic of the Comparative Method in Hoijer's *Linguistic sub-groupings by glottochronology and by the Comparative Method: The Athapaskan languages* (1962).

In his application of the Comparative Method and his expansion of the set of consonants reconstructed by Sapir, Hoijer is unable to provide evidence to support his earlier classification of Apachean languages into Eastern and Western groups (Hoijer 1938: 86). Instead, only Kiowa Apache is distinguishable on the basis of patterns of shared retentions and innovations. Pacific Coast languages are found to constitute a single stock, albeit with more internal variation than the Apachean languages (Hoijer 1963: 9). Hoijer distinguishes "Californian" and "Oregonian" as branches in Pacific Coast Athapaskan. Northern Athapaskan is not found to constitute a single sub-stock (Hoijer 1963: 14), diverging instead into *seven* groupings. Hoijer gives no names for the Northern Athapaskan sub-stocks, choosing instead to number them. Hoijer's 1962 classification is given in Figure 7.

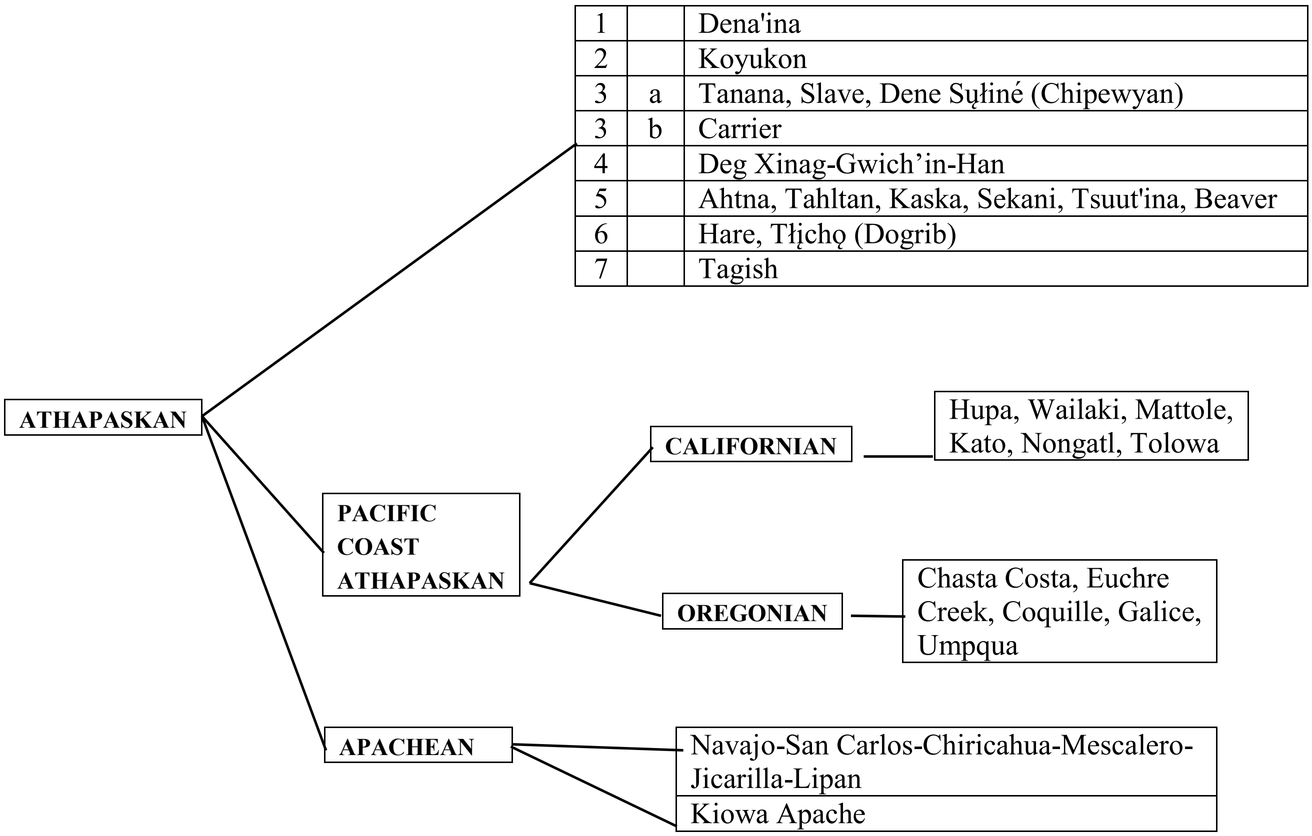


Figure 7. Hoijer's 1963 classification based on the Comparative Method

Hoijer notes that some Carrier dialects (in sub-grouping 3b) bear much closer affinities to his Northern Athapaskan sub-group 5 (Hoijer 1963: 27), making its position in the classification rather uncertain. Sub-group 5 itself presents an example of a genetic grouping Krauss deemed absurd since the languages it associates are otherwise very different from each other. Hoijer then classified Athapaskan languages into sub-groups according to whether the percentage of shared cognates between any pair of languages exceeded 77%. The resulting classification is given in Figure 8. Comparing these groupings with the results of his lexicostatistical measurements, Hoijer notes that the two sub-classifications agree in only three cases: Pacific Coast Athapaskan, Apachean, and the isolated status of Dena'ina (Hoijer 1962: 196). Hoijer could find lexicostatistical evidence supporting only the Oregonian branch of Pacific Coast Athapaskan only and not the Californian branch (Hoijer 1962: 198). Northern Athapaskan does not emerge as a group in itself (nor has it in any classification proposed to date, other than those based purely on geography). However, a group of languages that would later be found to fall into a Northwestern Canada grouping can already be seen to emerge in the sub-stock containing Hare, Dogrib, Slave, Chipewyan, Carrier, and Beaver.

Hoijer's lexicostatistic method is not able to find higher groupings, nor is it able to establish a relationship between Pacific Coast Athapaskan and Apachean, or between any of the other languages. Hoijer's arbitrary cut-off percentage of 77% is not well justified and it results in a flat classification with no information on deep branchings. The application of lexicostatistical analysis in the 1960s, simply put, did not reach the level of sophistication that would enable the comparison of groupings at higher levels, which is better accomplished with the help of clustering algorithms. Even though clustering techniques had already been in use in anthropology 30 years earlier (Driver and Kroeber 1932), Hoijer appears never to have taken them into consideration for his own work. However, the next most important study in Athapaskan classification, by the anthropologists Dyen and Aberle, would make use of clustering.

Despite Hoijer's lack of methodological sophistication, less than adequate data, and occasionally improbable groupings, he is to be lauded for two outstanding contributions to comparative Athapaskan. Firstly, he is the only comparative Athapaskanist to have published his dataset along with his analysis (the importance of which can hardly be overestimated), and he remains the only scholar to have published an internal classification of Athapaskan languages on the basis of linguistic principles. Hoijer's classification based on his lexicostatistic study are represented in Figure 8.

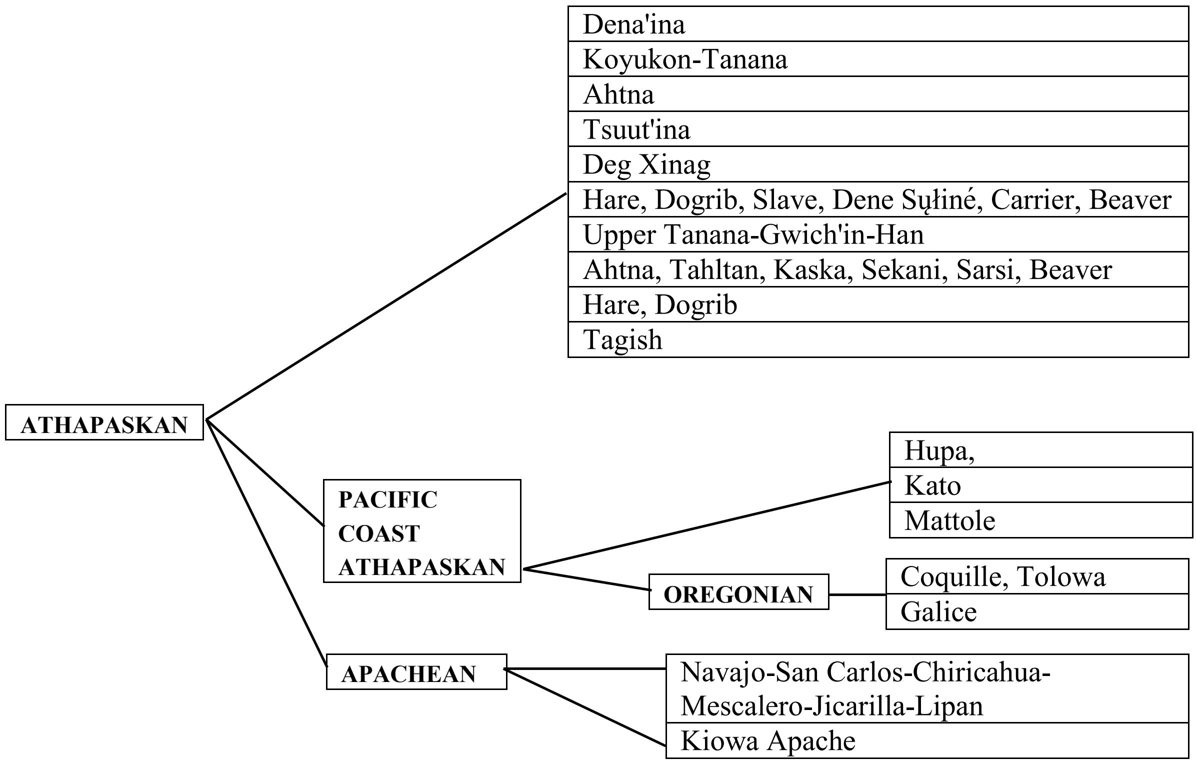


Figure 8. Hojer's 1962 Sub-grouping of Athapaskan languages by the lexicostatistical method

1.3.5 Dyen and Aberle's classification through the reconstruction of kinship terminologies

Dyen and Aberle studied the differentiation of kinship terminologies in Athapaskan, publishing their findings about ten years after Hoijer's glottochronological study (Dyen and Aberle 1974: 142ff.). In a large-scale study, they reconstructed the kinship terminology of Proto-Athapaskan. Kin terms were deemed particularly interesting since they allowed for inferences about social organization, a property that has been exploited by the archaeologist, Ives (1998), in developing models of the social structure of prehistoric Athapaskan societies in the Canadian Interior. Kin terms, furthermore, have semantic structure that can be described with relative ease. Since the possibilities of biological and marital relationship can be delineated as a universal set of possibilities, the kin terms that denote them can be compared across languages. With this motivation, Dyen and Aberle gathered as near complete as possible a sample of kin terms from across the language family.

Dyen and Aberle required Athapaskan languages to be sub-grouped in order to carry out their lexical reconstructions, since they were not only interested in Proto-Athapaskan as a whole, but also in the intermediate languages such as Proto-Hupic, Proto-Apachean, and so forth. Dyen and Aberle reinterpreted the results of Hoijer's lexicostatistic study (Hoijer 1962) in light of what they called the *language limit,* which is the maximal similarity between two languages defined in terms of a percentage rating obtained through counting the number of cognates on a Swadesh list (Swadesh 1952). Dyen and Aberle used the language limit to distinguish languages from dialects:

> If the similarity of two putative languages is not less than the language limit, then they are dialects of the same language. In lexicostatistics we use an arbitrarily set percentage to represent the language limit. (Dyen and Aberle 1974: 11)

They set this arbitrary limit at 70% for the 200-word Swadesh list, and 77% for the 100-word list. Hoijer's lexicostatistic groupings of Athapaskan languages are then re-interpreted to generate the groupings presented in Figure 9 (the numbers in parentheses indicate the percentage of shared cognates). From today's perspective, this sub-grouping is less than fully satisfactory since it, again, relies on an arbitrary value and on a set of meanings that are putatively universal. While lists of universal meanings are useful in establishing whether languages are related at all (McMahon and McMahon 2005), they are unnecessarily restrictive for internal classification (Matisoff 1978; see also the methodological discussion in Chapter 2). Nevertheless, Dyen and Aberle's attempt to formalize the dialect language distinction is interesting and, at the very least, constitutes a replicable and transparent method that is easy to criticize precisely because it is explicated fully by the authors, who also provided the full data set on which they based their calculations. Important as it is, their extensive reconstructions of Proto-Athapaskan kinship terminologies are of less interest here than the internal structure of Athapaskan that Dyen and Aberle propose. The idea of operationalizing the dialect/language distinction, as well as the search for the branchings at which further, intermediate proto-languages need to be postulated are key ideas that are returned to in Chapter 4.

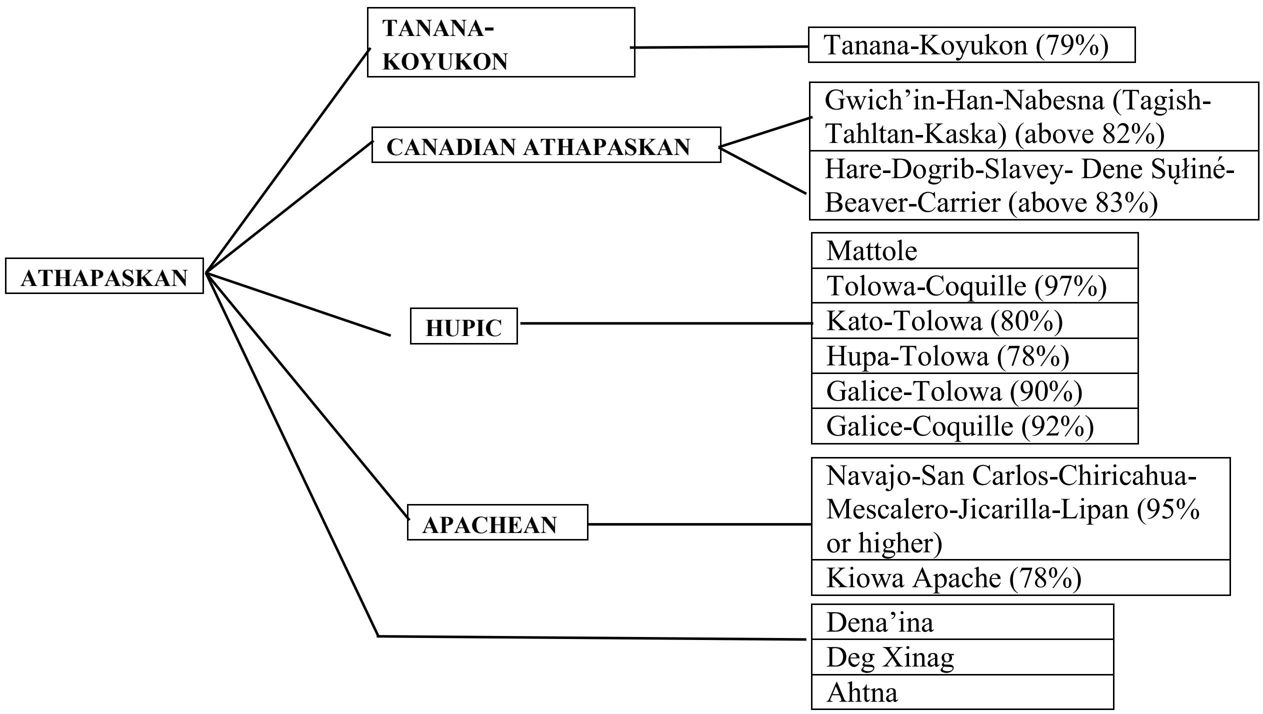


Figure 9. Dyen and Aberle's 1974 interpretation of Hoijer's classification

1.3.6 Classifications by Keren Rice

The most recent internal classifications of Athapaskan languages have been compiled by Keren Rice. They appear in two important overviews of Athapaskan (as well as other overviews of North American Indigenous languages): Ives Goddard's article on linguistic classification in the *Handbook of North American Indians* (1997: 5) and Marianne Mithun's monumental overview of Americanist linguistics north of Mexico (Mithun 1999: 345). The two classifications presented in these works were apparently created especially for each publication. Goddard cites the source as "communication to the editors 1995" (Goddard 1997: 4), while Mithun refers to K. Rice only by name. The two classifications differ insofar as the name for the family is listed as "Na-Dene" in Goddard, and "Athabaskan-Eyak-Tlingit" in Mithun. Both classifications are furnished with notes of caution. Mithun points out that:

> Divisions within Athabaskan are as much geographic as genetic. The Pacific Coast languages, for example, may not constitute a subgroup, but rather a chain with several deeply differentiated units. Among the Alaskan and Canadian languages, subgrouping is tentative; long contact has resulted in

dialect complexes with fuzzy boundaries between neighbors and many shared features due to areal diffusion. (Mithun 1999: 347)

Goddard warns that "other specialists argue that the overlapping distribution of numerous diagnostic features over the continuum formed by these languages precludes meaningful sub-classification into a tree with discrete branches" (1997: 4), citing Krauss and Golla (1981: 67). As described above, Krauss criticized Hoijer's work on classifying Athapaskan languages because he had drawn conclusions too far-reaching for the limited data he had, and the groups that resulted from his analysis seemed to produce unlikely arrays of languages. The innovations and retentions among Athapaskan languages deeply cross-cut the groupings expected from the overall similarities of the languages and their regional, geographic affiliations. The results of Hoijer's work were phylogenetic branchings that appear meaningless to language specialists, except in Apachean and, perhaps, Pacific Coast Athapaskan. The conclusion drawn from these studies by leading Athapaskanists was that discrete branching is an inappropriate model for the evolution of the Athapaskan language family.

Keren Rice's classifications appear to have taken these insights to heart. While no supporting evidence is given for either of her two published classifications, this is, perhaps, because the underlying logic in both cases is largely based on geographic proximity, and hence relatively transparent. The two classifications differ slightly in their details. At the topmost level, the classifications are the same. Goddard retained the name *Na-Dene*, while Mithun uses *Athapaskan-Eyak-Tlingit*. The latter is more appropriate since, strictly speaking, the name *Na-Dene* is associated with Sapir's inclusion of Haida in the language family. Table 2 gives both classifications, with the later one on the left. The classification reproduced in the *Handbook of North American Indians* (Goddard 1997) has three levels of branching under the node labeled *Athapaskan*, the family node. In the classification presented in Mithun (1999: 346), the groupings are the same at levels 1 and 2, but less diversified at level 3. Level 4 is altogether absent. Furthermore, Kwalhiouqua-Clatskanie is no longer associated with the Pacific Coast Athapaskan subgroup. This means there are now three "isolate" languages that are classified directly under the Athapaskan node: Ts'ets'aut, Tsuut'ina (Sarcee) and Kwalhioqua-Clatskanie. In both classifications, Rice maintains Hoijer's older (1938) grouping of Apachean languages into Eastern and Western groups, even though Hoijer himself could find no evidence to support this division with either lexicostatistic methods or through the reflexes of his reconstructed Proto-Athapaskan consonants.

The classification Rice provided for the *Handbook of North American Indians* (Goddard 1997) is the more detailed and interesting of the two. Without access to the argumentation behind her choices, however, her groupings cannot ultimately be viewed as revealing Athapaskan linguistic history and are, instead, a geographically ordered list of the Athapaskan languages. There are, however, some exceptions to this that are worth discussing further. Firstly, Rice identifies Slavey-Hare-Bearlake-Mountain as a dialect complex, as described in considerable detail in her own work (Rice 1989). Tahltan, Kaska, and Tagish are classed as “mutually intelligible but diverging dialects” (Mithun 1999: 348), an assessment that appears to go back to Patricia Shaw and/or Michael E. Krauss, who are identified as having personally communicated this information to Mithun.

Table 2. Keren Rice's classifications of Athapaskan languages

Mithun 1999			Goddard 1997			
Southern Alaska		*Ahtna, Dena'ina*	Southern Alaska			*Ahtna, Dena'ina*
Central Alaska Yukon		*Deg Xinag Holikachuk, Koyukon, Han, Gwich'in, Upper Kuskokwim, Lower Tanana, Tanacross, Upper Tanana, Tutchone*	Central Alaska Yukon	Koyukon-Ingalik		*Deg Xinag, Holikachuk, Koyukon*
				Tanana-Tutchone	Tanana	*Lower Tanana, Tanacross, Upper Tanana*
					Tutchone	*Northern Tutchone, Southern Tutchone*
						Upper Kuskokwim
Northwestern Canada		*Tagish, Tahltan, Kaska,*	Northwestern Canada	Cordillera	Central Cordillera	*Tagish, Tahltan, Kaska*
		Sekani			Southeastern Cordillera	*Sekani, Beaver*
		Beaver				
		Slavey, Mountain Bearlake Hare		Mackenzie	Slavey-Hare	*Slavey, Mountain, Bearlake, Hare*
		Dogrib				*Dogrib*
		Dene Sųłiné				*Dene Sųłiné*
Central British Columbia		*Babibe-Witsuwet'en, Carrier, Chilcotin*	Central British Columbia	Babine-Carrier		*Babine, Carrier*
						Chilcotin
						Nicola
Pacific Coast Athapaskan	Oregon Athabaskan	*Upper Umpqua, Rogue River, Galice-Applegate, Tolowa*	Pacific Coast Athapaskan	Oregon Athabaskan		*Upper Umpqua, Tututni, Galice-Applegate, Tolowa*
				California Athabaskan		*Hupa, Mattole, Eel River, Kato*
	California Athabaskan	*Hupa, Mattole, Eel River*				*Kwalhioqua-Clatskanie*
Apachean	Western Apachean	*Navajo, Western Apache, Chiricahua-Mescalero*	Apachean	Western Apachean		*Navajo, Western Apache, Chiricahua-Mescalero*
	Eastern Apachean	*Jicarilla, Kiowa Apache, Lipan*		Eastern Apachean		*Jicarilla, Kiowa Apache, Lipan*
		Tsuut'ina				*Tsuut'ina*
		Ts'ets'aut				*Ts'ets'aut*

1.5 Summary

The history of classification presented here shows that Athapaskanists have run into serious difficulties in applying the results obtained from the application of the Comparative Method to Athapaskan languages in an effort to discern internal family structure. Rice's modern groupings are essentially based on Hoijer's classification, informed by her own work on Canadian languages and emphasizing geographic locale rather than phylogenetic branching. The removal of finer internal classification in the later version of Rice's grouping in particular seem to be a more cautious assessment. It is clear, then, that to date shared innovation and retentions of sounds do not appear to reveal decisive groupings, except in the case of geographically isolated groupings, such as Apachean[7]. On the whole, it is far more productive to treat Athapaskan languages as what they, with rare exceptions, appear to be: members of a fascinatingly large and intricate dialect complex.

Whatever criticism may be leveled at the efforts to sub-classify Athapaskan languages, the greatest difficulty they have faced so far has always been a lack of adequate data. As Krauss pointed out:

> It is worse than useless in the meanwhile to speculate further on the internal relationships of the Athapaskan languages, before such a survey [of Athapaskan languages] is completed, and it is fully to be expected that virtually the only meaningful internal relationships will be those which can be shown far better in terms of isogloss maps than by other means.
>
> (Krauss 1976: 329)

Since the 1970s, considerable effort has been expended in order to document Athapaskan languages and to make lexicographic resources more accessible. The most important lexicographic works in the Athapaskan literature available today were all published after Krauss' review: Young and Morgan's *The Navajo Language: A Grammar and Colloquial Dictionary* (1987), Kari's *Ahtna Athabaskan Dictionary* (1990) and *Dena'ina Topical Dictionary* (2007), and Jetté and Jones' *Koyukon Athabaskan Dictionary* (2000). The major works are complemented by a number of smaller dictionaries, community dictionaries, and word-lists, all of which are listed in the reference section on lexicographic sources. While a full survey of Canadian languages such as Krauss called for still does not exist, the overall situation is much improved and extensive data are now more readily available. In light of such a substantial growth in available information, a new attempt at classifying Athapaskan languages and of furthering the field of Comparative Athapaskan studies more generally, is called for.

The present study takes Krauss' insight seriously by applying mapping and clustering techniques developed in dialectometry to detect groupings and affinities among Athapaskan languages. While the

[7] Which may, however, also be viewed as a dialect complex (Krauss 1976: 323).

definitive survey Krauss called for in 1976 has never been completed, the availability and reliability of data on many Athapaskan languages is much improved today. The data have been culled from published sources and field notes and compiled into a database making them amenable to quantitative and qualitative evaluation. Furthermore, this study goes beyond the dialectological approach suggested by Krauss by adding a further kind of character on which to base language affinity and descent: the semantic structures described in Chapter 3. These patterns of language similarity and difference will serve to classify the Athapaskan languages in a manner indicative of the historical evolution. Thus, one of the goals of this research will be to find a classification of Athapaskan languages, which is based on a sound methodology, is transparent, and is objectively verifiable. The second, and intertwined, goal is to explore the lexical semantics of Athapaskan anatomical terms in order to contribute to the study of lexicalization and semantic change in this lexical field, and to show that semantics can be profitably exploited in historical linguistic research.

This chapter has outlined the background to the present study. The entire study is based on the idea that all aspects of language can change over time, and therefore all aspects of language must be capable of bearing within themselves evidence for the historical processes that have shaped them. Historical linguistics not only allows us to identify and describe these processes, but also holds the potential to turn back the clock to reveal earlier stages in the historical trajectories of particular languages and language families. Since linguistic categories are mental representations in living people, turning back the linguistic clock reveals the semiotic traces of the mental representations held by the people of the past. Linguistics can therefore provide the kind of information that the archaeological record of non-literate, oral cultures can never reveal. The results of historical linguistic analysis of Athapaskan languages can therefore complement the archaeological, ethnographic, and ethno-historical research on Athapaskan prehistory. While the contribution potential of linguistic data to prehistoric research is not new, this study attempts to overcome the stagnation in the research on the internal structure of Athapaskan through the application of new methods. The next chapter outlines the methods with which this work is carried out.

2. Methodology

> "…data is theory's way of creating better models, and method is theory's way of creating better data."
>
> (D'Andrade 2003: 310)

The difficulties in the application of the Comparative Method outlined in the previous chapter motivate a fresh approach to the question of historical relatedness among Athapaskan languages. In particular, the increased availability of lexicographic source materials and the development of computer-aided analysis of linguistic data provide new avenues of research into historical linguistic problems. One of the central difficulties faced by historians of Athapaskan languages, as of any family of unwritten or only recently written languages, is of course the lack of a corpus of historical texts, which could give insight into processes of change as the languages evolved over time. The historical record for Athapaskan is shallow, and data, which could be truly useful for the purposes of studying semantic change in the family or providing the evidence for past sound changes, is largely absent. Since it seems extremely unlikely that detailed sources from the linguistic past of Athapaskan languages will ever emerge, Athapaskan linguistic history and prehistory must be inferred from more or less synchronic data alone (the oldest sources used here are lists of Lipan Apache words dating back to 1884, but since these are the only available lexical data for these languages, they are nevertheless considered to be synchronic). Comparison of sister languages is thus the only reliable means of uncovering the linguistic past of this family. As previously discussed, however, the comparative search for cognates and ancestral forms has also run aground. A new approach to historical linguistic problems in Athapaskan needs to subject these synchronic data to an analysis capable of revealing what has not been apparent to scholarly pursuit so far. For this reason, the phonological aspects of Athapaskan lexical items are backgrounded here and analyzed only in terms of the larger aggregate differences between languages. Instead, a much greater emphasis is placed on semantic analysis, a domain of inquiry which has been left largely untouched in Athapaskan historical linguistics. Bringing semantics into the central focus of the inquiry, however, necessitates a more principled treatment of the selection of data.

Traditionally, there has been no prerequisite method for selecting the sample of items in the search for the cognate sets used to uncover the sound correspondences, which are the *sine qua non* of the Comparative Method. It seems that, for practical reasons, a researcher begins from a set of meanings and then searches for phonetically similar forms that carry these same meanings across the languages under study (Fox 1995: 64-65). In the methodology of the traditional Comparative Method, the means of generating the data in the first place are not particularly important. After all, the method finds its validity in the *recurrence* of sound correspondences and, once these have been found, they are considered proven, provided a sufficient number of recurrences of the sound correspondence pattern can be demonstrated. In this process, meaning is of crucial importance, since only words with matching meanings can be considered cognates. Despite its pivotal role in the application of the Comparative Method, the treatment of meaning has been decidedly secondary, functioning mainly as a check on the possibility of identifying a true sound correspondence. Nevertheless, semantics has featured in historical linguistics since the 19th century (see Geeraerts 2010 and Blank 1997 for overviews), and systematic studies have resulted in a typology of semantic changes covering generalization, extension, broadening, specialization, restriction, pejoration, amelioration, synecdoche, metaphor, and metonymy (Campbell 2004: 254-262). However, the occurrence and effect of these processes was generally considered too unsystematic to be considered as an additional source of data in their own right. The inability of scholars to discover stable patterns, akin to the laws of sound change discovered by Verner and Grimm, meant that the role of meaning would always be overshadowed by phonological considerations in regard to questions of linguistic ancestry.

More recently, however, semantic criteria have come to play a more active role in historical linguistics, in particular in the case of patterns of semantic change. In the research framework known as cognitive semantics, meaning change has been linked to the workings of human cognition. The analysis of figurative expression known as metaphor and metonymy, especially, has shown that many processes of perception and conception are reflected in linguistic structures and in the processes that affect change in linguistic structures. This focus has led to new perspectives on semantic change (see especially Blank 1997). While, on the whole, the study of semantic change may still lag behind the scientific understanding of phonological changes, analytical tools are now in place that enable the rigorous exploitation of semantic structure for the investigation of linguistic history. These analytical tools emerge from the cognitive linguistic re-thinking of the method of *onomasiology*, which is, in essence, a formal list-based approach to linguistic comparison. In contrast to the approach taken by Swadesh, who proposed a list of universal items from diverse semantic domains, the onomasiological method focuses exclusively on one semantic domain.

The interest in focused rather than general lists dovetails with another trend in historical linguistics, which has seen scholars call for a more careful treatment of semantics in comparative research. Since the 1970s, Matisoff has been advocating the use of specialized word-lists in comparative linguistics and etymology (see especially Matisoff 1978). More culturally appropriate word-lists can be used alongside the generalized Swadesh-type lists, especially when the overall membership of languages in a family is known and the focus of interests are the specific relationships among member languages. Finally, the increased application of quantitative methods in linguistic sub-disciplines such as historical linguistics (MacMahon and MacMahon 2005), and dialectology (Wieling and Nerbonne 2015) has called for a renewed attention to systematic data collection. Rather than constructing sequences of sound changes, quantitative historical methods evaluate large collections of data on the basis of algorithms. For these methods to produce useable results, however, the data must be comparable: it must have been collected in an objective, systematic way.

It stands to reason, therefore, that the seemingly intractable problem of Athapaskan linguistic classification deserves to be approached in a manner that concentrates on precisely those aspects of historical linguistic research that have not received due attention heretofore. The lack of a systematic method of creating datasets for the study of linguistic history and the neglect of semantics represent two unexplored fields of potential historical linguistic insights, which can be fruitfully exploited through the application of the appropriate methods. This chapter outlines methods that can more fully exploit the potential offered by lexical data. None of the methods used are wholly new, indeed some of them, such as onomasiology, belong to methods that can look back on a century or more of application. However, recent developments, especially in the framework of cognitive linguistics, have increased their analytical efficacy, and it is now possible to link results obtained through their application to a growing body of research in lexical semantics and historical/comparative linguistics, and thereby contribute to a growing understanding both of semantic structure, generally, and historical relationships among Athapaskan languages, more specifically. The two main sources for these methods are comparative lexical semantics, especially as this has been studied among Romance languages and dialectometry as developed at the Universities in Salzburg and Groningen (Wieling and Nerbonne 2015).

2.1 The linguistic sign

The object of all the analyses carried out in this study are lexical items. Underlying the analysis of lexical items is a semiotic model of the linguistic sign. This model is adapted from Blank (1997: 102), who synthesized much theoretical thought concerning the linguistic sign and added a number of dimensions in order to derive a foundational semiotic model for his theory of semantic change. Rather than adopting Blank's model wholesale, it is used here only in its most pertinent aspects. The difference between the original model and the modified model used here stems from the fact that the range of possible analyses of semantic changes that can be detected from the structured sample used in this study is much smaller than for the Romance languages Blank was working on. Compared to the available data on Romance languages, the depth of the lexicographic description for Athapaskan languages is still comparatively shallow. While it may be possible in future studies to identify lexical changes related to such categories as prestige values (e.g. register shifts), there is, at present, insufficient information available for the identification of such changes in Athapaskan lexicography. A simplified model is therefore adequate for the purposes at hand. This model is represented in Figure 10. It departs from the accepted notion of the linguistic sign as a unit consisting of perceptual form, combinatorial properties (Traugott and Dasher 2002: 8, Mel'čuk 2006: 495), and meaning only insofar as it adds the idea of a *referent-concept* and includes the *phonetic realization* and *situational referent* of an actual discourse situation. The additional components of *phonetic realization* and *situational referent* are included to open the analysis to explanations from usage-based perspectives of language change.

In the diagram, the box labeled *sign* represents the unity of the phonological, morphosyntactic, and semantic components. The sign is related to the box labeled 'Referent-Concept' beyond the dashed, vertical line. The line indicates that the information contained in the 'Referent-Concept' comprises conceptual, extra-linguistic, and even experiential and cultural information, such as taught knowledge and visual imagery (Palmer 1996: 47). The phonetic realization of the sign allows interlocutors to identify the situational referents of discourse situations. The figure also illustrates the notational conventions which will be used in the description of Athapaskan anatomical terms to follow in subsequent chapters: semantic structures will be written in SMALL CAPS, phonemic transcriptions in IPA will be enclosed by slashes (/…/), and referent-concepts will be enclosed in single quotation marks ('…').

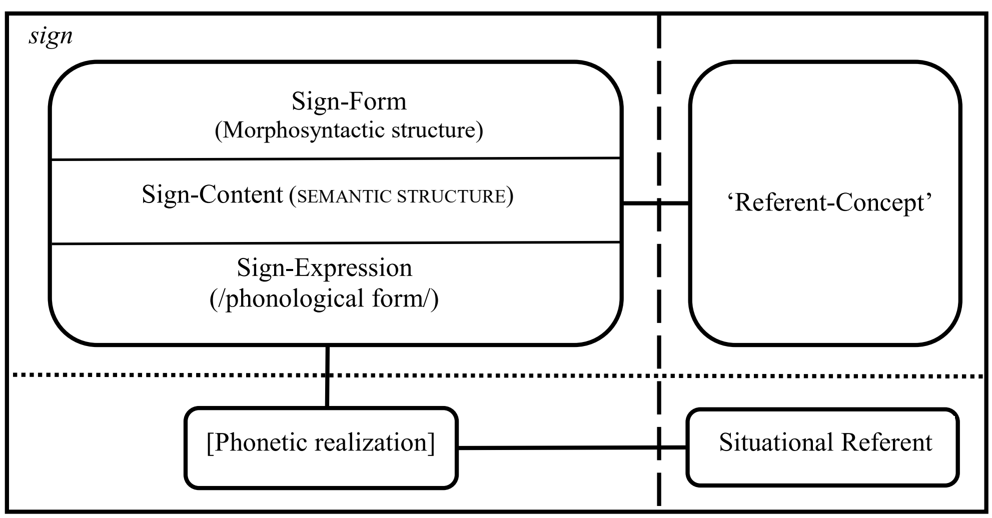


Figure 10. Model of the linguistic sign adapted from Blank (1997)

The example, *miinlachiné* 'my-wrist', in (1) below illustrates the distinctions and analytical categories made in the model. The term comes from the Athapaskan language Dene Dháh spoken in the Canadian interior.

(2)
Dene Dháh (Moore et al. ms)

	my wrist			
Sign	*miinlachiné*			
Phonological form	/miːnlatʃiné/			
Sign-form	*miin-* 1SG.POSS-	*-la-* HAND	*-tʃin-* BASE	*-é* -POSS
Sign-content	HAND-BASE			
Referent-concept	'wrist'			

The referent-concept is glossed in the English metalanguage as 'wrist'. The Dene Dháh expression, which encodes 'wrist', *miinlachiné,* is composed of four morphemes: a prefix, two stems, and a suffix. The form used to express 'wrist' is obligatorily possessed in Dene Dháh, which means that the entity to whom the body part belongs (or is presumably attached to in this case) must be indicated with an inflectional possessive prefix marking person and number of the possessing entity, as well as a generic possessive suffix. This term is therefore annotated as being inalienably possessed, a semantic criterion that will be discussed further in Section 2.5. Further morphological structure of this term is given by the two juxtaposed stems, encoding HAND and BASE respectively, and consequently the form is analyzed as being morphologically complex. The obligatory possessive marking is treated as a semantic property of the compounded stem form which is marked by an inflectional suffix, and is not considered relevant in the determination of morphological complexity. The category of morphological complexity, which has the values 'simplex' and 'complex', is relevant only with regard to derivational morphology for the purposes of the analysis here. The sign-content or semantic structure is identified as HAND-BASE, by translating the Dene Dháh terms into their closest equivalents in the metalanguage of description. All these aspects of the linguistic sign are encoded for each individual Athapaskan anatomical term in the sample used for this study (described in Section 2.7). Each individual item is annotated for the categories of morphological structure (simplex or complex), semantic structure (inalienability, glossing of lexical morphemes), the language of origin, and the geographic location associated with the language. Furthermore, each individual term is transcribed into IPA. The terms are compared on the basis of each of these properties, with the referent-concept acting as the key unifying element. The referent-concept is the *Tertium comparationis* on the basis of which terms, and ultimately languages, are compared.

The description of the morphology of the Athapaskan anatomical terms follows common linguistic practice and will not be discussed further. The results of the morphological analyses are described in

Chapter 4. However, the treatment of semantic structure and the idea of the referent-concept deserve further comment and are discussed in the following two sections. Particularities of the IPA transcription are described in Section 2.6.

2.2 The referent-concept

The term *referent-concept* is used here to denote a conceptual entity, that is, a type object. This contrasts with the standard usage of the term *referent*, which is closer to the notion of *situational referent* used here. For example, in a discussion between a doctor and a patient, the patient may indicate an experienced difficulty with his wrist by uttering the sequence /miːn-la-tʃʰin-é/, thereby drawing the doctor's awareness to the body part in question. If the doctor understands, then she will have successfully associated the phonetic sequence as the string of phonemes associated with the semantic form MY-HAND-BASE and associated it with the concept 'wrist'. The situational context and the possessive prefix will allow the doctor to identify the situational referent 'wrist' of the patient and to associate this particular referent as being a token of the more general conceptual type 'wrist', of which her experience and education will have allowed her to form a body of conceptual knowledge. This body of knowledge will have some components that are specific to the mind of this particular doctor, but a great deal of this knowledge is shared by other members of the doctor's culture, as well as cross-culturally. The patient, too, will have accumulated a body of knowledge about 'wrist', partly from personal experience and partly from his socio-cultural surroundings. While the doctor's and the patient's knowledge are likely different in the level of detail, they share enough of this information to at least begin a communicative interaction on the basis of a shared common ground: a shared perceptual reality (Andersen 1978: 346).

Yet studies have shown that this shared perceptual reality is no guarantor of sameness in linguistic anatomical terminology (Brown 1976, Andersen 1978). While human anatomy is less prone to exhibiting large scale semantic diversity across different cultures (especially as compared to more culturally variable domains such as kinship, for example, it is nevertheless an entity which is cognized in particular ways in different cultures and which — as can be discerned from the example of the patient and the doctor — exhibits variation even within cultures. For the analysis of language, the shared common ground among these different levels of knowledge present among speakers is of central relevance. It is this common ground that provides the basis for the meanings of individual terms. Analytically, the study must move from a total field of potential, all aspects of anatomy that might potentially be represented linguistically, to the subset of aspects and features of the human anatomy that are actually lexicalized in particular languages. In order to facilitate this analytical movement, it is helpful to describe the full potential, the maximum possible extent of the referent-concepts of the human body, in terms of a *cognitive model*.

The idea of cognitive models was developed by the cognitive scientist Philip Johnson-Laird (who referred to them as *mental models*), to account for all manner of human behavior, especially reasoning. This idea becomes useful in the comparative study of anatomy since a mental model is theorized to be "an inner mental replica that has the same 'relation structure' as the phenomenon it represents" (Johnson-Laird 1983: 11). Furthermore, mental models "allow language to be used to create representations comparable to those deriving from direct acquaintance with the world; and they relate words to the world by way of conception and perception" (ibid. 397). In cognitive linguistics, it has become common to use the term *Idealized Cognitive Model* (ICM) for these conceptual entities (Cienki 2010), while in anthropology the terms *schemata* (D'Andrade 1995, Casson 1983) and *cultural model* (Quinn and Holland 1987, Shore 1996) are also common. The anthropological perspective is important here since the type of model relevant to the exploration of semantic structure must be one that is shared among the population of speakers of the languages under analysis. The referent-concepts must be shared in order to provide the common ground necessary for successful communicative interactions. Quinn and Holland emphasize this aspect in their definition of *cultural models:*

> Cultural models are presupposed, taken-for-granted models of the world that are widely shared (although not necessarily to the exclusion of other, alternative models) by the members of a society and that play an enormous role in the understanding of that world and their behavior in it.
>
> (Quinn and Holland 1987: 4)

Cultural models are conceptual entities, which may differ in their specifics (see Shore 1996 for a typology of cultural models), but they share the properties of being mental abstractions over recurring situations, entities, or processes that may be differentially distributed over populations. As such, they can be the referents of linguistic expressions. Thus, the patient's wrist in the specific discourse situation of the example above is a concrete *situational referent,* which is an entity that is associated with the cognitive/cultural model of the 'wrist' shared by both the doctor and the patient (henceforth the term cognitive model will be used since this is closer to practice in lexical semantics, but both cultural model and cognitive model are considered equivalent here). In fact, both interlocutors could converse about the 'wrist' in the physical absence of the situational referent since they can reciprocally assume that the other will have some basic knowledge of the entity in question: the *referent-concept* 'wrist'.

Referent-concepts are important elements in the overall meaning of lexical items, but they are here considered distinct from semantic structure. Referent-concepts are conceptual constructs, which may exist independently of language. This is particularly evident in the terms denoting the human body and its by-products, since these are common to speakers of any language. The human body is encoded in different ways by different languages, but the material referent-concepts, which provide the matter that is to be encoded share basic physical characteristics. This is why the human body is such a good *tertium comparationis*: it is the quintessential common ground between speakers of different languages and members of different cultural backgrounds. Despite the paradoxical fact that the human body is a primary feature of distinction in the discourses that attempt to draw boundaries between groups of people on the grounds of phenotypic features, both from a common sense and a scientific view, the body is obviously and massively similar across cultures.

In the attempt to decipher the lexical semantics of Athapaskan anatomical terms, the human body provides the "bridgehead of understanding" (Foley 1997: 171) by which the unknown — the semantic structures — can be illuminated through the known features of the bodily referent-concepts. This methodological approach to lexical semantic analysis is known as *onomasiology*. Onomasiology is the approach to the study of lexical semantics that begins with the referent-concept and investigates how that entity is encoded by the linguistic means available to speakers. Approaching lexical data from an onomasiological perspective entails isolating a referent-concept and examining the structure of the lexical form used to express it. The Austrian linguist, Adolf Zauner, who was dissatisfied with the older term *Vergleichende Lexikologie* (comparative lexicology), which had been in use prior to his work (Quadri 1952: 52), coined the term onomasiology. Zauner was motivated to find a term, which would be complementary to the already existing term, *semasiology*:

> There are two branches in linguistics that complement each other: one begins with the external, the word, and asks which concept corresponds to it, which meaning it conveys, - hence semasiology (σημασία = meaning), the other begins from the concept and observes which terms, designations are available for this concept in the language, designation = όνομασία - hence Onomasiology: then one would have, I believe, a true parallelism in the designations.
>
> (Zauner 1902: 3-4)

As the older term *Comparative Lexicology* suggests this approach is particularly insightful applied to cross-linguistic research. Indeed, the most important onomasiological studies carried out in the first half of the 20th century all took a cross-linguistic perspective, focusing predominantly on Germanic and Romance languages (Grzega 2002: 1022). The idea still retains currency, however, as evidenced by recent interest in comparative studies of the body on the basis of pictorial aids (Enfield et al. 2006), and of cutting and breaking verbs on the basis of video clips (Majid et al. 2007) carried out on typologically much more diverse samples of languages. In those studies, the basis for the comparison of the linguistic expressions of individual languages is the encoding or lexicalization of the extra-linguistic referent-concepts. These types of studies differ methodologically from comparative studies that focus on the behavior of select groups of expressions and examine their conceptual reflexes, which are more properly termed *semasiological* (see for example Newman 2002, Newman 2009). While ultimately, both semasiological and onomasiological analysis can occur within the same study, as is the case here, it is important to distinguish the two in order to avoid the introduction of circularity: knowing the referent-concept that a particular morpheme makes reference to can reveal something about the semantics of the morpheme, and knowing about the semantics of the morpheme may reveal something about the referent-concept associated with it, but postulating the existence of referential-conceptual entities to explain the properties of individual morphemes leads to circularity in argumentation.

The foundation of this study of Athapaskan anatomical terms is an onomasiological one. The human body and its by-products as a set of referential-conceptual structures is represented by a set of English language terms: an onomasiological list. However, the onomasiological method differs from other list-based approaches, such as Swadesh lists, in that the items are chosen exclusively from one semantic domain, in this case the human body and its by-products. The list of referent-concepts is described in Section 2.7. It suffices to note here that the items were used to generate the sample of terms to be studied from Athapaskan lexicographic resources. The onomasiological list acts as "a sieve filtering out everything that corresponds to a pre-established criterion — the fact of designating a given concept —without our being able to manipulate the results" (Koch 2008: 109). This means that the sample so generated achieves a level of objectivity, which makes the application of quantitative methods viable. But in order for this to work, the sieve itself must be carefully constructed.

This prompts a return to the idea of the referent-concept as cognitive model outlined above. Situational referents are the language external entities that are evident to speakers either through physical co-presence or through their emergence in a discourse the interlocutors are participating in. Thus, knowledge of the body emerges foremost from the experiential encounters of individual bodies, not generalized models of bodies. These individual encounters provide the foundation on which the bridgehead of understanding is built, but the true entities of interest in an onomasiological study, the denotations of linguistic terms, are mental entities that represent type generalizations over individual tokens of bodies, body parts, and bodily by-products. It is important therefore to explore, however briefly, the aspects of the human body that are available for lexical encoding by any language. Medical science has provided anatomical descriptions in excruciating detail, and it can be assumed that these are at least potentially available to speakers of Athapaskan languages. However, the interest in this level of detail emerges in the very specific cultural domain of western science, and neither the average speaker of Athapaskan languages, nor for that matter, the average speaker of a European language can be expected to pay sufficient attention to these details for them to affect the lexical inventory of common expression. Instead the referent-concepts must be knowledge structures arising from practical, everyday interactions, akin to basic-level categories (Rosch 1978).

Such knowledge can arise from different sources. For speakers of English, or rather, for participants in modern western cultures, this body of knowledge is comprised both of folk wisdom and expert knowledge, which has seeped over into common cultural knowledge. It is not in question whether modern or present-day speakers of Athapaskan languages also have access to this knowledge, but rather whether elements of this knowledge have become enshrined at the level of semantic structure in their native languages. Therefore, the onomasiological list of anatomical concepts must be treated in a manner that is reflective of Athapaskan culture. This task contains an element of historical reconstruction. There are no longer direct sources from which to infer the conceptual structure of the domain of the human body and its by-products, not because there are no longer any Athapaskan peoples, or that they have no knowledge of human anatomy and physiology, but because the languages in the vast majority of cases are no longer evolving lexically. Even where this is the case, as could perhaps be argued for in some of the work carried out on the translation of legal vocabulary or bible texts the development of new terms is very limited and their acceptance by the remaining speaker community is questionable. Since Athapaskan languages are all endangered and there are few if any monolingual speakers left, there is a very limited community of speakers that could integrate modern knowledge on topics such as anatomy and physiology into lexical semantic structure of these languages. This means that semantic structure is analyzed in the context of facts known about historical Athapaskan culture. It can be readily assumed, for instance, that much of the knowledge of internal anatomy stems from the hunting and butchering of animals (Brown 1976: 419), something which is at least partially corroborated by the fact that many body-part terms comfortably refer to both animal and human anatomy, suggesting that this distinction is not clearly made at the level of semantic structure. Where anatomical differences among the species do require distinct vocabulary, animal anatomical nomenclature, at least for animals that were traditionally hunted, can be quite elaborate (Kari 2007: 88 gives names for moose anatomy, for example).

In addition to butchery as a source of the information contained in cognitive models, the bodies of speakers themselves also, of course, serve as the basis of insights into bodily structure and consequently, present potential material for lexical encoding. It is therefore useful to briefly explore generalities of mental body representation. Penfield and Rasmussen have long noted the particular arrangement of tactile surfaces relating to parts of the body on the neocortex, portrayed by in their famous homunculus (Penfield and Rassmussen 1950), reproduced in Figure 11. Vignemont et al. (2005) present a range of research carried out on body representation in their study of body mereology, the philosophical counterpart to lexical meronymy. While they do not review any linguistic work, some of their findings have consequences for an onomasiological study of body-part terms. In particular, they report two general findings that help guide the description of body-part concepts in a manner that will be useful for the subsequent analysis presented in Chapters 3 and 4. Unsurprisingly, Vignemont et al. note that the body can be broken down into constituent parts based on spatial information. However, they point out that:

> [i]n addition to simply pooling information from different senses, body representations also synthesize the various signals into an integrated meaningful experience by establishing consistent relationships between body parts and the whole. (Vignemont et al. 2005: 2)

The fact that bodies can be moved with simple intentions also imposes "additional functional organization" (2005: 5), especially since not all body parts can be moved independently. Furthermore, they observe that:

> A more conceptual way of thinking about body representation suggest that action plays an important role in imposing categorical structure on body space. In particular, we act around our joints and these become body part boundaries. (ibid.: 5)

These observations shape the referential-conceptual model of the human body that underlies the onomasiological approach to the semantics of Athapaskan terms pursued here. Visual information and understandings of functional organization are therefore of central importance. The structure of the visual information encoded in the cognitive model can be assumed to be reflective of the spatial relations body parts exhibit, following Finke (1989):

> The spatial arrangement of the elements of a mental image corresponds to the way objects or their parts are arranged on actual physical surfaces or in the actual physical space. (Finke 1989: 61)

Functional information presents a greater challenge since it is difficult to gauge the kind of understanding speakers of Athapaskan languages might have had of the functional properties of various body parts. However, the anatomical cognitive models of Athapaskan language speakers can uncontroversially be assumed to contain information regarding those functions that can no longer be performed once the body part in question has been damaged or impaired in some way: joints are associated with movements, perceptual organs with the sensual modality they allow access to, and so forth. This leads to a set of parameters for a cognitive model of anatomy which takes into account the following types of information (NB: the parameter values in 3 are exemplifying and do not represent a definitive list):

(3)

Form:	flat, tubular, round, indeterminate mass
Constitution:	bony, fleshy, fluid, solid, spongy
Location:	position on the body, internal or external to the body

Function: enabling movement, enabling a modality of perception

These parameters provide but an indication of the baseline conceptual structure that can be used in the description of body-part concepts. Keeping the human anatomy as idealized in a cognitive model in mind (aided by the occasional visual representation in Chapter 3) is especially important since, in practice, the body parts and associated referents are named by English words. This is of course practical since English is not only the language of analysis, but also the language of lexicographic description in all source materials: all Athapaskan dictionaries and word-lists used in this study are bilingual English-Athapaskan.

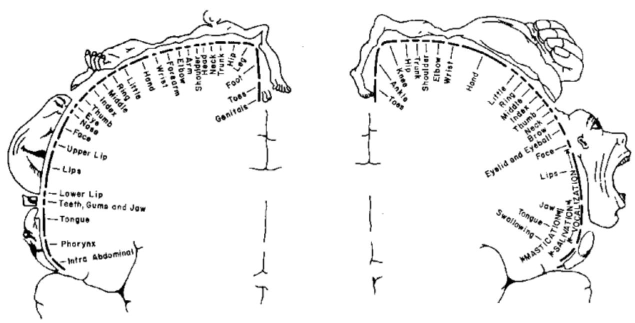


Figure 11. Original diagram of the sensory and motor homunculi (Penfield and Rasmussen 1950)

To summarize, onomasiology is a principled method with which to construct a sample for lexical semantic analysis on the basis of an extra-linguistic entity for which expressions are sought. This extra-linguistic entity takes the form of a cognitive model described by a set of English language terms. Care should be taken with the English terms since they also embody a set of cultural assumptions: they are not value-free standards of comparison. However, since the human body is universally present for speakers of human languages, it presents an exemplary "bridgehead of understanding" (Foley 1997: 171ff.) from which to cross from the West Germanic world of the language of description and analysis, to the world of Athapaskan anatomical semantics, and knowledge. On this basis, the data are gathered by selecting all and only those lexical items that correspond to the concepts in the list naming parts of the body. This curtails subjectivity and introduces a level of rigor to the semantic analysis that opens the way for both qualitative and quantitative exploration of the linguistic representation of referential-conceptual structure at the level of individual languages. Following the model of the linguistic sign outlined above, the levels of linguistic representation of particular interest are the level of semantic structure, morphological structure, and phonological structure. Semantic and phonological patterns directly feed into the classification of Athapaskan languages proposed in Chapter 5, while morphological criteria are used in the examination of higher level lexical structures such as semantic subdomains. Most important among all these, however, is the level of semantic structure, which is discussed in the following section.

2.3 Semantic structure

In the field of historical linguistics, the main strength of phonological analysis, when compared to semantic analysis, lies in the fact that phonological relationships between words across languages follow regular patterns in those cases where the words share a common origin, that is, when they are cognates, provided they underlie the same phonetic environments and are not influenced by non-phonetic factors (Hock 1991: 35). This regularity allows for two words to be identified as being cognates even when their phonological structure is different. A comparable degree of regularity of semantic association among words has never been found. Indeed, the semantic description of any word has proven to be a much more intractable problem than the description of the sound structure: phonemes are a generally, if not always uncritically, accepted means of describing sound structure. None of the strategies that have been proposed for the description of semantic structure enjoy a similar degree of acceptance. A detailed discussion of semantic theories and approaches is far beyond the scope of this study. Instead, two aspects shared by most approaches to semantic description — paraphrasing and semantic feature analysis — will be discussed at some length, since these bear directly on the subject matter at hand. Different schools of thought in semantics have elevated these two primarily descriptive notions to the level of explanatory theories: paraphrasing on the basis of a set of semantic primitives in the case of the Natural Semantic Metalangue (Goddard 1998, Wierzbicka 1972) and semantic features in structuralism and cognitive anthropology (Goodenough 1956; see also Blank 1997 for a review). However, neither has been able to fully account for the complexities of the semantic properties of a human language, and alternative approaches have been able to shed light on semantic phenomena, which had remained obscured by other perspectives. A particularly fruitful approach has been guided by the attempt to include the manner in which human minds experience the world in the analysis and description of semantic structure. This approach has found its greatest elaboration in the school of thought known as cognitive linguistics.

Cognitive linguistics (CL) provides the theoretical framework, which guides this study, in particular through lexico-semantic analyses of Athapaskan languages (Rice 2002, 2009 and especially Rice 2012), and through analyses of patterns of semantic change in body-part terms (Wilkins 1996). CL has synthesized notions of mental structure which organized perceptual data with a rethinking of category structure based on insights form cognitive psychology. This has allowed for the introduction of perceptual imagery, e.g. shapes and spatial locations, to the description of semantics, which is of particular relevance to the analysis of anatomical terms considered here. CL is, however, a field of scholarly pursuit that remains somewhat diffuse and is inclusive of an eclectic variety of approaches and theoretical constructs. Rather than a formally circumscribed theory, it is better viewed as a family of approaches to the study of language that share some guiding principles. As an approach to theory in a field in which much work remains to be done, this state of affairs is to be welcomed, lest some theoretical decision stifle creativity and prematurely close potentially fruitful avenues of pursuit. However, the work of research itself must define its constructs as clearly as possible, even if this makes their scope more immediate. Fundamental to CL is the understanding of meaning as conceptual.

> Meaning is equated with conceptualization (in the broadest sense); semantic structures are thus conceptualizations shaped in accordance with linguistic convention. (Langacker 1991: 61)

Conceptualizations, therefore, come in at least two different forms, which are relevant to language: a more dynamic field of mental phenomena, which are potentially linguistically encoded, and conventional, stable conceptual units, which form *semantic structure*. Langacker develops this distinction in a manner which has direct relevance to the comparison of languages through their semantic structures:

> ..[I]n large measure, semantic structure is language specific rather than universal. I make a terminological distinction between 'semantic structure' and 'conceptual structure'. Conceptual structure is the ongoing flow of cognition: any thought or concept, whether linguistic or non-linguistic. Semantic structure is specifically linguistic, referring to the semantic pole of a linguistic expression. Semantic structures are conceptual structures established by linguistic convention..
> (Langacker 1991: 108)

This quote suggests that semantic structure is characteristic of individual languages, rather than human language per se. This idea accords with the semiotic model described above, which distinguishes semantic structure, the lexical semantic patterns encoded by linguistic expressions in individual languages, from referent-concepts, which are conceptual models of entities and processes. The human body is more or less invariant across different cultures and speaker communities, but the manner in which it is represented at the lexical level of a linguistic system varies a great deal. Each language has a distinct set of terms and expressions for naming parts of the anatomy, each encoding different perceptual and conceptual aspects of the human body. The semantic structures that are found in the lexicalizations of body-part terms in a particular language are characteristic of that language and can serve to distinguish it from other languages. As anatomical terms evolve in time, they chart their own characteristic paths. These need not be unique however, as contact and common ancestry can result in shared evolutionary paths. From this it follows that similarities and differences among the semantic structures of different languages can be indicative of historical relationships among those languages.

Semantic structures found in individual terms are here referred to as *lexicalization patterns*. This draws on the synchronic understanding of lexicalization as "the coding of conceptual categories" (Brinton and Traugott 2005: 18), as well as the diachronic idea of linguistic entities becoming "conventionalized at the level of the lexicon" (Blank 2001: 1603). Lexicalization patterns are described by means of English language glosses written in small caps, as in the case of the semantic structure HAND-BASE FOR 'wrist' discussed above. The glosses are carefully chosen to represent the semantic structure of the Athapaskan terms and are written as sequences of words in small caps joined through hyphens, in those cases where the Athapaskan terms they translate are morphologically complex, and periods in those cases where the Athapaskan terms have a unified semantic structure which can only be translated through a series of English terms. The conventions used in the semantic descriptions are discussed further in the introduction to Chapter 3, which outlines all the lexicalization patterns found in the sample.

If lexicalization patterns are to serve as indicators of historical relationships, they must accurately represent the semantic structure they are used to encode. Since, as has been established above, the situational referents are entities common to speakers of different Athapaskan languages (as well as the analyst), the differences in their linguistic treatment will emerge only through a detailed, or *thick description,* of their semantics. This description takes the form of English language glosses, but the choice of glosses is determined through a careful matching of semantic characteristics between the Athapaskan terms and the English terms. These characteristics may be more aptly termed *features*. The latter term has attained a negative connotation in recent work in lexical semantics, especially in CL studies, and, therefore, the way in which features are understood and brought into this analysis is in need of some elaboration.

Before the advent of CL, semantic analysis focused on finding necessary and sufficient conditions that would determine the meaning of lexical items. By the 1950s, this approach to semantic research had been developed into a methodology known as *componential analysis* (see, for example, Goodenough 1956). Here, binary features were used to delimit and contrast word meanings so that, for example, male and female (of any species) are distinguished by the semantic markers [+FEMALE] and [-FEMALE]. Since this approach had not, in the end, led to the ever elusive set of semantic markers whose combination would give rise to the meanings of all words, it began to be questioned. Advocates of prototype theory especially rejected the componential analysis approach as wholly inadequate.

The negative associations of the idea of features arose through a historical development, which saw features as binary variables, which alone constitute necessary and sufficient criteria for the definition of linguistic, especially lexical semantic categories. The difficulty in applying this idea to all but a few, limited cases eventually led to the growing acceptance of a revised idea of category structure. This re-thinking of the nature of categorization is founded on evidence from psychological studies of category structure carried out by Eleanor Rosch in the 1970s (cf. especially Rosch 1975). This led to a development of a model of category structure that contrasts with the older idea that category membership should be defined by uniformly shared sets of criteria. While this idea of all or none category membership still persists and may be applied to certain cases, prototype theory recognizes the fact that there are categories that cannot be defined in that way. Instead, categories have a structure in which members exhibit definitional criteria to varying degrees, being more or less representative of a category. Category membership may even be uncertain presumably since members considered unrepresentative may eventually also be considered as peripheral members of other categories. Prototypical categories exhibit a family resemblance structure. This means that many members share attributes, but the set of shared attributes is varied and differentially distributed across category members. Finally, and most importantly for the present study, there is no single set of criterial attributes that would hold for all members of a category (this version of prototype theory is described in detail in Geeraerts 1989, and summarized succinctly in Lewandowska-Tomaszczyk 2010).

This rejection of the feature-based approach had the unfortunate consequence that principled lexical decomposition itself received less attention, as Geeraerts notes:

> The prototypists' reaction against this featural approach had, however, the negative side-effect of creating the impression that prototypical theories rejected any kind of componential analysis. This is a misconception for the simple reason that there can be no semantic description without some sort of decompositional analysis. As a heuristic tool for the description and comparison of lexical meanings, a componential analysis retains its value. (Geeraerts 2005: 4)

Following Geeraerts, the stronger and perhaps loftier goal of a finite set of semantic features that can serve as the building blocks of meaning is abandoned, in favor of the much less ambitious goal of having an adequate descriptive apparatus for lexical meanings. This idea has found resonance among lexical semanticists working within the CL framework (Cruse 2000; Paradis 2004, 2005). These researchers resort to the description of meanings based on feature structures, which they call *qualia*. In doing so, they develop approaches that share many attributes with, and are partially inspired by, James Pustejovsky's Generative Lexicon (1998). Despite these researchers' widely diverging theoretical frameworks — CL in the case of Cruse and Paradis, formal computational linguistics in the case of Pustejovksy — they resort to similar methodologies at the descriptive level. This points to the fact that lexical decomposition is a highly useful tool in lexical semantic analysis and, as such, lies beyond the vagaries of theoretical paradigm shifts. Indeed, lexical decomposition has, in Geeraerts' somewhat hyperbolic words, "been obvious to lexicographers from time immemorial" (Geeraerts 2005: 5).

Lexical decomposition is a useful tool that can be successfully deployed in the description of lexical meanings. Since, CL situates meanings at the conceptual level, lexical decomposition is re-constituted as a tool for describing conceptual information at the level of semantic structure. However, this idea can be taken further insofar as non-linguistic conceptual objects might equally well (if not better) be described by decomposing them into components or features. This is a crucial point for an onomasiological project. This implies that in order for onomasiology to successfully elucidate the semantic structure of a lexical item, the referent-concept the item denotes must be well understood. For example, the biological relationships of relatedness among a group of people can easily be understood outside of the linguistic terms used to refer to them. The English term *my aunt* is vague as to the gender of the connecting relative, since it can refer both to the father's sister and the mother's sister. In Koyukon, however, these two relatives would be distinguished by the terms *sebaats'e* and *seokk'ʉye*, respectively. The latter pair of terms encode an element of semantic structure that the English form does not, namely the distinction in the gender of the connecting relative (the father or the mother). This distinction does not lie at the level of the extra-linguistic concept itself since all types of 'aunt' are (at least potentially) present among all societies. In fact each 'aunt' can be described as carrying the feature [±RELATED THOUGH SAME SEX RELATIVE] from the viewpoint of some family member. This particular value of this feature of 'aunts' can be picked up on by the semantic structure of individual languages. A linguistic term can encode information related to this potential property of 'aunts', in which case it would be a feature of the semantic structure.

Within the study of anatomical nomenclatures, the potential composition of the referent-concept has already been carried out through the detailed study of human anatomy. The key question, however, is to ascertain which aspects of the human anatomy could be relevant properties encoded by the terms of individual languages. The properties of cognitive models of human anatomy discussed in the preceding section come into play here. As will emerge in great detail from the discussion of individual terms in Chapter 3, the form, location, and to a lesser extent function[8] of body- \part terms are properties, which are explicitly encoded by Athapaskan languages. The referent-concept 'wrist', for example, could be described as having the following structure:

[8] All these properties can possibly be integrated into a much more general classification of semantics. They are very similar to the qualia structures identified as useful descriptive semantic tools by Pustejovsky and Cruse. Pustejovsky describes similar properties in his discussion of "structured representation" (1998: 76), corresponding roughly to his *constitutive*, *formal*, and *telic* roles. Cruse, similarly, refers to these types of meaning-relevant information as "perspectives" and describes these semantic properties as relating to an entity being viewed as: a whole consisting of parts, as seeing something as a kind contrasting with other kinds, and seeing something as having a certain function (Cruse 2000: 118). These semantic properties are therefore quite general and worthy of reflection in lexical semantic theorizing.

(4)

Form:	flat (from a transverse perspective), prominent round bone
Constitution:	bone covered in skin, site of prominent veins
Location:	between the 'arm' and the 'hand'
Function:	enabling movement of 'hand'

Each and all of these properties are available for encoding in the semantic structure; that is each or all could be available for lexicalization. However, different Athapaskan languages avail themselves of different aspects of this complex conceptual structure in their actual lexicalizations. For example, the Dene Dháh term for 'wrist' /la-tʃʰin/ HAND-BASE, can be viewed as having lexicalized aspects of the locational component through the morphological root for BASE, which occurs in other parts of the Dene Dháh lexicon, such as in the term /ʃih tʃʰinah/ HILL-BASE for 'base of the hill'. Further specification of the location occurs through the modifier HAND which acts as a reference point (Langacker 1993) from which the conceptual representation of an adjacent part is accessed. Other Athapaskan languages lexicalize different aspects of the cognitive model of 'wrist'. Dene Sų̨łiné, for example, has the term /lá əɬhanarət'a/ HAND-REVOLVES.ON.ITSELF. Morphologically, this structure is a compound made up of a stem HAND as the modifier and a nominalization REVOLVES.ON.ITSELF as the head. While the modifier is again a reference point exploiting the constitutive component, the head lexicalizes the functional component: the range of movement which the wrist provides.

The languages Dene Dháh and Dene Sų̨łiné lexicalize the referent-concept 'wrist' by explicitly encoding different aspects of the same potential cognitive model of human anatomy. The morphological resources deployed in constructing a lexicalization pattern differ in their semantic structure even though the target of the lexicalizations (the referent-concept) is identical. This is because the elements that make up the lexicalization patterns bring with them varying packages of semantic information:

> An expression is said to impose a particular image on its domain. The conventionalized images embodied by the symbolic units of a language (both lexical and grammatical) are crucial to the semantic value. (Langacker 1991: 61)

The domain Langacker is referring to can here be equated with the referent-concepts, since the term *domain* is used to indicate bodies of knowledge that are relevant to, but not the same as, semantic structures (Langacker 1991: 61). In fact, semantic elements of languages portray the domain information they relate to in particular perspectives: they guide the interpreter of an expression to access the domain information through a particular conceptual path. The differences in the ways in which expressions construe access paths to extra-linguistic information — the different lexicalization patterns — are characteristics particular to the semantic structures of individual languages. Lexicalization patterns are the descriptive outcomes of the application of the onomasiological method and they are rendered as single glosses or strings of glosses in small caps. In the case of multiple glosses, hyphens separate those elements that correspond to multiple morphemes in the Athapaskan source language, while periods separate those glosses that only represent one morpheme in the source. For example, Dene Dháh /la-tʃʰin/ is glossed as HAND-BASE since the corresponding Athapaskan form is a compound. In contrast, if the meaning of a monomorphemic Athapaskan term is best described through multiple English glosses, these are joined by a period. For example, the semantics of the Deg Xinag term for 'abdomen', /ʧʰon̥/, are best described by a combination of two English words ABDOMINAL.VISCERA.

Lexicalization patterns are sequences of semantic elements that can be shared among different languages. The extent to which individual patterns are shared by different Athapaskan languages is described in detail in Chapter 3. Languages are also compared in terms of their mutual resemblance as measured on the basis of which and how many lexicalization patterns they share. This is done through an algorithm measuring language distance through lexicalization patterns as categorical variables, as described in Chapter 5. This method provides an overall judgment of the similarity among languages. The distributions of individual lexicalization patterns itself can also provide insight into the relationships between languages, especially when these are thought of as characteristics developed by languages and language groups over the course of their evolution. Lexicalization patterns, like all aspects of linguistic structure, can change over time. Following the logic of the comparative method, the sharing of changes in patterns should be considered as characteristics of a shared ancestry. As such, lexicalization patterns should be on par with shared innovations in phonological structure. However, difficulties with this line of reasoning arise because lexicalization patterns can be shared not only as the result of a common inheritance, but also as a result of independent origin, or through language contact (i.e. calquing). While both common inheritance and borrowing reveal the historical relationships among the language that share these patterns, they are indicative of very different historical processes. Independent origin, however, can distort the historical signal. Nevertheless, lexicalization patterns are potential characteristics to be exploited in historical linguistic analysis, if the reasons for their distribution can be distinguished. This requires a careful look at patterns of lexical change that have been observed for anatomical terms, as well as the treatment of semantic change in an epidemiological perspective.

2.4 Semantic change as an indicator of historical relationship

Anatomical terminology outside of the domain of medical specialization emerges through the necessity of dealing practically with injuries and, in the anatomically more revealing butchery of animals for the consumption of food. While traditional medicine among Athapaskans had little to do with anatomy (John Janvier personal communication; see also comments in Bross 1972), the pursuit of hunting-gathering lifestyles common among most Athapaskan-speaking peoples suggest an intimate knowledge of anatomy through animal butchery. This knowledge established through practice can be assumed to change little through the ages, especially if the fundamental subsistence strategies remain constant. Barring the advent of a major cultural development, such as the emergence of specialized anatomical knowledge in the field of medicine, the anatomical terminology can also be expected to remain more or less constant. In this context, however, it is worth considering Brown's ideas on the differential evolution of anatomical nomenclatures (1976: 419). Brown suggests that languages may shift back and forth with regard to the levels of differentiation expressed in their nomenclatures. He considers creolization or pidginization as possible causes for such changes. This seems a radical conclusion especially since one of the clearest cases of such shift toward lesser differentiation in the nomenclature that can be observed in the dataset, the case of Western Apache /kan/ encoding both 'hand' and 'arm', occurs in a language that otherwise exhibits no evidence of creolization. Brown's reach toward situations involving substantial social upheaval as an explanans for changes in the structure of anatomical nomenclatures is understandable, since it is difficult to see what might cause change in the terms for parts of the body otherwise. Anatomical terms might, in fact, be considered as a particularly stable domain, since both the body itself and practices such as animal butchery that offer glimpses into anatomical structure can look back on extremely long histories. Even the more recent classificatory taxonomies developed in the field of medicine have essentially only added new and more precise terms to the terminological inventory, not taken away or restructured older ones. And yet, anatomical terms do change. If these changes cannot be accounted for through cultural factors such as the development of relevant bodies of knowledge, or social factors such as creolization or pidginization, then any observed changes must be the result of a natural drift brought about through the process of transmitting the language from one generation to the next (Enfield 2014).

Enfield identifies four stages in the transmission of linguistic forms: exposure, representation, reproduction, and material. These stages are integrated in a 'four-stroke engine model', see Figure 12.

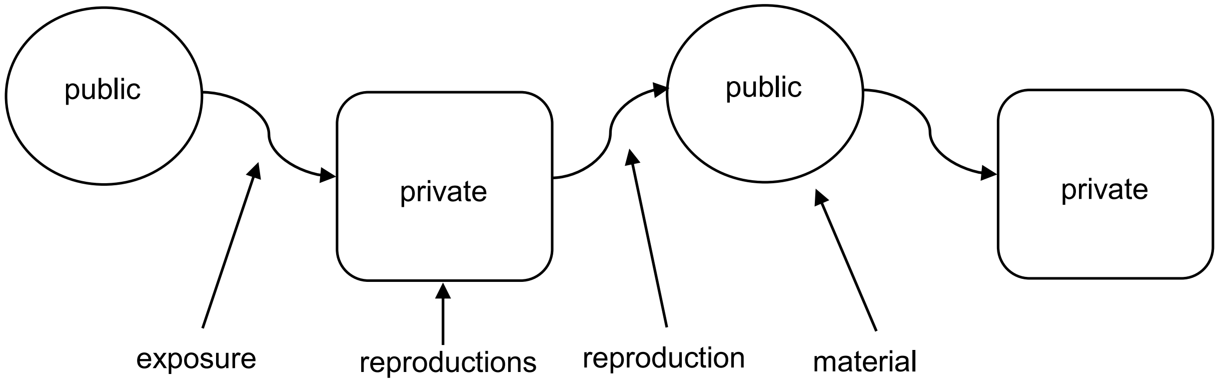


Figure 12. Four-stroke engine model of transmission (Enfield 2014: 5)

This model attempts to capture the way in which members of a speech community learn and reproduce linguistic forms. The individual is exposed to some linguistic form in a discourse situation. The form and its usage context, meaning, and so forth are internalized by the individual and can be reproduced at a later stage. The model identifies the exposure and reproduction stages as public aspects of transmission, while internalization is a private. The transitions between public and private aspects are affected by biases. For example, linguistic forms must occur in acts of communication between speakers or no exposure can take place. The linguistic form must also have some successful representational format so that it may be remembered and, crucially, reproduced. The material biases reflect the possibility of languages to be spoken or written or otherwise rendered material in some way. A study of terms in a database like this one can have little to say about most of aspects. However, the biases affecting representation can very well be studied through an onomasiological perspective. It follows that representational biases shall be given the most attention. Representational biases can be observed through the manner in which a particular linguistic sign lexicalizes the referent-concept that it is associated with. The manner of the relationship between the representational medium and the represented content can be understood at a basic level as being situated on a cline of opaqueness-analyzability: some forms allow ready associations of their component parts to other lexical items. When these lexical items denote properties that are intuitively associated with the referent-concept, then a representation emerges that can be easily grasped and remembered:

> …we benefit from what can be called natural meaning. If a word or grammatical expression is compatible with other information, for example by having iconic properties, it is better learnt and remembered. (Enfield 2014: 8)

Natural meaning has a long history in linguistics and philosophy, dating back at least as far as Plato's *Cratylus* (as discussed in linguistic terms in Keller 1995: 22ff.). More recently, the idea of natural meaning was resuscitated by Saussure (1916), who introduced the more modern terminology *motivation*. Saussure accepted motivation as the exceptional counterpoint to *arbitrariness*, the dominant relationship between the outward expression of a linguistic sign and its content. The phonological structure, for example, can be said to be arbitrary, insofar as no single combination of phonemes seems more appropriate than any other in representing the referent-concept it is associated with — in short, there is no evidence for onomatopoeia among Athapaskan anatomical terms, and the sound-meaning associations are purely arbitrary. On the morphological and semantic levels, however, this arbitrariness is less pervasive. Motivation is thought to be detectable in cases when the structure of function of particular referents is directly encoded, or rather, lexicalized, in the linguistic forms used to denote them. For example, *screwdriver* and *Schraubenzieher* are two words for the same object that reference different properties: the pushing in motion of the object 'screw' in the case of the English term, and the pulling out motion of the 'screw' in the case of the German term (Radden and Panther 2004: 5-7). The meanings of both terms are therefore *natural* since it reflects common actions associated with the object in question. Panther and Radden define motivation as:

> A linguistic sign (target) is motivated to the extent that some of its properties are shaped by a linguistic or non-linguistic source and language-independent factors.
>
> (Radden and Panther 2011: 9)

For the anatomical terms, all aspects of the cognitive model of the referent-concepts given in (3) can act as sources for motivated expressions if they are encoded explicitly. Thus the encoding of relative locations of body parts produces expressions motivated by perceptual factors, just as resemblances in shape or understanding of functions do. Both lexicalization patterns for 'wrist' cited earlier, HAND-BASE and HAND-REVOLVES.ON.ITSELF, are motivated, but the monomorphemic form encoding the concept 'wrist' in Gwich'in /ʧʲ'àːʔ/ is not.

The terms expressing anatomical referents in Athapaskan can, therefore, be grouped into motivated and unmotivated forms. In general, monomorphemic forms can be said to be unmotivated, expressing their meanings exclusively through convention; they are purely arbitrary signs. Polymorphemic expressions, on the other hand, frequently show indication of being motivated: that is, their component parts as well as the logic behind their combination for the lexicalization of particular referent-concepts can be revealed through analysis. Furthermore, even monomorphemic forms can sometimes show indications of having undergone motivational lexicalization processes in cases of semantic change. While the relative naturalness of lexicalization patterns themselves can only be judged vis-à-vis that sample of terms constructed for this study, semantic changes among body-part terms can be compared to a wider typological sample thanks to the comparative work of David Wilkins.

Wilkins (1996) began with a single semantic domain, the human body, and studied patterns of semantic change that occurred within this domain, across widely diverse languages. His approach was onomasiological, but its concern lay with only the semantic aspect of the method. The reason for this is that Wilkins wanted to develop a tool, a list of terms and their relationships, which could be an aid to historical linguistic work. Finding stable patterns of semantic change make it possible to relax the requirement of a matching meaning between two compared terms suspected to be cognate. If meanings can be shown to be related through one of the patterns of semantic change established by Wilkins, forms denoting different meanings can be taken into consideration as potential cognates.

Wilkins (1996) studied semantic change in anatomical nomenclatures across four language families: Dravidian, Bantu, Indo-European, and Tibeto-Burman. Wilkins found that semantic change conformed to five general tendencies (1996: 273-274), which are cited in (4).

(4)

i. It is a natural tendency for a term for a visible person-part to shift to refer to the visible whole of which it is a part, but the reverse change is not natural (e.g. 'navel' → 'belly' → 'trunk' → 'body' → 'person').

ii. It is natural tendency for a person-part term to shift to refer to a spatially contiguous person part within the same whole (e.g. 'belly' ↔ 'chest' ↔ 'skull' ↔ 'brain').

iii. Where the waist provides a midline, it is a natural tendency for terms referring to parts of the upper body to shift to refer to pans of the lower body and vice versa (e.g. 'elbow' ↔ 'knee'; 'uvula' → 'clitoris'; 'anus' → 'mouth').

iv. It is a natural tendency for the term for an animal part to shift to refer to a person part (e.g. 'snout' → 'nose'; 'beak' → 'face').

v. It is a natural tendency for a term for a verbal action involving the use of a particular person part to shift to refer to that person part (e.g. 'walk' → 'leg'; 'hold' → 'hand').

Wilkins developed this typology on the basis of a study of etymological dictionaries (Wilkins 1996: 272). For Athapaskan languages, however, very few historical records exist that date back any significant amount of time. Even when historical documents are available, they are not detailed enough to enable the construction of etymologies. As a consequence, all inferences about semantic change in Athapaskan languages have to be arrived at through cross-linguistic comparison and semantic reconstruction. For example, the language Upper Tanana lexicalizes 'shin' through the form /ʥâ:t/. Since the association of this form with the referent-concept 'leg' is more firmly established across the Athapaskan languages (14/51;

proportion = 27%)[9], than its use in terms for ‘shin’ (5/24; proportion=0.21), the association [/ʣâ:t/ ‘shin’] can be inferred to have arisen through the semantic change: [/ʣâ:t/ ‘leg’] > §[10] > [/ʣâ:t / ‘shin’][11]. The underlying logic in the identification of patterns of semantic change is parallel to the identification of sound changes in the Comparative Method: all things being equal, languages tend to be conservative. This means that cross-linguistically, common forms can be taken as being retentions of ancestral forms. This procedure allows for the identification of a semantic change. The next task is to reconstruct the semantic pathway along which this change could have occurred.

Semantic reconstruction is guided by the insight that linguistic forms do not abruptly change meaning, rather, they acquire new senses as a result of contextual re-interpretations of their meanings (Wilkins 1996, Blank 1997, Traugott and Dasher 2001). This implies that semantic changes must first pass through stages of polysemy. It is helpful in this context to envision the semantic and referential-conceptual structures associated with lexical items as rhizomatic networks (Frank 2010: 72). Following this botanical metaphor, a lexical item is associated with networks of senses that can each develop their own additional senses, given time and the right contextual situations. The semantic and referential-conceptual structures associated with a particular phonological form can grow and sprout new structures, even while older structures persist or fade away and die. Given that, in the majority of cases, the available data on Athapaskan languages, takes the form of word-lists:

> …the task that falls to the investigator is that of identifying the cognitive pathways that once existed, by analyzing the semantic debris left behind and attempting to reconstruct the bridging mechanisms, albeit hypothetically, along with the cognitive processes that could have led to the sequence of semantic extensions that appear to be present in the network. (Frank 2010: 74)

Discussion of the terms for ‘leg’ and ‘skin’ above already indicated that this referent-concept is lexicalized through a number of different cognate terms in Athapaskan languages. The most widespread pattern among these is the cognate set of which Kaska /ts’an/ is a representative. It can further be observed that cognates of /ts’an/ express the referent-concept ‘bone’ in the language Kaska as well as the vast majority of other Athapaskan languages (lexicalizations of the concepts ‘leg’ and ‘bone’ are described in detail in Chapter 3). Since the form-meaning pairings of the pattern [/ts’an/ ‘bone’] are far more frequently represented among Athapaskan languages than form-meaning pairings of the pattern [/ts’en/ ‘leg’], a semantic shift

[9] This notation is shorthand for ‘14 of 51 observed cases’.

[10] The symbol ‘§’ will be used throuout to indicate a *semantic* change. See also Chpater 3: Introduction.

[11] This actual etymology of these terms is more complex, as described in detail in Chapter 3.

[/tθ’en/ ‘bone’] > § > [/tθ’en/ ‘leg’] is posited[12]. However, in many languages, the form /ts’en/ lexicalizes both ‘bone’ and ‘leg’ at the same time. Such constellations are identified as polysemy patterns and described through the notation [/ts’en/ ‘bone’] ℙ [/ts’en/ ‘bone, leg’][13]. Since the pattern [/ts’en/ ‘bone’] is far more dominant (49/51; proportion= 94%) than the pattern [/ts’en/ ‘leg’] (26/52; proportion = 49%), it may be inferred that the directionality assumed above, in which the ‘bone’ term came to denote ‘leg’, rather than vice versa, is correct. From the perspective of the botanical model alluded to above, the term /ts’en/ has extended a root toward the meaning ‘leg’. This process of extension, has, following Blank (1997: 150), passed through three cognitive-historical stages: association, innovation, and lexicalization. In the first stage, some discourse situation leads to ‘leg’ being associated with ‘bone’. The relationship between the concepts that the two meanings represent are related through their location on the human body. Since the two body parts are directly adjacent or ‘touching’, the relationship between them is referred to as a relationship of contiguity. This is particularly evident, for example, with the more specific meaning of /ts’en/ found in the Frances Lake and Ross River dialects of Kaska, where the term denotes the concept ‘lower leg’. As discussed above, the Kaska term must have denoted the referent-concept ‘bone’, before it acquired the additional referent-concept ‘lower leg’. This part of the leg features its bone component in a particularly prominent fashion, leading to a ready association between ‘bone’ and ‘lower leg’, as in part (a) of Figure 13. The innovation comes about through the use of /ts’en/ to express the referent ‘lower leg’, without the referent ‘bone’ being germane to the particular contextual interpretation of the term. If this kind of usage pattern becomes established at the level of linguistic convention, it leads to a stage of polysemy (b), and expansion of the “rhizomatic” network. If some of the connecting roots are broken, that is, if the full network is not learned by a new generation of speakers, the form /ts’en/ loses the association with ‘bone’ and can be said to have undergone a full semantic change, shown in (c).

[12] This notation is a shorthand for the sign described in Figure 12, where the morphological and phonological components are conflated in the phonological representation encased in slashes (/), the referent-concept is indicated through quotation marks (‘’), and semantic structure can be represented through glosses in SMALL CAPS.
[13] The symbol ‘ℙ’ will be used throuout to indicate a pattern of polysemic extension. See also Chpater 3: Introduction.

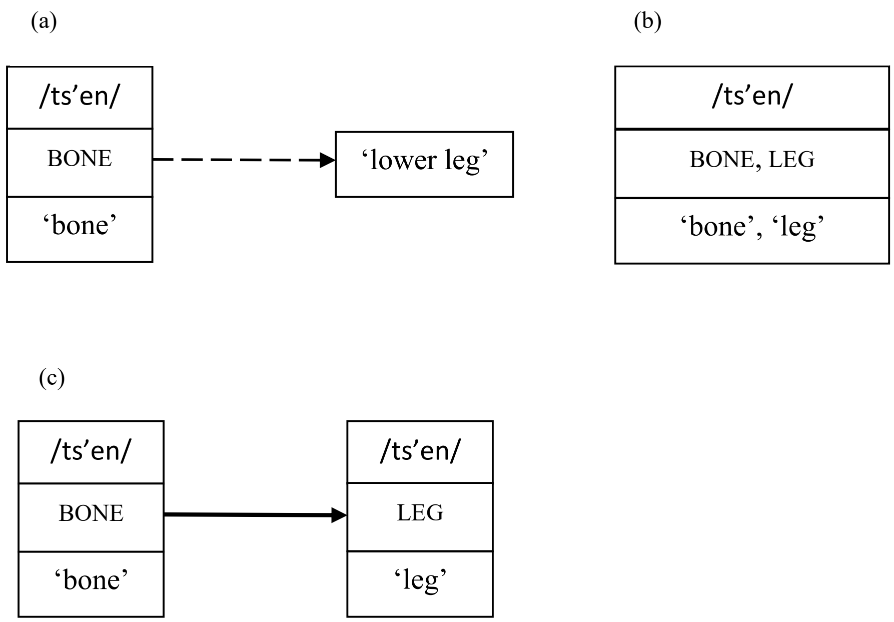


Figure 13. Association of a term with a contiguous body part (a), leading to innovative use of term for the contiguous body part resulting in a polysemy pattern for /ts'en/ represented in (b). In time, the additional associations LEG 'leg' could completely supplant supplant the older form-meaning pairing resulting in semantic change, (c).

From the perspective of an epidemiology of representations, the association of ‘leg’ with ‘bone’ can be thought of as a natural association, since it is both a reasonable association to make introspectively and an empirically attested pattern with a wide distribution. The general tendency to associate parts with wholes, that pulls a term denoting one body part to come to denote another along the lines of Wilkins’ generalization (ii), is a bias that affects the distribution of terms. In epidemiological terms, the higher-order partonym acts as an attractor with a high likelihood of eventually affecting its contiguously associated terms (Sperber 1996: 108). High likelihood attractors lead to *natural* change whose polygenesis among the Athapaskan languages is a likely possibility. Wilkins’ typology of semantic changes allows for the classification of the changes found among Athapaskan anatomical terms into those that have a high probability of occurring, and those that run counter to the broader typological trend. The latter category, when found to be shared among several languages, are good indicators of shared evolutionary processes, since their independent arising can be considered as highly unlikely (although, of course, not wholly impossible). Semantic changes found among Athapaskan anatomical terms and their classification into strong and weak indicators of shared linguistic ancestry is discussed in Chapter 4.

The types of representation and their implications for classification are worked out in Chapter 4, on the basis of the patterns described in Chapter 3. However, two other aspects of the linguistic sign are also under investigation: the phonological and the morphological properties of terms. These two aspects are discussed in the following two sections.

2.5 Morphological structure

The differences in representational semantics discussed above in terms of motivation and arbitrariness have correlates at the morphological level. It has already been noted that the systems of anatomical terms consist of a set of monomorphemic forms — morphological roots that express their content meanings through convention alone. These are the core morphological elements provided by Athapaskan languages whose combination can result in more complex, motivated forms. At the morphological level, the distinction between these two types is most clearly and simply identified in the dichotomy: simplex vs. complex. Each item in the sample has been identified as morphologically simplex or complex. The categorization of individual items according to their morphological complexity can give an indication of the tendency of the particular referents that they lexicalize to be encoded in a certain way. The measurement of complexity is operationalized as the ratio of complex to simplex for any given term across the languages of the family. In this way, information can be gathered about the ability of the onomasiological list to track the unanalyzable *primary lexemes* (Brown 1976: 403), the morphological building blocks of Athapaskan languages and arguably the best candidates for ultimately stable, cognate forms. Furthermore, morphological complexity can be an aid to ascertaining whether certain forms are innovative, i.e. in those cases when a referent-concept is encoded as a monomorphemic, cognate form in the majority of languages, but as a complex multimorphemic form in some languages. Taking morphological complexity as an additional factor in language comparison leads to the categorization of referents according to the predominance of one of four patterns among them: monomorphemic cognate, multimorphemic cognate, monomorphemic non-cognate, and multimorphemic non-cognate. These analyses reveal common patterns in the morphological encoding of referents across Athapaskan. These cross-Athapaskan patterns can indicate general tendencies, which in turn can be used to identify which languages exhibit divergent behavior. For example, the referent-concept 'eye' is encoded in simplex forms in all but two cases in the sample. Both these cases, which are not morphologically related, occur among the dialects of Dena'ina. This is important in the larger project of tracing the origins of certain forms, especially if these are thought to have diffused across some subset of the Athapaskan languages and represent patterns shared through lateral contact and not ancestral inheritance.

A second morphological variable encoded for each item in the sample is obligatory possessive marking. Many Athapaskan anatomical terms require the possessor of the particular body part to be indicated through a pronominal prefix. In other words, many of the terms in the sample are bound roots. Obligatory marking is here referred to as alienability, with obligatorily possessed forms being inalienable, while those that undergo only optional possessive marking being alienable. Alienability as a property of referent-concepts exhibits some variability among the languages, but its overall import can be measured statistically. The results from these measurements have consequences for the onomasiological method since they allow for the segmentation of the referent-concept list into sub-domains as discussed in Chapter 4.

2.6 Phonological structure

The final aspect of the linguistic sign that is investigated in this study is the phonological representations of individual terms. For this purpose, each individual term was transcribed into phoneme strings in accordance with published information on the phoneme inventories of Athapaskan languages. In some cases this was not possible due to a lack of information on the languages in question. In this case, the terms were transcribed into symbols of the International Phonetic Alphabet (IPA)[14] that were thought most likely to represent the orthographic segments in question. This constitutes, in essence, educated guess work. Four guiding principles were used as heuristics in carrying out the transcriptions:

1. In general, it was assumed that in alveolar and velar stop series, the distinction was one of aspiration and not voicing. Consequently, all of these stops were transcribed into the corresponding IPA symbols: t/t^h, k/k^h. The exception here were prenasalized alveolar stops, especially as they occur in the Athapaskan languages of the Mackenzie Basin which where transcribed as $/^nd/$.
2. Word-final stops were always transcribed as unaspirated.
3. Affricates were considered to have phonemic status and treated as single phonemes.
4. Compounds were transcribed as single phoneme sequences, even when written separately in the sources. Postpositional phrases or postpositional phrase-noun phrase combinations were transcribed as separate phonological strings separated by whitespace, when they were written separately in the sources. Whitespaces are counted as units with a distance of one in phoneme string comparisons (see discussion of distance measures in Section 2.8 below).

[14] The IPA was chosen as a medium of representation for all Athapaskan languages, since this opens the study to scrutiny from both within and without the specialist field of Athapaskan studies. The dataset used, which contains both the orthographic forms and their IPA transcriptions will eventually be made public allowing for the inspection of individual transcription decisions.

All the transcribed forms are listed in the tables of Chapter 3. The database itself, however, also includes information about the associated lexicalization pattern, the morphological complexity value, and the impressionistic categorization of that term into the category of body part, ephemera, or effluvia (discussed further below). The lexicographic source is also indicated. A sample of the database is found in Appendix II.

2.7 Structure of the sample

The terms for the parts of the body, ephemera, and effluvia investigated in this study are sampled from a larger lexical database of Athapaskan languages called the Pan-Athapaskan Comparative Lexicon (PACL). This database was created for the purpose of interdisciplinary lexicological research in linguistics and archaeology[15]. PACL is divided into semantic domains and strives to attain an exhaustive coverage of all terms in different semantic domains such as Flora, Fauna, Kin terms, Tools, Numerals, and Body-Part terms. The latter domain was added for the purpose of this dissertation, and expanded to include two further related sub-domains: effluvia and ephemera. The data were gathered by casting the net widely in order to build up the database, and the three subdomains of the large semantic domain of human anatomy were combined while labeling each item according to its supposed sub-domain affiliation. This categorization procedure was based on reasoning along two types of semantic criteria: (1) the idea that each domain represents a distinction in terms of importance to the organism as a whole. For example, effluvia can be discarded or lost most easily and generally with the least impact on the entire organism, while body parts are crucially retained with loss resulting in the death of the organism or, injury at least a major physiological adjustment. (2) The relative solidity or mass of each item. Here, again, effluvia and body-parts represent the ends of a continuum, with the former being typically in liquid or near-liquid form, and the latter being more solid. On both axes ephemera represent a mid-point. Ephemera are exemplified by the referents ‘fingernail’ and ‘hair’. This distinction was not assumed to have implications for the actual morphological or semantic treatment of these terms in Athapaskan languages, but was set up as a variable to be tested following the initial impressionistic observations that terms denoting bodily fluid seemed to exhibit a particular tendency to be lexicalized through monomorphemic cognates across the Athapaskan family. The adequacy of sub-domain distinctions is tested in Chapter 4.

The onomasiological list of terms was drawn from the BEET (**B**ody-part, **E**phemera, and **E**ffluvia **T**erms) subsection of PACL. The sampling procedure was to draw 72 random terms from the database.

[15] http://www.linguistics.ualberta.ca/Research/Projects/PanAthapaskanComparativeLexico.aspx/

However, the resulting sample is not fully random since items which were not well represented in the database were dismissed. The sample is therefore best described as a quasi-random sample of those terms that were best distributed for comparative analysis. The randomness is sufficient to limit the introduction of the analyst's bias in the quantitative evaluations. The referents that make up the onomasiological list are (in alphabetical order, with their assigned sub-domain given in brackets: BPT for Body-Part Term, EPH for ephemera, and EFF for Effluvia):

'inner abdomen' (BPT), 'abdomen, outer' (BPT), 'ankle' (BPT), 'arm' (BPT), 'arm, lower' (BPT), 'back' (BPT), 'blood' (EFF), 'blood vessel' (BPT), 'body' (BPT), 'bone' (BPT), 'breast' (BPT), 'breath' (EFF), 'butt' (BPT), 'chest' (BPT), 'chin' (BPT), 'ear' (BPT), 'ear, inner' (BPT), 'ear, outer' (BPT), 'earwax' (EFF), 'elbow' (BPT), 'excrement' (EFF), 'eye' (BPT), 'eyelid' (BPT), 'face' (BPT), 'flatus' (EFF), 'fat' (EPH), 'finger' (BPT), 'fingernail' (EPH), 'flesh' (BPT), 'foot' (BPT), 'gall' (EFF), 'gallbladder' (BPT), 'gums' (BPT), 'hair' (EPH), 'hand' (BPT), 'head' (BPT), 'heart' (BPT), 'heel' (BPT), 'hip' (BPT), 'intestines' (BPT), 'jaw' (BPT), 'knee' (BPT), 'leg' (BPT), 'lips' (BPT), 'liver' (BPT), 'lungs' (BPT), 'mother's milk' (EFF), 'mouth' (BPT), 'neck' (BPT), 'nose' (BPT), 'pus' (EFF), 'ribs' (BPT), 'saliva' (EFF), 'scab' (EPH), 'shin' (BPT), 'sinew' (BPT), 'skin' (BPT), 'skull' (BPT), 'stomach, inner' (BPT), 'stomach, outer' (BPT), 'sweat' (EFF), 'tear' (EFF), 'teeth' (EPH), 'tendon' (BPT), 'thigh' (BPT), 'throat' (BPT), 'toe' (BPT), 'toenail' (EPH), 'tongue' (BPT), 'urine' (EFF), 'vomit' (EFF), and 'wrist' (BPT).

This resulted in a sample of 2692 terms distributed across the three sub-domains in the manner shown in Table 3.

Table 3. Numbers of referent-concepts and corresponding terms

Sub-Domain	Referent-Concepts	Terms
BPT	53	2034
EPH	6	255
EFF	13	403
TOTAL	72	2692

These terms were drawn from 55 Athapaskan languages and dialects[16]:

[16] Many of these languages have different names in the published literature. An overview of names and iso-codes for these languages is given in Appendix I.

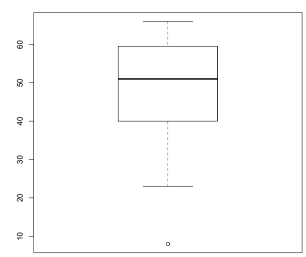
Table 4. Alphabetic list of languages in the sample

Ahtna	Hupa	Northern Tutchone
Bearlake	Jicarilla Apache	San Carlos Apache
Beaver	Kaska (Dease Lake)	Sekani
Central Carrier	Kaska (Frances Lake)	South Slavey
Chilcotin	Kaska (Good Hope Lake)	Southern Tutchone
Deg Xinag	Kaska (Liard)	Tagish
Dena’ina (Iliamna)	Kaska (Lower Liard)	Tahltan
Dena’ina (Inland)	Kaska (Pelly)	Tanacross
Dena’ina (Outer Cook Inlet)	Kaska (Ross River)	Tolowa
Dena’ina (Upper Cook Inlet)	Kato	Ts’ets’aut
Dene Dháh	Kiowa Apache	Tsuut’ina
Dene Sųłiné	Koyukon	Tututni
Dogrib	Kwalhioqua-Clatskanie	Upper Kuskokwim
Galice	Lipan Apache	Upper Tanana
Gwich’in (Gw)	Lower Tanana	Wailaki
Gwich’in (Tl)	Mattole	Western Apache
Han	Mescalero Apache	Witsuwit’en
Hare	Mountain Slavey	
Holikachuk	Navajo	

The geographic locations associated with these languages are shown Chapter 3. Not all languages are represented equally well, with an average of 49 terms being available for each language. These differences are detailed in Table 5, which lists the number of available terms for each language (the boxplot gives a visual overview of the distribution of the data showing that most languages are represented by 40-60 terms).

Table 5. Number of items in the sample for each language

Language	**Items**	**Language**	**Items**	**Language**	**Items**
Wailaki	8	Upper Kuskokwim	48	Han	60
Kaska (DL)	23	Mescalero Apache	49	Kaska (L)	60
Kato	24	Western Apache	49	Deg Xinag	62
Holikachuk	26	Dena'ina (IN)	51	Dogrib	62
Lower Tanana	26	Kaska (LL)	51	Gwich'in (Tl)	62
Tagish	31	Kaska (P)	51	Central Carrier	63
Beaver	33	Kiowa Apache	51	Dene Dháh	63
Lipan Apache	33	Bearlake	53	South Slavey	63
Kw-Cl	34	Gwich'in (Gw)	53	Navajo	64
Tahltan	34	Kaska (FL)	53	Ahtna	65
Mattole	35	Witsuwit'en	53	Upper Tanana	65
Galice	37	Dena'ina (OCI)	55	Hupa	66
San Carlos Apache	38	Dena'ina (UCI)	55	Koyukon	66
Tututni	39	Sekani	56		
Tolowa	41	Kaska (RR)	57		
Dena'ina (IL)	43	Tsuut'ina	57		
Chilcotin	45	Kaska (GHL)	58		
Jicarilla Apache	45	Northern Tutchone	58		
Ts'ets'aut	45	Southern Tutchone	58		
Mountain Slavey	48	Hare	59		
Tanacross	48	Dene Sųłiné	60		



The dataset in this study is therefore constituted by 2692 Athapaskan expressions each of which:

- is transcribed into a string of phonemes
- is given a morphological complexity value (simplex / complex)
- is given an alienability value (alienable / inalienable)
- is identified with a lexicalization pattern (a string of semantic glosses in small caps)
- is assigned to a semantic sub-domain, and
- is associated with a language and a geographic location

The identification of lexicalization patterns is carried out through the systematic comparison of the lexicographic sources. The results of this procedure are described in Chapter 3. The other variables are open to quantitative evaluation. The most important of the quantitative methods are used the construction of distance matrices and cluster dendrograms. These are described in Chapter 4.

2.10 Chapter summary

This chapter addressed the theoretical foundations for the description of lexicalization patterns in Chapter 3 and the analysis to follow in Chapter 4. The entire study is based on the method of onomasiology built around the linguistic sign as a complex multi-faceted unit of the lexicon. Each facet considered here — morphological, semantic, phonological, and referential — feed into the analysis of anatomical terms and the classification of Athapaskan languages presented in Chapter 4. The main descriptive focus, however, is on the lexicalization patterns that encode each anatomical term. The description of lexicalization patterns is centered on two aspects: the semantic structure of each pattern and the geographic location of each pattern. These are presented in Chapter 3, according to the referent-concept with which each pattern is associated. Therefore, Chapter 3 takes the form of a long list of referent-concepts, each of which is encoded through a number of lexicalization patterns. Each pattern is also indicated on a geographic map attached to each section.

3. Lexicalization patterns and their distributions

This chapter describes in detail the form and geographic distribution of the lexicalization patterns for each referent on the onomasiological list described in Chapter 2. The list is reproduced in Figure 14. This chapter is organized by the onomasiological list of referent-concepts discussed in Section 2.7: Section 3.1 deals with anatomical referent-concepts that concern the body as a whole or denote body parts which are found throughout the body. Section 3.2 discusses all terms belonging to the head, face, and neck. Section 3.3 describes terms for the upper body as well as internal organs. Section 3.4 discusses terms pertaining to the limbs. Finally, Section 3.5 describes lexicalization patterns found among effluvia terms. Each sub-section deals with an individual referent-concept and is comprised of a textual description, a table listing all the data points for that referent-concept, and a map. Terms from individual languages are given in IPA transcription to facilitate cross-linguistic comparison.

When a languages has multiple lexicalizations for a given referent, then these are separated by a slash , '/', if there are variant pronunciations for the same lexicalization pattern, they are separated by a comma, ','. For example, Koyukon has both the form /t͡sax/ and the form /t͡saj/ to lexicalize the pattern HEART$_1$, and these are listed in the table separated by a comma (see Section 3.3.6). Navajo has two separate lexicalization patterns, not two pronunciation variants, that lexicalize the referent 'lips': /zápãːh/ and /taːʔ/. These are listed in the table separated by a backslash (see Section 3.2.10).

The languages in the tables are arranged according to geographic proximity. This is not intended to be a serious classification of any kind, merely a practical and heuristic arrangement, partially reflecting traditional groupings of Athapaskan languages. The maps are provided to show which sets of cognates are found where in the Athapaskan geographic space. On the maps, the color blue is used to mark locations where a particular cognate is present, turquoise marks locations for which more than one term is available for the same referent-concept, but only one term corresponds to the pattern identified in the particular map being shown. Locations colored in white indicate languages where the particular pattern under scrutiny is absent, while the grey color indicates locations for which no data were available, as well as those areas that are not traditionally associated with Athapaskan languages. Figure 15, for example, shows the geographic distribution of terms denoting the referent-concept 'back' that fall under the pattern designated BACK$_1$.

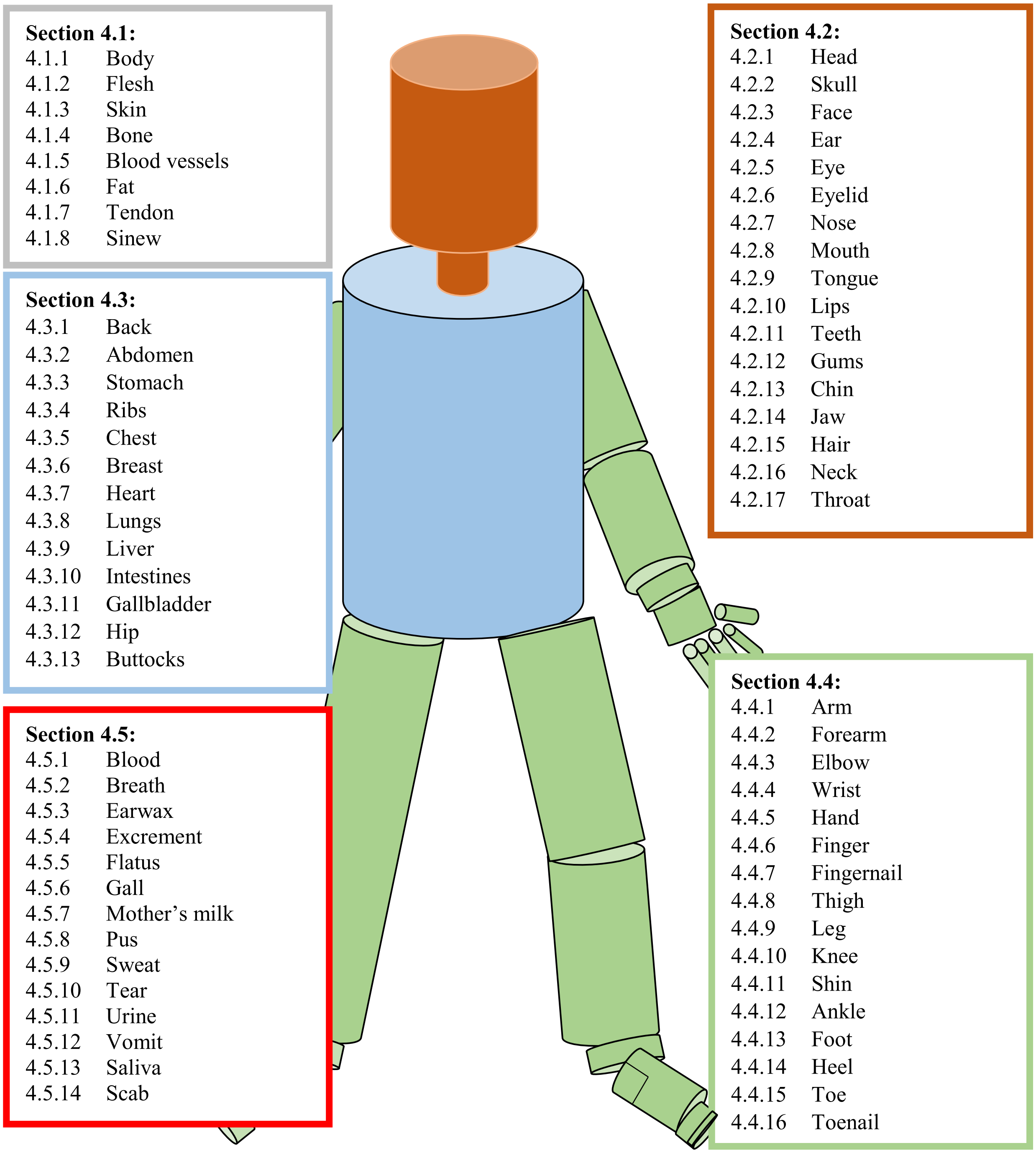


Figure 14. The onomasiological list of BEETs serves as an outline to Chapter 3

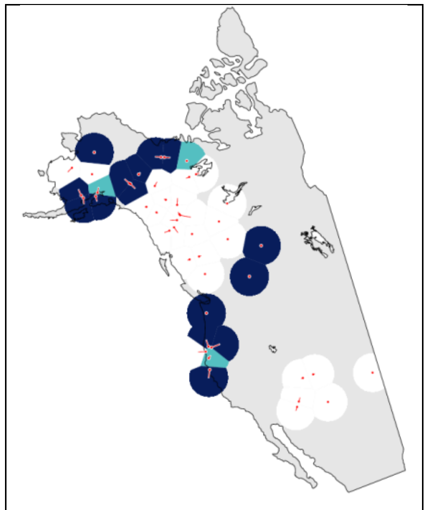


Figure 15. Distribution of the lexicalization pattern BACK$_1$

The map in Figure 15 shows that this pattern is present among some languages in Alaska, at the southern end of the languages of the Canadian Interior, and on the Pacific Coast (blue areas). Among the Apachean languages and in British Columbia, this pattern is completely absent (white areas). In one language of Alaska (Dena'ina Upper Cook Inlet dialect), one in Canada (Hare), and one in California (Hupa), the pattern represented by BACK$_1$ is not the sole means of lexicalizing 'back' as other forms are also available (turquoise areas). In this case, these forms are discussed in Section 3.3.1 and listed in the table accompanying that section. These maps are intended to give an overview of the distributions rather than the exact form for each language, which are found in the tables and textual descriptions. The map in Figure 16 indicates the locations at which the data used in this study were recorded. The locations marked on this map correspond to the colored areas in the maps showing the geographic distributions of lexicalization patterns.

The description of each term identifies and describes lexicalization patterns. Forms occurring under the same referent-concept that have similar phonological forms are considered cognates. However, these cognates should be considered hypothetical cognates established on the basis of shared semantic and phonological information, not on the basis of an established regular sound correspondence. In the cases where the term *cognate set* is used, the correlation in meaning and form has been considered strong enough to make a later plausible reconstruction highly likely. These putative cognates are labeled with the name of the referent they lexicalize, as in the case of the BACK$_1$ example shown in Figure 15. The index '$_1$' is added because there is more than one cognate sets which lexicalizes the referent back (see Section 3.3.1). The numbering is arbitrary and serves only to distinguish patterns. The patterns so named are written in small caps, as in the example BACK$_1$ from Figure 15. Lexicalization patterns are designated following the notation described in Chapter 1. For example, a common pattern for the lexicalization of the referent-concept 'wrist' is HAND-BASE (see Section 3.4.4). Patterns of semantic change are described with the following schematic notation:

(i) [/phonological form/ SEMANTIC FORM 'referent-concept$_1$'] > § > [/phonological form/ SEMANTIC FORM 'referent-concept$_2$']

(ii) [/phonological form/ SEMANTIC FORM 'referent-concept$_1$'] > ℙ > [/phonological form/ SEMANTIC FORM 'referent-concept$_1$, referent-concept$_2$']

Finally, compounded forms are indicated with the symbol ⊕ as in (3):

(iii) [/phonological form/ SEMANTIC FORM ⊕ /phonological form/ SEMANTIC FORM 'referent-concept']

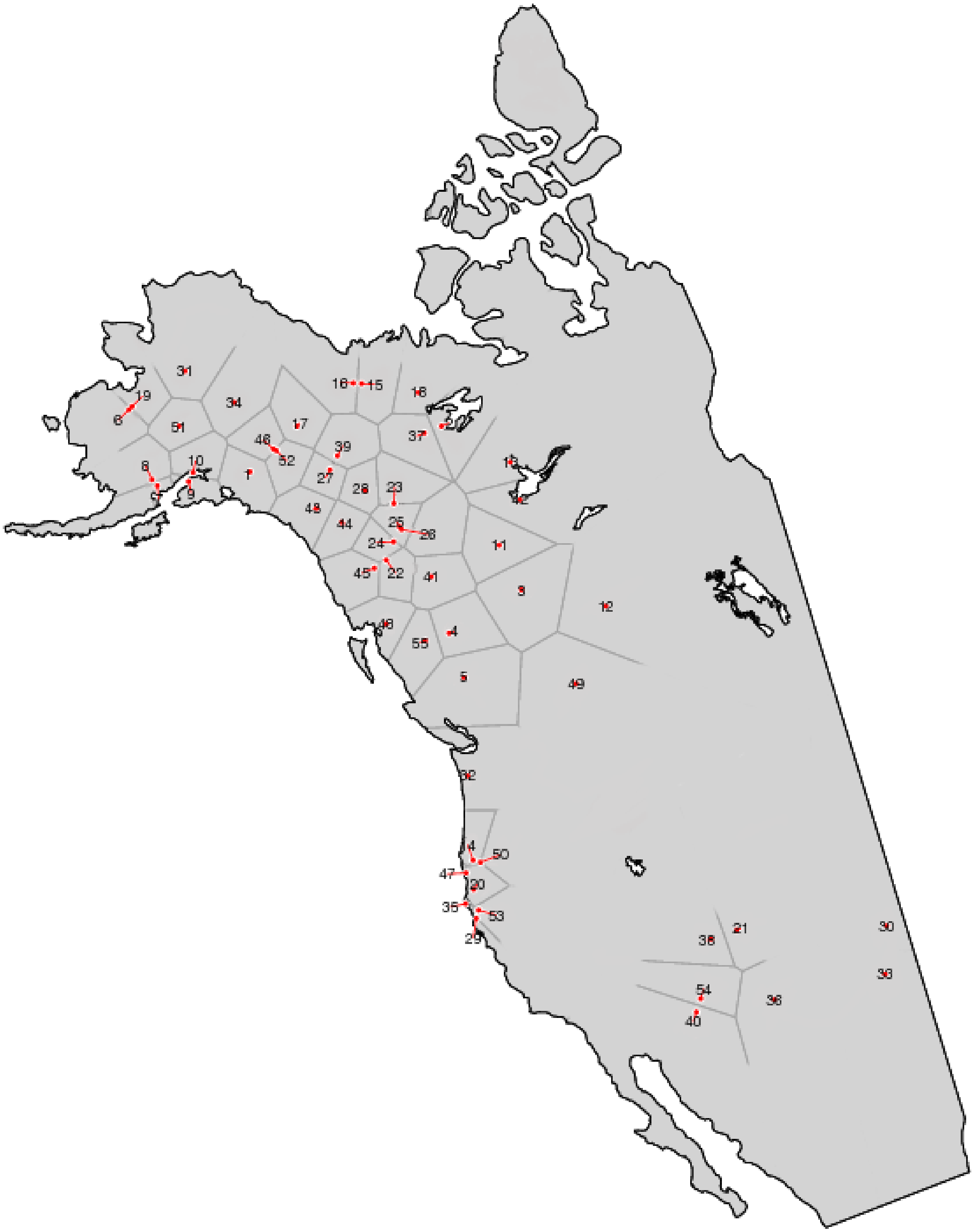


Figure 16. Map of Athapaskan languages

Table 6. Legend to Figure 16 Map of Athapaskan language

No.	Language	No.	Language	No.	Language
1	Ahtna	20	Hupa	39	Northern Tutchone
2	Bearlake	21	Jicarilla Apache	40	San Carlos Apache
3	Beaver	22	Kaska (Dease Lake)	41	Sekani
4	Central Carrier	23	Kaska (Frances Lake)	42	South Slavey
5	Chilcotin	24	Kaska (Good Hope Lake)	43	Southern Tutchone
6	Deg Xinag	25	Kaska (Liard)	44	Tagish
7	Dena'ina (Iliamna)	26	Kaska (Lower Liard)	45	Tahltan
8	Dena'ina (Inland)	27	Kaska (Pelly)	46	Tanacross
9	Dena'ina (Outer Cook Inlet)	28	Kaska (Ross River)	47	Tolowa
10	Dena'ina (Upper Cook Inlet)	29	Kato	48	Ts'ets'aut
11	Dene Dhah	30	Kiowa Apache	49	Tsuut'ina
12	Dene Suline	31	Koyukon	50	Tututni
13	Dogrib	32	Kwalhioqua-Clatskanie	51	Upper Kuskokwim
14	Galice	33	Lipan Apache	52	Upper Tanana
15	Gwich'in (Gw)	34	Lower Tanana	53	Wailaki
16	Gwich'in (Tl)	35	Mattole	54	Western Apache
17	Han	36	Mescalero Apache	55	Witsuwit'en
18	Hare	37	Mountain Slavey		
19	Holikachuk	38	Navajo		

3.1 Terms relating to the body as a whole

The terms described in this first subsection are general to the entire human body or are found throughout body. In general, these terms tend to be monomorphemic and homogenous across the different Athapaskan languages. The exceptional referent-concept in this subsection is 'blood vessel', which features a small number of morphologically more complex expressions. The terms in this sub-section do not form semantic systems, in the sense that some of the terms found in the sections on limbs do. In the case of the terms for different parts of the leg, a semantic change in one of the leg terms can cause other terms in the system to change as well.

3.1.1 Body

The referent-concept 'body' is lexicalized predominantly through monomorphemic stems belonging to two major cognate sets, identified as BODY$_1$ and BODY$_2$. Two further patterns are also found among the lexicalization patterns, BODY$_3$ and BACK$_2$-FRONT, but these are far less widespread.

(1) BODY$_1$: The first set is characterized by a stem-initial alveolar fricative (retroflex in Deg Xinag and Upper Kuskokwim) and a high front vowel, as exemplified by Kaska /zí/. It has been give the semantic value BODY$_1$.

(2) BODY$_2$: The second set, BODY$_2$, found among Navajo, Western Apache, San Carlos Apache, Jicarilla Apache, Kiowa Apache, as well as Tsuut'ina. This cognate set is characterized by a stem-initial alveolar affricate followed by high front vowel and a fricative in stem-final position, as in Kiowa Apache /ʦʼíːs/.

(3) BODY$_3$: A third pattern is found among the Dena'ina dialects (Outer Cook Inlet and Upper Cook Inlet) as well as in three languages of the Pacific Coast region: Galice, Tututni and Hupa. It is characterized by an alveolar stop or nasal in stem-initial position and a complex coda of the form /-stʼ/, such as in Hupa /nɪstʼ/. The syllable structure of this form may indicate that it is bi-morphemic. It is possible that the element /ne/, /ni/ is related to the forms for 'back' that have been identified here as BACK$_1$ (see Section 3.3.1). However, the evidence is not conclusive and the interpretation of the remaining morphemes is difficult, which is why the form is here treated as a monomorphemic stem here and assigned the semantic value BODY$_3$.

(4) BODY$_4$ & (5) BODY$_5$: A morpheme possibly related to the element /ne/ discussed above is also found in the 'body' terms for Northern Tutchone terms, but without further evidence the relationship remains unclear.

(6) BACK$_1$-BASE: In Southern Tutchone the cognate form of this element combines with the element BASE to encode the referent-concept 'body' through the lexicalization pattern BACK$_1$-BASE.

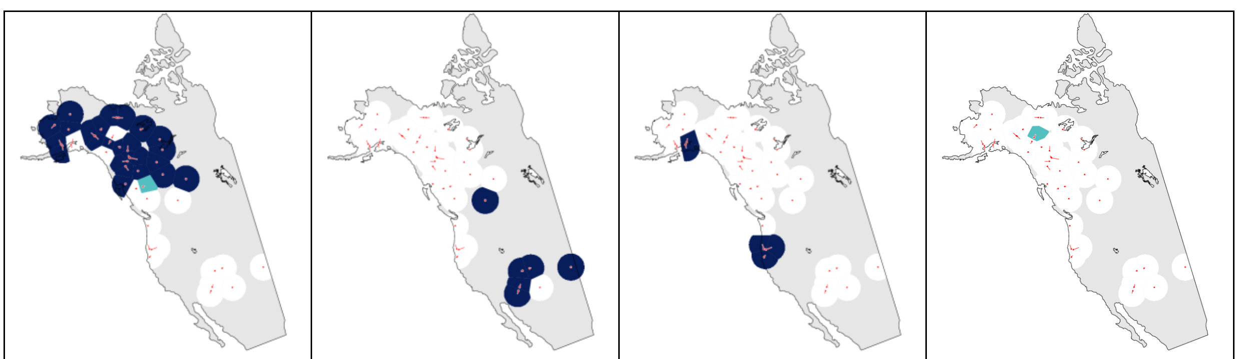
(7) BACK$_1$: In Chilcotin, the form /naθ/ is cognate with many of the 'back' terms in other languages (see Section 3.3.1), but no longer lexicalizes the referent-concept 'back'. This indicates a semantic change [/naθ/ BACK$_1$ 'back'] > § > [/naθ/ BODY 'body'].

(8) BACK$_2$-FRONT: In Witsuwit'en and Central Carrier a further lexicalization pattern is found BACK$_2$-FRONT, as exemplified in Witsuwit'en /jəs-tʼəj/.

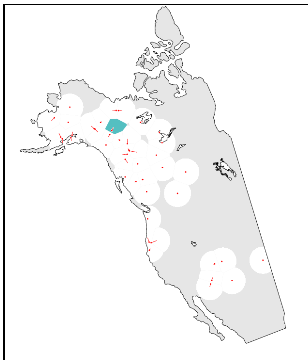
(9) BODY$_6$ & (10) BODY$_7$: The forms in Mescalero Apache and Kwalhioqua-Clatskanie remain difficult to identify and do not appear to have cognates elsewhere among the Athapaskan languages.

Table 7. Body

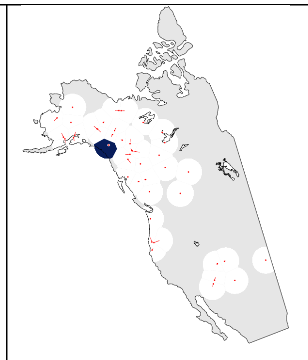
	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʐik	1	**INTERIOR CANADA**	Hare	-	
	Koyukon	sək	1		Mountain	-	
	Dena’ina (Iliamna)	-			Bearlake	jĩ́	1
	Dena’ina (Inland)	ʒek’	1		Tłı̨chǫ	ʒìː	1
	Dena’ina (OCI)	nest’a	3		South Slavey	ʒį́	1
	Dena’ina (UCI)	nest’a	3		Dene Sų̨łiné	zí	1
	Ahtna	zɪʔ	1		Dene Dháh	zí	1
	Holikachuk	-			Beaver	ʧɪ̨	1
	Gwich’in (Teetl’ıt)	ʒin	1	**BRITISH COLUMBIA**	Carrier	zi / jus̠t’e	1/8
	Gwich’in (Gwıchya)	ʒin	1		Witsuwit’en	jəst’əj	8
	Hän	ʒən̥	1		Sekani	zìʔ	1
	Lower Tanana	-			Ts’ets’aut	xɛiːə	1
	Upper Kuskokwim	ʐeʔ	1		Chilcotin	naθ	7
	Upper Tanana	ʒin̥	1	**PACIFIC COAST**	Hupa	nɪst’	3
	Tanacross	jɛn̥	1		Galice	tɑst’	3
YUKON	Northern Tutchone	nehtʰínʔ / neʒɑn	4/5		Kato	nəst’	
	Southern Tutchone	nɑʧʰì	6		Tolowa	-	
	Kaska (DL)	zíʔ	1		Tututni	-	3
	Kaska (FL)	zíʔ	1		Mattole	-	
	Kaska (GHL)	zíʔ	1		Wailaki	-	
	Kaska (L)	zíʔ	1		Kwa-Clat	te	10
	Kaska (LL)	zíʔ	1	**APACHEAN**	Navajo	ʦ’íːs	2
	Kaska (P)	zíʔ	1		Western A.	ʦ’ĩ́	2
	Kaska (RR)	zíʔ	1		S. Carlos A.	ʦ’íh	2
	Tagish	-			Jicarilla A.	ʦ’is	2
	Tahltan	-			Kiowa A.	ʦ’íːs	2
					Mescalero A.	kʰáʃí	9
	Tsuut’ina	ʦ’ítʰà	2		Lipan A.	-	



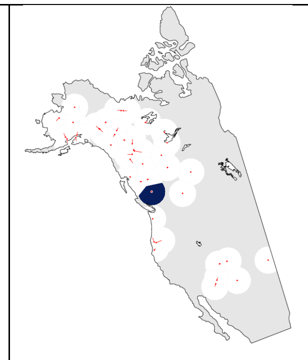
(1) BODY$_1$ (2) BODY$_2$ (3) BODY$_3$ (4) BODY$_4$



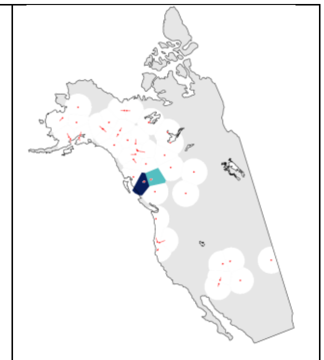
(5) BODY$_5$



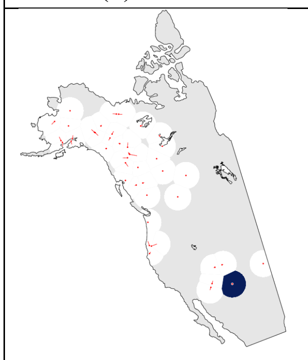
(6) BACK$_1$-BASE



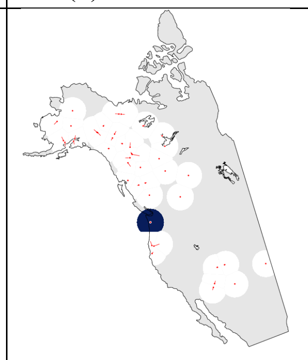
(7) BACK$_1$



(8) BACK$_2$-FRONT



(9) BODY$_6$



(10) BODY$_7$

Figure 17. Distributions of terms for ‘body’

3.1.2 Flesh

Three lexicalization patterns occur for the referent ‘flesh’.

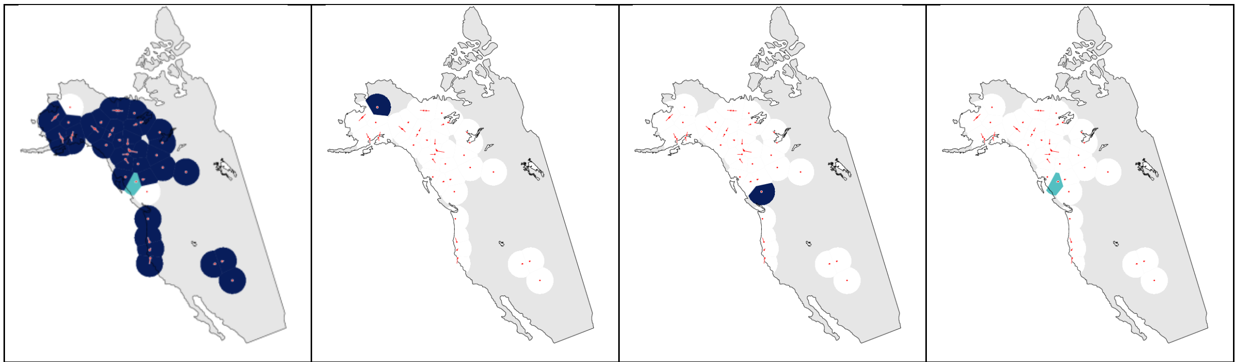
(1) FLESH$_1$: The first and most common is a monomorphemic cognate with a syllable-initial alveolar fricative, dental fricative alveolar or dental affricate (or a bilabial or velar plosive in northern Canada) and a syllable-final nasal, as for example in Dene Sųłiné /tθə́n/. This form has been designated FLESH$_1$. The Witsuwit’en form /t͡səj/ appears an unlikely member of this group, and is in fact glossed as ‘meat’. However, Hargus identifies palatal approximant in stem-final position as a reflex of Proto-Athapaskan (henceforth PA) *ŋ > y (Hargus 2007: 740), making this a cognate by regular sound correspondence (Hoijer 1963: 14).

(2) FLESH$_2$: Koyukon diverges from this pattern with the form /linis/, FLESH$_2$.

(3) SKIN$_1$: Chilcotin has the same term for ‘skin’ and for ‘flesh’. This is a clear case of a developing polysemy pattern in the term /ðɛ̀ð/ since this term is cognate with the term for ‘skin’ in most Athapaskan languages (see Section 3.2.3 Skin). Hence, the directionality of the emerging semantic shift can be identified as [/ðὲð/ SKIN1 ‘skin’] > ℙ > [/ðὲð/ FLESH ‘flesh’]. A pattern with opposite directionality can be observed in the language Tłı̨chǫ in which the terms for ‘flesh’ are extended to also denote ‘skin’ (see Section 3.1.3). **(4) FLESH3:** Witsuwit’en has two terms lexicalizing the referent ‘flesh’. The first term forms part of the cognate set SKIN1, as described above. The second term, /jet/, is glossed as ‘flesh, weight’, and considered to originate from earlier terms for ‘fish meat’ (Hargus 2007: 740). Although potentially cognate with SKIN1 terms especially in Dena’ina (see Section 3.1.3), in the absence of further evidence the term is identified as FLESH3 here.

Table 8. Flesh

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθiŋʔ	1	INTERIOR CANADA	Hare	fẽ́	1
	Koyukon	linis	2		Mountain	pẽ́ʔ	1
	Dena’ina (Iliamna)	ʦʰən	1		Bearlake	kʷʰẽ́	1
	Dena’ina (Inland)	ʦʰən	1		Tłı̨chǫ	kʷõ̀	1
	Dena’ina (OCI)	ʦʰən	1		South Slavey	tθẽ́	1
	Dena’ina (UCI)	ʦʰən	1		Dene Sųłiné	tθə́n	1
	Ahtna	ʦʰɛnʔ	1		Dene Dháh	tθén	1
	Holikachuk	tθinʔ	1		Beaver	ʦʰʌn	1
	Gwich’in (Teetl’ıt)	tθʰã̀ĩʔ	1	BRITISH COLUMBIA	Carrier	t̠s̠ʌŋ	1
	Gwich’in (Gwıchya)	tθʰàiʔ	1		Witsuwit’en	ʦəj / jet	1/4
	Hän	tθʰĩ̀ʔ	1		Sekani	ʦʰàn	1
	Lower Tanana	-			Ts’ets’aut	ʦʰxa’	1
	Upper Kuskokwim	ʦin	1		Chilcotin	ðέð	1
	Upper Tanana	tθĩ̀ːʔ	1	PACIFIC COAST	Hupa	ʦɪŋʔ	1
	Tanacross	tθĩʔ	1		Galice	sɑnʔ	1
YUKON	Northern Tutchone	tθʰɑ́nʔ	1		Kato	sʌɲʔ	1
	Southern Tutchone	tθʰə̀n	1		Tolowa	-	
	Kaska (DL)	ʦʰén	1		Tututni	-	
	Kaska (FL)	ʦʰén	1		Mattole	-	
	Kaska (GHL)	ʦʰén	1		Wailaki	-	
	Kaska (L)	ʦʰán	1		Kwa-Clat	tsún	1
	Kaska (LL)	ʦʰán	1	APACHEAN	Navajo	ʦʰĩ̀	1
	Kaska (P)	ʦʰén	1		Western A.	-	
	Kaska (RR)	ʦʰén	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	tsĩ	1
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	-			Lipan A.	-	



(1) FLESH$_1$[17]	(2) FLESH$_2$	(3) SKIN	(4) FLESH$_3$

Figure 18. Distributions of terms for ‘flesh’

3.1.3 Skin

The referent-concept ‘skin’ is predominantly lexicalized through a monomorphemic cognate form that has fricatives in both syllable initial and syllable final positions. The group of languages which do not conform to that pattern present a more heterogeneous picture which shows, however, some evidence of regional association.

(1) SKIN$_1$: Of the 48 languages for which data were available, 35 fall into the pattern of lexicalization here identified as SKIN$_1$, as exemplified Gwich’in (Teetl’ıt) /ðòh/. The inclusion of the term /jet/ found among the Dena’ina dialects is speculative, but supported at least by a similar pattern of correspondences among the terms for ‘mouth’ (Section 3.2.8; especially Upper Cook Inlet Dena’ina /jaqʼ/).

(2) SKIN$_2$: The languages Deg Xinag and Holikachuk, which were once spoken in adjacent regions, also share a pattern, whose exact nature remains unclear.

(3) SKIN$_3$: Navajo, Western Apache and San Carlos Apache share a pattern which remains unidentified. This pattern distinguishes these, western Apachean languages from their more eastern neighbors. The distribution of ‘skin’ terms neatly divides the two Apachean branches in a manner which was also noted by Hoijer (1938: 86). , but the actual etymologies of both forms themselves are not evident.

(4) SKIN$_4$: Lipan and Kiowa, two eastern Apachean languages also share a cognate form lexicalizing ‘skin’.

(5) SKIN$_5$ & (6) SKIN$_6$: Two forms are available for the language Mattole, but they are isolated occurrences and have no related forms anywhere else among the Athapaskan languages in the sample.

(7) SKIN$_7$: the Ts’ets’aut term /ʦʼíl/ could be related to terms in Dena’ina, /ʦʼis/ and /ʦʼix/ which are glossed with ‘outer skin covering, exposed skin’, but is otherwise unique among the ‘skin’ terms. It is possible that the final sound in the Ts’ets’aut form I a lateral fricative that have become voiced intervocalically. The

[17] The turquoise shading indicates that the term representing this location is one of two variants denoting the referent-concept in this language.

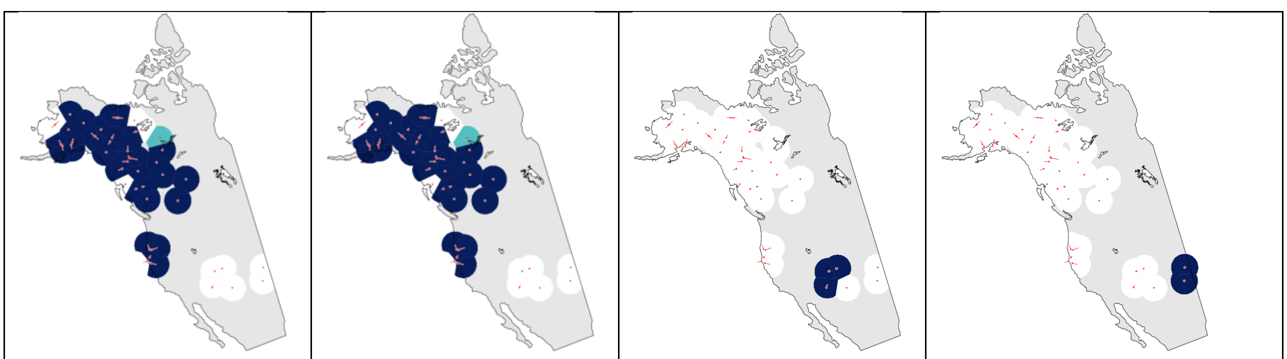
form is transcribed by Boas and Goddard as *εts'ílε* (1924: 13), but there is no indication of the shape of the uninflected stem. If these forms do constitute a cognate set, however, a stem-final /ɬ/ would seem more likely.

(8) BARK: In the languages Bearlake and Hare, the term for 'skin' also encodes 'bark'. Since this clearly does not conform to the larger pattern of cognation for 'skin' terms, the polysemy pattern can be hypothesized to originate within the domain of plants: [/t'úw/ BARK 'bark'] > ℙ > [/t'úw/ SKIN 'skin'].

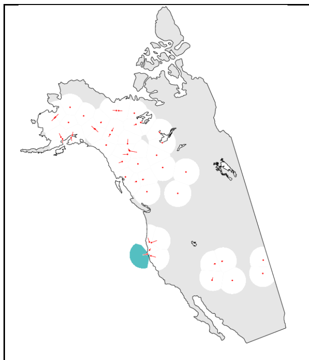
(9) FLESH: The lexicographic source for Tłı̨chǫ lists two terms of which the first falls under SKIN_1. The second form, /kʷǒ̀/, also lexicalizes the referent-concept 'flesh' and has cognates with the same meaning across several languages. Therefore, the occurrence of this form with the gloss 'skin' indicates a polysemy pattern brought about by polysemic extension [/kʷǒ̀/ FLESH_1 'flesh'] > ℙ > [/kʷǒ̀/ SKIN 'skin'] (a polysemy pattern evolving in the opposite direction to the pattern found in Chilcotin; see Section 3.1.2). This change has also occurred in Mescalero Apache.

Table 9. Skin

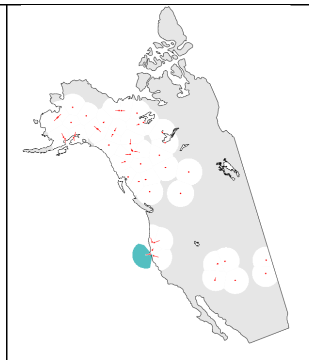
	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	laq’að	2	**INTERIOR CANADA**	Hare	t’úw	8
	Koyukon	ləɬ	1		Mountain	véʔ	1
	Dena’ina (Iliamna)	jes	1		Bearlake	tʰúé	8
	Dena’ina (Inland)	jes	1		Tłı̨chǫ	wò / kʷǒ̀	1/9
	Dena’ina (OCI)	jes	1		South Slavey	ðéh	1
	Dena’ina (UCI)	jes	1		Dene Sųłiné	ðə́θ	1
	Ahtna	zəs	1		Dene Dháh	ðé	1
	Holikachuk	lo:q’að	2		Beaver	zɪs	1
	Gwich’in (Teetl’ıt)	ðòh	1	**BRITISH COLUMBIA**	Carrier	z̠ʌz̠	1
	Gwich’in (Gwıchya)	ðòh	1		Witsuwit’en	zəz	1
	Hän	ðǒ̀h	1		Sekani	zàs	1
	Lower Tanana	ðeθ	1		Ts’ets’aut	ʦ’íl	7
	Upper Kuskokwim	zis	1		Chilcotin	ðɛ́ð	1
	Upper Tanana	θʊ̀h	1	**PACIFIC COAST**	Hupa	sɪʦ’	1
	Tanacross	ðɛθ	1		Galice	sɑ:s / ʃi:	
YUKON	Northern Tutchone	ðó	1		Kato	sʌʦ	1
	Southern Tutchone	ðɨ			Tolowa	-	
	Kaska (DL)	-			Tututni	səʔs	1
	Kaska (FL)	zés	1		Mattole	ʦʰɛʔs / tá:s	
	Kaska (GHL)	zés	1		Wailaki	-	
	Kaska (L)	zás	1		Kwa-Clat	-	
	Kaska (LL)	zás	1	**APACHEAN**	Navajo	kˣákí	3
	Kaska (P)	zés	1		Western A.	kʰák	3
	Kaska (RR)	-			S. Carlos A.	kʰák	3
	Tagish	-			Jicarilla A.	-	
	Tahltan	ʒɛθ	1		Kiowa A.	nǎ̀:sl	4
					Mescalero A.	kʰáʃí	9
	Tsuut’ina	jisdl	1		Lipan A.	næstɬɛ	4



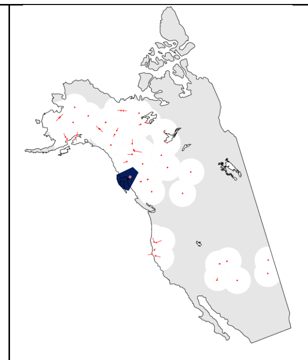
(1) SKIN$_1$ (2) SKIN$_2$ (3) SKIN$_3$ (4) SKIN$_4$



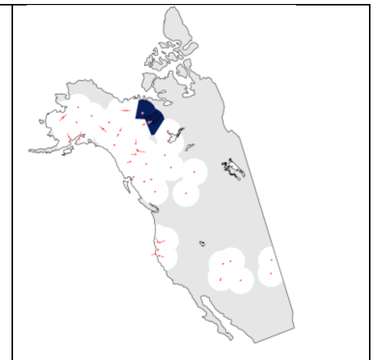
(5) SKIN$_5$



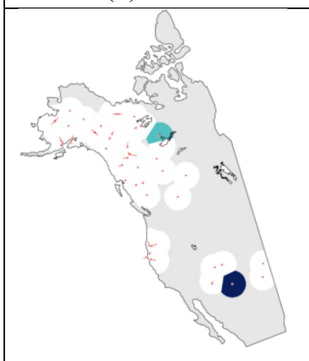
(6) SKIN$_6$



(7) SKIN$_7$



(8) BARK



(9) FLESH

Figure 19. Distributions of terms for ‘skin’

3.1.4 Bone

The term ‘bone’ is exclusively lexicalized by a monosyllabic form throughout the Athapaskan languages in the sample. Three different forms are found in the sample, of which the first is clearly the most widespread pattern.

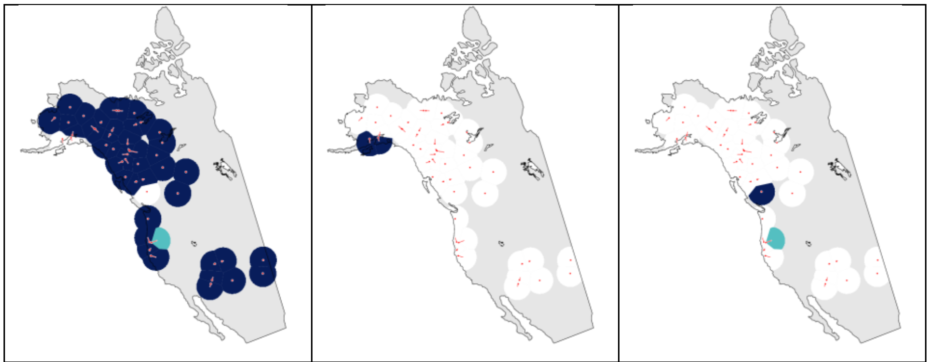
(1) BONE$_1$: The pattern is dominated by a form here referred to as BONE$_1$, which is characterized by an alveolar or dental ejective affricate (with the predictable velar and labial reflexes in Interior Canada) in stem-initial position and an alveolar nasal in stem-final position, such as in the case of Gwich’in (Teetl’ıt) /tθ’an/, resulting in the correspondence set {tθ’ = tɬ’ = ts’ = tʃ’ = w’ = p’ = kʷ’}.

(2) BONE$_2$: Dena’ina (Outer Cook Inlet) appears to have innovated the form /ʁəs/ which Kari considers an ‘elite replacement’, that is, ‘a term for a common referent-concept for which Dena’ina has a unique innovated term (2007: xxi). This form has been labeled BONE$_2$.

(3) KNEE$_1$: Tututni is recorded as having two terms for ‘bone’. The first form is part of the cognate set identified as BONE$_1$ above. The second one takes the form /gʷət/, which has a clear cognate in the Chilcotin term /gʷɛ́t/. These terms are cognates with the terms for ‘knee’ (see Section 3.3.11 Knee) and, hence, Tututni and Chilcotin have developed the polysemy pattern [/gwət/ KNEE ‘knee’] > ℙ > [/gʷət/ BONE ‘knee, bone’]. There is some indication that Central Carrier has a pattern similar to Chilcotin, since a cognate of the ‘knee’ term also occurs in the term for ‘skull’ /t̠s̠in-kʷʌt/, literally HEAD-BONE, but etymologically HEAD-KNEE (see Section 3.2.2 ‘Skull’). In Mattole, this term also occurs in a compound lexicalizing the referent ‘wrist’ in a position occupied by BONE terms in other Athapaskan languages (see the discussion in Section 3.4.4). Mattole is therefore recorded here as having the term /kʷóːxʷ/ to lexicalize ‘bone’, even though this term is recorded in the source materials only as part of the compound /laʔ-kʷóːxʷ/ HAND-BONE. The latter element is discussed further in Section 3.3.10.

Table 10. Bone

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθ’in̥	1	**INTERIOR CANADA**	Hare	w’én	1
	Koyukon	tɬ’ən̥	1		Mountain	p’en	1
	Dena’ina (Iliamna)	-			Bearlake	kʷ’en	1
	Dena’ina (Inland)	-			Tłįchǫ	kʷ’õ̀ː	1
	Dena’ina (OCI)	ʁəs	2		South Slavey	tθ’en	1
	Dena’ina (UCI)	ʦ’ən	1		Dene Sųłiné	tθ’en	1
	Ahtna	ʦ’ɛn	1		Dene Dháh	tθ’en	1
	Holikachuk	tθ’an	1		Beaver	ʦ’ʌn	1
	Gwich’in (Teetl’ıt)	tθ’an	1	**BRITISH COLUMBIA**	Carrier	ʦ’ʌn	1
	Gwich’in (Gwıchya)	tθ’ən̥	1		Witsuwit’en	ʦ’ən	1
	Hän	ʦ’ɛn	1		Sekani	ʦ’ã̀	1
	Lower Tanana	tθ’en̥	1		Ts’ets’aut	ʦ’ə́n	1
	Upper Kuskokwim	ʦ’in̥	1		Chilcotin	gʷɛ́t	3
	Upper Tanana	tθ’ən	1	**PACIFIC COAST**	Hupa	ʦ’ɪŋ	1
	Tanacross	tθ’ɛn	1		Galice	ʦ’ɔ̃ʔ	1
YUKON	Northern Tutchone	tθ’án	1		Kato	-	
	Southern Tutchone	tθ’ən	1		Tolowa	-	
	Kaska (DL)	ʦ’en	1		Tututni	ʦ’ən / gʷət	1/3
	Kaska (FL)	ʦ’en	1		Mattole	ts’in	1
	Kaska (GHL)	ʦ’an	1		Wailaki	ʦ’in	1
	Kaska (L)	ʦ’en	1		Kwa-Clat	tsʰún	1
	Kaska (LL)	ʦ’an	1	**APACHEAN**	Navajo	ʦ’in	1
	Kaska (P)	ʦ’an	1		Western A.	ʦ’in	1
	Kaska (RR)	ʦ’en	1		S. Carlos A.	ʦ’in	1
	Tagish	ʧ’ín	1		Jicarilla A.	ʦ’in	1
	Tahltan	tθ’ɛn̥	1		Kiowa A.	ʦ’ĩ̀ː	1
					Mescalero A.	ʦ’in	1
	Tsuut’ina	ʦ’īn	1		Lipan A.	ʦʰæ̃	1



(1) BONE$_1$	(2) BONE$_2$	(3) KNEE$_1$

Figure 20. Distributions of terms for 'bone'

3.1.5 Blood vessel

The referent 'blood vessel' is also glossed as 'vein' or, more rarely, 'artery' in the lexicographic sources. However, the available evidence indicates that the meaning of the Athapaskan root word is close to the general term 'blood vessel', or more accurately 'blood tube'. The reasons for this are outlined in the discussion of cognate set TUBE$_1$. Overall, there are 11 distinct lexicalization patterns for the referent 'blood vessel'.

(1) TUBE$_1$: Navajo distinguishes the notions 'artery' and 'vein' through the morphologically derived forms *'ats'oos dootł'izhígíí* /ʔa-tsʼoːs doːtɬʼiʒíkíː/ 'the blood vessels (or 'tube', see below) that are blue' for 'vein' and *'ats'oos łichí'ígíí* /ʔa-tsʼoːs ɬitʃíʔíkíː/ 'the blood vessels that are red' for 'artery', but the most general gloss 'blood vessel' is expressed simply by /tsʼoːs/, a form that also co-lexicalizes the referent-concept 'nerve' (Young and Morgan 1987: 136). This form has a cognate in Koyukon /kʼutɬ/. The initial and final segments of this form correspond to the Navajo form through the correspondence set identified by Hoijer as III.5 and I.5 (Hoijer 1963). In the case of the stem-initial segments, III.5 predicts PA *kyʼ- > Navajo tsʼ- ; Koyukon kʼ- (Hoijer 1963: 1; 22). For the stem-final segments (which Hoijer does not discuss) one can suggest that Hoijer's I.1 PA *sʼ- > Navajo s ; Koyukon ɬ (Hoijer 1963) holds. The forms found in two of the Apachean languages deserve further comment. The Lipan Apache form /tsʰõs/ does not strictly conform to this pattern, since the stem-initial sound is not ejectivized. In general, the distinction between ejectives and non-ejectives is taken as being indicative of important distinctions. However, in this case, since the stem-final consonant does conform to the cognate pattern, the difference is put down to an inaccuracy of the lexicographic source materials, which stem from a very different time (Gatschet 1884). The Lipan form is therefore analyzed as falling into the TUBE$_1$ cognate set. In Kiowa Apache, the cognate form is glossed as 'tube' (Bross 1976: 17), and this gloss is chosen to designate this pattern: TUBE$_1$.

(2) STRAW: In Dena’ina (Inland), the referent is lexicalized through the monomorphemic stem /ʧʼuʧʼ/. This form is phonologically close to the forms described STRING, however, they differ in the stem-final segment. Furthermore, Hoijer’s correspondence would predict a stem-initial kʼ- for this form. This Dena’ina form remains unidentified, but Koyukon /tɬʼɒtɬ/, glossed as ‘suck, lick object with sucking, smooching sound, draw on, siphon, vacuum object (with pipe, straw, bone)’ (Jetté and Jones 2000: 616). This would indicate a meaning such as STRAW for this stem, and this designation is tentatively adopted here.

(3) BLOOD$_1$-TUBE$_1$: In Deg Xinag, Southern Tutchone, Dena’ina (Upper Cook Inlet), and Holikachuk, ‘blood vessel’ is lexicalized through the pattern BLOOD$_1$-TUBE$_1$, as for example in Deg Xinag /tiɬ ʧʼetθ/. The second element of the compound is cognate with the forms designated TUBE$_1$ by the sound correspondence PA *kyʼ- > Deg Xinag tʃʼ-; Southern Tutchone tʃʼ-; Dena’ina kʼ- (Hoijer 1963), to which Holikachuk PA *kyʼ- > kʼ can now be added.

(4) BLOOD$_1$: In three dialects of Kaska (Good Hope Lake, Liard, and Lower Liard) the referent ‘blood vessel’ is lexicalized with the form /tal/, corresponding to the cognate set BLOOD$_1$ an example of a CONTAINER FOR CONTENTS metonymy (see discussion in Chapter 4). This indicates a pattern of polysemic extension originating from ‘blood’: [/tal/ BLOOD ‘blood’] > ℙ > [/tal/ BLOOD VESSEL ‘blood vessel’].

(5) BLOOD$_1$-STRING: Kaska dialects (Frances Lake, Pelly and Ross River), as well as Tłı̨chǫ, the referent ‘blood vessel’ is lexicalized through the form BLOOD$_1$ (see Section 3.5.1) and the element /tɬʼuːɬ/ and its cognates, identified as STRING (compare Koyukon /tɬʼaɬ/, Jetté and Jones 2000: 331). This results in the lexicalization pattern BLOOD$_1$-STRING, exemplified by Kaska (Pelly) /telé? tɬʼuːɬ/.

(6) BLOOD$_2$-STRING: In Witsuwit’en, the referent ‘blood’ is lexicalized through the form /sqʰəj-tɬʼoɬ/, composed of the element designated BLOOD$_2$ (see Section 3.5.1) and the element /tɬʼoɬ/ STRING (compare Koyukon /tɬʼaɬ/, Jetté and Jones 2000: 331), giving rise to the lexicalization pattern BLOOD$_2$-STRING.

(7) THING.IN.VESSEL-STRING: In Koyukon, ‘blood vessel’ can also (in addition to the pattern described in 1) be lexicalized as /lə-qʰɒn-ə tɬʼaɬ/, a form composed of the elements /lə-qʰɒn/, literally ‘thing in container’ but used to denote ‘blood’ (Jetté and Jones 2000: 331; also see Section 3.5.1), and /tɬʼaɬ/ ‘string’ (Jetté and Jones 2000: 614). This lexicalization path has been designated THING.IN.VESSEL-STRING.

(8) SKIN$_1$: In South Slavey and Dene Dháh the form lexicalizing ‘blood vessel’ also co-lexicalizes ‘skin’. The form belongs to the cognate set SKIN$_1$ described in Section 3.1.3 above, where it was the dominant lexicalization for the referent ‘skin’. This leads to the inference that in South Slavey and Dene Dháh the ‘skin’-term was the source for a pattern if polysemic extension [/ðeð/ SKIN ‘skin’] > ℙ > [/ðeð/ BLOOD VESSEL ‘blood vessel’]. This somewhat peculiar evolutionary path becomes more plausible when a potential intermediary stage in which the form referred to ‘container’ is posited. Evidence for this intermediary stage comes from the fact that /ðeð/ still forms part of expressions denoting types of containers, such as *gódaidhéh* ‘container’ and *ebaatthíé’ dhéh* ‘needle case’ in Dene Dháh (Moore et al. MS: 32, 170), and *edįhtł’éh dhéh* ‘paper bag, envelope’ and *sombá dhéh* ‘wallet’ in South Slavey (South Slavey Divisional Board of Education 2008: 91, 95, 98). In Tsuut’ina, the form /zīz/ has no other meanings associated with it, outside of ‘blood vessel’. Since the form etymologically means ‘skin’, however, a now completed semantic change, [/zīz/ SKIN ‘skin’] > § > [/zīz/ BLOOD VESSEL ‘blood vessel’], must have occurred for the pattern found in contemporary Tsuut’ina to have emerged.

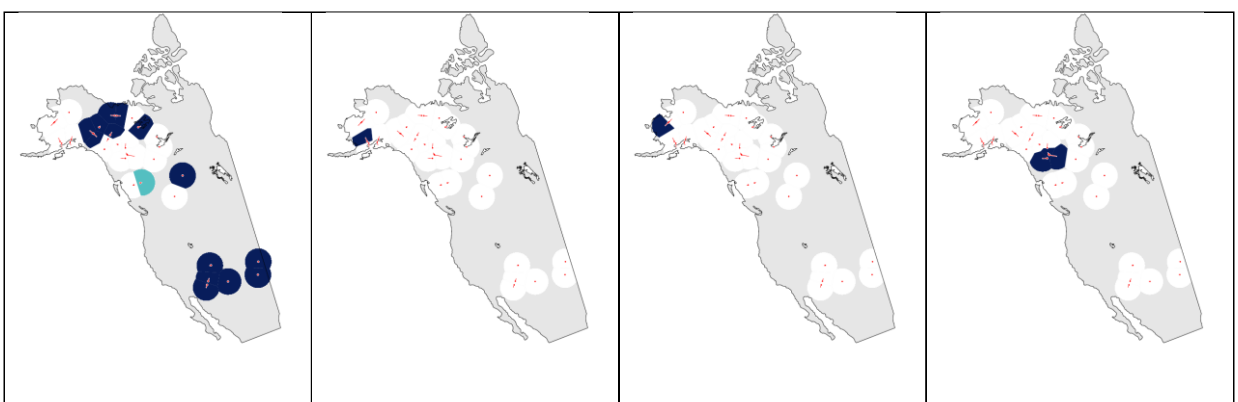
(9) HEART$_1$-TUBE$_1$: Central Carrier lexicalizes the referent ‘blood vessel’, through the semantic element s HEART$_1$ (see Section 3.3.7) and TUBE (see pattern 1 above), resulting in the lexicalization pattern HEART$_1$-TUBE: /ʥi-ʧʼuz/.

(10) BLOOD.VESSEL$_1$: The Iliamna and Outer Cook Inlet dialects of Dena’ina lexicalize ‘blood vessel’ through the form /kʼətʼ/, that is unique to these two varieties and is therefore simply identified as BLOOD.VESSEL$_2$.

(11) BLOOD$_1$-TUBE$_2$: Hare encodes the referent ‘blood vessel’ through the compound /tél-ɾah-ʧʼúw/ that has some similarity to those identified as BLOOD$_1$-TUBE$_2$ (pattern 3 above), insofar as the semantic element BLOOD$_1$ forms the first part, and TUBE$_1$ the final of the compound. The Hare expression also contains the unidentified element /ɾah/, and the pattern is designated BLOOD$_1$-TUBE$_2$ to reflect this difference.

Table 11. Blood vessel

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tiɬ ʧ’etθ	3	**INTERIOR CANADA**	Hare	tél rahʧ’úw	11
	Koyukon	k’utɬ / ləqʰɒnə tɬ’aɬ	1/7		Mountain	-	
	Dena’ina (Iliamna)	k’ət’	10		Bearlake	ʧ’u	1
	Dena’ina (Inland)	ʧ’uʧ’	2		Tłı̨chǫ	dohtɬ’ìː	5
	Dena’ina (OCI)	k’ət’	10		South Slavey	ðeð	8
	Dena’ina (UCI)	təl k’is	3		Dene Sųłiné	ʧ’uð	1
	Ahtna	k’uːz	1		Dene Dháh	ðeð	8
	Holikachuk	tiɬ k’oːdð	3		Beaver	-	
	Gwich’in (Teetl’ıt)	ʧ’ȕː	1	**BRITISH COLUMBIA**	Carrier	ʦiʧ’uz	9
	Gwich’in (Gwıchya)	ʧ’ùː	1		Witsuwit’en	sqʰəjtɬ’oɬ	6
	Hän	ʧ’ìiʔ	1		Sekani	-	
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ʧ’ȉũʔ	1	**PACIFIC COAST**	Hupa	-	
	Tanacross	ʧ’ũðʔ	1		Galice	-	
YUKON	Northern Tutchone	ʧ’úʔ	1		Kato	-	
	Southern Tutchone	təlʧ’ɨ̀	3		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	teléʔtɬ’u:ɬ	5		Mattole	-	
	Kaska (GHL)	tal	4		Wailaki	-	
	Kaska (L)	tal	4		Kwa-Clat	-	
	Kaska (LL)	tal	4	**APACHEAN**	Navajo	ʦ’oːs	1
	Kaska (P)	teléʔtɬ’u:ɬ	5		Western A.	ʦ’oːs	1
	Kaska (RR)	teléʔtɬ’u:ɬ	5		S. Carlos A.	ʦ’õːs	1
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	ts’ȍs	1
					Mescalero A.	ʦ’uːs	1
	Tsuut’ina	zīz	8		Lipan A.	ʦoːs	1



(1) STRING | (2) TUBE | (3) BLOOD$_1$-TUBE | (4) BLOOD$_1$

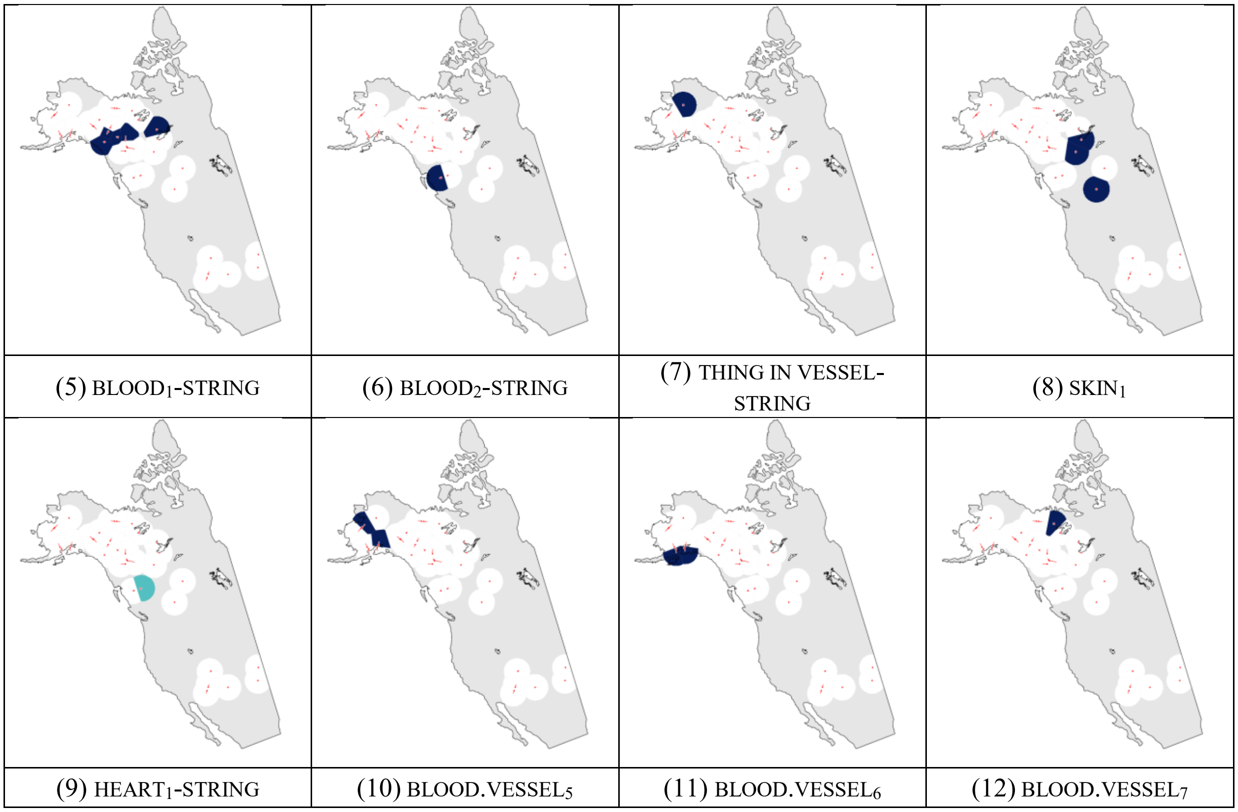


Figure 21. Distributions of terms for 'blood vessel'

3.1.6 Fat

Only two monosyllabic cognate forms are found lexicalizing the referent 'fat' in all of the Athapaskan languages of the sample.

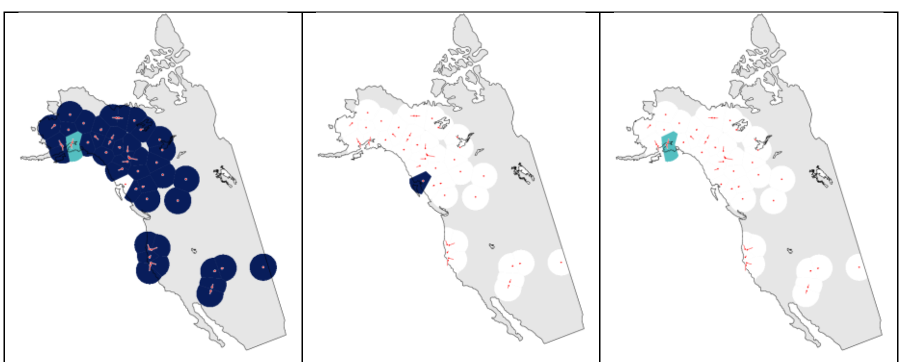
(1) FAT$_1$: The most frequent stem is characterized by an initial ejective velar or uvular plosive and an occasional glottal fricative in final position, such as in the case of Kaska (Liard) /k'ah/. For two languages, Chilcotin and San Carlos Apache, the lexicographic source materials provided only verbal forms glossed as 'it is fat', but each contain a verb stem of the same phonological shape and meaning as the stems just described.

(2) FAT$_2$: Ts'ets'aut is the only language diverging from this pattern with the stem /xɛ/.

(3) FAT$_3$: The two alternative terms for 'fat' found in Dena'ina Outer Cook Inlet and Upper Cook Inlet dialects are local innovations (Kari 2007: 94; xxi). They have no cognate form and are of uncertain meaning.

Table 12 .Fat

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	q’ux	1	INTERIOR CANADA	Hare	k’a	1
	Koyukon	q’ɔχ	1		Mountain	-	
	Dena’ina (Iliamna)	q’əχ	1		Bearlake	k’a	1
	Dena’ina (Inland)	q’əh	1		Tłı̨chǫ	k’a	1
	Dena’ina (OCI)	q’əh / tiɬkʰiti	1/3		South Slavey	k’a	1
	Dena’ina (UCI)	q’əh / tiɬkʰiti	1/3		Dene Sųłiné	k’a	1
	Ahtna	k’ɑχ	1		Dene Dháh	k’á	1
	Holikachuk	-			Beaver	k’a	1
	Gwich’in (Teetl’ıt)	k’eh	1	BRITISH COLUMBIA	Carrier	k’o	1
	Gwich’in (Gwıchya)	k’eh	1		Witsuwit’en	q’aɣ, q’a	1
	Hän	k’ɑh	1		Sekani	k’a	1
	Lower Tanana	k’ox	1		Ts’ets’aut	χɛ’	2
	Upper Kuskokwim	k’uh	1		Chilcotin	-k’á (ɬek’á)	1
	Upper Tanana	k’ah	1	PACIFIC COAST	Hupa	q’ah	1
	Tanacross	k’e	1		Galice	k’ɑh	1
YUKON	Northern Tutchone	k’ɑ	1		Kato	-	
	Southern Tutchone	k’eh	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	k’ah	1		Mattole	-	
	Kaska (GHL)	k’ah	1		Wailaki	-	
	Kaska (L)	k’ah	1		Kwa-Clat	kuh	1
	Kaska (LL)	k’ah	1	APACHEAN	Navajo	k’ah	1
	Kaska (P)	k’ah	1		Western A.	k’ah	1
	Kaska (RR)	k’ah	1		S. Carlos A.	-k’aʔ (ɬik’a:ʔ)	1
	Tagish	-			Jicarilla A.	k’ãh, k’ã	1
	Tahltan	k’ɑh	1		Kiowa A.	k’àh	1
					Mescalero A.		
	Tsuut’ina	k’ó	1		Lipan A.	-	



(1) FAT$_1$	(2) FAT$_2$	(2) FAT$_3$

Figure 22. Distributions of terms for ‘fat’

3.1.7 Tendon

Like the 'fat' terms discussed above, the terms denoting the referent 'tendon' form a very homogeneous group. There are three different lexicalization patterns for this referent, but two of these are unique forms occurring only in one language each.

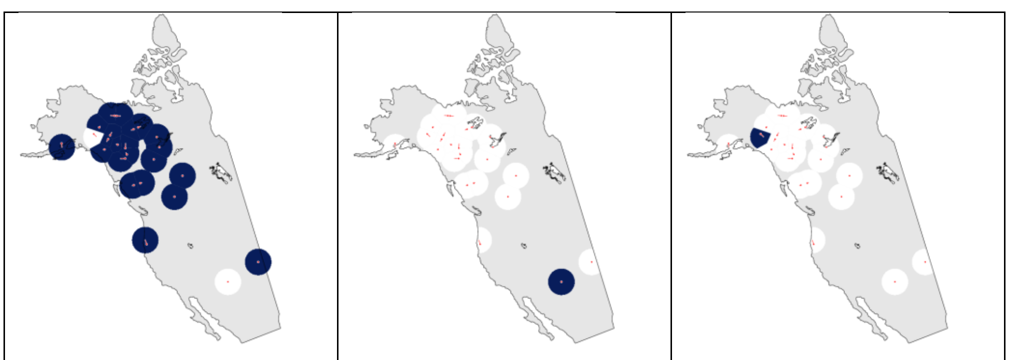
(1) TENDON$_1$: All but two of the lexicalization patterns involve a cognate form characterized by an alveolar or alveo-palatal ejective and, frequently, an alveolar plosive in final position, as for example in Southern Tutchone /ʧ'ə̀t/. Dena'ina (Iliamna) and Galice have ejective plosives in final position. This morpheme is identified as TENDON$_1$.

(2) TENDON$_2$: In Mescalero Apache, the otherwise unique form /kʰáze/ lexicalizes the referent-concept 'tendon'.

(3) SINEW$_1$-BIG: In Upper Tanana, the form lexicalizing TENDON$_1$ is a compound. The first element is a form belonging to the cognate set SINEW$_1$ (See Section 3.18). The second part is the qualifying element /ʧʰoh/ BIG resulting in the pattern TENDON$_1$-BIG.

Table 13. Tendon

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag			INTERIOR CANADA	Hare	ʧ’ít	1
	Koyukon				Mountain	ʧ’ír	1
	Dena’ina (Iliamna)	ʦ’aq’	1		Bearlake	ʧ’ì:	1
	Dena’ina (Inland)				Tłı̨chǫ	ʧ’ít	1
	Dena’ina (OCI)				South Slavey	ʧ’ər	1
	Dena’ina (UCI)				Dene Sųłiné	tθ’éh	1
	Ahtna				Dene Dháh	ʧ’ít	1
	Holikachuk				Beaver	-	
	Gwich’in (Teetl’ıt)	ʧ’at	1	BRITISH COLUMBIA	Carrier	ts̠’eh	1
	Gwich’in (Gwıchya)	ʧ’at	1		Witsuwit’en	ʦ’eχ	1
	Hän	ʧ’ət	1		Sekani		
	Lower Tanana				Ts’ets’aut		
	Upper Kuskokwim				Chilcotin		
	Upper Tanana	tθ’ê:h ʧʰoh	3	PACIFIC COAST	Hupa		
	Tanacross				Galice	ʧ’o:k’	1
YUKON	Northern Tutchone	ʧ’át	1		Kato		
	Southern Tutchone	ʧ’ət	1		Tolowa		
	Kaska (DL)				Tututni		
	Kaska (FL)	ʧ’ét	1		Mattole		
	Kaska (GHL)	ʧ’et	1		Wailaki		
	Kaska (L)	ʧ’et	1		Kwa-Clat		
	Kaska (LL)			APACHEAN	Navajo		
	Kaska (P)	ʧ’ét	1		Western A.		
	Kaska (RR)	ʧ’ét	1		S. Carlos A.		
	Tagish				Jicarilla A.		
	Tahltan				Kiowa A.	ʧ’ìt	1
					Mescalero A.	kʰáze	2
	Tsuut’ina	ʧʰ’ìt	1		Lipan A.		



(1) TENDON$_1$	(2) TENDON$_2$	(3) SINEW-BIG

Figure 23. Distributions of terms for ‘tendon’

3.1.8 Sinew

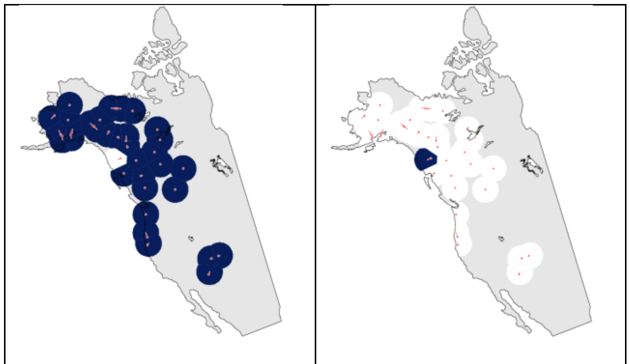
Among the terms encoding the referent-concept ‘sinew’ there is little variation across the languages in the sample. Only two patterns are found overall.

(1) SINEW$_1$: In the predominant pattern, ‘sinew’ is encoded through a monomorphemic form characterized by an alveolar, dental, or alveo-palatal affricate in initial position, and a glottal, velar, or uvular fricative in stem-final position, as for example in Deg Xinag /tθ’ax/. This form has been identified with the semantic value SINEW$_1$.

(2) SINEW$_2$: The only exception to the pattern described above is found in Tahltan, which lexicalizes ‘sinew’ through a compound in which the head conforms with the pattern just described, but the modifier is /t’ɑn̥/.

Table 14. Sinew

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθ’ax	1	INTERIOR CANADA	Hare	w’iéʔ	1
	Koyukon	tɬ’ah	1		Mountain	kʷ’è	1
	Dena’ina (Iliamna)	ʦ’ah	1		Bearlake		
	Dena’ina (Inland)	ʦ’ah	1		Tłįchǫ		
	Dena’ina (OCI)	ʦ’ah	1		South Slavey	tθ’éh	1
	Dena’ina (UCI)	ʦ’ah	1		Dene Sųłiné	tθ’é	1
	Ahtna	ʦ’aχ	1		Dene Dháh	tθ’eh	1
	Holikachuk	ʧ’eh	1		Beaver	ʦ’ɛh	1
	Gwich’in (Teetl’ıt)	ʧ’ih	1	BRITISH COLUMBIA	Carrier	ʦ’eh	1
	Gwich’in (Gwıchya)	tθ’èh	1		Witsuwit’en		
	Hän	tθ’ax	1		Sekani	ʦ’èh	1
	Lower Tanana	ʦ’ah	1		Ts’ets’aut	ʦ’ín	1
	Upper Kuskokwim	tθ’ê:	1		Chilcotin	tθ’áx	1
	Upper Tanana	tθ’eɣ	1	PACIFIC COAST	Hupa	kʲ’oʦ’	1
	Tanacross	tθ’ax	1		Galice	ʦ’ɛh	1
YUKON	Northern Tutchone				Kato		
	Southern Tutchone				Tolowa		
	Kaska (DL)				Tututni		
	Kaska (FL)	ʦ’éh	1		Mattole		
	Kaska (GHL)				Wailaki		
	Kaska (L)	ʦ’éh	1		Kwa-Clat	ʦ’êx	1
	Kaska (LL)			APACHEAN	Navajo	ʦ’it	1
	Kaska (P)	ʦ’éh	1		Western A.	ʦ’it	1
	Kaska (RR)	ʦ’éh	1		S. Carlos A.		
	Tagish				Jicarilla A.	ʦ’e:	1
	Tahltan	t’ɑn̥ tθ’ɛ	2		Kiowa A.		
					Mescalero A.		
	Tsuut’ina	ʦ’àx	1		Lipan A.		



(1) SINEW$_1$ | (2) SINEW$_2$

Figure 24. Distributions of terms for 'sinew'

3.2 Terms relating to the head and neck

The referents relating to parts of the head and neck are described in this section. This is the largest section covering 17 referent-concepts.

3.2.1 Head

Wholly innovated forms for 'head' are found in Dena'ina (Outer Cook Inlet and Upper Cook Inlet dialects), but in the absence of lexicographic or comparative clues, their etymology remains unidentified.

(1) HEAD$_1$: The terms for 'head' fall predominantly under a cognate pattern characterized by a stem-initial alveolar or palatal affricate (with the predictable corresponding sounds among the Mackenzie languages and Koyukon; see Hoijer's correspondence set I.) followed by a high front vowel, as for example in Dena'ina (Iliamna) /ʦʰi/. This pattern has been designated HEAD$_1$.

(2) HEAD$_1$-BONE$_1$: In San Carlos and Western Apache, the referent-concept 'head' is encoded through the lexicalization pattern HEAD-BONE indicating a polysemy pattern [/ʦʰi/ HEAD ⊕ /ʦ'in/ BONE 'skull'] > § > [/ʦʰiʦ'in/ HEAD 'head'], with the older pairing of the morphologically simpler form [/ʦʰi/ HEAD] seemingly lost.

(3) HEAD$_2$ & **(4) HEAD$_3$:** These two items occurring in the Outer Cook Inlet and Upper Cook Inlet dialects of Dena'ina, respectively, are considered 'Dena'ina elite replacements' by Kari (2007: 87). They are innovated forms, which are unique to these dialects. The form found in Outer Cook Inlet dialect seems to have fused the stem with the possessive prefix /bən-ʁʔi/.

(4) HEAD$_4$: The lexicalization /nɣen/ for ‘head’ is unique to Witsuwit’en. The form is possibly related to the HUMP cognate set (see Section 3.3.1).

Table 15. Head

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθeʔ	1	INTERIOR CANADA	Hare	fí	1
	Koyukon	tɬi	1		Mountain	píʔ	1
	Dena’ina (Iliamna)	ʦʰi	1		Bearlake	kʷʰí	1
	Dena’ina (Inland)	ʦʰi	1		Tłı̨chǫ	kʷì	1
	Dena’ina (OCI)	(bən-)ʁʔi	3		South Slavey	tθʰí	1
	Dena’ina (UCI)	kʰin i	4		Dene Sųłiné	tθí	1
	Ahtna	ʦʰəʔ	1		Dene Dháh	tθí	1
	Holikachuk	-			Beaver	ʦʰi	1
	Gwich’in (Teetl’ıt)	ʧʰìʔ	1	BRITISH COLUMBIA	Carrier	t̪s̪ʰi	1
	Gwich’in (Gwıchya)	ʧʰìʔ	1		Witsuwit’en	ʦi / nɣen	1/4
	Hän	tθʰìʔ	1		Sekani	ʦʰìʔ	1
	Lower Tanana	-			Ts’ets’aut	ʦʰéː	1
	Upper Kuskokwim	ʦʰeʔ	1		Chilcotin	tθí	1
	Upper Tanana	tθìʔ	1	PACIFIC COAST	Hupa	ʦeʔ	1
	Tanacross	tθiʔ	1		Galice	sɪʔ	1
YUKON	Northern Tutchone	tθʰíʔ	1		Kato	siʔ	1
	Southern Tutchone	θì	1		Tolowa	siʔs	1
	Kaska (DL)	-			Tututni	siʔ	1
	Kaska (FL)	ʦʰíʔ	1		Mattole	ʦʰiʔ	1
	Kaska (GHL)	ʦʰíʔ	1		Wailaki	-	
	Kaska (L)	ʦʰíʔ	1		Kwa-Clat	ʦíe	1
	Kaska (LL)	ʦʰíʔ	1	APACHEAN	Navajo	ʦʰiːʔ	1
	Kaska (P)	ʦʰíʔ	1		Western A.	ʦʰiʦʼin	2
	Kaska (RR)	ʦʰíʔ	1		S. Carlos A.	ʦʰiʦʼin	2
	Tagish	ʧì	1		Jicarilla A.	-	
	Tahltan	ʦʰi	1		Kiowa A.	ʦìːh	1
					Mescalero A.		
	Tsuut’ina	ʦʰi	1		Lipan A.	tʃʰɛ	1

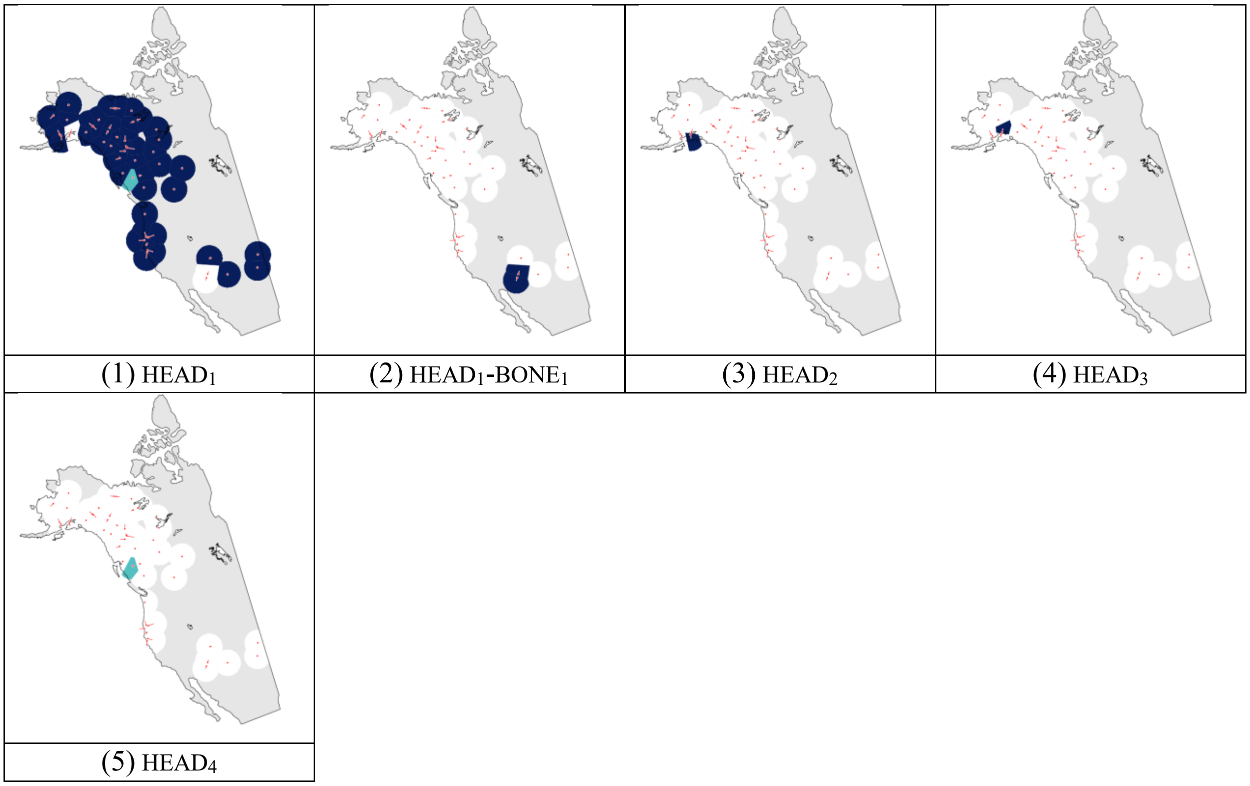


Figure 25. Distributions of terms for 'head'

3.2.2 Skull

The dominant lexicalization pattern for the term 'skull' is HEAD-BONE. It occurs in 18 of the 22 languages for which data were available.

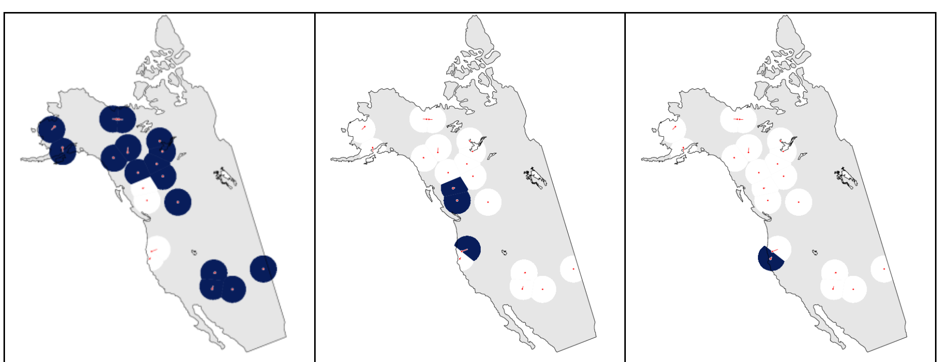
(1) HEAD$_1$-BONE$_1$: The majority of the languages in the sample lexicalize the referent 'head' through a compound constituted of the reflexes of HEAD$_1$ (see Section 3.2.2) and BONE$_1$ (see Section 3.1.4), giving rise to the lexicalization pattern HEAD-BONE.

(2) HEAD$_1$-KNEE$_1$: The languages Chilcotin and Central Carrier present lexicalize 'skull' through a pattern, which is semantically related to HEAD$_1$-BONE$_1$. However, Chilcotin and Central Carrier have formed the compound on the basis of the terms /gʷɛ́t/ and /kʷʌt/ respectively. These terms for 'bone' are etymologically related to terms for 'knee' (see Sections 3.3.10 and 3.1.4), and the pattern is consequently designated as HEAD-KNEE. It should be noted that Chilcotin and Central Carrier exhibit a pattern of polysemic extension [{/gʷət/, /kʷʌt/} KNEE 'knee'] > ℙ > [{/gʷət/, /kʷʌt/} BONE 'knee, bone'] and [/kat/ KNEE 'knee'] > § > [/kʷʌt/ BONE 'knee, bone'].

(3) HEAD₁-PELVIS: The most divergent form for ‘skull’ occurs in Hupa where the expression /ʦʰe:-qe:ʧ’/ which encodes the lexicalization pattern HEAD-PELVIS.

Table 16. Skull

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθiɬtθ’in	1	INTERIOR CANADA	Hare	-	
	Koyukon	tɬ’iɬtɬ’ən	1		Mountain	-	
	Dena’ina (Iliamna)	ʦʰiʦ’əna	1		Bearlake	-	
	Dena’ina (Inland)	-			Tłįchǫ	kʷìkʷ’ȍ:	1
	Dena’ina (OCI)	-			South Slavey	tθʰítθ’ēḗ	1
	Dena’ina (UCI)	-			Dene Sųłiné	-	
	Ahtna	ʦʰɪʦ’ənəʔ	1		Dene Dháh	tθítθ’ené	1
	Holikachuk	-			Beaver	ʦʰiʔʦ’ʌn	
	Gwich’in (Teetl’ıt)	ʧʰi:tθ’an	1	BRITISH COLUMBIA	Carrier	t̠s̠inkʷʌt	2
	Gwich’in (Gwıchya)	ʧʰi:tθ’an	1		Witsuwit’en	-	
	Hän	-			Sekani	ʦʰìʦ’an	
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	tθígʷɛ́t	2
	Upper Tanana	-		PACIFIC COAST	Hupa	ʦʰe:qe:ʧ’eʔ	3
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	-	
	Kaska (DL)	-			Tututni	sikat	2
	Kaska (FL)	ʦʰíʦ’en	1		Mattole	-	
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	ʦʰi:ʦ’i:n	1
	Kaska (P)	-			Western A.	ʦʰiʦ’in	1
	Kaska (RR)	-			S. Carlos A.	-	
	Tagish	ʧiʧ’ín	1		Jicarilla A.	-	
	Tahltan	-			Kiowa A.	ʦìʦ’ȉ:	1
					Mescalero A.		
	Tsuut’ina	ʦʰiʦ’īn	1		Lipan A.	-	



(1) HEAD₁-BONE₁ | (2) HEAD₁-KNEE₁ | (3) HEAD₁-PELVIS

Figure 26. Distributions of terms for ‘skull’

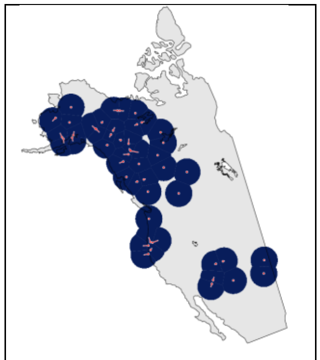
3.2.3 Face

‘Face’ ranks among the most stable referent-concepts among the Athapaskan languages. ‘Face’ terms are encoded with clearly cognate forms in all of the languages of the sample.

(1) FACE: This cognate set is characterized by a stem-initial alveolar nasal followed by a front vowel. The stem-final segment presents a locus for variation being realized through a voiced or voiceless alveolar nasal or a glottal stop.

Table 17. Face

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	naŋ̊	1	INTERIOR CANADA	Hare	níʔ	1
	Koyukon	nan	1		Mountain	níʔ	1
	Dena’ina (Iliamna)	nan	1		Bearlake	níʔ	1
	Dena’ina (Inland)	nan	1		Tłı̨chǫ	nì	1
	Dena’ina (OCI)	nan	1		South Slavey	ní	1
	Dena’ina (UCI)	nan	1		Dene Sųłiné	né	1
	Ahtna	nan	1		Dene Dháh	ní	1
	Holikachuk	nìnʔ	1		Beaver	ni	1
	Gwich’in (Teetl’ıt)	nìnʔ	1	BRITISH COLUMBIA	Carrier	nin	1
	Gwich’in (Gwıchya)	nı̃̀ʔ	1		Witsuwit’en	nin	1
	Hän	naŋ̊	1		Sekani	nẽ̀ʔ	1
	Lower Tanana	-			Ts’ets’aut	neːn	1
	Upper Kuskokwim	nanʔ	1		Chilcotin	nín	1
	Upper Tanana	nı̃̂ːʔ	1	PACIFIC COAST	Hupa	nɪŋʔ	1
	Tanacross	nɛ̃ʔ	1		Galice	nɪʔ	1
YUKON	Northern Tutchone	nínʔ	1		Kato	-	
	Southern Tutchone	nì	1		Tolowa	ninʔ	1
	Kaska (DL)	-			Tututni	niʔ	1
	Kaska (FL)	níʔ	1		Mattole	niʔ	1
	Kaska (GHL)	níʔ	1		Wailaki	-	
	Kaska (L)	níʔ	1		Kwa-Clat	neːn	1
	Kaska (LL)	néʔ	1	APACHEAN	Navajo	niːʔ	1
	Kaska (P)	níʔ	1		Western A.	niːʔ	1
	Kaska (RR)	níʔ	1		S. Carlos A.	niː	1
	Tagish	niʔ	1		Jicarilla A.	niː	1
	Tahltan	-			Kiowa A.	nı̃̂ː	1
					Mescalero A.		
	Tsuut’ina	nì	1		Lipan A.	næ	1



FACE

Figure 27: Distributions of terms for 'face'

3.2.4 Ear

Terms for the referent 'ear' fall into three categories: they can be identified as referring specifically to either the 'outer ear', the 'inner ear', or to the 'ear' without further specification. The identification of the terms with the referential specification of the inner or outer ear comes from two sources of evidence. In the first case, the lexicographic source clearly states that the item in question refers to either the inner or the outer ear. For example, two terms are reported for Sekani /tsaɣ/ 'outer ear' and /tsi/ 'inner ear'. Similar descriptions are found for: Beaver /ʧʰʌɣ/ 'outer ear' and /ʧʰʌk/ 'inner ear', Central Carrier /tso/ outer ear and /tse/ 'inner ear'', Gwich'in /ʦè:ʔ/ 'outer ear' and /ʦì:ʔ/ 'inner ear', Hän /ʦàjʔ/ 'outer ear' and /ʦìt/ 'inner ear', Navajo /ʧa:ʔ/ 'outer ear' /ʧé:-/ 'inner ear'. These lexical pairs conform to phonological contrasts which encode the semantic specifications INNER and OUTER. The phonological structure of the distinction resides in both a contrast of stem-final consonants and a contrast in vowel quality. The INNER semantic feature is associated with velar plosives (e.g. Liard Kaska /ʦi:k/), glottal plosives (e.g. Lower Liard Kaska /ʦi:ʔ/), and mid or high front vowels. Open syllables are also possible (e.g. Bearlake /ʦí:/). The stem-final segments in terms associated with the OUTER semantic specification are velar fricatives (e.g. Chilcotin /ʣaɣ/), uvular fricatives (e.g. Ahtna /ʦaʁ/), velar plosives (e.g. Upper Tanana /ʣak/), or glottal plosives (e.g. San Carlos Apache /ʧa:ʔ/), and low front vowels (e.g. Sekani /ʦaɣ/), or mid back vowels (e.g. Carrier /ʦo/).

Some languages have pairs of terms which are only partially identified in the sources. Kiowa Apache /ʤè:k/ is noted as referring to the 'inner ear' (Bross 1976: 6), but the second term /ʤàɣ/ is not listed with any further information. It can be observed, however, that the contrast in stem-final segments (/k/ vs. /ɣ/) as well as the relative height of the two vowels (è: vs. à) conforms to the INNER/OUTER distinction described above. Taking these phonological features as indicators of the referents, it becomes possible to assign further unspecified terms to the inner and outer groups. The terms referring to the ‘inner ear’ and ‘outer ear’ will be treated in two groups of lexicalization patterns. The third group concerns those terms that were not specified for ‘inner’ or ‘outer’ in the sources, and which cannot be assigned to either referent on the basis of phonological evidence. These have been listed simply as referring to ‘ear’ and are treated last.

3.2.3.1 ‘Inner Ear’

(1) EAR.INNER: The referent ‘inner ear’ is lexicalized through a monomorphemic cognate stem characterized by an alveolar or post-alveolar affricate followed by a high front vowel. Kari analyzes the Ahtna term /ʦiː/ ‘inner ear’ as resulting from /tsaɣ/ ‘ear’ ⊕ /jiː/ ‘inside’ (1990: 167). However, the morphological evidence for this is scant. Many languages, such as for example Central Carrier /tse/ ‘inner ear’ and /tso/ ‘outer ear’, show a distinction in the vowel quality between the terms marking these two related but distinct referent-concept. Therefore it seems that, without further evidence, it is more reasonable to suppose that these are distinct forms, encoding semantic distinctions, and not the results of phonological processes. For Gwich’in (Teetl’ıt dialect) the forms /ʦìːʔ/ and /ʦèːʔ/ are both glossed as ‘outer ear’, however the vowel contrast conforms to the high vs. low pattern identified with the semantic specifications INNER and OUTER, respectively. Therefore, the forms have been reinterpreted as denoting the respective referents ‘inner ear’ and ‘outer ear’. Mattole /ʧíːx/ is included under the ‘inner ear’ terms on the strength of the high front vowel, as well as the glossing in the source.

(2) EAR.INNER-INSIDE: In several Dena’ina dialects (Inland, Outer Cook Inlet, and Upper Cook Inlet), as well as Koyukon, Lower Tanana, and South Slavey, ‘inner ear’ is lexicalized through the combination of the EAR.INNER term with a postpositional element indicating INSIDE, as in Dena’ina (Inland) /ʧi-jiqʼ/.

(3) EAR.OUTER-INSIDE: This lexicalization pattern occurs only in Mescalero Apache /ʧâː-jeː/ and Navajo /ʧaː-jiʔ/ and is formed on the basis of the EAR.OUTER cognate combined with a postpositional element INSIDE, resulting in EAR.OUTER-INSIDE.

3.2.3.2 ‘Outer Ear’

(4) EAR.OUTER: The dominant lexicalization pattern for ‘outer ear’ is through a monomorphemic cognate characterized by low front vowels and stem-final fricatives and plosive as described above. Both of the terms for the Teetl'it dialect of Gwich'in are glossed with 'ear, outer' in the source materials (Firth 2005: 77), but the lexical pair conforms to the phonological pattern of distinction outlined above, allowing for the classification of the terms as referring to the 'inner' and the 'outer' ear. A similar case can be made for Lower Liard Kaska /ʦak/.

(5) EAR.OUTER-EDGE: In Bearlake, Tagish, Kaska (Frances Lake and Pelly dialects), and Tłı̨chǫ the expression lexicalizing 'ear' is formed from cognates of the term for EAR.OUTER and an EDGE morpheme, resulting in the pattern EAR.OUTER-EDGE, as for example in Tłı̨chǫ /ʣèː-bàː/.The Tłı̨chǫ pattern contrasts with the geographically close South Slavey /ʦíh-mpal/ and Hare /ʦe-páɾ/ languages, where these, clearly parallel, lexicalization patterns encode the referent 'earlobe'. This leads to the conclusion that Tłı̨chǫ has undergone a semantic change [/ʣèː-bàː/ EAR.OUTER-EDGE 'earlobe'] > § > [/ʣèː-bàː/ EAR.OUTER-EDGE 'outer ear'].

(6) EAR.INNER-EDGE: The lexicalization pattern for 'outer ear' found in Tagish /ʧí-ʃ-mbə̀ɬ/ and Dene Dháh /ʣih-bǎ/ is a variation on the term presented in the previous sub-section. The pattern is essentially parallel to the EAR.OUTER-EDGE cases, but the cognate for EAR.INNER replaces the EAR.OUTER cognate.

3.2.3.3 'Ear'

(7) EAR$_1$: The lexicalization /məsrɤeʔ/ for 'ear' is unique to Tolowa.

(8) EAR$_2$: In Dena'ina (Upper Cook Inlet dialect) the referent 'ear' is lexicalized through the form /ʧil-ʔu/. The first part of this morphologically complex form appears to be a reflex of the EAR.INNER cognate described above, but the remaining morphological structure remains obscure.

(9) EAR$_3$: The lexicalization /tʃɪwʔ/ for 'ear' is unique to Hupa.

Table 18. 'Ear'

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʥiɣ / tse	4/1	INTERIOR CANADA	Hare	ʥe / ʥíʔ	4/1
	Koyukon	ʥəɣ / tsəjət			Mountain	ʥihbǎ	5
	Dena'ina (Iliamna)	-			Bearlake	dʒípar / ʥíː	5/1
	Dena'ina (Inland)	ʧəʁ / tʃijiq'	4/2		Tłı̨chǫ	dzèːbàː / dzîː	5/1
	Dena'ina (OCI)	ʧəʁ / tʃijiq'	4/2		South Slavey	ʥíe / ʥıé ʒíh	1/2
	Dena'ina (UCI)	tʃiluʔ / tʃiq'ə	8/2		Dene Sųłiné	ʥaɣ	4
	Ahtna	tsaʁ	4		Dene Dháh	ʥiéʔ	1
	Holikachuk	-			Beaver	ʧʰʌɣ / ʧʰʌkʔ	4/1
	Gwich'in (Teetl'ıt)	ʦèːʔ / ʥìːʔ	4/1	BRITISH COLUMBIA	Carrier	ʥo / tse	4/1
	Gwich'in (Gwıchya)	ʥèːʔ	4		Witsuwit'en	ʥəq	4
	Hän	ʥàjʔ / ʥìt	4/1		Sekani	ʥaɣ / ʥi	4/1
	Lower Tanana	ʥhej / ʥijit	4/2		Ts'ets'aut	ʥeː	1
	Upper Kuskokwim	dziɣ / dzej	4/1		Chilcotin	dzaɣ	4
	Upper Tanana	dzak	4	PACIFIC COAST	Hupa	ʧɪw	9
	Tanacross	ʥaːɣʔ	4		Galice	-	
YUKON	Northern Tutchone	ʥák	4		Kato	ʧʔk	4
	Southern Tutchone	zəj	1		Tolowa	məsrɣeʔ	7
	Kaska (DL)	-			Tututni	sreɣ	4
	Kaska (FL)	ʥasbal / ʥi:k	5/1		Mattole	ʧíːɣ	4
	Kaska (GHL)	ʥî̂k	1		Wailaki	dʒiɣ	4
	Kaska (L)	ʥi:k	1		Kwa-Clat	tsax	4
	Kaska (LL)	ʥak / ʥi:ʔ	4/1	APACHEAN	Navajo	ʧaːʔ / ʧaːjiʔ	5/3
	Kaska (P)	ʥasba:l	5		Western A.	ʧaːʔ	4
	Kaska (RR)	ʥî̂k	1		S. Carlos A.	ʧaːʔ	4
	Tagish	ʧíʃmbəɬ	6		Jicarilla A.	ʧaː	4
	Tahltan	-			Kiowa A.	dʒàx	4
					Mescalero A.	ʧâːjeː	3
	Tsuut'ina	dzaɣ / dzak	4/1		Lipan A.	ʧa	4

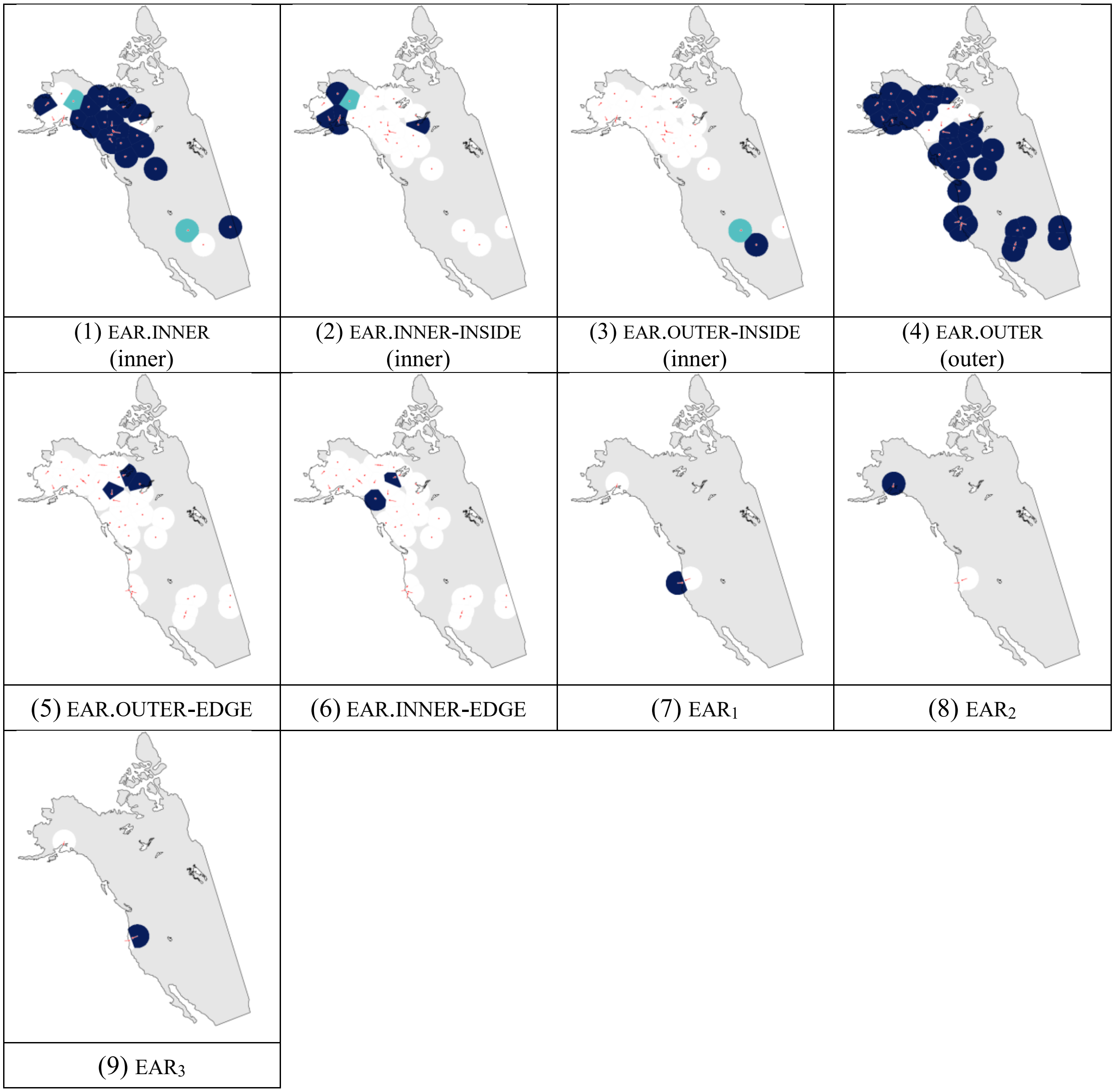


Figure 28. Distributions of terms for 'ear'

3.2.5 Eye

There are six patterns to be found in the lexicalizations of the referent-concept ‘eye’. The frequencies of these patterns are widely divergent, however, and two sets of cognates dominate the field of terms for ‘eye’.

(1) EYE$_1$: The most frequent pattern is found in 35 languages. The pattern is constituted by a monomorphemic cognate characterized by a stem-initial alveolar nasal or pre-nasalized alveolar stop. Velar or uvular fricatives, and velar or glottal stops occur in final position. The stem-final variation between /n/ and /^{n}d/ is stipulated to have come about as the result of a sound shift /n/ > /^{n}d/. In Mescalero Apache, the older form of EYE$_1$ is preserved in the morphologically complex form /na-kʼe:/ which expresses the lexicalization pattern EYE$_1$-CAVITY. The recognition of this sound change means that terms lexicalizing the referent ‘eye’ can be divided into two cognate sets, one of which has shift /n/ or /^{n}d/ in stem-initial position, EYE$_1$, and one with only voiceless alveolar stops in stem-initial position, EYE$_2$ described below. Evidence in supporting the existence of two cognate sets comes from the languages Tahltan, Tłı̨chǫ, and Jicarilla Apache, which have multiple terms lexicalizing ‘eye’ that contrast for this phonological distinction. For example, in Tahltan both /tɑ:ʔ/ and /^{n}dɑ́/ are found corresponding to the gloss ‘eye’.

(2) EYE$_2$: This cognate set is characterized by a stem-initial alveolar stop and stem-final glottal or velar stops, as exemplified by Dease Lake Kaska /tǎʔ/.

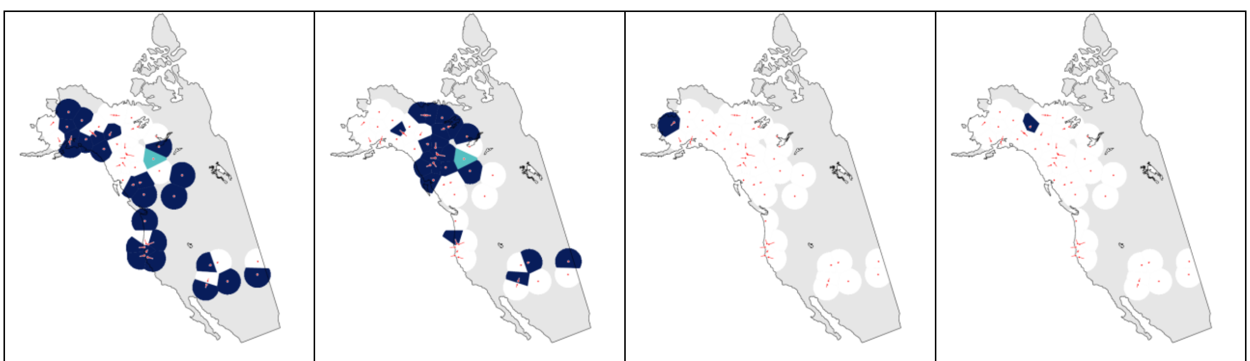
(3) EYE$_3$: The language Deg Xinag has a unique term for ‘eye’, /maq/. While it seems possible that this form may belong to cognate set EYE$_1$, there is no evidence to substantiate this at present.

(4) EYE$_4$: Hän encodes ‘eye’ through the form /ʧɑ̀w̥ʔ/ which is unique, bearing no obvious relationship to other forms in the sample.

(5) LIQUID.IS.WITHIN: Dena’ina (Outer Cook Inlet dialect) appears to have fully innovated the expressions for ‘eye’ /beɬ t^{h}uʁʔa/ which has the semantic structure LIQUID.IS.WITHIN following the glossing in Kari (2007: 88).

Table 19. Eye

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	maq	3	**INTERIOR CANADA**	Hare	táʔ	2
	Koyukon	nɒχ	1		Mountain	tǎʔ	2
	Dena'ina (Iliamna)	-			Bearlake	tá:	2
	Dena'ina (Inland)	nɒχ	1		Tłı̨chǫ	tà: / ⁿdâ:	2/1
	Dena'ina (OCI)	beɬ tʰuʁʔa	5		South Slavey	ⁿda:	1
	Dena'ina (UCI)	nɒχ	1		Dene Sų̨łiné	nɒx	1
	Ahtna	naq	1		Dene Dháh	te: / ⁿda:	2/1
	Holikachuk	-			Beaver	daɪʔ	2
	Gwich'in (Teetl'ıt)	tè:ʔ	2	**BRITISH COLUMBIA**	Carrier	nɑ	1
	Gwich'in (Gwıchya)	tè:ʔ	2		Witsuwit'en	neɣ	1
	Hän	ʧàw̥ʔ	4		Sekani	tə̀ʔ	2
	Lower Tanana	nax	1		Ts'ets'aut	txa:'ə	2
	Upper Kuskokwim	naɣ	1		Chilcotin	naɣ	1
	Upper Tanana	nâ:k	1	**PACIFIC COAST**	Hupa	na:ʔ	1
	Tanacross	ta:ɣʔ	2		Galice	tɑ:i	2
YUKON	Northern Tutchone	ⁿdá:k	1		Kato	nɑʔ	1
	Southern Tutchone	nəj	1		Tolowa	nɑ:x	1
	Kaska (DL)	tǎʔ	2		Tututni	nəx	1
	Kaska (FL)	tǎʔ	2		Mattole	nɑ́:k	1
	Kaska (GHL)	ta:k	2		Wailaki	-	
	Kaska (L)	tǎʔ	2		Kwa-Clat	náχ	1
	Kaska (LL)	tǎʔ	2	**APACHEAN**	Navajo	ná:ʔ	1
	Kaska (P)	ta:k	2		Western A.	tá:ʔ	2
	Kaska (RR)	tǎʔ	2		S. Carlos A.	nā:ʔ	1
	Tagish	ⁿdá	1		Jicarilla A.	tá: / ná	2/1
	Tahltan	tɑ:ʔ	2		Kiowa A.	tà:h	2
					Mescalero A.	ⁿda:	1
	Tsuut'ina	nax	1		Lipan A.	ⁿda	1



(1) EYE$_1$ (2) EYE$_2$ (3) EYE$_3$ (4) EYE$_4$

(5) LIQUID.IS.WITHIN

Figure 29. Distributions of terms for 'eye'

3.2.6 Eyelid

The referent-concept 'eyelid' is lexicalized through several different patterns. The most prominent shared semantic element among these lexicalizations in SKIN$_1$ (see Section 3.1.3).

(1) EYE$_1$-SKIN$_1$: The most frequent pattern is formed from the semantic elements EYE$_1$ and SKIN$_1$, to form the compound EYE$_1$-SKIN$_1$. This compound occurs with both major cognate forms for 'eye' as for example in Dene Sųłiné /na-ðéð/.

(2) EYE$_1$-EDGE: In Central Carrier the form /ba/ is glossed as 'edge' (Antoine et al. 1974: 57), resulting in the lexicalization pattern EYE$_1$-EDGE$_1$. Parallel patterns are also found in Tolowa and Tagish.

(3) EYE$_1$-AROUND.IT: In Deg Xinag and Hän, the form lexicalizing the element EYE$_1$ is combined with the morpheme /toʔ/ or /tô:/. This morpheme also occurs in words for 'gunwale' in Deg Xinag, and 'lungs' /wu-dˤeh-to:ʔ/ in Hän. Since the lungs are somewhat wrapped around the heart (see Figure 51), the latter term can be identified as HEART-AROUND.IT. This provides the identification of the terms in Deg Xinag and Hän as EYE$_1$-AROUND.IT.

(4) EYE$_1$-BLANKET: The variant term /nɒχ-ʦ’ət/ in Koyukon is also a compound. The term lexicalizing EYE$_1$ is combined with a form glossed as 'cover' or 'blanket' (Jetté and Jones 2000: 488).

(5) EYE$_1$-BLADDER: In Witsuwit'en the referent-concept 'eyelid' is lexicalized through the pattern EYE$_1$-BLADDER.

(6) EYELID: The semantics of the term /ra-póʔ/ in Hare could not be identified, and the form is therefore identified merely as EYELID.

(7) EYE$_2$-SKIN$_1$: Kiowa Apache lexicalizes 'eye-lid' with /tã̄:-zı̀s/. This expression is made up of the elements EYE$_2$ (see Section 3.2.6) and SKIN$_1$ (see Section 3.1.3). This form is glossed as 'eye-cover' in the source (Bross 1971: 16), but /zı̀s/ is clearly a cognate of terms for 'skin' (see Section 3.1.3).

(8) EYE$_1$-SKN$_5$: This pattern, found in Mattole, is semantically identical to EYE$_1$-SKIN$_1$, but the corresponding form lexicalizing 'skin' in Mattole, /tɑ́:s/ occurs instead of the more common cognate (see Section 3.2.5).

Table 20. Eyelid

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	naxtoʔ	4	INTERIOR CANADA	Hare	rapóʔ	7
	Koyukon	nɒχləɬ / nɒχʦ'ət	1/5		Mountain	-	
	Dena'ina (Iliamna)	nuʁejes	1		Bearlake	-	
	Dena'ina (Inland)	nuʁəjəs	1		Tłı̨chǫ	nawò	1
	Dena'ina (OCI)	nuʁəjəs	1		South Slavey	^{n}da: ðéh	1
	Dena'ina (UCI)	nahjəs	1		Dene Sų̨łiné	naðéθ	1
	Ahtna	nɛhzɛsʔ	1		Dene Dháh	-	
	Holikachuk	-			Beaver	-	
	Gwich'in (Teetl'ıt)	-		BRITISH COLUMBIA	Carrier	nɑpɑn	3
	Gwich'in (Gwıchya)	-			Witsuwit'en	neluh	6
	Hän	nətô:ʔ	4		Sekani	-	
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	-		PACIFIC COAST	Hupa	-	
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	na:ɣeʔpe:l	3
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	-			Mattole	nɑ́:kɛʔ tɑ́:s	3
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	náziz	1
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	-			S. Carlos A.	náziz	1
	Tagish	^{n}dá:pəl	3		Jicarilla A.	názis	1
	Tahltan	-			Kiowa A.	tã̄:zı̀s	1
					Mescalero A.		
	Tsuut'ina	-			Lipan A.	-	

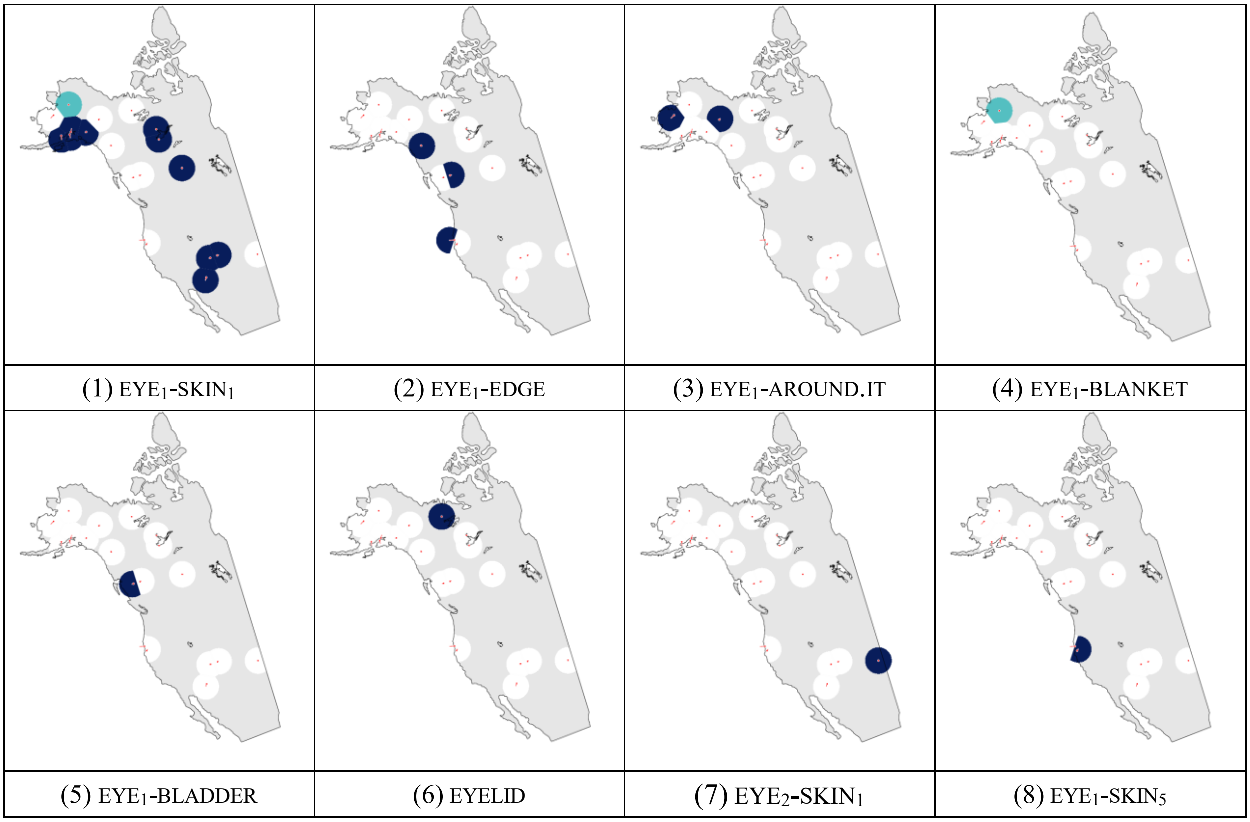


Figure 30. Distributions of terms for 'eyelid'

3.2.7 Nose

There are seven patterns in the lexicalization of the referent-concept 'nose'. Two of these patterns, NOSE$_1$ and NOSE$_2$, are closely related and differ only by the inclusion of the morpheme /-nə-/ or its cognates in the morphological structure of the term.

(1) NOSE$_1$: The most frequent pattern for 'nose' is found throughout the geographical area where Athapaskan languages are spoken. The forms accompanied by /ən/-type morphemes, however, are found among Alaskan Athapaskan languages, Carrier and some Pacific Coast languages only.

(2) NOSE$_2$: The second most common pattern takes the form of a monomorphemic root with an alveolar or palatal affricate or alveolar fricative in syllable-initial position, followed by a mid or high front vowel that is frequently nasalized in those languages for which nasalization is part of the phonological system. This form is closely related to the NOSE$_1$ forms but they carry an additional nasal segment or vowel + nasal sequence before the root as exemplified by Ahtna /ən-ʦ^{h}i:s/. It is possible that the /ən/ and /n/ forms originated as a gender markers (Kari 1990: 390).

(3) NOSE$_3$: The second most frequent pattern in the lexicalization of the referent-concept 'nose' also has a specifically regional distribution. This pattern, a cognate set exemplified by Hare /ɣő̃ʔ/, is only found among languages of the Canadian interior.

(4) NOSE$_4$: The form /wõũʔ/ found in Beaver possibly belongs to set described as NOSE$_3$, but since there is no further corroborating evidence at this point, the form has been treated as a separate pattern here.

(5) NOSE$_5$: Witsuwit'en lexicalizes 'nose' through a unique form /ncəs/, which is simply designated as NOSE$_5$.

(6) NOSE$_6$: Tolowa and Tututni lexicalize 'nose' through the form /miʃ/, which is otherwise unique among the Athapaskan languages in the sample. This form has been designated NOSE$_6$. The variant form /mĩːsr/ is additionally found in Tolowa. This latter form has been analyzed as a pronunciation variant of the same cognate here.

(7) NOSE$_8$: Galice also lexicalizes 'nose' through the unique form /sɑs/, designated NOSE$_8$.

Table 21. Nose

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	an̥tsʰe	1	**INTERIOR CANADA**	Hare	ɣṍʔ	3
	Koyukon	əntsʰex	1		Mountain	ɣṍʔ	3
	Dena'ina (Iliamna)	ntʃʰix	1		Bearlake	ɣṍ	3
	Dena'ina (Inland)	ntʃʰiʃ	1		Tłı̨chǫ	ɣȍ	3
	Dena'ina (OCI)	ntʃʰiʃ			South Slavey	ɣṍ	3
	Dena'ina (UCI)	ntʃʰiʃ	1		Dene Sųłiné	tsʰĩ	2
	Ahtna	əntsʰiːs			Dene Dháh	ɣon	3
	Holikachuk	-			Beaver	wõũʔ	4
	Gwich'in (Teetl'ıt)	ntsʰih	1	**BRITISH COLUMBIA**	Carrier	nitsʰis	1
	Gwich'in (Gwıchya)	ntsʰih	1		Witsuwit'en	ncəs	5
	Hän	ntsʰɑ̃j	1		Sekani	ɣȍʔ	3
	Lower Tanana	ntsʰej̊	1		Ts'ets'aut	tsʰé'	2
	Upper Kuskokwim	ntsʰeʃ	1		Chilcotin	tsĩx	2
	Upper Tanana	tsʰĩ̂ː	2	**PACIFIC COAST**	Hupa	ntʃʷɪʍ	1
	Tanacross	ntsʰih	1		Galice	sɑs	7
YUKON	Northern Tutchone	tsʰin	2		Kato	ʌntʃ	2
	Southern Tutchone	sĩ	2		Tolowa	mĩːsr, miʃ	6
	Kaska (DL)	-			Tututni	miʃ	7
	Kaska (FL)	-			Mattole	ntʃˣix	1
	Kaska (GHL)	tsʰĩh / ɣṍʔ	2/3		Wailaki	-	
	Kaska (L)	ɣṍʔ	3		Kwa-Clat	íntsus	1
	Kaska (LL)	ɣṍʔ	3	**APACHEAN**	Navajo	tʃʰĩː	2
	Kaska (P)	ɣṍʔ	3		Western A.	tʃʰĩh	2
	Kaska (RR)	ɣṍʔ	3		S. Carlos A.	tʃʰĩ'	2
	Tagish	tʃĩ̀	2		Jicarilla A.	tʃʰĩʃ	2
	Tahltan	tsʰih	2		Kiowa A.	tʃĩ̀ːʃ	2
					Mescalero A.	-	
	Tsuut'ina	tsʰi	2		Lipan A.	tʃʰish	2

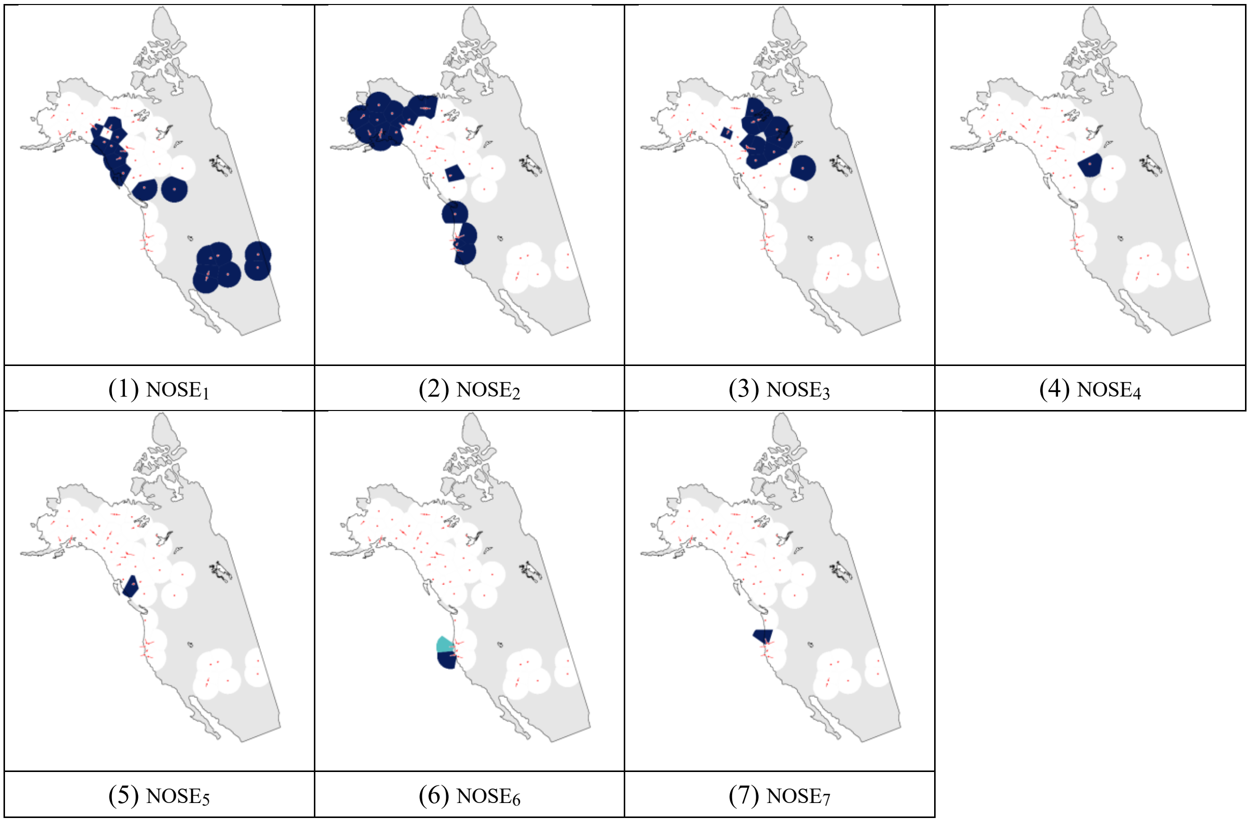


Figure 31. Distributions of terms for 'nose'

3.2.8 Mouth

The referent 'mouth' is a complex category that can be shown to cover two semantically distinct anatomical referent-concepts in Athapaskan languages: MOUTH.INNER and MOUTH.OUTER. While the 'inner mouth' is a region defined by the lips at one end and the throat at the other, both of which are encoded in individual lexical expressions in Athapaskan languages (see Sections 3.2.10 and 3.2.17), the 'outer mouth' is an area which defies exact delineation. The occurrence of morphemes expressing 'outer mouth' in compound forms denoting 'facial hair' or possibly 'chin' and 'jaw' (see Section 3.2.13 and Section 3.2.14) makes it likely that the area referred to by 'outer mouth' covers much of the face below the nose. The evidence for this distinction comes from those lexicographic sources that have explicitly recorded which terms denote the outer and the inner mouth. Witsuwit'en, for example, has a term /te/ which is glossed as 'mouth, lips' (Hargus 2007: 428), while the second term, /zeq/, is glossed as 'inside of mouth'. Only one term corresponding to the onomasiological referent 'mouth' is provided in the lexicographic sources for Kiowa Apache: /zè:k/, but this form is glossed as 'mouth interior' (Bross 1971: 7). The glossing in the lexicographic sources for Kiowa Apache and Witsuwit'en suggest that /zeq/ and /zè:k/ are reflexes of a cognate whose etymological meaning can be identified as MOUTH.INNER. Consequently, /te/ is given the designation MOUTH.OUTER. The presence of a semantic specification for outer is supported by the occurrence of forms cognate with /te/ in terms for 'facial hair', 'jaw' and 'chin' as mentioned above. Compound terms for 'facial hair' are exclusively constructed on the basis of /te/-cognates[18].

The terms found in three dialects of Dena'ina (Inland, Outer Cook Inlet, and Upper Cook Inlet) appear to contradict the association of /te/-cognates with the specification OUTER and /zè:k/-cognates with the specification INNER, since they have exactly the opposite pattern. In the Inland dialect, for instance, the form /tu/ is glossed as 'interior of mouth' (Kari 2007: 89), while /zaq'/ is glossed simply as 'mouth'. However, the association of /tu/ with the interior of the mouth is the result of semantic changes in Dena'ina. The form /tu/ is still found in compounds denoting the 'lips and around the mouth' /tu-vun/ (Kari 2007: 89) and 'beard, moustache, whiskers' /tu-vun/ (Kari 2007: 87). Furthermore, the form /zaq'-eztli/ (Kari 2007: 87) containing the reflex of the 'interior mouth' cognate lexicalizes the referent 'teeth' in the Outer Cook Inlet dialect of Dena'ina. The two forms for 'mouth' found in compounds are closely aligned with the association of the semantic specifications INNER and OUTER found in Witsuwit'en and Kiowa Apache. This leads to the conclusion that the Dena'ina dialects have undergone a semantic change [/tu/ MOUTH.OUTER 'outer mouth'] > § > [/tu/ MOUTH.INNER 'inner mouth'], and in addition, that the form /zaq'/ has lost the semantic specification INNER.

The 'inner'/ 'outer' semantic distinction has not been maintained in the majority of Athapaskan languages, although some, such as Dene Dháh and Tłįchǫ have lexicalized the difference through other morphological means as discussed below. In general, the Athapaskan languages have encoded the referent 'mouth' through morphemes that are cognate with either the MOUTH.INNER or the MOUTH.OUTER forms described for Witsuwit'en. Table 22 lists both 'outer mouth' and 'inner mouth' terms.

(1) MOUTH.INNER$_1$: Those forms cognate with Witsuwit'en /zeq/, exhibit some variation in the stem-initial position having either [w], [ð/θ], [z/s], [j], or [ʒ]. The cognate set is essentially part of the sound correspondence I.1 which Hoijer reconstructed as being reflexes of Proto-Athapaskan *s (Hoijer 1963: 22). The only exceptions are the palatals and palatalized segments found in Dena'ina (Upper Cook Inlet), Tagish, and Northern Tutchone, which Hoijer seems not to have been aware of. In Tłįchǫ, the form /wá/

[18] See for example: Deg Xinag /to-ɣoʔ/ (Kari 1978: 33), Hän /tə-ɣàʔ/ (Ritter 1978: 7), Southern Tutchone /tɑ-ɣà/ (Tlen 1993: 12), Beaver /tɑ-ɣɑ/ (Goddard 1917: 411), Ts'ets'aut /tɣǻ-xa/ (Boas and Goddard 1924: 5), Tolowa /tɑː-wɑʔ/ (Bommelyn 2006: 80), Navajo /tá-ɣaːʔ/ (Young and Morgan 1987: 825), Lipan Apache /ta-ra/ (Gatschet 1884: 2)

occurs in a second lexicalization pattern related to the referent 'mouth': /wàh-t'à:/. This pattern is glossed as 'inside of the mouth' (1996: 179). Since it must have appeared necessary to ancestral speakers of Tłı̨chǫ to encode the semantic feature 'inner' through an additional postpositional element, it can be inferred that the form /wàh/ on its own does not carry the feature. Since the cognates are associated with this feature, however, a semantic change of the form [/wàh/ MOUTH.INNER 'inner mouth'] > § > [/wàh/ MOUTH 'mouth'] must have occurred. A parallel development has occurred in Dene Dháh. The two forms available for Lipan are treated as variant pronunciations of the MOUTH.INNER cognate set since both stem-initial consonants appear in this set, while neither appears in the MOUTH.OUTER cognate set. The Koyukon form /lɒt/ (also /lɑ/) is also included in the MOUTH.INNER cognate set. In the lexicographic sources, this form is glossed as 'mouth, in the mouth' (Jetté and Jones 2000: 404). The form occurs in expressions lexicalizing many referents of the inner mouth such as the 'hard palate' MOUTH.AREA-UP-ABOVE /lɒ-tɑ-qɔ̓t/ (Jetté and Jones 2000: 130; 404) or /lɒ-tɬənʔ/ 'gums' MOUTH.AREA-FLESH (see Section 3.2.12). This distribution indicates a strong association with the interior of the mouth. Jetté and Jones (ibid.) indicate the stem-initial consonant is a reflex of Proto-Athapaskan *z (see also Hoijer 1963: 22), strengthening the case for the identification of /lɒt/ as MOUTH.INNER.

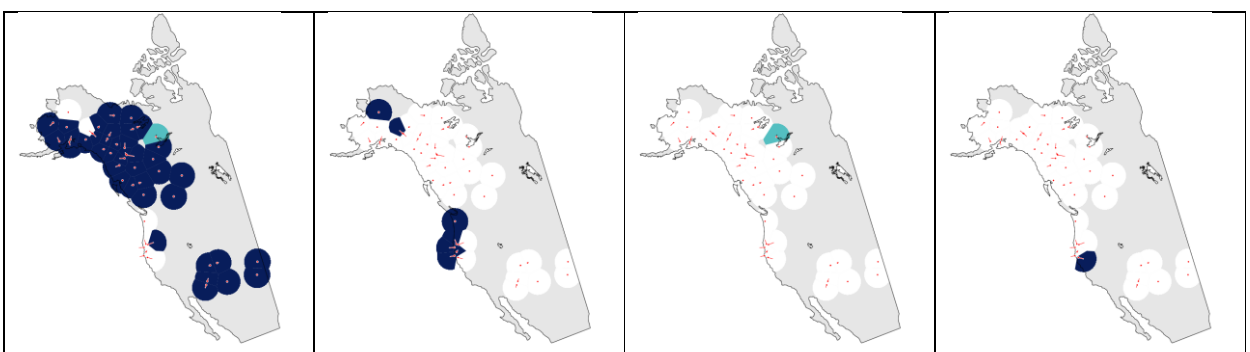
(2) MOUTH.OUTER: The set of cognates identified with the semantic specification MOUTH.OUTER are characterized by an alveolar stop in stem-initial position followed by a low front vowel, and occasionally a glottal plosive, as exemplified by Galice /tɑʔ/. As discussed above, these forms also occur in lexicalizations of the referent 'facial hair' (see fn. 2), and 'lips' (see Section 3.2.9).

(3) MOUTH.INNER-INSIDE: The languages Tłı̨chǫ and Dene Dháh, both spoken in the Canadian Interior, have two forms for 'mouth'. The first conforms to the pattern described as MOUTH.INNER. The second form combines the MOUTH.INNER term with a postpositional element glossed as INSIDE resulting in the lexicalization path MOUTH.INNER-INSIDE, as exemplified by Dene Dháh /ðá-t'áe/. This suggests that speakers of Tłı̨chǫ and Dene Dháh have re-created the semantic contrast lexicalized through the pair of contrasting stems in Witsuwit'en after the loss of semantic features in their 'mouth' terms. Tłı̨chǫ might be seen to have preserved the MOUTH.OUTER term in the form /tã:/ which is glossed as 'mouth area'.

(4) MOUTH$_1$: Kwalhioqua-Clatskanie lexicalizes 'mouth' through the form /naɣ/, which does not appear to be related to any of the other forms in the sample.

Table 22. Mouth

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ðot	1	INTERIOR CANADA	Hare	wáʔ	1
	Koyukon	tɑ / lɒt	2		Mountain	váʔ	1
	Dena’ina (Iliamna)	-			Bearlake	wá	1
	Dena’ina (Inland)	tu / zaq’	2/1		Tłı̨chǫ	wà / wàht’à:	1/3
	Dena’ina (OCI)	ti / zaq’	2/1		South Slavey	ðá	1
	Dena’ina (UCI)	tu / jaq’	2/1		Dene Sųłiné	ða	1
	Ahtna	zɑ:	2		Dene Dháh	ðá / ðát’áe	1/3
	Holikachuk	-			Beaver	zaʔ	1
	Gwich’in (Teetl’ıt)	ʒik	1	BRITISH COLUMBIA	Carrier	ze̠	1
	Gwich’in (Gwıchya)	-			Witsuwit’en	te / zeq	2/1
	Hän	ðàt	1		Sekani	zàʔ	1
	Lower Tanana	to / ðot			Ts’ets’aut	saʔ	1
	Upper Kuskokwim	zo	1		Chilcotin	ðɛ	1
	Upper Tanana	ðâ:t	1	PACIFIC COAST	Hupa	taʔ / sah	2/1
	Tanacross	ta:	2		Galice	tɑʔ	2
YUKON	Northern Tutchone	ðʲá:k	1		Kato	tɑʔ	2
	Southern Tutchone	ðe	1		Tolowa	taʔ	2
	Kaska (DL)	-			Tututni	taʔ	2
	Kaska (FL)	ze:k	1		Mattole	táʔ	2
	Kaska (GHL)	ze:k	1		Wailaki	-	
	Kaska (L)	ze:k	1		Kwa-Clat	-	
	Kaska (LL)	zǎʔ	1	APACHEAN	Navajo	zé:ʔ	1
	Kaska (P)	ze:k	1		Western A.	zé	1
	Kaska (RR)	ze:k	1		S. Carlos A.	zé	1
	Tagish	jìk	1		Jicarilla A.	zẽʔ	1
	Tahltan	ðɑ:t	1		Kiowa A.	zè:k	1
	Tsuut’ina	zò	1		Lipan A.	jɛ / sɛ	1/1



(1) MOUTH.INNER$_1$ | (2) MOUTH.OUTER | (3) MOUTH.INNER-INSIDE | (4) MOUTH$_1$

Figure 32. Distributions of terms for ‘mouth’

3.2.9 Tongue

Two major sets of cognates lexicalize the referent-concept 'tongue' in all but three of the Athapaskan languages in the sample.

(1) TONGUE₁: The first of these sets is based on a stem with an initial alveolar affricate and final fricative or lateral approximant, as exemplified by the Ts'ets'aut form /ʦus/.

(2) TONGUE₂: The second most widespread cognate appears to be morphologically complex. This form is based on the term for MOUTH.INNER (see Section 3.2.8) followed by a morpheme with an unclear meaning. Besides the fact of the anatomical location of this particular body part, the evidence indicating that the first part of this form is correctly identified as MOUTH.INNER stems from the observation that these forms are the cognates of the MOUTH.INNER forms in their respective languages: Hare /wáʔ/ MOUTH.INNER and /wari/ TONGUE. Similarly, Dene Dháh /ðáʔ/ MOUTH.INNER and /ðatih/ TONGUE.

(3) MOUTH.INNER-STICK.LIKE.OBJECT.LIES: In Hupa and Mattole, the morphologically complex forms are constituted of terms for MOUTH.INNER and the classificatory verb denoting the resting position of 'stick-like objects', hence: MOUTH.INNER-STICK.LIKE.OBJECT.LIES.

(4) MOUTH.INNER-LONG.MUSCLE: Among some of the languages of the Pacific Coast (Mattole, Kwalhioqua-Clatskanie, Tolowa) as well as some languages of the northern Mackenzie Basin in Canada, the referent 'tongue' been lexicalized through a localized pattern taking the form MOUTH.INNER-LONG.MUSCLE, as for example in Tłįchǫ /wa-lìː/. The first part of the compound is formed by the reflex of the cognate identified as MOUTH.INNER in Section 3.2.8. The second part has been designated LONG.MUSCLE since it also forms part of several other expressions in Tłįchǫ: /dza-lìː/ 'calf of the leg', /ɣo-lìː/ 'thigh muscle', and /kʷʼı̃̀-lìː/ 'arm muscle (biceps)'. The form /lìː/ has a cognate in South Slavey /ʦa-lúe/ 'calf of the leg', whose structure and form matches that of Tłįchǫ exactly. In Central Carrier, this form becomes /ʦɑ-lo/, and in Witsuwit'en /dze-loq/. With these meanings and phonological forms so closely matched, it is clear that /lìː/ LONG.MUSCLE forms part of a wider pattern of cognation in which the initial sound is a lateral approximant, the vowel a back vowel and the syllable-final sound alternates between zero and a uvular plosive. The semantic specification LONG used in the description of this form receives further justification in the glossing found in Koyukon where the cognate of this form is glossed as 'elongated muscle, calf' (Jetté and Jones 2000: 419). In Tłįchǫ, /wa-lìː/ is found to alternate with /wa-rìː/. This variation can be seen as a phonological change in progress, which has already taken hold in Hare /wa-ri/ and Bearlake /waré/. Among the languages of the Pacific Coast region, the pattern most clearly parallel to the northern forms is found in Tolowa /saːɨ-lu/ and Tututni /sa-ɬu/. Kato /soʊ/ is analyzed as part of this pattern here from the point of view that the final approximant has disappeared due to reduction. The inclusion of the Kato form in this group remains speculative, however.

(5) MOUTH.OUTER-MUSCLE: Galice follows the pattern outlined above, but has substituted the form /tɑː/ MOUTH.OUTER for the cognates of the MOUTH.INNER forms found among the languages exhibiting the MOUTH.INNER-LONG.MUSCLE lexicalization pattern.

(6) MOUTH.INNER-UNDER: In Kiowa Apache, /zéːsíʔầːtè/ the location of the tongue serves as the reference point for the lexicalization in the semantic construction MOUTH.INNER-UNDER (Bross 1971: 7).

Table 23. Tongue

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθel	1	INTERIOR CANADA	Hare	wari	4
	Koyukon	tɬʰuɬ	1		Mountain	vale	4
	Dena'ina (Iliamna)	-			Bearlake	waré	4
	Dena'ina (Inland)	ʦʰil	1		Tłįchǫ	walìː, warìː	4
	Dena'ina (OCI)	ʦʰil	1		South Slavey	ðáı	2
	Dena'ina (UCI)	ʦʰil	1		Dene Sųłiné	tθú	1
	Ahtna	ʦʰul	1		Dene Dháh	ðátih	2
	Holikachuk	-			Beaver	ʦʰʌd	1
	Gwich'in (Teetl'ıt)	ʧʰàːʔ	1	BRITISH COLUMBIA	Carrier	t̪s̪ul	1
	Gwich'in (Gwıchya)	-			Witsuwit'en	ʦʰol	1
	Hän	tθʰûːʔ	1		Sekani	zùt	2
	Lower Tanana	-			Ts'ets'aut	ʦus	1
	Upper Kuskokwim	ʦʰul	1		Chilcotin	ʦol	1
	Upper Tanana	tθûːl	1	PACIFIC COAST	Hupa	saːstaːn	3
	Tanacross	tθulʔ	1		Galice	tɑːɬoʔ	5
YUKON	Northern Tutchone	tθʰjáwʔ	1		Kato	soʊʔ	4
	Southern Tutchone	ðɑ̀t	2		Tolowa	saːɬlu	4
	Kaska (DL)	-			Tututni	sału	4
	Kaska (FL)	zaːt	2		Mattole	sɑstxsɑ́ːn	3
	Kaska (GHL)	zaːt	2		Wailaki	-	
	Kaska (L)	zaːt	2		Kwa-Clat	ʦú	1
	Kaska (LL)	zaːt	2	APACHEAN	Navajo	ʦʰoːʔ	1
	Kaska (P)	zaːt	2		Western A.	zaːt	2
	Kaska (RR)	zaːt	2		S. Carlos A.	-	
	Tagish	ʒàːt	2		Jicarilla A.	zaːt	2
	Tahltan	ðɑːt	2		Kiowa A.	zéːsíʔầːtè	5
					Mescalero A.	zaːt	2
	Tsuut'ina	ʦʰu	1		Lipan A.	sat	2

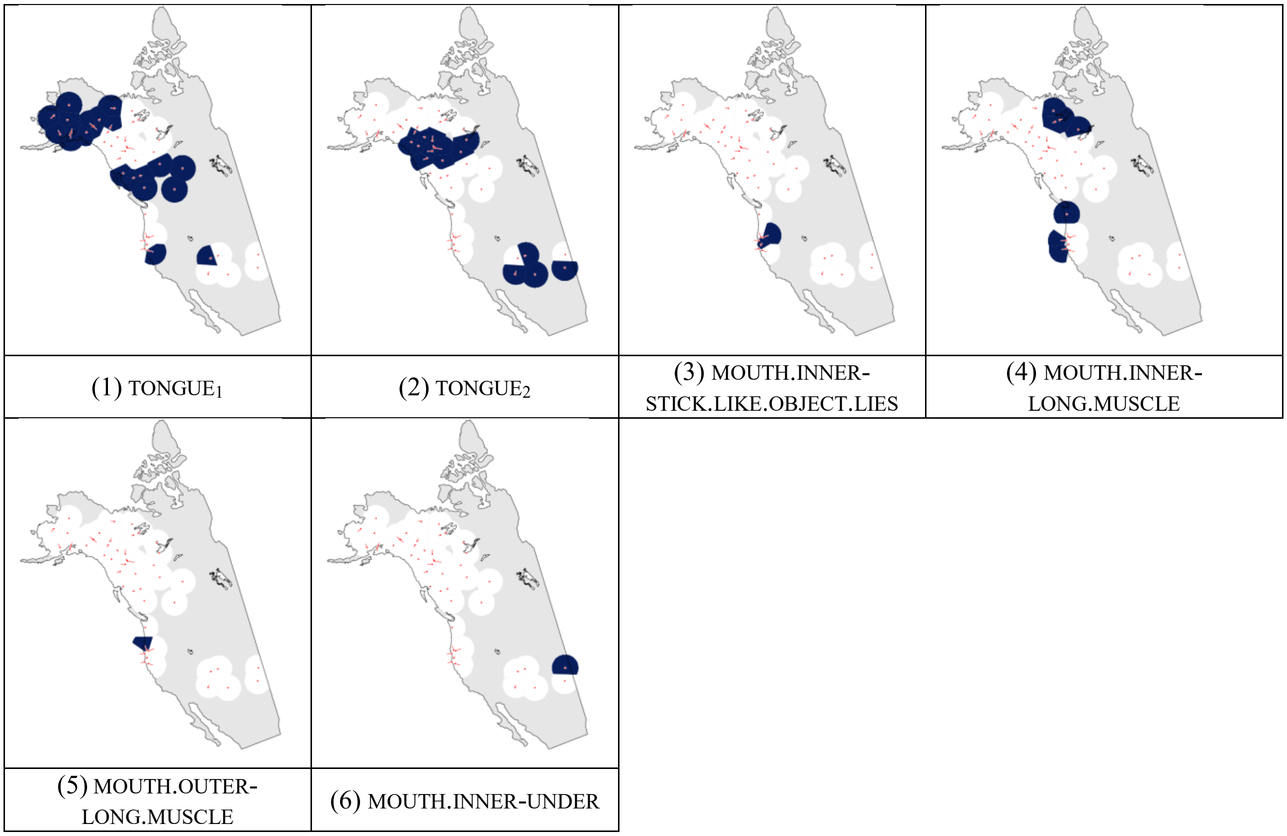


Figure 33. Distributions of terms for 'tongue'

3.2.10 Lips

The referent 'lips' is lexicalized through 9 distinct patterns. Morphemes lexicalizing the 'mouth', described in Section 3.2.8, form part of the majority of these lexicalization patterns.

(1) MOUTH.OUTER-EDGE: The most widespread pattern in the lexicalization of 'lips' is a compound formed from the constituent denoting either MOUTH.OUTER or MOUTH (as these were described in Section 3.2.8 Mouth) and a morpheme glossed as EDGE, rendering the composite MOUTH.OUTER-EDGE. The EDGE element typically has a bilabial or labio-dental sound in stem-initial position and a wide variety of sounds in stem-final position, such as in the Dena'ina term /vun/. All stems expressing EDGE form closed monosyllables. The stem-initial sounds are in accordance with the sound correspondences outlined by Krauss and Leer as being modern reflexes of Proto-Athapaskan *w (1981: 77). The exception here is Tsuut'ina, which has /jón/ rather than the predicted /nón/. The form is nonetheless included in the pattern here, although with the proviso that its inclusion is tenuous.

(2) MOUTH.OUTER-SKIN: The lexicalization pattern MOUTH.OUTER-SKIN is a compound exemplified by Dene Sų̨łiné /ta-ðéð/. The compounded stems are described in Sections 3.2. 8 and 3.1.3 respectively. This lexicalization pattern is also found in South Slavey, Dene Dháh, and Hupa.

(3) MOUTH.INNER-EDGE: This pattern is found only in the Apachean languages Navajo, San Carlos Apache, Western Apache, Mescalero Apache, and Lipan Apache. It is parallel to the patterns identified as MOUTH.OUTER-EDGE**,** described above, except that in this case the cognate of the MOUTH.INNER term (see Section 3.2.8) occurs in the compound.

(4) MOUTH.OUTER: Among the Apachean languages, Jicarilla, Navajo, and Mescalero, as well as Chilcotin the form identified as MOUTH.OUTER also co-lexicalizes 'lips', such as in the case of Jicarilla Apache /taː/. Since the association of this form with the referent 'outer mouth' is found in many languages (see Section 3.2.8 'Mouth'), it is possible to infer the direction of the extension of this polysemic lexicalization pattern [/taː/ MOUTH.OUTER 'outer mouth'] > ℙ > [/taː/ MOUTH.OUTER 'mouth, lips'].

(5) MOUTH.OUTER-NEAR.TO: In Hare and Bearlake, the referent 'lips' is lexicalized through a cognate of the form for MOUTH.OUTER combined with a postpositional element NEAR.TO (K.Rice 1989: 281), as in Hare /ta-ɣóʔ/. These forms indicate that Hare and Bearlake retain forms that distinguish the semantic features INNER /wáʔ/ and OUTER, /ta/, among the terms for 'mouth', at least within these compounds (see Section 3.2.8).

(6) MOUTH.INNER-RIM: The languages, Tłı̨chǫ and Beaver, diverge from the patterns described as MOUTH.INNER-EDGE only in that the head of the compound is composed of a different morpheme, as in Tłı̨chǫ /wà-tãː/. The /tãː/-morpheme is also found in the expressions /kȍːmbâː tãː/ 'cuffs' (Dogrib Divisional Board of Education 1996: 48), /ts'ah-tãː/ 'hat trim' (Dogrib Divisional Board of Education 1996: 174), and /we-tãː/ 'rim' (Dogrib Divisional Board of Education 1996: 107). Therefore this morpheme has been identified with the semantic value RIM. The semantic structure lexicalized by this morpheme is therefore referent-conceptually similar to EDGE. Beaver and Tłı̨chǫ follow the idea of dominant Athapaskan lexicalization for 'lips', but they realize it through different morphological means.

(7) LIPS$_1$: The form /tɑʔ-mɑːʔkʰuh/ found in Galice could not be fully interpreted, although the first component of the lexicalization pattern appears to be a reflex of the MOUTH.OUTER cognate. This pattern is similar, but not identical, to the pattern found in Tolowa.

(8) LIPS$_2$: The form /taʔ-mojnʔseɬ/ found in Tolowa could also not be fully interpreted, although the first component of the lexicalization pattern appears to be a reflex of the MOUTH.OUTER cognate. This pattern is similar, but not identical, to the pattern found in Galice.

(9) LIPS₃: In Sekani, the referent 'lips' is lexicalized through the form /tōne/. This form does not appear to be related to those of the other languages in this set, although it is close to Koyukon /tɑne/ 'around the mouth; around the edge of' (Jetté and Jones 2000: 144).

Table 24. Lips

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tavon	1	INTERIOR CANADA	Hare	taɣóʔ	5
	Koyukon	tɒban	1		Mountain	tabel	1
	Dena'ina (Iliamna)	tuvun	1		Bearlake	taɣó:	5
	Dena'ina (Inland)	tuvun	1		Tłı̨chǫ	wàtã:	6
	Dena'ina (OCI)	tuvun	1		South Slavey	taðéh	2
	Dena'ina (UCI)	tuvun	1		Dene Sų̨łiné	taðéð	2
	Ahtna	tɑpəl	1		Dene Dháh	ta:ðéh	2
	Holikachuk	-			Beaver	jɛtaʔ	6
	Gwich'in (Teetl'ıt)	te:và:ʔ	1	BRITISH COLUMBIA	Carrier	tɑ	4
	Gwich'in (Gwıchya)	te:và:ʔ	1		Witsuwit'en	tepeɣ	1
	Hän	təpə̀w̰ʔ	1		Sekani	tōne	9
	Lower Tanana				Ts'ets'aut	tamáʔ	1
	Upper Kuskokwim	domon	1		Chilcotin	dǽ	4
	Upper Tanana	dâ:mbə̀lʔ	1	PACIFIC COAST	Hupa	ta:sɪʦʼ	2
	Tanacross	ta:mɛlʔ	1		Galice	tɑʔmɑ:ʔkʰuh	7
YUKON	Northern Tutchone	tɑmpáwʔ	1		Kato	-	
	Southern Tutchone	tɑmpáwʔ	1		Tolowa	taʔmojnʔseɬ	8
	Kaska (DL)	-			Tututni	taməs	1
	Kaska (FL)	-			Mattole	tɑʔbágʷ	1
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	zápã:h / ta:ʔ	3/4
	Kaska (P)	-			Western A.	zá:ba:n	3
	Kaska (RR)	ta:nibel	1		S. Carlos A.	zébá:n	3
	Tagish	tʰá mbə́l	1		Jicarilla A.	ta:	4
	Tahltan	-			Kiowa A.	tà:h	4
					Mescalero A.		
	Tsuut'ina	tàjón	1		Lipan A.	ʒapah	3

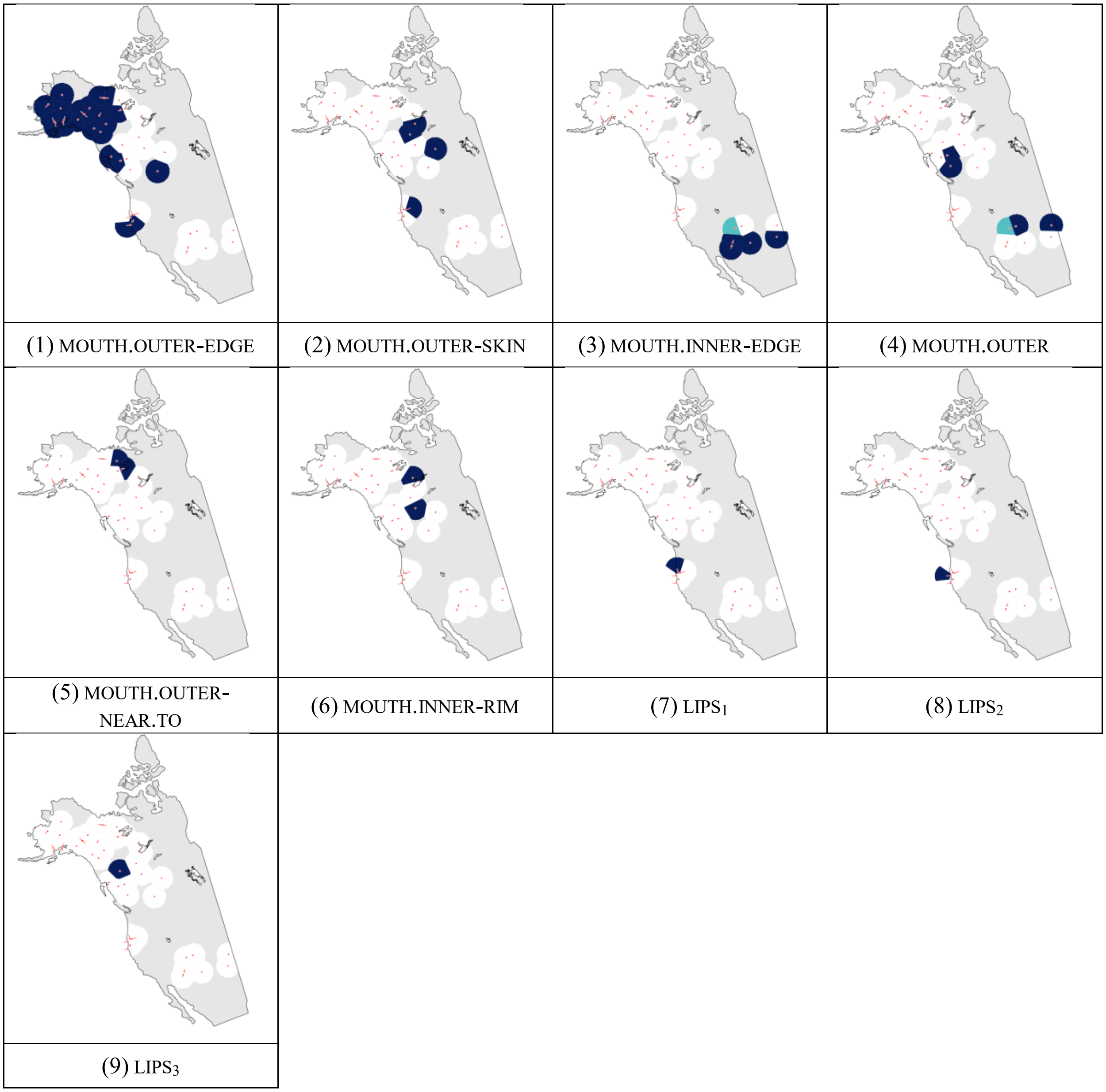


Figure 34. Distributions of terms for 'lips'

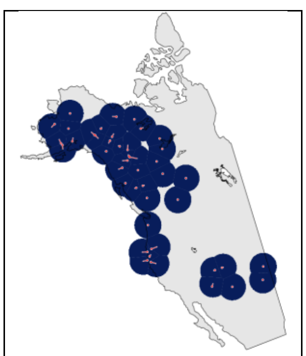
3.2.11 Teeth

The terms for the referent-concept 'teeth' represent one of the most stable sets in the sample, all recorded terms being representative of the same cognate set.

(1) TEETH: All terms are monosyllabic having either a velar fricative, uvular fricative, palatal approximant or labial-velar approximant as the stem-initial consonant.

Table 25. Teeth

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ɣeʔ	1	INTERIOR CANADA	Hare	ɣúʔ	1
	Koyukon	ʁuʔ	1		Mountain	-	
	Dena’ina (Iliamna)	-			Bearlake	ɣú	1
	Dena’ina (Inland)	ʁi	1		Tłįchǫ	ɣò:	1
	Dena’ina (OCI)	-			South Slavey	ɣú	1
	Dena’ina (UCI)	-			Dene Sųłiné	ɣú	1
	Ahtna	ʁuʔ	1		Dene Dháh	wú	1
	Holikachuk	-			Beaver	wouʔ	1
	Gwich’in (Teetl’ıt)	ɣòʔ	1	BRITISH COLUMBIA	Carrier	ɣu	1
	Gwich’in (Gwıchya)	-			Witsuwit’en	ɣu	1
	Hän	ɣòʔ	1		Sekani	ɣùʔ	1
	Lower Tanana	-			Ts’ets’aut	xo:	1
	Upper Kuskokwim	ɣuʔ	1		Chilcotin	ɣʷó	1
	Upper Tanana	ɣùʔ	1	PACIFIC COAST	Hupa	woʔ	1
	Tanacross	ɣuʔ	1		Galice	kuʔ	1
YUKON	Northern Tutchone	ɣúʔ	1		Kato	woʊʔ	1
	Southern Tutchone	jù	1		Tolowa	ɣuʔ	1
	Kaska (DL)	-			Tututni	ɣʷuʔ	1
	Kaska (FL)	júʔ	1		Mattole	ɣʷoʔ	1
	Kaska (GHL)	ɣúʔ	1		Wailaki	ɣʷoʔ	1
	Kaska (L)	ɣúʔ	1		Kwa-Clat	ɣu / wo	1
	Kaska (LL)	ɣúʔ	1	APACHEAN	Navajo	wo:ʔ	1
	Kaska (P)	júʔ	1		Western A.	ɣo:ʔ	1
	Kaska (RR)	júʔ	1		S. Carlos A.	-	
	Tagish	ɣù	1		Jicarilla A.	wo:	1
	Tahltan	ɣuʔ	1		Kiowa A.	ɣò:	1
	Tsuut’ina	wu	1		Lipan A.	-	



(1) TEETH

Figure 35. Distributions of terms for ‘teeth’

3.2.12 Gums

The referent 'gums' is lexicalized in several different ways, but never in a monomorphemic form. The dominant forms are compounds that involve the notion of TEETH.

(1) TEETH-FLESH: Especially prominent is the lexicalization pattern TEETH-FLESH, a compound which occurs in 24 of the 39 languages for which data were available, as for example in Hare /ɣú-fẽ́ʔ/.

(2) TEETH-SOFTNESS: The next most common pattern is found in the languages Gwich'in (Teetl'ıt and Gwıchya dialects) /-ɣòʔ atɬok/ which expresses the lexicalization pattern TEETH-SOFTNESS. An identical pattern is also found in Hän.

(3) TEETH-BASE: Among two Dena'ina dialects the (Inland and Outer Cook Inlet) the pattern /ʁi-kʰən/ TEETH-BASE serves to lexicalize 'gums' (the term BASE will be discussed further in Chapter 4).

(4) MOUTH.INNER-BONE-TOOTH-FLESH: The semantic component MOUTH occurs in Kiowa Apache which expresses 'gums' through /zéː-ʦ'ĩ̀ː ɣóː-ʧîːʃ/ lexicalizing the pattern MOUTH.INNER-BONE-TOOTH-FLESH.

(5) MOUTH.AREA-FLESH: In Koyukon 'gum' is lexicalized through /lɒ-tɬənʔ/ MOUTH.AREA-FLESH.

(6) GUMS1: The form /taʔ-kɪnʧeʔ/ in Hupa contains the morpheme /taʔ/ which was identified as MOUTH.OUTER (see Section 3.2.8). While the final syllable is reminiscent of 'flesh' terms in other Athapaskan languages (see Section 3.1.2 'Flesh'), this possible morpheme should exhibit the syllable-initial reflex /ʦ/ rather than /ʧ/. This could of course be a form that has resisted a sound change, but this has to remain speculative in the absence of further evidence.

(7) GUMS2: Tolowa lexicalizes 'gums' through /ɣusʔ-sriːt/ contains the morpheme /ɣus/ which is similar to the terms for 'teeth' (see Section 3.2.11).

(8) GUMS3: The form /wu-da-kʰa/ in Tsuut'ina appears to contain forms for 'teeth' /wu/, but the remaining construction is difficult to identify and has no parallels in other Athapaskan languages.

Table 26. Gums

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ɣetθiŋʔ	1	INTERIOR CANADA	Hare	ɣúfẽ́ʔ	1
	Koyukon	lɒtɬənʔ	5		Mountain	ɣúpẽ́ʔ	1
	Dena'ina (Iliamna)	-			Bearlake	ɣukʷʰẽ́	1
	Dena'ina (Inland)	ʁikʰən	3		Tłı̨chǫ	ɣokʷõ̀	1
	Dena'ina (OCI)	ʁikʰən	3		South Slavey	ɣutθʰẽ́	1
	Dena'ina (UCI)	-			Dene Sųłiné	ɣútθə́n	1
	Ahtna	ʁuʦʰɛnʔ	1		Dene Dháh	wutθén	1
	Holikachuk	-			Beaver	-	
	Gwich'in (Teetl'ıt)	ɣòʔ atɬok	2	BRITISH COLUMBIA	Carrier	ɣuʦʈ̺ʂ̺ʌŋ	1
	Gwich'in (Gwıchya)	ɣòʔ atɬok	2		Witsuwit'en	-	
	Hän	ɣotɬʰô:ʔ	2		Sekani	-	
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ɣutθî̃ːʔ	1	PACIFIC COAST	Hupa	taʔkɪnʧeʔ	6
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	ɣutθʰánʔ	1		Kato	-	
	Southern Tutchone	jùtθʰə̀n	1		Tolowa	ɣusʔsriːteʔ	7
	Kaska (DL)	ɣúʦʰén	1		Tututni	-	
	Kaska (FL)	júʦʰén	1		Mattole	-	
	Kaska (GHL)	ɣúʦʰén	1		Wailaki	-	
	Kaska (L)	ɣṹʦʰán	1		Kwa-Clat	-	
	Kaska (LL)	wúʦʰán	1	APACHEAN	Navajo	wóʦʰíːn	1
	Kaska (P)	júʦʰén	1		Western A.	wóʦʰį̀	1
	Kaska (RR)	júʦʰén	1		S. Carlos A.	wóʦʰĩ́	1
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	zéːʦ'ĩ̀ː / ɣóːʧìːʃ	4
					Mescalero A.		
	Tsuut'ina	wudakʰa	8		Lipan A.	-	

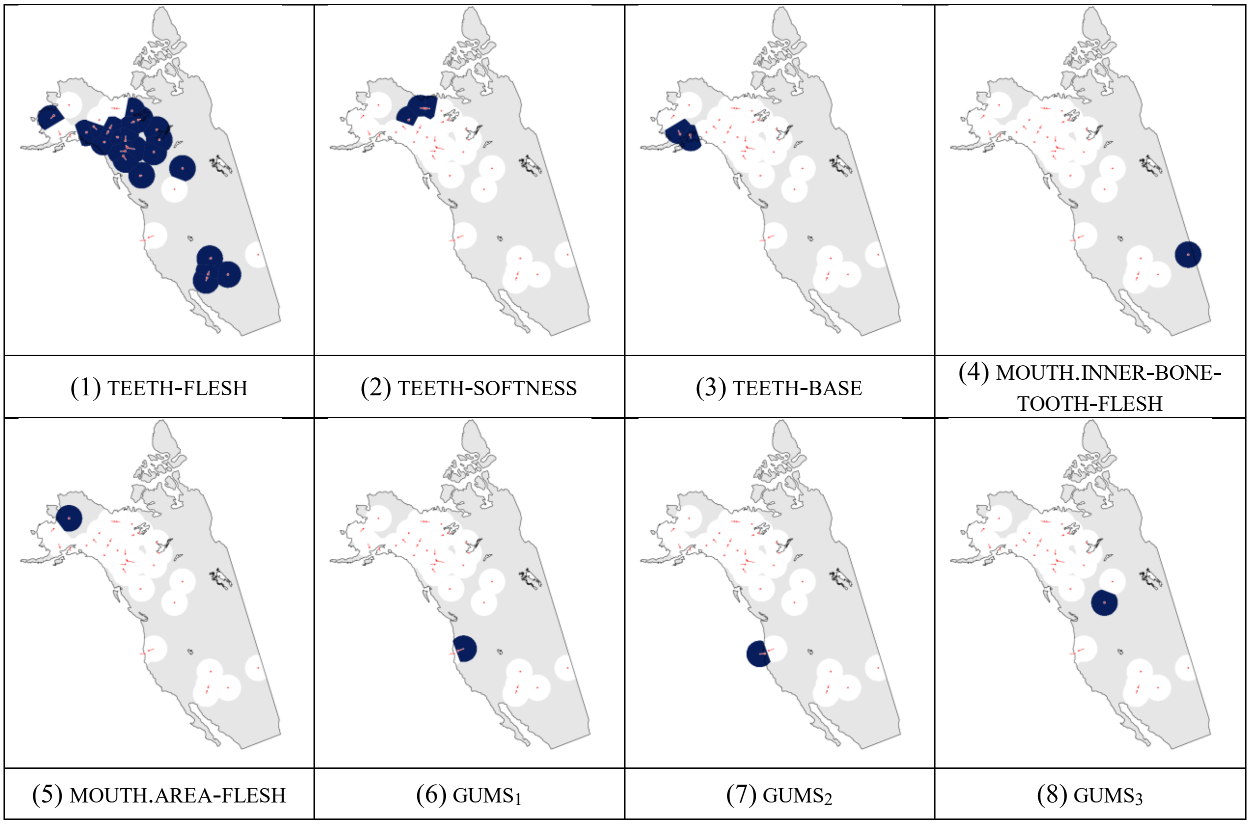


Figure 36. Distributions of terms for ‘gums’

3.2.13 Chin

Many of the terms denoting the referent-concept ‘chin’ feature a morpheme characterized by a palatal approximant, labio-velar approximant, alveolar fricative, or velar fricative in stem-initial position. This morphological element always occurs in combination with another element, as described under pattern (2) CHIN$_1$ below, but it does not appear to have a clearly identifiable independent meaning. It is therefore a submorphemic element or submorpheme (Kubrjakova 2000: 417). An exception can perhaps be seen in the form /tʃàʔ/ found in Hän, this submorpheme alone lexicalizes ‘chin’ (and is therefore properly a morpheme in this case), as in the pattern identified as CHIN$_4$ (see below). This morpheme always occurs in a compound, such as for example in Koyukon /ja-təʔ/, but also in Navajo /jaː-tsʼiːn/. This morpheme does not appear among any other lexicalization patterns in the sample, except in the closely related terms for ‘jaw’ (see Section 3.2.14 ‘Jaw’). It does, however, bear great similarity to verb stems lexicalizing actions related to speaking such as Ahtna /jaːʔ/ or Tłı̨chǫ /jah-t^{h}i/. This morpheme is also found in terms for ‘jaw’ (see Section 3.2.14). Beyond these distributional facts, however, the meaning of the morpheme remains difficult to decipher.

(1) MOUTH.OUTER: In five languages, Bearlake, Tłįchǫ, Tanacross, Upper Tanana, and Jicarilla Apache, the MOUTH.OUTER cognate co-lexicalizes 'chin', as for example in Tanacross /taʔ/. Since the association between /taʔ/ and the referent 'outer mouth' is more widespread, this polysemy pattern can be inferred to have extended to cover 'chin': [/taʔ/ MOUTH.OUTER 'outer mouth'] > ℙ > [/taʔ/ MOUTH.OUTER 'outer mouth, chin'].

(2) CHIN$_1$: The patterns identified as CHIN$_1$ are all compounds whose first element corresponds to the /ja/- morpheme, described above, and whose second element is a syllable characterized by an alveolar plosive followed by a mid or low front vowel. This morpheme corresponds to the MOUTH.OUTER forms identified in Section 3.2.8. For example, the first element in Deg Xinag 'facial hair' /to-ɣoʔ/ corresponds to the latter element in /ja-toʔ/ 'chin'. In Hupa, the /taʔ/ lexicalizing 'outer mouth' corresponds to the second element in /we:-taʔ/ 'chin'. Similar correspondences exist in Ahtna, Beaver, Dene Sų̨łiné, Hare, Southern Tutchone, San Carlos Apache, and Western Apache. Since the meaning of /ja/ and its cognates is not easily represented by a single gloss, the pattern is identified simply as CHIN$_1$.

(3) CHIN$_2$: This form occurs only in the dialects of Gwich'in and appears unrelated to other forms in the sample.

(4) CHIN$_3$: In Tahltan as well as the Dease Lake dialect of Kaska, 'chin' is lexicalized through a compound whose head is a reflex of the MOUTH.OUTER cognate. The modifier of this compound appears to be similar to the form denoting 'teeth' (see Section 3.2.11), e.g. Tahltan /ɣu/ 'teeth' and /ɣu-tʌʔ/ 'chin'.

(5) CHIN$_4$: In Hän, the form /tʃɑ̀ʔ/ lexicalizes chin (along with another form CHIN$_7$). The pattern is unusual in being the only instance of a cognate of the morpheme /jɑ̀ʔ/ associated with the referent 'chin' occurring outside of a compound. This pattern may have arisen as a result of a fusion of phonological elements, with a reflex of the compound form CHIN$_1$ as an earlier form. More evidence is needed to substantiate this hypothesis, however.

(6) JAW$_1$: Three languages. Witsuwit'en, Kwalhioqua-Clatskanie and Navajo lexicalize 'chin' through a pattern more frequently associated with the referent 'jaw' (see Section 3.2.14). The lexicographic resources for these languages do not list any term for 'jaw', making it seem probable that the two referents are not distinguished lexically in these languages. Since the association between patterns cognate with Navajo /ja:-ʦ'i:n/ and the referent 'jaw' are more widespread, the lexicalization of the reference-concept 'chin' by these terms must historically have come about through a polysemic extension [/ja:-ʦ'i:n/ JAW$_1$ 'jaw'] > ℙ > [/ja:-ʦ'i:n/ JAW$_1$ 'jaw, chin'].

(7) MOUTH.OUTER-HAND: This lexicalization pattern occurs in Dene Dháh /ta-lá/ and South Slavey /ta:-la/. The pattern takes the form of a compound whose first component is a reflex of the MOUTH.OUTER cognate. The second component is identified as HAND (see Section 3.3.5). The semantic oddness could be mitigated by positing an intermediate stage of meaning for 'hand', EXTREMITY, in which the form denotes the ends of limbs or other extremities; but conclusive evidence for such a polysemy pattern could not be found.

(8) CHIN$_5$: The form /ʦʰæ̃/ is unique to Lipan Apache, although it bears some resemblance to CHIN$_4$.

(9) CHIN$_6$: Tsuut'ina /wu-da-ts'in/ resembles the patterns described as CHIN$_4$ in that it appears to contain the element TEETH as the first part of a tri-partite compound which can be glossed as TEETH-MOUTH.OUTER-BONE. This form co-lexicalizes 'jaw'.

(10) CHIN$_7$: The form /ʒeh-tʃɑ̀ʔ/ is found exclusively in Hän. The pattern contains the morpheme /jɑ̀ʔ/, but in the head position of a compound, unlike any of the other terms lexicalizing the referent 'chin'.

Table 27. Chin

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	jatoʔ	2	INTERIOR CANADA	Hare	ɣatáʔ	4
	Koyukon	jatəʔ	2		Mountain	jétáʔ	2
	Dena'ina (Iliamna)	jata	2		Bearlake	tá	1
	Dena'ina (Inland)	jata	2		Tłı̨chǫ	dà	1
	Dena'ina (OCI)	jata	2		South Slavey	talá	7
	Dena'ina (UCI)	jata	2		Dene Sų̨łiné	ʒə́tá	2
	Ahtna	jɪtɑʔ	2		Dene Dháh	jí:tá / ta:la	1/7
	Holikachuk	-			Beaver	jɛta	2
	Gwich'in (Teetl'ıt)	tjèʔ	3	BRITISH COLUMBIA	Carrier	-	
	Gwich'in (Gwıchya)	tìʔ	3		Witsuwit'en	jiʦ'ən	6
	Hän	tʃàʔ / ʒehtʃàʔ	5/10		Sekani	jètàʔ	2
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	jadaʔ	2		Chilcotin	-	
	Upper Tanana	dàʔ	1	PACIFIC COAST	Hupa	we:taʔ	2
	Tanacross	taʔ	1		Galice	-	
YUKON	Northern Tutchone	jétéʔ	2		Kato	-	
	Southern Tutchone	jètà	2		Tolowa	-	
	Kaska (DL)	jiʦ'ən	6		Tututni	-	
	Kaska (FL)	ɣútáʔ	4		Mattole	-	
	Kaska (GHL)	zétáʔ	2		Wailaki	-	
	Kaska (L)	zétáʔ	2		Kwa-Clat	játs'ŭn[19]	6
	Kaska (LL)	zétáʔ	2	APACHEAN	Navajo	ja:ʦ'i:n	6
	Kaska (P)	jétáʔ	2		Western A.	jeta:	2
	Kaska (RR)	zétáʔ	2		S. Carlos A.	jeta:ʔ	2
	Tagish	zɛta	2		Jicarilla A.	ta:	1
	Tahltan	ɣutʌʔ	4		Kiowa A.	-	
					Mescalero A.		
	Tsuut'ina	wudaʦ'in	9		Lipan A.	ʦʰæ̃	8

[19] In the sources this term is listed with *wi-yá-tsŭ-ni*. Despite the lack of the ejective this term was interpreted as falling into the pattern ya-BONE and the discrepancy attributed to a transcription error or inaccuracy.

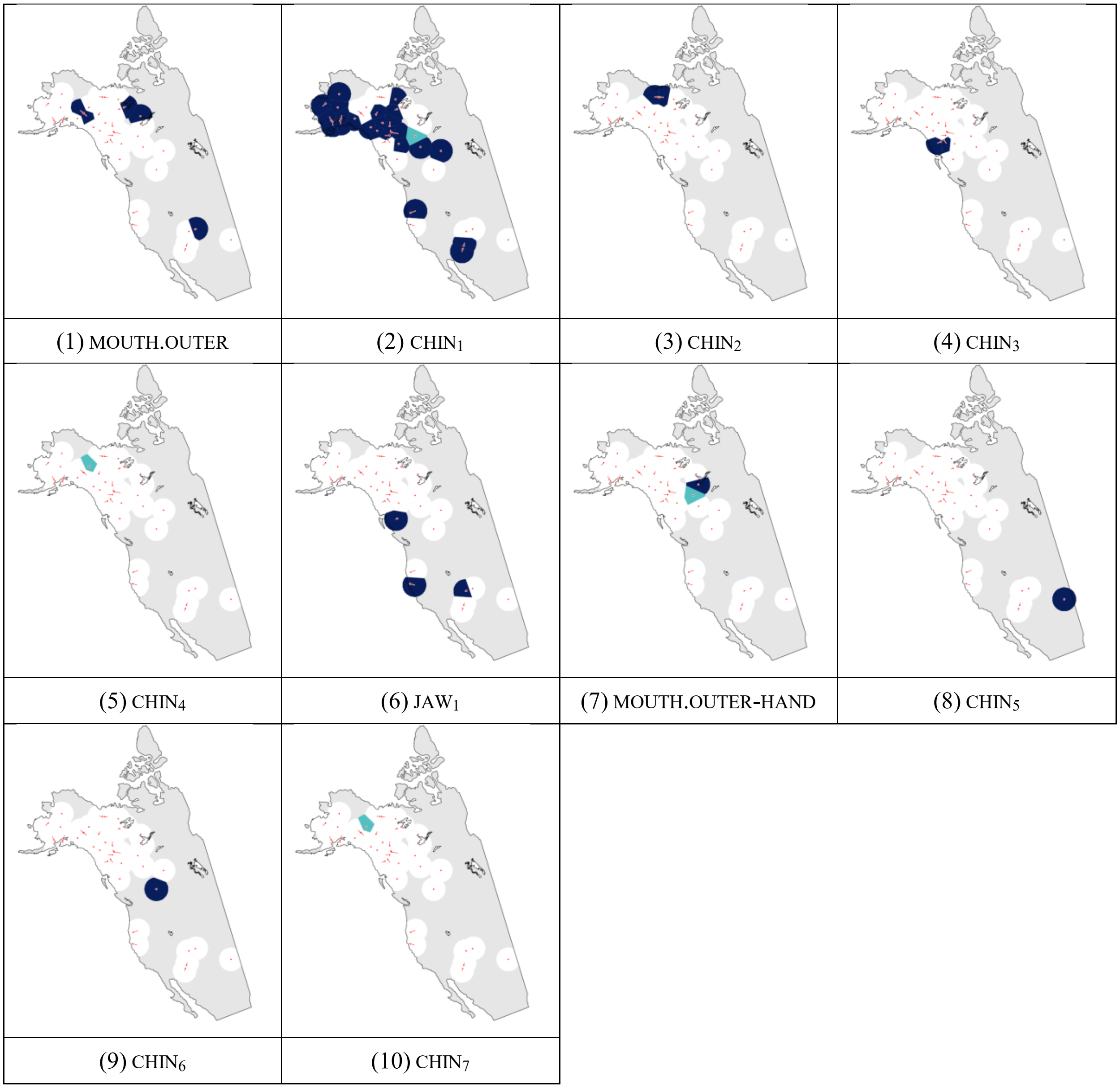


Figure 37. Distributions of terms for 'chin'

3.2.14 Jaw

Many of the lexicographic sources list terms for either 'jaw' or 'jaw bone'. Furthermore, in cases where both terms are listed, the actual forms are frequently identical. The situation is further complicated by the fact that in English usage, the terms *jaw* and *jaw bone* are often interchangeable. In any case, both terms are treated in this section. The lexicalization patterns for these referent-concepts are rather homogenous and languages that distinguish morpho-semantically between them are notable exceptions that are discussed individually.

(1) JAW$_1$: The dominant pattern combines the submorphemic element /ja/, /je/, or /ji/ (already described in Section 3.2.17 'Chin') with head morphemes encoding BONE (Section 3.24). Since no semantic value can be assigned to the /ja/, /je/, or /ji/ morphemes the entire pattern is identified as JAW$_1$. This pattern is found in Southern Tutchone /jè-tθ'ən/, and is also found in Deg Xinag, Dena'ina (Inland), Hän, Upper Tanana, Kaska (Lower Liard), South Slavey, Dene Sųłiné, Hupa, Central Carrier, Sekani, and Western Apache.

(2) CHIN$_1$-BONE: In Dena'ina (Outer and Upper Cook Inlet dialects), Dene Dháh, Mountain Slavey and Upper Kuskokwim[20] which combine it with the whole 'chin' term resulting in the lexicalization pattern CHIN$_1$-BONE, as exemplified by Mountain Slavey /je-tap'en/.

(3) MOUTH-BONE: In Jicarilla Apache as well as several dialects of Kaska (Dease, Lake Frances Lake, Good Hope Lake, Liard, Pelly), 'jaw' is lexicalized through the pattern MOUTH-BONE[21], as for example in Jicarilla Apache /zeː-ʦ'in/.

(4) BONE: In Gwich'in and Tłı̨chǫ the referent-concept 'jaw' is co-lexicalized by the form for BONE as a result of the polysemy pattern [/tθ'ànʔ/ BONE 'bone'] > ℙ > [/tθ'ànʔ/ JAW 'jaw'].

(5) CHIN$_1$: In Dena'ina (Iliamna dialect) and Galice the form that lexicalizes 'jaw' is cognate to the forms identified as CHIN$_1$ in Section 3.2.17. Since that form can confidently be associated with the meaning CHIN$_1$ it is possible to posit a polysemic extension [/ja-taʔ/ CHIN 'chin'] > ℙ > [/ja-taʔ/ JAW 'jaw'] for these two languages. The second form listed for Galice as well as the forms in Tolowa and Ts'ets'aut have no parallels elsewhere in the sample and remain unidentified. In Tsuut'ina the referent-concepts 'chin' and 'jaw' are lexicalized though identical constructions. Both constructions contain the semantic element BONE, but the remaining components remain unidentified.

(6) JAW$_2$: The Frances Lake, Ross River, and Pelly dialects of Kaska lexicalize 'jaw' through a compound based on the reflexes of BONE, but modified through the unidentified submorphemic element /ʦé/.

(7) JAW$_3$: This form is found only in Ts'ets'aut and bears not apparent similarity to other forms in the sample.

(8) JAW$_4$: This pattern, encoded by /ʧ'eː-tʰaː-k'e/, is unique to Tolowa.

(9) JAW$_5$: Galice lexicalizes the referent 'jaw' through /jiː-kɑl/, which contains /jiː/ a likely cognate of the /ja/-morpheme described in Section 3.2.14. The compound is otherwise unique to Galice.

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20 For Upper Kuskokwim the gloss is 'jaw bone' but the parallelism to the other forms in this set marked as 'jaw' makes a true distinction in the semantic system of Upper Kuskokwim unlikely.

21 For three of ther Kaska dialects the gloss is 'jaw bone', but the forms are identical.

(10) **CHIN₆:** The Tsuut'ina form /wu-da-ts'in/ co-lexicalizes the referent 'chin', which is why the lexicalization path is identified as being the same.

(11) INNER.CHEEK-BONE: Koyukon has a unique variation of lexicalization for 'jaw' based on BONE: /ʁʊs-tɬ'ən/. In this case, the BONE term is combined with the morpheme /ɣus/ meaning INNER.CHEEK (Jetté and Jones 2000: 265).

Table 28. Jaw

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		INTERIOR CANADA	Hare	-	
	Koyukon	ʁʊstɬ'ən	11		Mountain	jetap'en	
	Dena'ina (Iliamna)	jata	5		Bearlake	kʷ'en	5
	Dena'ina (Inland)	jaʦ'ən	1		Tłįchǫ	kʷ'ǒ̀:	5
	Dena'ina (OCI)	jataʦ'ən	2		South Slavey	ʒĩtθ'ẽ̆:	1
	Dena'ina (UCI)	jajʦ'ən	1		Dene Sųłiné	ʒétθ'en	1
	Ahtna	-			Dene Dháh	jé:ta / jé:tatθ'en	1/2
	Holikachuk	-			Beaver	-	
	Gwich'in (Teetl'ıt)	tθ'ànʔ	5	BRITISH COLUMBIA	Carrier	jeʦ'ʌn	1
	Gwich'in (Gwıchya)	tθ'ànʔ	5		Witsuwit'en	-	
	Hän	ʒetθ'ən̥ʔ	1		Sekani	jèʦ'ã̀ʔ	1
	Lower Tanana	-			Ts'ets'aut	tá:ga	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ʒê:tθ'ə̀n	1	PACIFIC COAST	Hupa	we:ʦ'ɪŋʔ	1
	Tanacross	-			Galice	ji:kɑl	9
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	jètθ'ən	1		Tolowa	ʧ'e:tʰa:k'e	8
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	ʦéʦ'en	6		Mattole	-	
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	zéʦ'en	1		Kwa-Clat	-	
	Kaska (LL)	je:ʦ'en	1	APACHEAN	Navajo	ja:ʦ'i:n	1
	Kaska (P)	ʦéʦ'en	6		Western A.	jáʦ'in	1
	Kaska (RR)	ʦe:ʦ'en	6		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	ze:ʦ'in	1
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut'ina	wudaʦ'in	10		Lipan A.	-	

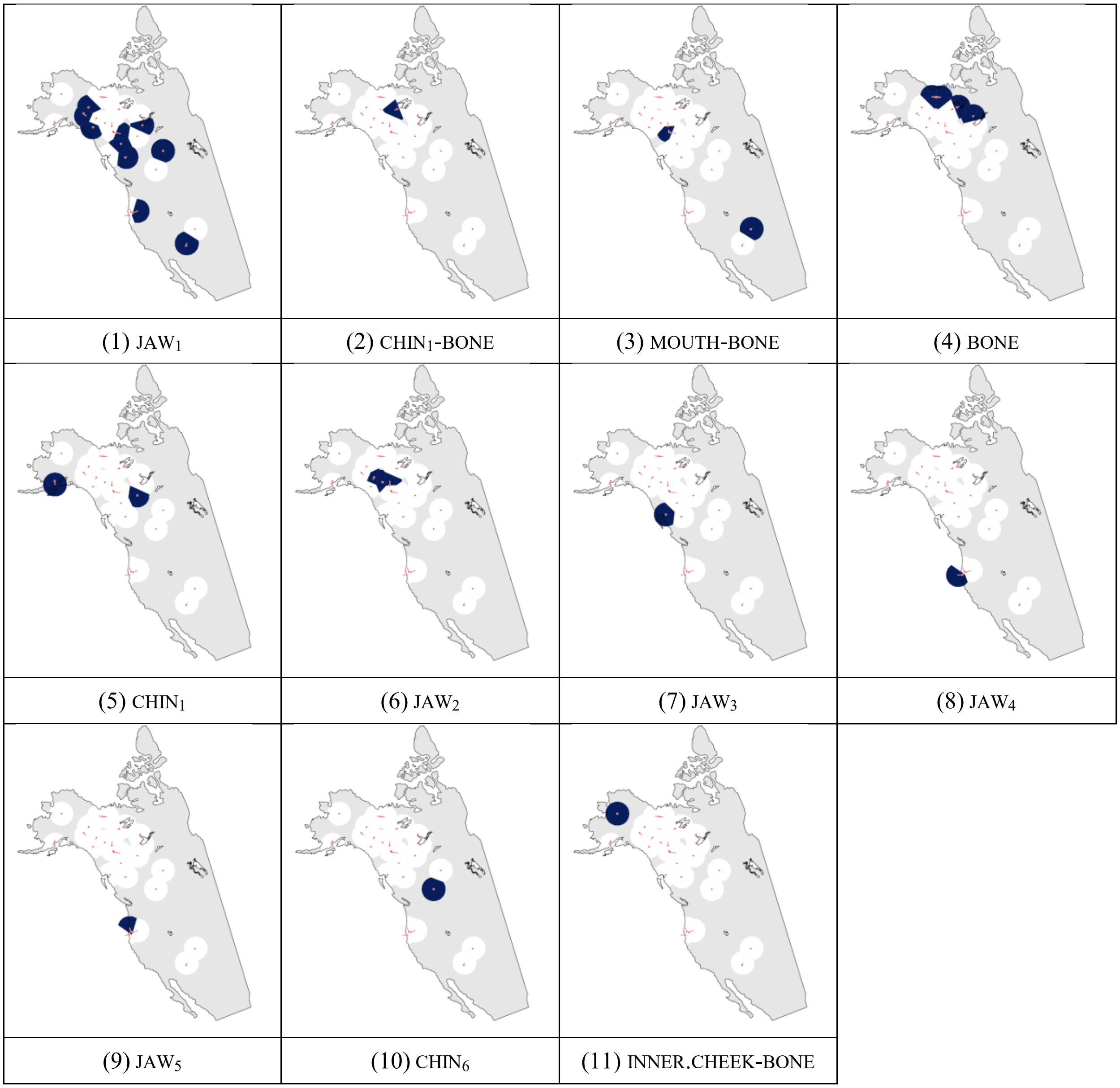


Figure 38. Distributions of terms for 'jaw'

3.2.15 Hair

The terms for 'hair' are quite uniform across the languages is the sample. Only three languages diverge or partially diverge from the dominant pattern.

(1) HAIR$_1$: The dominant lexicalization pattern takes the form of a monomorphemic cognate stem characterized by a stem-initial alveolar, velar or uvular fricative, velar stop or palatal approximant followed by a front vowel and sometimes a glottal stop in final position, as in Upper Kuskokwim /ɣoʔ/.

(2) HEAD$_1$: The Tolowa sources also list /siʔ/ as the term for 'hair' (Bommelyn 1996: 81). This form co-lexicalizes 'head' and represents the reflex in Tolowa of the form identified as HEAD$_1$ (see Section 3.2.1). This Tolowa term for 'hair' has therefore arisen through a polysemic extension [/siʔ/ HEAD 'head'] > ℙ > [/siʔ/ HAIR 'hair']. This polysemy pattern is also found in terms for 'hair' or 'head hair' in Tututni and Jicarilla Apache.

(3) MOUTH.INNER-HAIR: The first of the two terms listed for Tolowa in Table 29 is not found as an individual items in the lexicographic source. The stem /ɣaʔ/ is found only as a part of /saː-ɣa/ under the gloss 'hair'. It is likely that /saː-ɣa/ is an older term for 'facial hair' since /saː/ is cognate with forms identified as MOUTH.INNER (see Section 3.2.8), and the lexicalization pattern is in line with many other lexicalizations of the referent 'facial hair' (see footnote in Section 3.2.8). However, the Tolowa dictionary records /taː-waʔ/ as the expression for 'facial hair', while the non-compounded form /waʔ/ is glossed as 'pubic hair'. This last form is cognate with the Hupa term for 'hair', which was identified as a reflex of HAIR$_1$. However, Hupa does not seem to distinguish between the hair on the head and on other parts of the body. Under the assumption that the more common /ɣ/ in stem-initial position of the 'hair' terms is the older form, it can be surmised that the Hupa terms for 'hair' and 'facial hair' have both undergone the sound change /ɣ/ > /w/, while Tolowa has retained the /ɣ/ in the compound. However, the glossing of the form /saː-ɣa/ as 'hair' suggests that the entire compound has been re-analyzed to denote only the general referent 'hair' as a consequence of the SPECIFIC FOR GENERIC semantic change [/saː-ɣa/ HAIR.FACIAL 'facial hair'] > § > [/saː-ɣa/ HAIR 'hair'].

(4) IT.IS.WOOLY: In Kiowa Apache, 'hair' is encoded by /dítɬ'òh/, a deverbal noun glossed in the source as 'it is woolly' (Bross 1974: 4). The stem /tɬ'òh/ is a cognate of the term meaning GRASS in many languages.

(5) HAIR$_2$: This pattern is found in Dena'ina (Outer Cook Inlet dialect) /ʧ'ix/ and is considered a "Dena'ina elite replacement" (Kari 2007: 87). The only other language in the sample to have a similar form is Navajo /ʦ'iːʔ/. It is worth noting however that this implies a sound correspondence ʧ' = ʦ', which conflicts with Hoijer's (and Sapir's) ʦ' = ʦ' for this pair of sounds (Hoijer 1963: 1).

Table 29. Hair

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ɣoʔ	1	**INTERIOR CANADA**	Hare	ɣáʔ	1
	Koyukon	ʁɒʔ	1		Mountain	ɣáʔ	1
	Dena’ina (Iliamna)	-			Bearlake	ɣá	1
	Dena’ina (Inland)	ʁu			Tłı̨chǫ	ɣà	1
	Dena’ina (OCI)	ʧ’ix	5		South Slavey	ɣá	1
	Dena’ina (UCI)	ʁu	1		Dene Sųłiné	ɣá	1
	Ahtna	ʁɑʔ	1		Dene Dháh	ɣá	1
	Holikachuk	ɣoʔ	1		Beaver	ɣaʔ	1
	Gwich’in (Teetl’ıt)	ɣèʔ	1	**BRITISH COLUMBIA**	Carrier	ɣɑʔ	1
	Gwich’in (Gwıchya)	ɣèʔ	1		Witsuwit’en	ɣe	1
	Hän	ɣâʔ	1		Sekani	ɣàʔ	1
	Lower Tanana	-			Ts’ets’aut	xá	1
	Upper Kuskokwim	ɣoʔ	1		Chilcotin	ɣá	1
	Upper Tanana	ɣàʔ	1	**PACIFIC COAST**	Hupa	waʔ	1
	Tanacross	ɣaʔ	1		Galice	kɑʔ	1
YUKON	Northern Tutchone	jéʔ	1		Kato	kɑʔ	1
	Southern Tutchone	ɣɑ̀	1		Tolowa	sa:gha’ / si’	3/2
	Kaska (DL)	-			Tututni	siʔ	2
	Kaska (FL)	ɣáʔ	1		Mattole	ɣɑ́	1
	Kaska (GHL)	ɣáʔ	1		Wailaki	ɣɑʔ	1
	Kaska (L)	ɣáʔ	1		Kwa-Clat	rá	1
	Kaska (LL)	ɣáʔ	1	**APACHEAN**	Navajo	ɣaʔ / ts’i:	1/5
	Kaska (P)	ɣáʔ	1		Western A.	ɣa:ʔ	1
	Kaska (RR)	ɣáʔ	1		S. Carlos A.	ɣa:ʔ	1
	Tagish	ráʔ	1		Jicarilla A.	tsʰi:	
	Tahltan	-			Kiowa A.	dítɬ’òh	4
					Mescalero A.		
	Tsuut’ina	ɣa	1		Lipan A.	ra	1

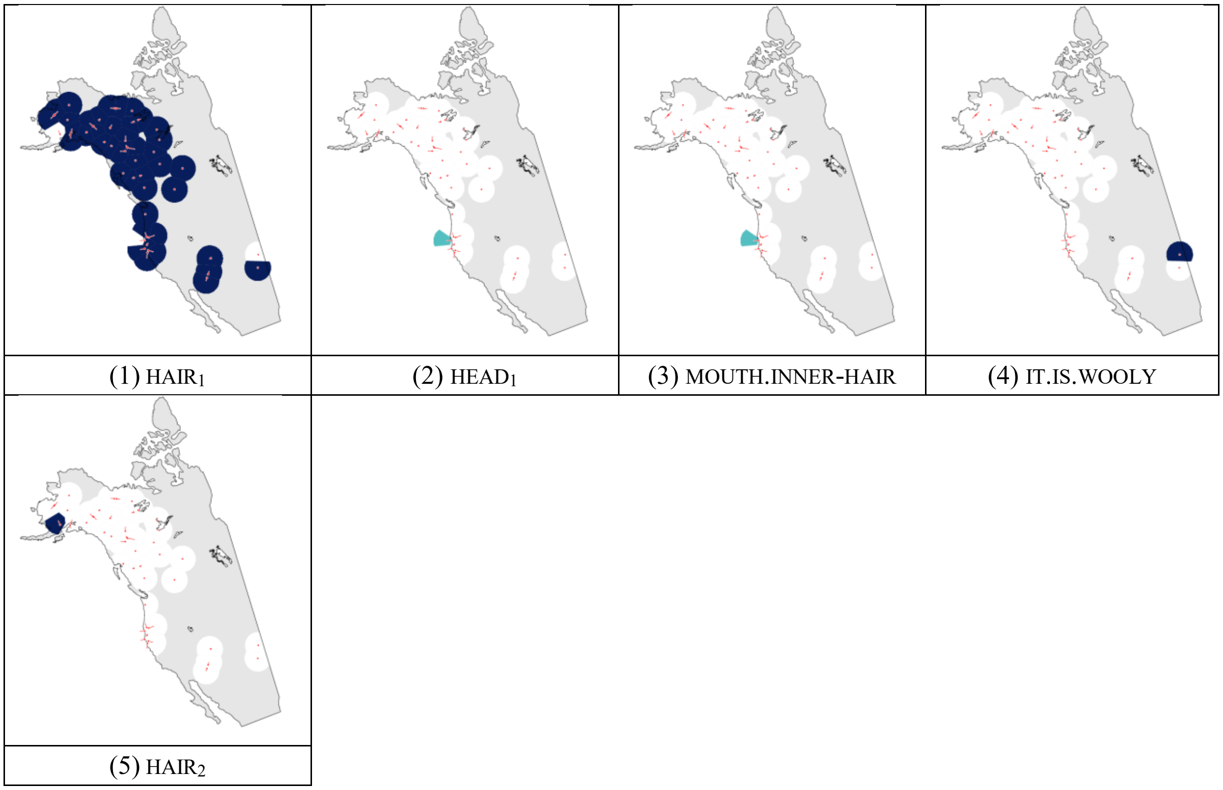


Figure 39. Distributions of terms for ‘hair’

3.2.16 Neck

The gloss ‘neck’ is here understood to mean the outer portion of the segment of the body connecting the head to the torso. It is distinct from the term ‘throat’ which is understood as denoting the inner portion. This inner/outer distinction is lexicalized with two distinct morphemes in most Athapaskan languages. A further refinement is found in some of the sources in terms denoting ‘windpipe’ or ‘trachea’. The terms for neck fall into 6 distinct patterns, the first of which is clearly dominant.

(1) OUTER.NECK: The dominant pattern among the terms for ‘neck’ is a monosyllabic form with an initial ejective velar or uvular plosive followed by a back vowel and, frequently, a final fricative. This morpheme has been identified as NECK.OUTER. The Koyukon form /q’ʊɬ/ belongs to this cognate set, since the stem-final segment conforms to Hoijer’s sound correspondence I.1 *s > ɬ (Hoijer 1963: 22), even though Hoijer is only concerned with stem-initial segments.

(2) NECK$_1$: Carrier lexicalizes the referent ‘neck’ through a compound. The head of the compound is formed by a reflex of BASE (see Section 3.4.4) in a similar fashion to Witsuwit’en. The modifying element of the compound is the unidentified component /t̠s̠’il/, however.

(3) NECK$_2$: Kato lexicalizes ‘neck’ through /t’ɑɪ/. This form is unique in the sample.

(4) MOUTH.INNER: Navajo lexicalizes the referent-concept ‘neck’ through a polysemic extension [/zé:ʔ/ MOUTH.INNER ‘inner mouth’] > ℙ > [/zé:ʔ/ NECK ‘neck’] (see Section 3.2.8).

(5) HEAD₁-BASE: Witsuwit’en lexicalizes ‘neck’ with the compound /ʦe-cən/ HEAD₁-BASE (see Section 3.2.1 and Section 3.4.4).

Table 30. Neck

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	q’uθ	1	**INTERIOR CANADA**	Hare	k’o	1
	Koyukon	q’ʊɬ	1		Mountain	k’os	1
	Dena’ina (Iliamna)	q’əs	1		Bearlake	k’o	1
	Dena’ina (Inland)	-			Tłı̨chǫ	k’oh	1
	Dena’ina (OCI)	-			South Slavey	k’o	1
	Dena’ina (UCI)	-			Dene Sųłiné	k’oð	1
	Ahtna	k’os	1		Dene Dháh	k’oh	1
	Holikachuk	k’oh	1		Beaver	k’ous	1
	Gwich’in (Teetl’ıt)	k’oh	1	**BRITISH COLUMBIA**	Carrier	t̪s̪’ilʧʌn	2
	Gwich’in (Gwıchya)	k’oh	1		Witsuwit’en	ʦecən	5
	Hän	k’oh	1		Sekani	k’wos	1
	Lower Tanana	k’wθʔ	1		Ts’ets’aut	k’ɔʔ / kʷ’ɔʔ	1
	Upper Kuskokwim	k’os	1		Chilcotin	k’ɔθ	1
	Upper Tanana	-		**PACIFIC COAST**	Hupa	q’os	1
	Tanacross	k’oθ	1		Galice	kʷʰɑs	1
YUKON	Northern Tutchone	k’o	1		Kato	t’ɑɪ	3
	Southern Tutchone	k’u	1		Tolowa	k’wəs	1
	Kaska (DL)	-			Tututni	k’wəs	1
	Kaska (FL)	-			Mattole	k’ós	1
	Kaska (GHL)	k’os	1		Wailaki	-	
	Kaska (L)	k’os	1		Kwa-Clat	kʷus	1
	Kaska (LL)	k’os	1	**APACHEAN**	Navajo	zé:ʔ	4
	Kaska (P)	k’os	1		Western A.	-	
	Kaska (RR)	k’os	1		S. Carlos A.	k’os	1
	Tagish	k’uʃ	1		Jicarilla A.	kʰós	1
	Tahltan	k’oθ	1		Kiowa A.	k’òs	1
					Mescalero A.	k’us	1
	Tsuut’ina	k’ūs	1		Lipan A.	-	

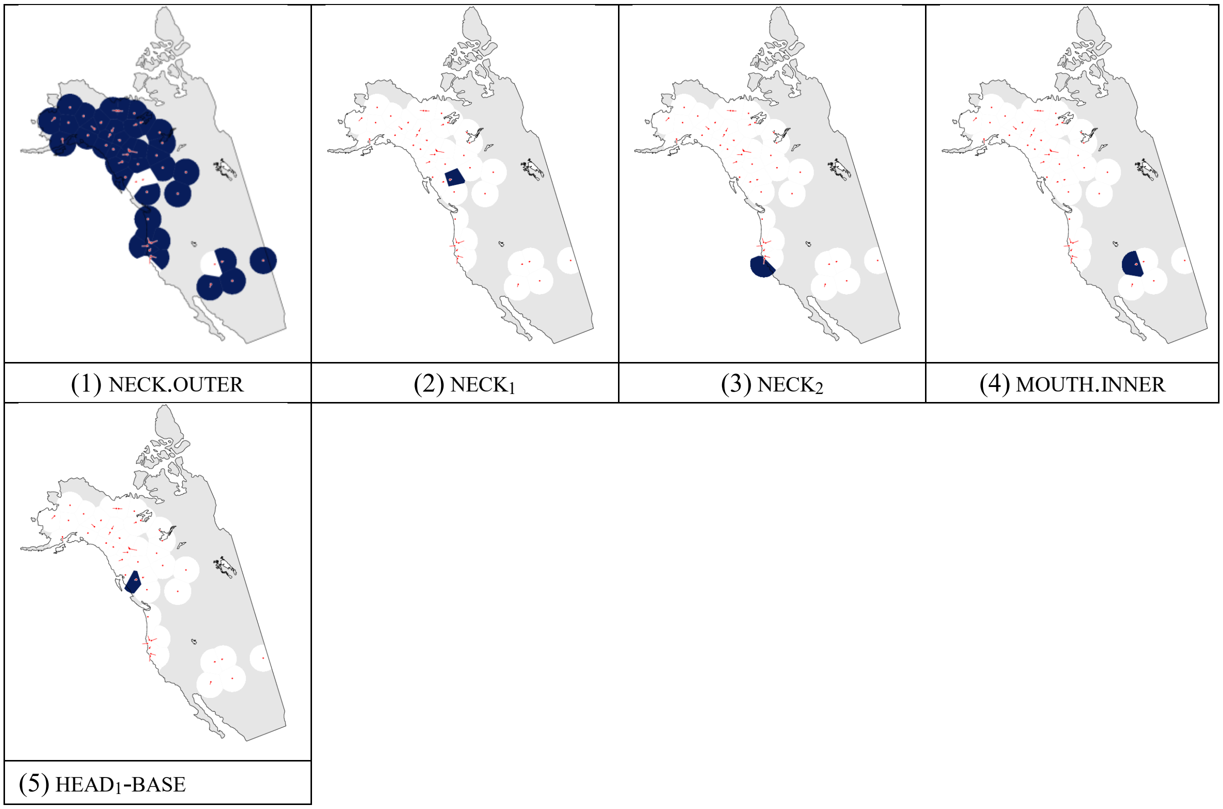


Figure 40. Distributions of terms for 'neck'

3.2.17 Throat

The terms for 'throat' form a much more diverse set than those described for 'neck' (Section 3.2.16). The reasons for this may ultimately lie with the complexity of this part of the anatomy and the difficulty of seeing it clearly. The English gloss also allows some diversity in interpretation as indicated by the description in the Oxford English Dictionary:

> The front of the neck beneath the chin and above the collar-bones, containing the passages from the mouth and nose to the lungs and stomach…'throat' is sometimes said with the wider sense of the 'neck'.

Since the English terms, the onomasiological tools used for generating these data, are vague, the semantic designators used in identifying specific forms in Athapaskan languages are not identical with the names of the referent-concepts 'throat' and 'neck'. Instead NECK.OUTER is used to identify those terms dealing with the outer portion of the neck (described in Section 3.2.16), while NECK.INNER has been used to identify forms described in this section. This is justified since the referential vagueness of the English term is reflected in the lexicographic sources. The terms for ‘trachea’ and ‘esophagus’, for example, have also been included in the following table as body parts situated in the inner part of the neck in those cases where no other term corresponding to ‘throat’ or ‘inner neck’ was available.

(1) INNER.NECK$_1$: This is the most widespread lexicalization pattern in the lexicalizations of the referent ‘throat (inner neck)’, it occurs in 15 of the languages in the sample. The pattern takes the form of a monomorphemic cognate characterized by a stem-initial ejective velar or uvular plosive followed by a low front vowel (in one case, Koyukon, a mid back vowel), and frequently a stem-final alveolar fricative. These terms are very similar to those described as NECK.OUTER in Section 3.2.16, but the vowels contrast in most of the languages that have this lexical pair: Kaska (GHL, L, LL, P, RR) /k’os/ ‘neck’ and /k’às/ ‘throat’; Hare /k’o/ ‘neck’ and /k’aí/ ‘throat’; Mountain /k’os/ ‘neck’ and /k’á/ ‘throat’; Beaver /k’ous/ ‘neck’ and /k’as/ ‘throat’; Dene Sųłiné /k’oð/ ‘neck’ and /k’ai/ ‘throat’; and Kwalhioqua-Clatskanie /kʷus/ ‘neck’ and /k’ai/ ‘throat’ (the lack of ejectivization in Kwalhioqua-Clatskanie form for ‘neck’ appears a likely transcription error from the comparative perspective). The wide distribution of the vowel contrast supports the conclusion that the semantic specifications INNER and OUTER are encoded in a lexical pair.

(2) INNER.NECK$_2$: In the languages Dene Dháh, Beaver, Hän, Deg Xinag, Tłı̨chǫ, Upper Kuskokwim[22], and Tanacross, the inside of the neck is lexicalized through a monomorphemic cognate characterized by a stem-initial dental or alveolar fricative and a stem-final velar plosive, glottal fricative or voiceless velar approximant, such as in the case of Hän /ðèw̥ʔ/.

(3) BREATH$_1$-MOUTH.OUTER: In Ahtna, Central Carrier, Chilcotin, and Upper Kuskokwim ‘throat (inner neck)’ is lexicalized through a compound composed of the terms for BREATH (see Section 3.5.2) and MOUTH.OUTER (see Section 3.2.8), as for example in Upper Kuskokwim /jih-do/. While MOUTH.OUTER is used here as the etymological meaning for /-do/ and /-tɑh/ and the equivalent items in the other languages, it seems likely that these forms actually carry the semantic specification OPENING. The Ahtna from /-tɑh/ is listed with this meaning in the lexicographic sources (Kari 1990: 136), lending support to this analysis.

(4) PIPE.LIKE.OBJECT: This pattern relies on the morpheme /zoːɬ/ (Jicarilla Apache) and its cognates. The gloss ‘pipe-like object’ found in association with the cognate form /lutɬ/ in the lexicographic source materials for Koyukon (Jetté and Jones 2000: 422) motivates the identifier PIPE.LIKE.OBJECT for this morpheme, which is also found in lexicalization patterns ‘lungs’ (see Section 3.3.8), and ‘chest’ (see Section 3.3.5).

[22] The lexicographic source for Upper Kuskokwim lists /zak’/ glossed as ‘esophagus, throat’ and /zan/ glossed simply as ‘throat’. The latter term seems to be an innovation found only in this languages, whereas the former corresponds to a larger pattern of cognation.

(5) BREATH1: In Witsuwit'en 'throat (inner neck)' is encoded by the forms /jiz/ and /jih/ which also co-lexicalize 'breath'. Since the latter form-meaning association corresponds to the dominant cognate in among the lexicalizations for 'breath', the lexicalizations of 'throat (inner neck)' can be inferred to have emerged as a result of a polysemic pattern of extension: [/jih/ BREATH 'breath'] > ℙ > [/jih/ BREATH 'breath, throat (inner neck)'].

(6) OUTER.NECK: In Hupa the term /q'os/ can be found with both 'neck' and 'throat'. Since the form is cognate with a majority of terms lexicalizing the referent '(outer) neck', the Hupa term is considered to have emerged as a result of a pattern of polysemic extension: [/q'os/ NECK.OUTER '(outer) neck'] > ℙ > [/q'os/ NECK.INNER '(outer) neck, throat (inner neck)']. A similar case is found in Navajo /k'os/. The Lipan Apache form /kʰos/ is included in this set, even though it apparently lacks ejectivization in the stem-initial segment

(7) MOUTH.OUTER: Both dialects of Gwich'in (Gwıchya and Teetl'ıt) lexicalize 'throat (inner neck)' through a form corresponding to the cognate pattern MOUTH.OUTER (see Section 3.2.8).

(8) OUTER.NECK-TOWARD: In the Pacific Coast languages Tolowa and Tututni, 'throat (inner neck)' is lexicalized through a compounded form consisting of a stem, which corresponds to the pattern identified as NECK.OUTER (see Section 3.2.16) and the postpositional element TOWARD, as for example in Tolowa /k'wəs-tr'eʔ/. The identification of /tr'e/ as TOWARD comes from its similarity to the final morpheme in the lexicalization of 'throat (inner neck)' in Kiowa Apache (see pattern 9 below), as well as Navajo /tʃ'ĩʔ/ 'toward' (Young and Morgan 1972: 26).

(9) MOUTH.INNER-STRING-TOWARD: This pattern occurs only in Kiowa Apache and is glossed as 'that tube toward the mouth' /zé:-ɬ-ʦ'ṍ:-ʦ'è:/. The glossing diverges from the order of the morphemes in the compound itself which composed of the semantic elements MOUTH.INNER (see Section 3.2.8), STRING (see Section 3.1.5 for a description of this morpheme), and the postpositional element TOWARD, a cognate of Navajo /tʃ'ĩʔ/ 'toward' (Young and Morgan 1972: 26), resulting in the lexicalization pattern: MOUTH.INNER.STRING-TOWARD.

(10) MOUTH.INNER: The lexicalization /zé:ʔ/ for 'throat (inner neck)' is found only in Navajo. The term is a reflex of the cognate set identified as MOUTH.INNER in Section 3.2.17. Since the association of the form /zé:ʔ/ to the referent 'inner mouth' is firmly established, additional referential reach of this morpheme must have emerged as a consequence of a polysemic extension: [/zé:ʔ/ MOUTH.INNER 'inner mouth'] > ℙ > [/zé:ʔ/ MOUTH.INNER 'throat'].

(11) INNER.NECK3: The lexicalization /i:ʃ/ for 'throat (inner neck)' is unique to Mattole.

(12) INNER.NECK4: The lexicalization /wè:/ for 'throat (inner neck)' is unique to Tłı̨chǫ.

(13) INNER.NECK$_5$: The lexicalization /tɑlnɪʔ/ for ‘throat (inner neck)’ is unique to Galice. The syllable /tɑ/ is possibly related to the MOUTH.OUTER cognate.

(14) INNER.NECK$_6$: The lexicalization /kəɬ/ for ‘throat (inner neck)’ is unique to Dena’ina (Iliamna dialect).

(15) INNER.NECK$_7$: The lexicalization /ʧʰòlʔ/ for ‘throat (inner neck)’ is unique to Upper Tanana. It is a possible reflex of the PIPE.LIKE.OBJECT form, but further phonological evidence for sound correspondence is required to substantiate this.

Table 31. Throat

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ðak	2	INTERIOR CANADA	Hare	k’aíʔ	1
	Koyukon	q’ɔs / lutɬ	1/4		Mountain	k’áʔ	1
	Dena’ina (Iliamna)	kəɬ	13		Bearlake	k’á:	1
	Dena’ina (Inland)	-			Tłı̨chǫ	wè:	11
	Dena’ina (OCI)	-			South Slavey	k’á:	1
	Dena’ina (UCI)	-			Dene Sų̨łiné	k’ás	1
	Ahtna	jɪtɑh	3		Dene Dháh	ðe:h	2
	Holikachuk	-			Beaver	k’as / zɛk	1/2
	Gwich’in (Teetl’ıt)	tài:ʔ	7	BRITISH COLUMBIA	Carrier	jistɑ	3
	Gwich’in (Gwıchya)	tȁĩ:ʔ	7		Witsuwit’en	zul / jiz	4/5
	Hän	ðèw̥ʔ	2		Sekani	k’ȁs	1
	Lower Tanana	-			Ts’ets’aut	su:́l	4
	Upper Kuskokwim	jihdo / zak’	3/2		Chilcotin	jɛhdé	3
	Upper Tanana	ʧʰòlʔ	14	PACIFIC COAST	Hupa	q’os	6
	Tanacross	ðɛkʔ	2		Galice	tɑlnɪʔ	12
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	k’wəstr’eʔ	8
	Kaska (DL)	-			Tututni	k’wəsʦ’eʔ	8
	Kaska (FL)	k’ấ:s	1		Mattole	i:ʃ	10
	Kaska (GHL)	k’ás	1		Wailaki	-	
	Kaska (L)	k’ás	1		Kwa-Clat	k’ǽs	1
	Kaska (LL)	k’ás	1	APACHEAN	Navajo	k’os / zé:ʔ	6/2
	Kaska (P)	k’ás	1		Western A.	zo:ɬ	4
	Kaska (RR)	k’ás	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	zo:ɬ	4
	Tahltan				Kiowa A.	zé:ɬʦ’ő:ʦ’è:	9
					Mescalero A.	zul	4
	Tsuut’ina	-			Lipan A.	k’os	6

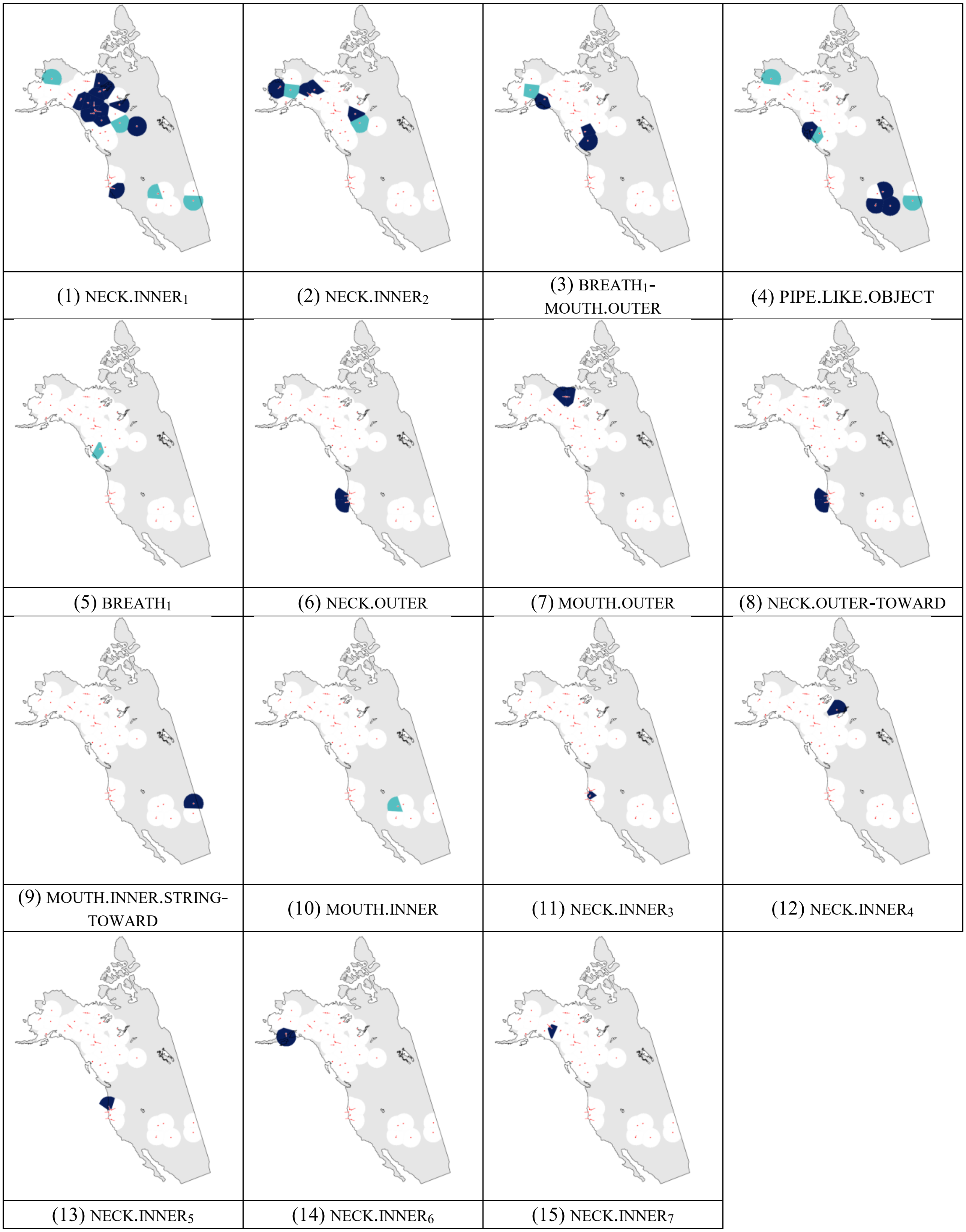


Figure 41. Distributions of terms for ‘throat’

3.3 Terms for the upper body and inner organs

3.3.1 Back

The terms for ‘back’ present one of the most heterogeneous sets of terms in the sample (see Chapter 4 for a discussion of the general heterogeneity of referent referent-concepts), with 20 distinct lexicalization patterns. While certain elements occur widely, such as BACK, BASE and HUMP, any unity among the semantic encodings of this terms arises only in what can be considered a recombination of a small set of shared morphological substance to give similar but distinct expressions.

(1) BACK$_1$: The most frequent pattern in the lexicalization of the referent-concept ‘back’ is found in a monomorphemic syllable that has an initial /n/, and frequently also a final /n/, as for example in Dene Sųłiné /nen/.

(2) BASE: In 11 languages, reflexes of the morpheme identified as BASE (see also Sections 3.4.4 ‘Wrist’ and 3.3.12 ‘Ankle’) form the means of lexicalizing the referent ‘back’, as in Tahltan /ʧʰin/.

(3) BACK$_2$: Sekani, Deg Xinag, and Lower Liard Kaska share expressions for ‘back’, which are here identified as belonging to the same lexicalization pattern, exemplified by Deg Xinag /t’oʦ/.

(4) BACK$_3$: This lexicalization pattern is found almost exclusively in Ahtna /jɛn/. None of the other ‘back’ terms in the sample resemble this form, other than the term in Deg Xinag described below.

(5) BACK$_3$-ON: The Upper Cook Inlet dialect of Dena’ina exhibits a second, slightly more elaborate lexicalization pattern, beside its reflex of BACK$_1$. This second pattern is expressed by /jən-q’ə/, which is composed of the reflex of BACK$_3$ found also in Ahtna, combined with a postpositional element expressing the relation ON.

(6) BONE$_1$: Jicarilla Apache lexicalizes the referent ‘back’ through the form /ts’ĩ/, glossed as ‘back, backbone’ in the source materials (Phone et al. 2007: 475). Although orthographically distinct from the form listed for ‘bone’ *-ts’in* (ibid.), the distinction between a nasalized vowel and the sequence of segments /in/ is considered slight enough to postulate a credible common etymological source, especially given the conflation of the referents ‘back’ and ‘backbone’ under this form. Thus /ts’ĩ/ is identified as BONE.

(7) BEHIND: In Liard Kaska, a variant lexicalization of the referent ‘back’ is expressed through /neʦ’ẽ́/. This form resembles Koyukon /nits’ən/, which is glossed as ‘behind postpositional object’ (Jetté and Jones 2000: 431), giving rise to the semantic identifier BEHIND.

(8) HUMP: The Western Apache form /ɣáń/ has the semantic value HUMP (compare Ahtna /ɣɑːn/ 'hump' Kari 1990: 203), as the lexicalization pattern for the referent 'back'.

(9) HUMP-AREA.UNDER: San Carlos Apache /ɣan-t'ah/ is glossed as 'back' or 'along the back' (De Reuse 2006: 293). The first element in this morphologically complex form is glossed as 'back, shoulder' (ibid.), but can be identified as HUMP (compare Ahtna /ɣɑːn/ 'hump' Kari 1990: 203). The second element is a postposition glossed as 'beside' (de Reuse 2006: 293). However, it may be equally if not more accurate to describe the meaning of this postposition as indicating the surface *under* the postpositional object. For example, in San Carlos Apache /t'ah/ is also found in /nãː-t'ah/ 'eye socket', and /ziz-t'ah/ 'waist'. The stem /ziz/ has the meaning 'belt', and hence the 'waist' is lexicalized as the area under the belt, etymologically SKIN[23]-AREA.UNDER. The semantic description AREA.UNDER describes the occurrence of /t'ah/ in the expressions above more felicitously than 'beside'. Furthermore, a cognate of this term is found in Ahtna /t'ɑːx/ which is glossed as 'general area beneath' (Kari 1990: 339). The full lexicalization path expressed by San Carlos Apache /ɣan-t'ah/ therefore lexicalizes the referent back as the 'area under the hump of the shoulders and upper back': HUMP-AREA.UNDER. This particular lexicalization may be informed as much by certain animals such as bison or moose, as it is by the human form. This analysis informs the discussion below of terms found among some Canadian and, Alaskan languages

Figure 42. Moose

[23] The source of the form /ziz/ SKIN_1 is in forms indicating the referents 'skin' and 'hide', see Section 4.1.3 'Skin' for cognates of this term.

(10) AREA.UNDER: Upper Kuskokwim, Central Carrier, Witsuwit'en, and Chilcotin share a lexicalization pattern identified as AREA.UNDER in the discussion of a related term above in (9). This term has perhaps emerged through the simplification of a compounded form more akin to the term found in San Carlos Apache. The pattern is exemplified in Upper Kuskokwim /t'ok'/.

(11) BACK$_1$-HUMP: In Navajo, the referent 'back' is lexicalized through the lexicalization path BACK$_1$-HUMP as based on the similarity of the constituents of the morphologically complex form /ná-ɣah/ to elements described under BACK$_1$ and HUMP (compare Ahtna /ɣɑːn/ 'hump' Kari 1990: 203).

(12) HUMP-BASE: In Mescalero Apache, the referent 'back' is lexicalized through a similar pattern to that found in San Carlos Apache given in (9). The 'back' is still referenced through the HUMP, but the back below the shoulders is lexicalized through the form BASE (or 'trunk', see the discussion of this term in Chapter 5), resulting in the lexicalization pattern HUMP-BASE.

(13) BACK$_4$: In Tolowa, the referent 'back' is lexicalized through the monomorphemic stem-form /miːn/. This form might belong to the cognate set identified as BACK$_1$ above, but no other similar correspondences were found in this sample or in the published literature, which is why this form is treated as a separate case here.

(14) PACK: In Hare, the form for 'back' co-lexicalizes 'pack' (K. Rice 1978: 160), suggesting that this term emerged through a process of polysemic extension: [/ɣél/ PACK 'pack'] > ℙ > [/ɣél/ PACK 'pack, back'].

(15) BACK$_5$: In Beaver, the referent 'back' is lexicalized through the form /ʦ'ʌ/, which has no similar forms among the other Athapaskan languages of the sample.

(16) BACK$_6$: In Kiowa Apache, the referent 'back' is lexicalized through the form /ʤȍːk/, which has no similar forms among the other Athapaskan languages of the sample.

(17) BACK$_7$: In Tagish, the referent 'back' is lexicalized through the form /t'ántíkí/, which has no similar forms among the other Athapaskan languages of the sample.

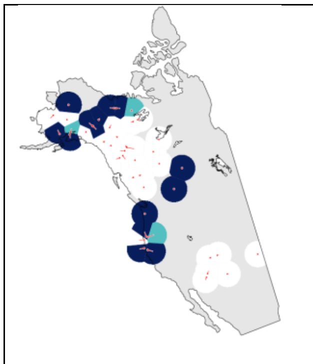
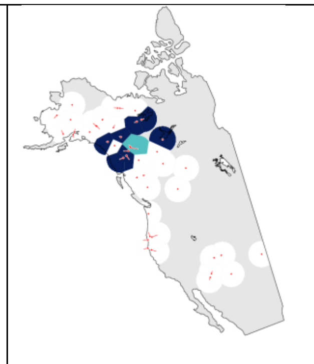
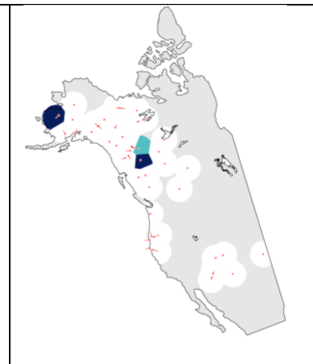
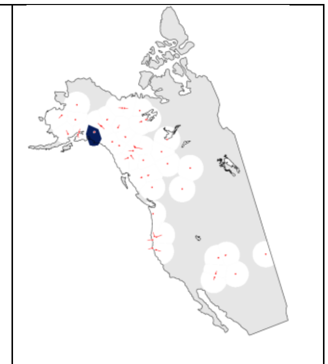
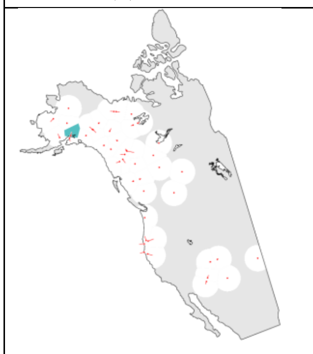
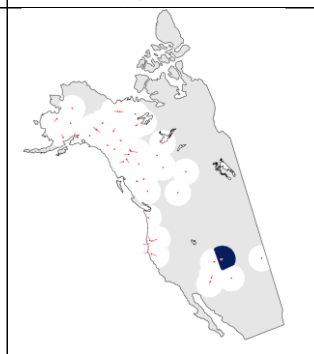
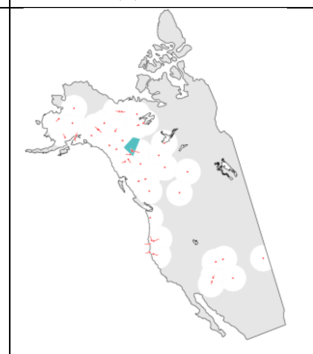
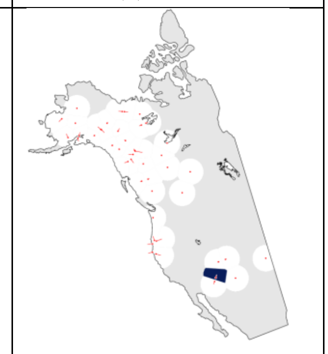
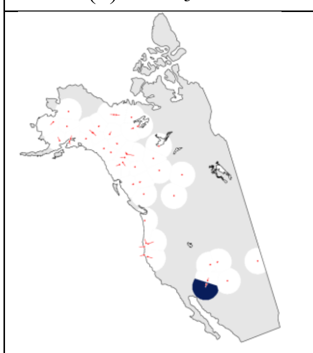
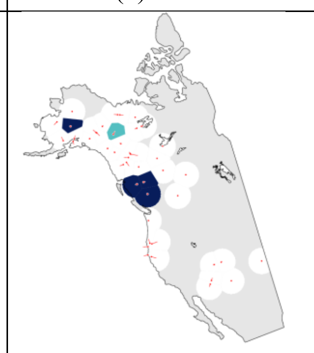
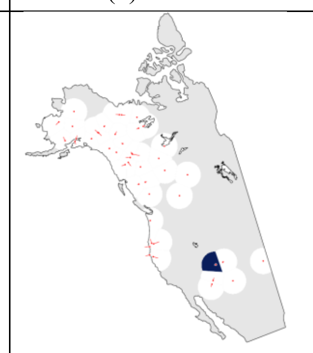
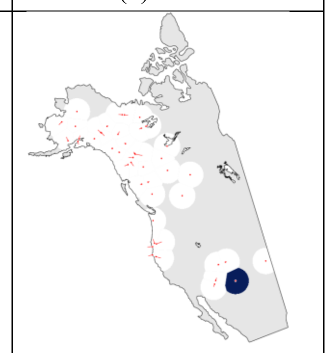
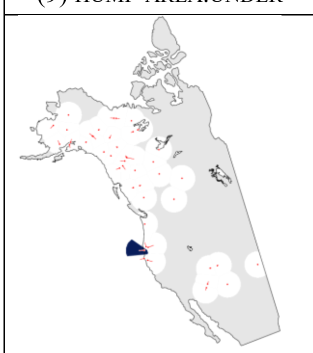
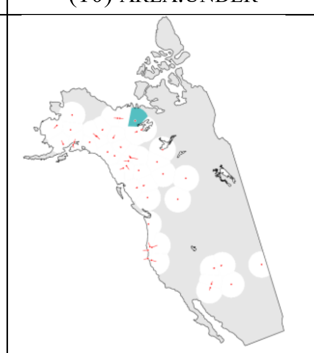
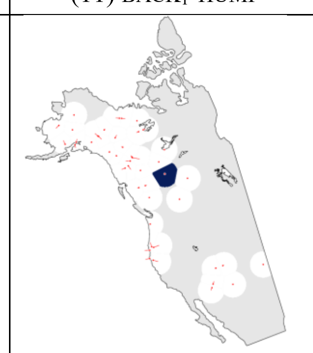
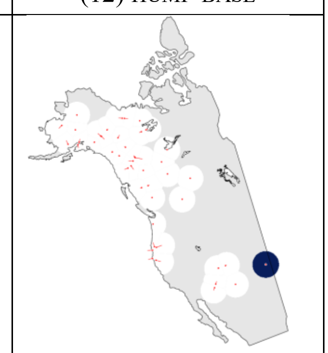
(18) BACK$_8$: In Dene Dháh, the referent 'back' is lexicalized through the form /neː-t'ainh/ which has similarities both with the terms described under BACK$_1$ and possibly those described as AREA.UNDER, but additional evidence is required to substantiate this hypothesis

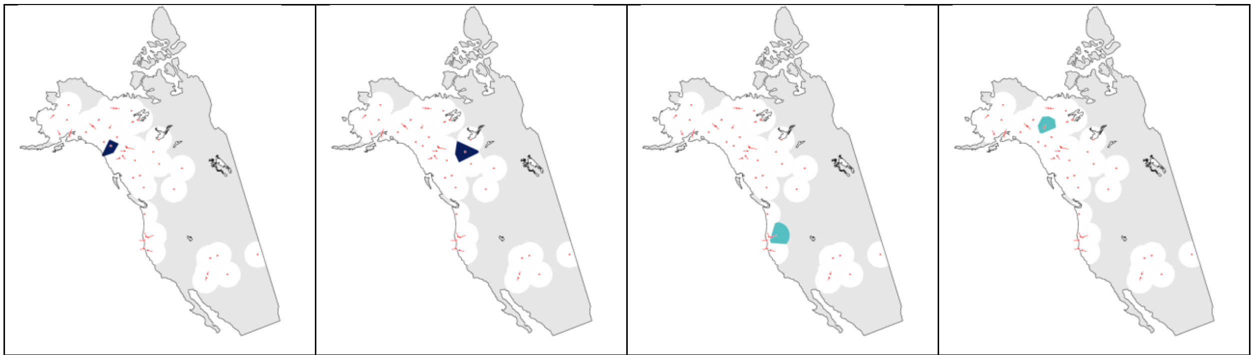
(19) OPPOSITE.CHEST: An innovative lexicalization pattern is found in Hupa /ʧeːʔ-mɪʧiŋʔ/, which is glossed as OPPOSITE.CHEST. This pattern is unique to Hupa.

(20) BACK$_1$-AREA.UNDER: The expression /nɑ-t'ɑːk/ is unique to Northern Tutchone. It is composed of the elements BACK$_1$ (see pattern 1 above) and AREA.UNDER (see patterns 9 and 10) above, resulting in the lexicalization path BACK$_1$-AREA.UNDER.

Table 32. Back

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	t’oʦ	3	**INTERIOR CANADA**	Hare	ɣél / nén	14/1
	Koyukon	nən	1		Mountain	ʧʰín	2
	Dena’ina (Iliamna)	-			Bearlake	-	
	Dena’ina (Inland)	niq’	1		Tłı̨chǫ	-	
	Dena’ina (OCI)	niq’	1		South Slavey	ʧʰı̨́ɛ̨́	2
	Dena’ina (UCI)	niq’ / jənq’ə	1/5		Dene Sųłiné	nen	1
	Ahtna	jɛn	4		Dene Dháh	ne:t’ainh	18
	Holikachuk	-			Beaver	ʦ’ʌ	15
	Gwich’in (Teetl’ıt)	nàn	1	**BRITISH COLUMBIA**	Carrier	t’ɑ	10
	Gwich’in (Gwıchya)	nàn	1		Witsuwit’en	t’aq	10
	Hän	nə̀n̥ʔ	1		Sekani	t’aʥ	3
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	t’ok’	10		Chilcotin	t’éi	10
	Upper Tanana	nə̀nʔ	1	**PACIFIC COAST**	Hupa	neq’ / ʧe:ʔmɪʧiŋʔ	1/19
	Tanacross	nɛnʔ	1		Galice	nɛʔ	1
YUKON	Northern Tutchone	nɑt’ɑ:k / t’ɑ	20/10		Kato	nɛʔ	1
	Southern Tutchone	ʃə̀n	2		Tolowa	mi:n	13
	Kaska (DL)	ʧʰén	2		Tututni	neʔ	1
	Kaska (FL)	ʧʰén	2		Mattole	-	
	Kaska (GHL)	ʧʰén	2		Wailaki	-	
	Kaska (L)	ʧʰén / neʦ’ɛ̃́	2/7		Kwa-Clat	ne	1
	Kaska (LL)	ʧʰén / t’a:ʦi	2/3	**APACHEAN**	Navajo	náɣah	11
	Kaska (P)	ʧʰén	2		Western A.	ɣáń	8
	Kaska (RR)	ʧʰén	2		S. Carlos A.	ɣánt’ah	9
	Tagish	t’ántíkí	17		Jicarilla A.	ʦ’ĩʔ	6
	Tahltan	ʧʰin	2		Kiowa A.	ʤȍ:k	16
					Mescalero A.	ɣaʃí	12
	Tsuut’ina	-			Lipan A.	-	

			
(1) BACK$_1$	(2) BASE	(3) BACK$_2$	(4) BACK$_3$
			
(5) BACK$_3$-ON	(6) BONE	(7) BEHIND	(8) HUMP
			
(9) HUMP-AREA.UNDER	(10) AREA.UNDER	(11) BACK$_1$-HUMP	(12) HUMP-BASE
			
(13) BACK$_4$	(14) PACK	(15) BACK$_5$	(16) BACK$_6$



(17) BACK$_7$	(18) BACK$_8$	(19) OPPOSITE.CHEST	(20) BACK$_1$-AREA.UNDER

Figure 43. Distributions of terms for 'back'

3.3.2 Abdomen

In the academic study of anatomy, the 'abdomen' is defined as a cavity. Grey's famous anatomical reference describes the abdomen as:

> …[T]he largest cavity in the body. It is of an oval shape, the extremities of the oval being directed upward and downward. The upper extremity is formed by the diaphragm which extends as a dome over the abdomen, so that the cavity extends high into the bony thorax, reaching on the right side, in the mammary line, to the upper border of the fifth rib; on the left side it falls below this level by about 2.5 cm. The lower extremity is formed by the structures which clothe the inner surface of the bony pelvis…. (Gray 1918: 246)[24]

The Canadian Oxford Dictionary similarly defines abdomen as: "The part of the body containing the digestive and reproductive organs", while Merriam-Webster calls it "the part of the body below the chest that contains the stomach and other organs"[25]. In contrast to the technical definition given by Gray, the English language dictionaries are vague as to whether abdomen refers to the cavity or the outer section of the body, which encompasses the cavity. The English term *abdomen* is an onomasiological tool that requires careful handling, since the ambiguities of the English term can distort the translation of the Athapaskan responses. A similar and related situation occurs in the case of 'stomach', discussed in Section 3.3.3, which can also have the more technical reading as "the most dilated part of the digestive tube" (Gray 1918: 247[26]),

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[24] Henry Gray *Anatomy of the Human Body*, retrieved from http://www.bartleby.com/107/246.html, 31-10-2014
[25] Merriam-Webster, retrieved http://www.merriam-webster.com/dictionary/abdomen, 331-10-2014
[26] Henry Gray *Anatomy of the Human Body*, retrieved from http://www.bartleby.com/107/247.html, 31-10-2014

but also the more vague “The abdomen or belly”[27]. Kari for example lists Dena’ina expressions for the referent terms ‘whole stomach’, ‘belly’, ‘inner abdomen’, and ‘inner stomach’, which all relate to the region of the body beneath the chest and above the pelvis. However, the exact difference in the referential reach of these terms remains unclear. To this it may be added that the Athapaskan terms themselves might not refer to clearly delimited boundaries either, indicating regions which may be salient in one context or another, but which may not be usefully distinguished outside of the domain of surgery.

The difficulties with these terms therefore emerge from two distinct sources: the glossing might not be reliable in all cases, and the referential domain of these terms may be inherently vague. These difficulties are tackled by examining the morphological forms that populate this entire semantic space, and reconstructing proto-meanings from them. Two heuristics are helpful here: (1) meanings are essentially relational, in the sense that they depend on other meanings in the same lexicon (Fox 1995: 112), and (2) true semantic redundancy in the soccer/football sense, is rare, with different forms having different meanings most of the time. For example, the Gwich’in forms /tʃit/ and /vàt/ are both glossed as ‘stomach (inner)’ (Firth 2005: 232). Following heuristic (2), the accuracy of these glosses can be brought into question (*pace* Firth), rather than postulating semantic changes, since it is more reasonable to suppose that the two forms encode distinct meanings than it is to claim that they have both incurred a loss of semantic specifications. The form /vàt/ corresponds to the pattern of cognates identified as OUTER.STOMACH which is described in Section 3.3.3 ‘Stomach’.

(1) OUTER.ABDOMEN$_1$: The most widespread cognate stem lexicalizing the referent-concept ‘outer abdomen’ is takes the form of a monomorphemic stem characterized by an alveolar or retroflex stem-initial affricate followed by an alveolar affricate or lateral approximant in stem-final position. The Dena’ina (Inland) form /tʃʰutɨ’/ presents an example of this type. The form is glossed as ‘whole stomach’ (Kari 2007: 96). The latter form is related to Ahtna /ʦʰɑtɨ/ which Kari identifies as having the meaning ‘abdomen’. This glossing seems rather loose, however, since further expressions involving this stem are glossed as ‘belly’ (Kari 1990: 370). A further form in this group is found in Tanacross /ʦʰâːlʔ/ which is glossed as ‘belly’ and contrasts with /met/ ‘stomach’ (discussed in Section 3.3.3 ‘Stomach’). The main target in the words glossed as ‘belly’ appears to be on the referent-concept ‘outer abdomen’, a conclusion corroborated by the data from those languages that maintain the lexical semantic contrast in the stems, such as Gwich’in, which shares the cognate pattern just described: the form /tʳìl/ glossed as ‘belly’ and /ʧʰìt/ glossed as ‘stomach’. These forms correspond to the Dena’ina forms /tʃʰutɨ’n/ and /kʰun/ respectively by the sound

[27] The American Heritage Dictionary of the English Language, retrieved from https://ahdictionary.com/word/search.html?q=stomach, 31-10-2014.

correspondences tʳ = tʃʰ and tʃʰ = kʰ (Hoijer's correspondence sets II.4 and III.4). Therefore, /tʳìl/ and its cognates have been identified with the semantic value OUTER.ABDOMEN.

(2) ABDOMINAL.VISCERA: The 'inner abdomen' is encoded through a cognate form characterized by a velar plosive, or alveolar affricate in stem-initial position and variably a nasal or alveolar plosive in stem-final position. In Deg Xinag both variants are recorded: /ʧʰon̥/ and /ʧʰot/. Terms specific to the 'inner abdomen' are listed to the right of the slash in Table 33. These terms also occur in some of the forms denoting 'ribs' (see Section 3.3.4), where they have been interpreted as having the semantic value ABDOMINAL.VISCERA. This interpretation is supported by the glossing in the source materials for Deg Xinag, Koyukon, and Lower Tanana which are vague as to a potential distinction between the inside of the abdomen and the viscera, that is the contents of the abdomen. In Witsuwit'en, the 'inner abdomen' is encoded through the lexicalization pattern FRONT$_3$-INSIDE. The first part of this construction is a morpheme with the etymological meaning FRONT, but which has likely taken on an association with the referent-concept 'chest' before forming part of the lexicalization pattern for 'inner abdomen' (see Section 3.3.5). These terms form part of a cognate set characterized by the sound correspondence kʰ = tʃʰ = ts that is also found among the terms expressing base (see further discussion in Section 3.3.12 'Ankle' and Chapter 4).

(3) STOMACH$_1$: The term lexicalizing 'abdomen' in Jicarilla Apache shares its phonological shape with the cognate identified as STOMACH$_1$ (see Section 3.3.3). Since the latter is strongly attested across Athapaskan languages, the Jicarilla Apache term's additional association with 'abdomen' must have arisen through the polysemic extension: [/bi/ STOMACH$_1$ 'outer stomach'] > ℙ > /bi/ STOMACH$_1$ 'outer stomach, outer abdomen']. A similar pattern is found in Witsuwit'en.

(4) ABDOMEN.AREA$_1$: The languages Hän, Gwıchya Gwich'in and Upper Tanana share a cognate stem characterized by a stem-initial retroflex or post-alveolar fricative and a velar plosive in stem-final position, as for example in Gwich'in /ʐàk/. The Gwich'in form is glossed variously as 'whole belly area' or 'stomach' (Firth 2005: 232, in two places), while the terms in Hän and Upper Tanana are glossed as 'belly' and 'abdomen' respectively. This glossing pattern suggests the identifier ABDOMEN.AREA for this group of cognates.

(5) ABDOMEN.AREA$_2$: The form /bi-ti-ki/ is unique to Navajo. Following the glossing in the source material it is identified as ABDOMEN.AREA$_2$.

(6) WAIST$_1$: Hare and Bearlake express 'abdomen' through a term which also co-lexicalizes 'waist': /tɬ'er/. The association of /tɬ'er/ and its cognates with 'waist' is more frequently attested, also occurring in Hän /tɬ'öː/, Upper Tanana /tɬ'ət/, Tanacross /tɬ'ɛt/, Northern Tutchone /tɬ'ɑ́t/, Southern Tutchone /tɬ'ət/, Dena'ina (Inland) /tɬ'ət/, Dena'ina (Outer Cook Inlet) /tɬ'əh/, and Dena'ina (Upper Cook Inlet) /tɬ'ət/, Witsuwit’en /tɬ’ət/, and Tsuut’ina /tɬ’àd/. These data indicate that the terms for ‘abdomen’ in Hare and Bearlake are the result of a pattern of polysemic extension: [/tɬ’eɾ/ WAIST ‘waist’] > ℙ > [/tɬ’eɾ/ WAIST ‘waist, outer abdomen’].

(7) STOMACH.OUTER-BUTTOCKS: In Central Carrier /pʌt’/ OUTER.STOMACH (see Section 3.3.3 ‘Stomach’) is combined with the form for BUTTOCKS (see Section 3.1.13), resulting in the lexicalization pattern STOMACH.OUTER-BUTTOCKS.

Table 33. Abdomen

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʧʰon̥	2	INTERIOR CANADA	Hare	tɬ’eɾ	6
	Koyukon	kʰɒn̥	2		Mountain	-	
	Dena’ina (Iliamna)	tʃʰutɬ’n / kʰun	1/2		Bearlake	tɬ’eɾ	6
	Dena’ina (Inland)	tʃʰutɬ’ / kʰun	1/2		Tłı̨chǫ	-	
	Dena’ina (OCI)	tʃʰutɬ’ / kʰun	1/2		South Slavey	-	
	Dena’ina (UCI)	tʃʰutɬ’ / kʰun	1/2		Dene Sų̨łiné	-	
	Ahtna	ʦʰɑtɬ / kʰɑn	1/2		Dene Dháh	-	
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	tʳı̀l	1	BRITISH COLUMBIA	Carrier	pʌttɬ’ɑh	7
	Gwich’in (Gwıchya)	ʐàk / tʳı̀l	4/1		Witsuwit’en	pət	3
	Hän	ʐə̀k	4		Sekani	-	
	Lower Tanana	ʧʰon̥			Ts’ets’aut	-	
	Upper Kuskokwim	ʒak / ʧʰogwʃ	4/1		Chilcotin	-	
	Upper Tanana	ʦʰâ:lʔ		PACIFIC COAST	Hupa	kʲa:n	2
	Tanacross	ʦʰâ:lʔ			Galice	-	
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	ʧahn	1
	Kaska (LL)	-		APACHEAN	Navajo	bi-ti-ki	5
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	-			S. Carlos A.	-	
	Tagish	-			Jicarilla A.	bi	3
	Tahltan	-			Kiowa A.	-	
					Mescalero A.	-	
	Tsuut’ina	-			Lipan A.	-	

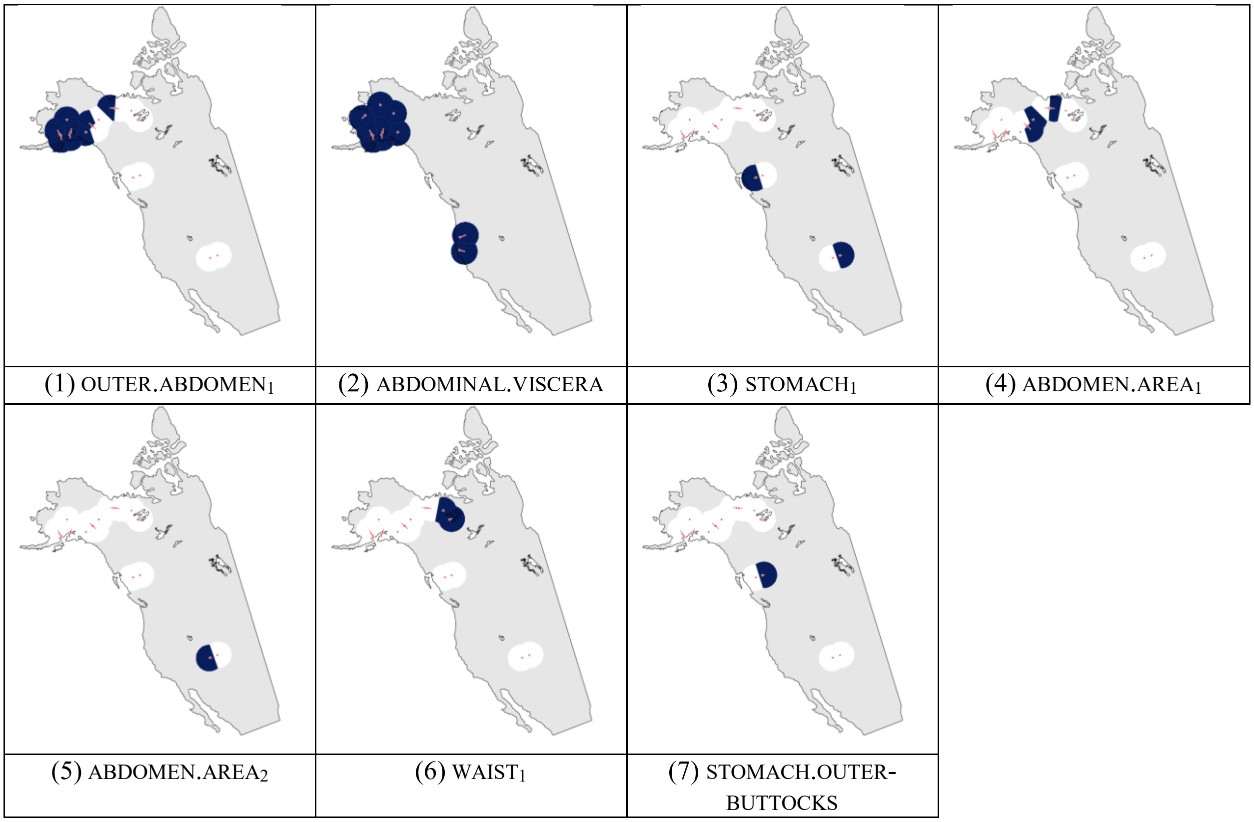


Figure 44. Distributions of terms for ‘abdomen’

3.3.3 Stomach

The lower portion of the upper body, the ‘belly’ or ‘stomach’ is lexicalized through several different terms in Athapaskan languages. In several languages, Dene Sųłiné, South Slavey, Gwich’in (Teetl’ıt), Tagish, and Kiowa Apache, a lexical distinction is made between the ‘inner stomach’ and the ‘outer stomach’. Consequently, the lexicalization patterns are discussed in two sub-sections.

3.3.3.1 Outer stomach

(1) STOMACH.OUTER$_1$: The belly or ‘outer stomach’ is encoded, in the vast majority of the languages in the sample, by a clearly cognate monomorphemic stem. This stem is characterized by a bilabial plosive, bilabial nasal or labio-dental fricative in stem-initial position and, frequently, an alveolar plosive in stem-final position. Among the Dena'ina dialects this form is represented by /vet/, which is glossed in the source as 'belly' (Kari 2007: 96).

(2) STOMACH.OUTER$_2$: The analysis of the terms /ʧʰah-kat/ and /ʧʰoh-kat/ found among the Kaska dialects remains uncertain. The element /ʧʰah/ could be a cognate of STOMACH.INNER$_1$ (see below), but the final element remains un-deciphered. The pattern is identified as STOMACH.OUTER$_2$.

(3) STOMACH.OUTER$_3$: Lipan Apache has a unique lexicalization pattern for 'outer stomach', /ʦʰāsta/, which is here identified as STOMACH.OUTER$_3$.

3.3.3.2 Inner stomach

(4) STOMACH.INNER$_1$: In lexicalizing the referent 'inner stomach' the languages Deg Xinag, Gwichya Gwich'in, Teetl'it Gwich'in, and Kiowa Apache share a cognate form characterized by an alveo-palatal affricate in stem-initial position and an alveolar plosive in stem-final position. This cognate set is identified as STOMACH.INNER$_1$.

(5) STOMACH.INNER$_2$: The Dene Sųłiné form /pí/ is unique to this language. It is possibly derived from the form for STOMACH.OUTER /pər/.

(6) STOMACH.INNER$_3$: The expression /ʧʰáː-kʰəí/ is unique to Tagish. The first element could be cognate with the forms of the STOMACH.INNER$_1$ set.

(7) STOMACH.OUTER-INSIDE: South Slavey lexicalizes the referent 'inner stomach' through the bi-morphemic expression /mpé ʒíe/. The second component of this expression is glossed as INSIDE since the expression is glossed as 'stomach, inside' (South Slave Divisional Education Council 2009: 27) is also found in expressions such as /tθí ʒíe teðe/ 'throb with pain in head'. The lexicalization pattern is identified as STOMACH.OUTER-INSIDE.

Table 34. Stomach (outer/inner)

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	vit / ʧʰot	1/4	INTERIOR CANADA	Hare	péʔ	1
	Koyukon	pət	1		Mountain	béʔ	1
	Dena'ina (Iliamna)	vet	1		Bearlake	pé	1
	Dena'ina (Inland)	vet	1		Tłı̨chǫ	bò, mbò	1
	Dena'ina (OCI)	vet	1		South Slavey	mpé / mpé ʒíe	1/7
	Dena'ina (UCI)	vet	1		Dene Sųłiné	pə́r / pí	1/5
	Ahtna	pət'	1		Dene Dháh	pé	1
	Holikachuk	-			Beaver	bat	1
	Gwich'in (Teetl'ıt)	vat / ʧʰit	1/4	BRITISH COLUMBIA	Carrier	pʌt'	1
	Gwich'in (Gwıchya)	ʧʰit	4		Witsuwit'en	pət	1
	Hän	pə̀t	1		Sekani	pàt	1
	Lower Tanana	pet	1		Ts'ets'aut	bɛ	1
	Upper Kuskokwim	mit'	1		Chilcotin	bə́t	1
	Upper Tanana	-		PACIFIC COAST	Hupa	mɪt'	1
	Tanacross	met			Galice	pɑiʔ	1
YUKON	Northern Tutchone	bát	1		Kato	pʌt'	1
	Southern Tutchone	mpə̀t	1		Tolowa	-	
	Kaska (DL)	bét, ʧʰahkat	1, 2		Tututni	-	
	Kaska (FL)	bét	1		Mattole	-	
	Kaska (GHL)	bát, ʧʰahkat	1, 2		Wailaki	-	
	Kaska (L)	bát, ʧʰohkat	1, 2		Kwa-Clat	-	
	Kaska (LL)	bét	1	APACHEAN	Navajo	bit	1
	Kaska (P)	bét	1		Western A.	pit	1
	Kaska (RR)	bát	1		S. Carlos A.	pit	1
	Tagish	mbə̀t / ʧʰá:kʰə̀í	1/6		Jicarilla A.	bi	1
	Tahltan	pɛt	1		Kiowa A.	bìt / ʧʰã̀:t	1/4
					Mescalero A.		
	Tsuut'ina	mí	1		Lipan A.	ʦʰāsta	3

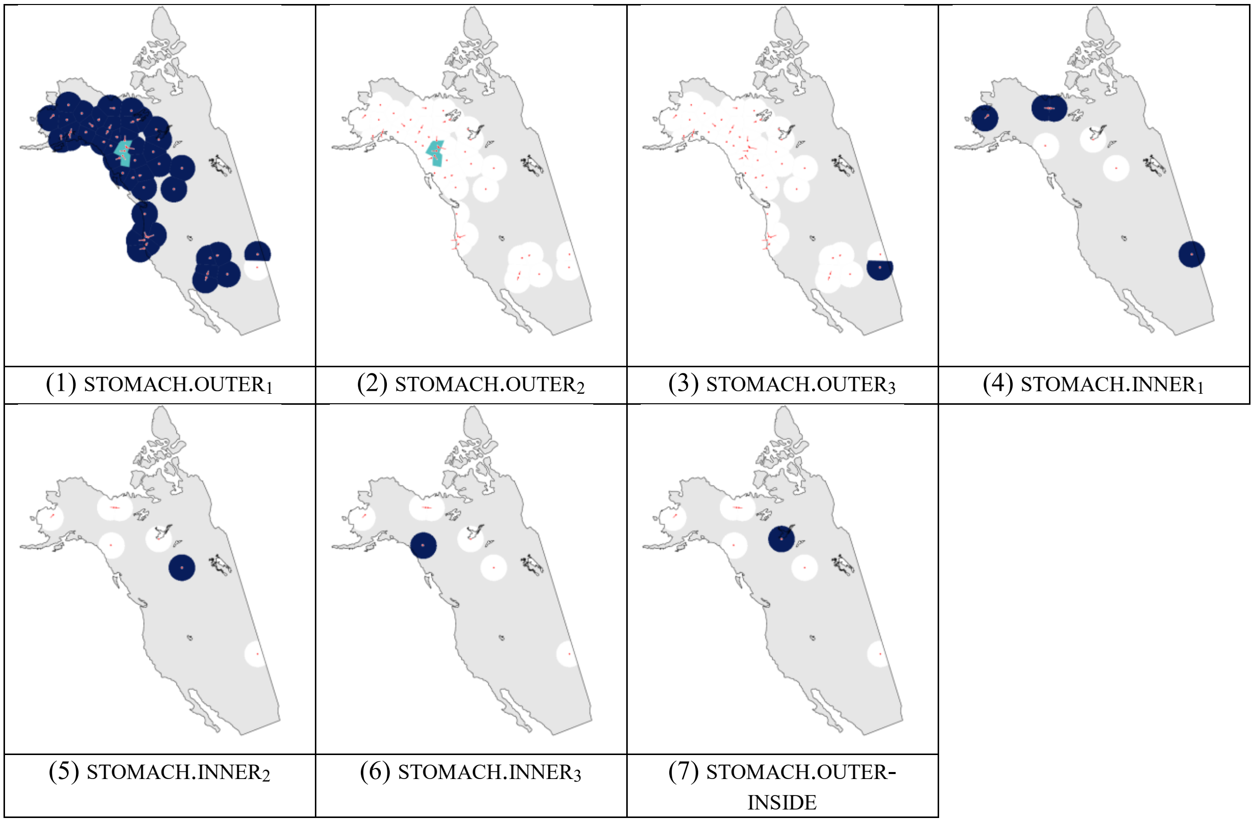


Figure 45. Distributions of terms for 'stomach'

3.3.4 Ribs

The terms denoting 'ribs' fall into seven distinct patterns, but two related patterns cover the majority of cases. Two of the patterns found among the terms for 'ribs' are unique to the languages they occur in, Hupa and Hän, and the morpho-semantic structures remain unidentified.

(1) ABDOMINAL.VISCERA-ON: The most frequent of the lexicalization patterns is a compound form consisting of a monomorphemic stem and a postpositional element. The stem is characterized by a velar plosive or alveolar affricate in initial position, followed by a front vowel or mid-back vowel. This pattern is found in Ahtna /kʰɑːq/, which Kari glosses as /kʰaːn/ 'viscera' ⊕ /q'/ 'on' (Kari 1990: 256) encoding the lexicalization pattern ABDOMINAL.VISCERA-ON. The postpositional element is more fully preserved in some cases, such as Jicarilla Apache /ʦʰá-kéː/, but some indication of a postpositional suffix is found in thirty of the languages in the sample.

(2) ABDOMINAL.VISCERA: The second largest group of patterns is made up of languages in which the ABDOMINAL.VISCERA element encodes the referent-concept 'ribs' directly by a semantic change, as exemplified by Tłı̨chǫ [/ʧǒ̀ː/ ABDOMINAL.VISCERA ‘viscera’] > § > [/ʧǒ̀ː/ ABDOMINAL.VISCERA ‘abdominal viscera, ribs’]. This pattern is also found in Northern Tutchone, Southern Tutchone, Hare, Mountain Slavey, South Slavey, Dene Sų̨łiné, Central Carrier, Ts’ets’aut, Chilcotin, Navajo, Mescalero Apache, and Lipan Apache. These terms form part of a cognate set characterized by the sound correspondence kʰ = tʃʰ = ts that is also found among the terms expressing base (see further discussion in Section 3.3.12 ‘Ankle’ and Chapter 4).

(3) ABDOMINAL.VISCERA-BONE: In Bearlake, the element that is the reflex of the ABDOMINAL.VISCERA is combined with the BONE cognate (see Section 3.1.4 ‘Bone’), to form the compound /ʧʰǒ̆ː-kʷʰʼen/ ABDOMINAL.VISCERA-BONE.

(4) ABDOMEN.OUTER: A second lexicalization of the referent ‘ribs’ occurs in Western Apache which arises through the polysemic extension of [/ʦʰát/ ABDOMEN.OUTER ‘outer abdomen’] > ℙ > [/ʦʰát/ RIBS ‘outer abdomen, ribs’].

(5) RIBS$_1$: The lexicalization /jaːðʔ/ for the referent ‘ribs’ is unique to Tanacross.

(6) RIBS$_2$: The lexicalization /ʧʼɪtɪɬwulʔ/ for the referent ‘ribs’ is unique to Hupa.

(7) RIBS$_3$: The lexicalization /ʒə̂ːʔ/ for the referent ‘ribs’ is unique to Hän.

Table 35. Ribs

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʧʰoq	1	INTERIOR CANADA	Hare	ʃő̃ʔ	2
	Koyukon	kʰɒq’	1		Mountain	ʧʰõ	2
	Dena’ina (Iliamna)	kʰaq’	1		Bearlake	ʧʰõ̌ːkʷʰ’en	3
	Dena’ina (Inland)	kʰaq’	1		Tłįchǫ	ʧõ̀ː	2
	Dena’ina (OCI)	kʰaq’	1		South Slavey	ʧʰõː	2
	Dena’ina (UCI)	kʰaq’	1		Dene Sųłiné	ʧõ	2
	Ahtna	kʰɑːq	1		Dene Dháh	ʧʰonk	1
	Holikachuk	-			Beaver	ʧʰouŋk	1
	Gwich’in (Teetl’ıt)	ʧik	1	BRITISH COLUMBIA	Carrier	ʧʰɑ	2
	Gwich’in (Gwıchya)	ʧik	1		Witsuwit’en	caq	1
	Hän	ʒə̂ːʔ	7		Sekani	ʧʰow	1
	Lower Tanana	ʧok	1		Ts’ets’aut	ʧʰáːʔ	2
	Upper Kuskokwim	ʧʰok’	1		Chilcotin	ʧẽ	2
	Upper Tanana	ʧʰã̂ːk	1	PACIFIC COAST	Hupa	ʧ’ɪtɪɬwulʔ	6
	Tanacross	jaːðʔ	5		Galice	kʰɑ̃ːk’ɑɪʔ	1
YUKON	Northern Tutchone	ʧʰáːnʔ	2		Kato	kʷɑɲkʰɛ	1
	Southern Tutchone	ʃĩ	2		Tolowa	xak’eʔ	1
	Kaska (DL)	-			Tututni	ʧʰaː́’	2
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	ʧʰo:k	1		Wailaki	-	
	Kaska (L)	ʧʰō:k	1		Kwa-Clat	tcā’.k̠e	1
	Kaska (LL)	ʧʰō:w	1	APACHEAN	Navajo	ʦʰãːʔ	1
	Kaska (P)	ʧʰā:k	1		Western A.	ʦʰát	1
	Kaska (RR)	ʧʰā:k	1		S. Carlos A.	ʦʰát	1
	Tagish	ʧʰã̀k	1		Jicarilla A.	ʦʰákéː	1
	Tahltan	ʧʰɑːk	1		Kiowa A.	ʧõ̀ːk	1
					Mescalero A.		
	Tsuut’ina	ʧʰak’	1		Lipan A.	ʧʰhõ	1

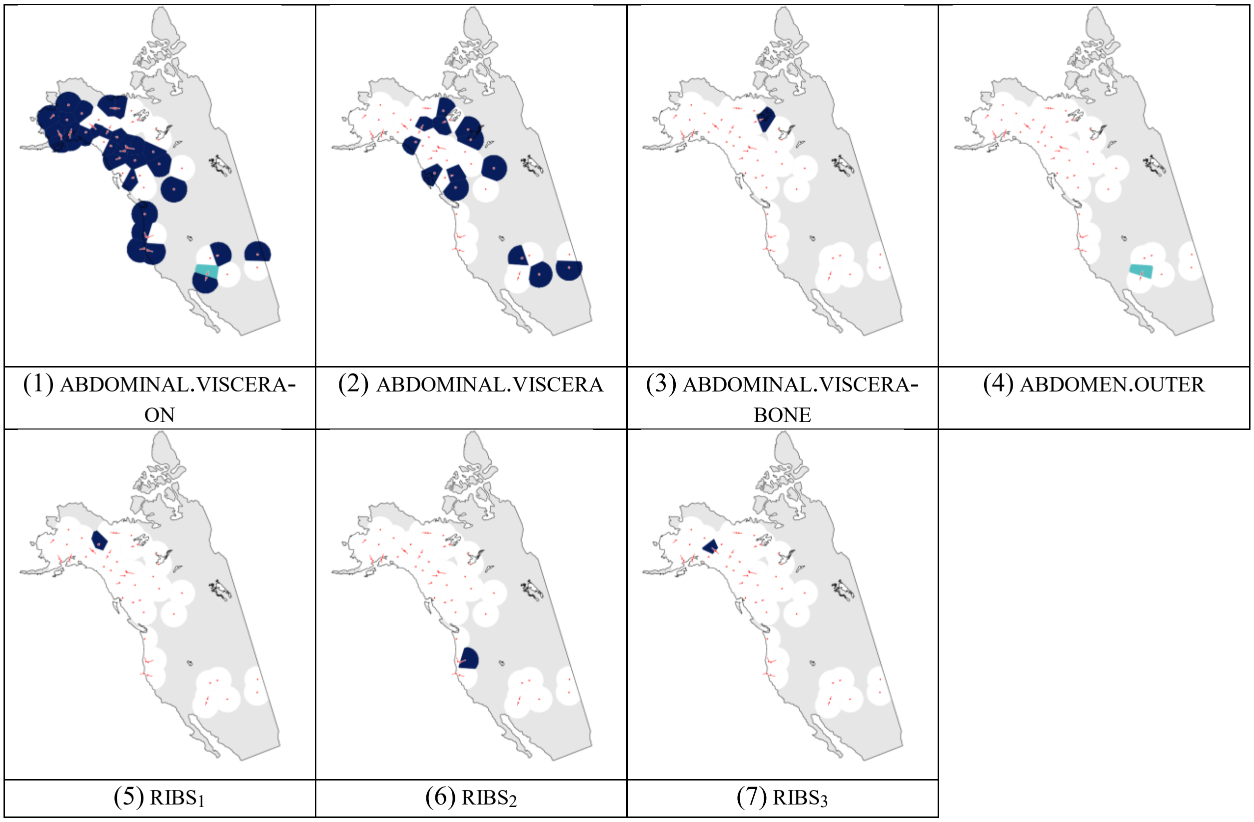


Figure 46. Distributions of terms for 'ribs'

3.3.5 Chest

There are 20 distinct patterns in the lexicalization of 'chest' making this referent one of the more heterogeneous in the sample. While the patterns are different, they share many similarities such as the two focal reference points 'heart' and the 'front' of the body.

(1) CHEST$_1$: In only eleven of the forty-eight languages for which the lexicographic source materials provided information on the referent-concept 'chest', is this referent-concept encoded in a monomorphemic cognate stem.

This stem is characterized by an alveolar affricate or aspirated alveolar plosive in stem-initial position, a front vowel and a uvular or velar fricative in stem-final position. The form /ʦãɣ/ in Dene Sųłiné exemplifies this pattern. This form has been identified with the semantic value CHEST$_1$. In Kaska (Frances Lake and Pelly dialects) a form which is seemingly cognate with the CHEST$_1$ forms is combined with the unidentified morpheme /tãh/ or /tõh/ in a lexicalization pattern here identified as CHEST$_2$. Cognates of this form are sometimes found as part of morphologically more complex lexicalizations of 'chest' (see for example pattern 5 below).

(2) CHEST$_2$: In South Slavey, as well as Beaver, Kaska (Dease Lake, Good Hope Lake, Liard and Lower Liard dialects), Dene Dháh and Sekani, the referent ‘chest’ is lexicalized through a monomorphemic cognate stem characterized by an alveolar or alveo-palatal affricate, as for example in South Slavey /tʃoh/. This form is identified here as CHEST$_2$.

(3) CHEST$_3$: In Hän, Upper Tanana, Tanacross, Northern Tutchone, Gwich’in (Gwıchya), and Gwich’in (Teetl’ıt), the referent ‘chest’ is lexicalized through a bi-morphemic compound of which the first component is a reflex of HEART$_1$ forms (see Section 3.3.7). The second component could not be identified, as this pattern is designated simply CHEST$_3$.

(4) FRONT.PART.OF.THE.BODY: In San Carlos and Mescalero Apache ‘chest’ is expressed through /tʰíl/ and /tʰél/ respectively. This element, the sole and direct lexicalization of the referent ‘chest’ in these two Apachean languages, is glossed as ‘front part of the body’ (De Reuse 2006: 171).

(5) CHEST$_4$: In Kaska (Frances Lake and Pelly dialects) a form which is seemingly cognate with the CHEST$_1$ forms is combined with the unidentified morpheme /tãh/ or /tõh/ in a lexicalization pattern here identified as CHEST$_4$.

(6) FRONT$_1$-HUMP: In Deg Xinag, Upper Kuskokwim and Koyukon, as well as in both Gwich’in dialects, the ‘chest’ is lexicalized through the elements /tɒ/ FRONT$_1$[28] (see Jetté and Jones 2000: 137) and /ɣɒn/ HUMP (Jetté and Jones 2000: 254), and their cognate forms to realize the pattern FRONT-HUMP.

(7) HEART$_1$-HUMP: Ahtna is unique among the languages of the sample to lexicalize the referent ‘heart’ through the combination of the terms for HEART$_1$ (see Section 3.3.7) and HUMP (Kari 1990: 205).

(8) HEART$_1$: Among the languages Tolowa and Jicarilla Apache the forms lexicalizing HEART$_1$ (see Section 3.3.7) are also found associated with ‘chest’. Since the HEART$_1$ form is found lexicalizing ‘heart’ across many Athapaskan languages, while it is associated with ‘chest’ in only these two, the form is inferred to have arisen through a pattern of polysemic extension: [{/sriʔ/, /ʧeʔ/} HEART ‘heart’] > ℙ > [{/sriʔ/, /ʧeʔ/} CHEST ‘chest’].

(9) HEART$_1$-BONE: The form /ʧéí-ʦ’iːn/ for ‘chest’ is unique to Navajo. The first element of this form is a reflex of HEART$_1$ (see Section 3.3.7), while the second corresponds to the BONE cognate set (see Section 3.1.4). The pattern is designated HEART$_1$-BONE.

(10) HEART$_1$-AREA: In Southern Tutchone, Tagish, Tłı̨chǫ and Tututni ‘chest’ is lexicalized through the expressions /ze-tɑn/, /ʥèː-tʰa/, and /sreʔ-tən/ respectively. In each of these bi-morphemic expressions, the first element is a reflex of the HEART$_1$ cognate. The second element is a modifying particle that indicates

[28] Two phonologically distinct goups of forms lexicalize the meaning ‘front’: cognates of Koyukon /tɒ/, and cognates of Ahtna /t'ɑːj/. These forms are here designated FRONT$_1$ and FRONT$_2$ respectively.

a regions relative to the noun it modifies. It occurs in Tłı̨chǫ /tetʃí-tʰa/ ‘bush area’ (or ‘tree area’), and is also translated as ‘among’ (in the gloss for the cognate form in Hare and Bearlake, K.Rice 1989: 282). The English word ‘among’ does not felicitously capture the meaning of this particle in these forms, however. The designation AREA is deemed more accurate for these cases, resulting in the lexicalization pattern: HEART$_1$-AREA.

(11) FRONT$_2$: In Ahtna, Hare, Dene Dháh and Witsuwit’en the referent ‘chest’ is lexicalized through the semantic element FRONT[12], as exemplified by Ahtna /t’ɑːj/ (Kari 1990: 342).

(12) FRONT$_2$-DOWN: In Witsuwit’en the referent ‘chest’ is also lexicalized through the combination of the semantic element FRONT[12], with the postpositional element DOWN (Hargus 2007: 314; see also Slavey /juw/ or /juwé/ ‘under’ K.Rice 1989: 311), to render the lexicalization pattern FRONT$_2$-DOWN.

(13) FRONT.BULGING.OUT: Tsuut’ina lexicalizes ‘chest’ through the unique form /ɣá-tɬ’ìk/, which is glossed as ‘front part bulging out’ (Starlight and Donovan 2008: 986). The form /ɣá/ is possibly related to forms designated HUMP (see patterns 5 and 6 above).

(14) HEART$_1$-PIPE.LIKE.OBJECT: In Tagish, Mountain Slavey, and Ross River Kaska, the referent ‘chest’ is lexicalized through the elements HEART$_1$ (see Section 3.3.7), and PIPE.LIKE.OBJECT (See Section 3.2.17, pattern 4 for a discussion of this element). This results in the lexicalization path HEART$_1$-PIPE.LIKE.OBJECT, as exemplified by Ross River Kaska /ʥi-zul/. The corresponding form in Mountain Slavey is /vel/. This implies a correspondence /z/ = /v/, which is also attested in terms for ‘skin’ (see Section 3.1.3; also see K.Rice 1989: 10).

(15) CHEST$_5$: The form /ʧiː-láh/ for ‘chest’ is unique to Western Apache. The first element of this form is a reflex of HEART$_1$ (see Section 3.3.7). The second element remains unidentified and the pattern is simply designated CHEST$_5$.

(16) CHEST$_6$: The form /joh/ for ‘chest’ is unique to Central Carrier, and is simply designated CHEST$_6$. This form is possibly related to the Chilcotin term designated CHEST$_7$.

(17) CHEST$_7$: The form /jɛt/ for ‘chest’ is unique to Chilcotin, and is simply designated CHEST$_6$. This form is possibly related to the Central Carrier term designated CHEST$_6$.

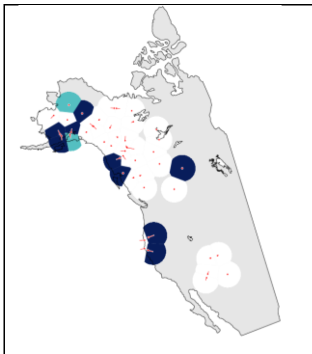
(18) CHEST$_8$: The form /ʥa-kʰon/ for ‘chest’ is unique to Tsuut’ina. The first element of this form is a reflex of HEART$_1$ (see Section 3.3.7). The second element remains unidentified and the pattern is simply designated CHEST$_8$.

(19) PIPE.LIKE.OBJECT: The lexicalization of ‘chest’ solely through the form /wíl/, PIPE.LIKE.OBJECT, is unique to Hare. The cognates of this form appear in several lexicalization patterns, such as pattern 14 above, but also for the referents ‘lungs’ (see Section 3.3.8) and ‘throat’ (see Section 3.2.17). The stem-initial segment is a reflex of Proto-Athapaskan *z and corresponds variously to /z/ and /v/ in other Athapaskan languages (see also K.Rice 1989: 10).

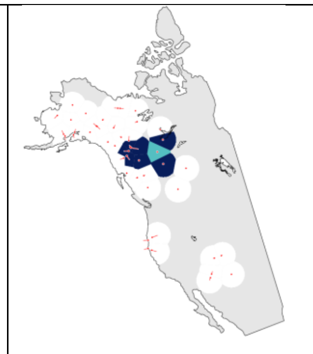
(20) STOMACH.OUTER₁: In Outer Cook Inlet Dena’ina, the referent ‘chest’ is lexicalized through the form /vet/. This form is designated STOMACH.OUTER₁ (see Section 3.3.3) indicating a pattern of polysemic extension [/vet/ STOMACH.OUTER₁ ‘outer stomach’] > ℙ > [/vet/ STOMACH.OUTER₁ ‘outer stomach, chest’].

Table 36. Chest

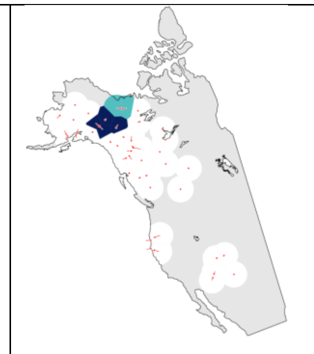
	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	doɣonʦ	6	INTERIOR CANADA	Hare	t’ák / wíl	11/19
	Koyukon	tɒɣɒn	6		Mountain	ʦivel	14
	Dena’ina (Iliamna)	ʧaʁ	1		Bearlake	-	
	Dena’ina (Inland)	ʧaʁ	1		Tłı̨chǫ	ʥè:ta / ʥì:wì:	10
	Dena’ina (OCI)	ʧaʁ / vet	1/20		South Slavey	ʧoh	2
	Dena’ina (UCI)	ʧaʁ	1		Dene Sų̨łiné	ʥãɣ	1
	Ahtna	t’ɑ:j / ʦɛtʁɑ:n	12/7		Dene Dháh	ʥonh / t’oe	2/11
	Holikachuk	-			Beaver	ʧouʰ	2
	Gwich’in (Teetl’ıt)	dʳi:ʧʰiʔ / te:ɣànʔ	3/6	BRITISH COLUMBIA	Carrier	joh	16
	Gwich’in (Gwıchya)	dʳi:ʧʰiʔ / te:ɣànʔ	3/6		Witsuwit’en	t’aj / t’ajəq	11/12
	Hän	dʳehʧʰî̀ʔ	3		Sekani	ʦõh	2
	Lower Tanana	dʳa	1		Ts’ets’aut	tˣɛ́j	1
	Upper Kuskokwim	diɣon	6		Chilcotin	jɛt	17
	Upper Tanana	ʥehʧʰî:ʔ	3	PACIFIC COAST	Hupa	ʧe:xʷ	1
	Tanacross	ʦiʧʰi	3		Galice	-	
YUKON	Northern Tutchone	ʦeʧʰínʔ	3		Kato	-	
	Southern Tutchone	zetɑn	10		Tolowa	sriʔ	8
	Kaska (DL)	dzõh	2		Tututni	sreʔtən	10
	Kaska (FL)	ʦatõh	5		Mattole	-	
	Kaska (GHL)	dzoh	2		Wailaki	-	
	Kaska (L)	dzõh	2		Kwa-Clat	tséi	1
	Kaska (LL)	dzõh	2	APACHEAN	Navajo	ʧéíʦ’i:n, ʦéíʦ’i:n	9
	Kaska (P)	dzatãh	5		Western A.	ʧi:láh	15
	Kaska (RR)	ʥizul	14		S. Carlos A.	tʰíl	4
	Tagish	ʧɛ́ʒjúl / ʧɛ́tán	14/10		Jicarilla A.	ʧeʔ	8
	Tahltan	dzʌ:	1		Kiowa A.	-	
					Mescalero A.	tʰél	4
	Tsuut’ina	ʥakʰon / ɣátɬ’ìk	18/13		Lipan A.	-	



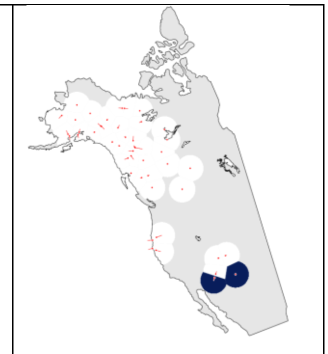
(1) CHEST$_1$



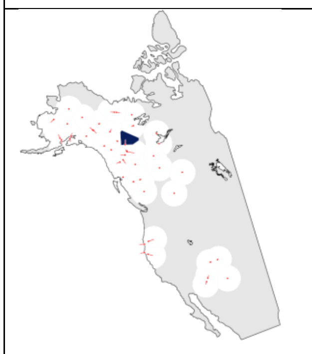
(2) CHEST$_2$



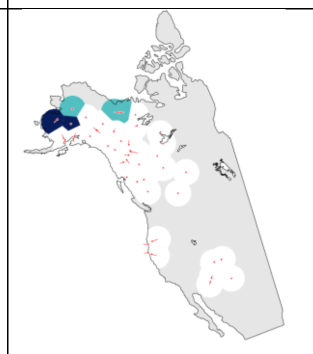
(3) CHEST$_3$



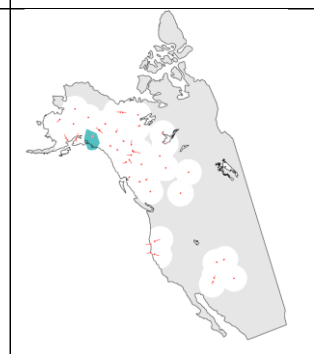
(4) FRONT.PART.OF.THE.BODY



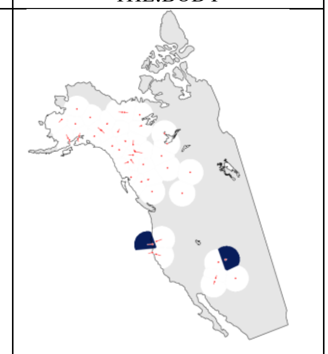
(5) CHEST$_4$



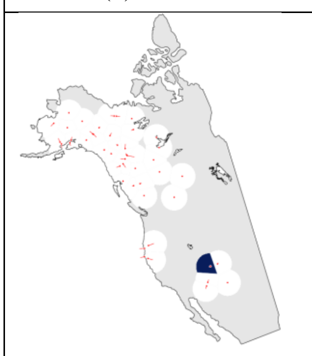
(6) FRONT$_1$-HUMP



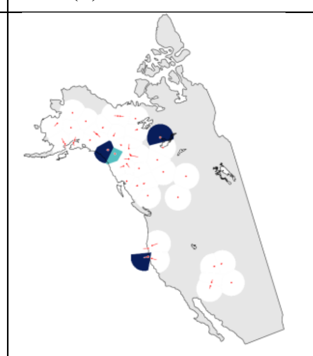
(7) HEART$_1$-HUMP



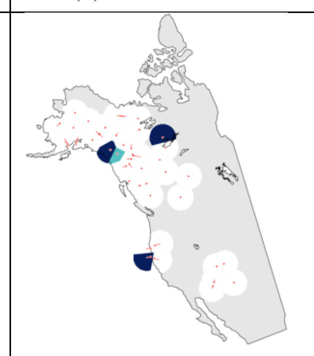
(8) HEART$_1$



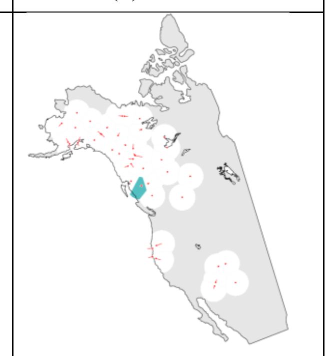
(9) HEART$_1$-BONE



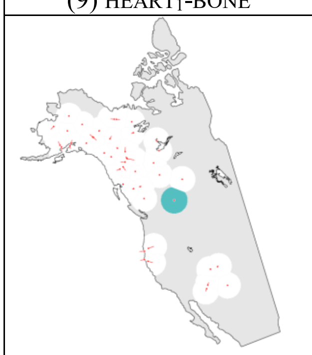
(10) HEART$_1$-AREA



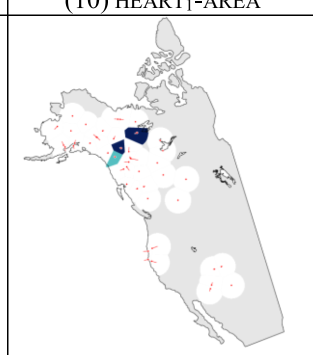
(11) FRONT$_2$



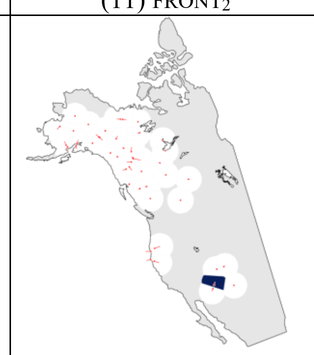
(12) FRONT$_2$-DOWN



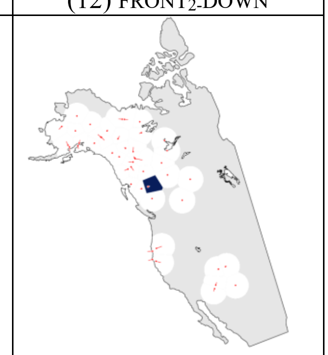
(13) FRONT.BULGING.OUT



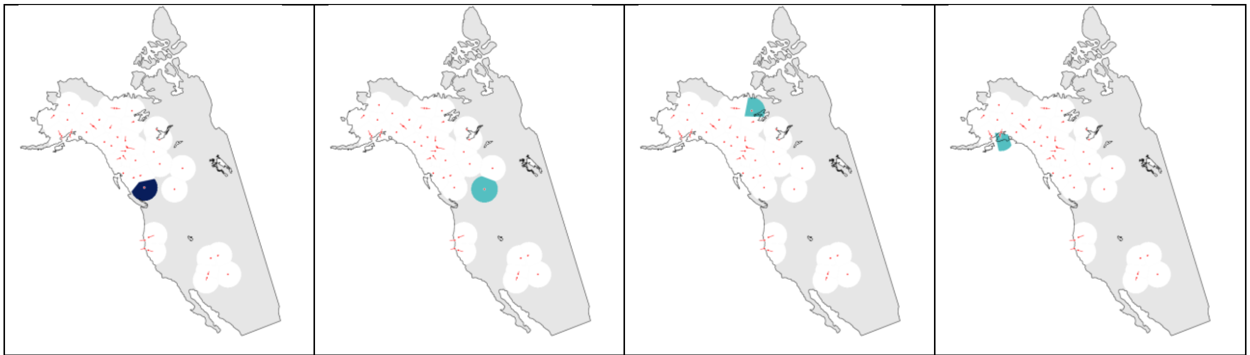
(14) HEART$_1$-PIPE.LIKE.OBJECT



(15) CHEST$_5$



(16) CHEST$_6$



(17) CHEST$_7$	(18) CHEST$_8$	(19) PIPE.LIKE.OBJECT	(20) STOMACH.OUTER$_1$

Figure 47. Distributions of terms for 'chest'

3.3.6 Breast

Two sets of cognate forms exhaust the field of terms for the referent-concept 'breast'. Both are monomorphemic and similar in meaning. They have been assigned the meanings BREAST$_1$ and BREAST$_2$.

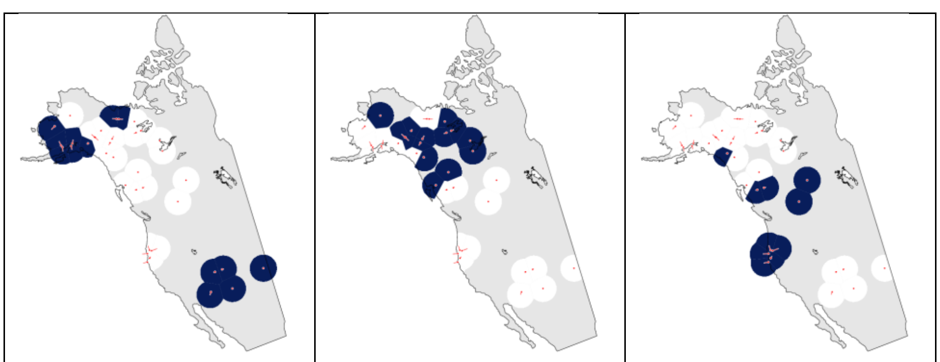
(1) BREAST$_1$: The most common form for 'breast' is characterized by a bilabial nasal or plosive in stem-initial position, and a glottal plosive of bilabial nasal in stem-final positions, as for example in Dena'ina (Outer Cook Inlet dialect) /mam/.

(2) SUCK: This cognate set is characterized by an alveolar ejective in stem-initial position followed by a back vowel and an occasional labio-velar approximant in final position. This form is a deverbal root as exemplified by South Slavey /t'ô:/, which is glossed as 'suck' (Dehcho Divisional Education Council 1990: 454).

(3) POINTED: The third lexicalization pattern for 'breast' is characterized by a stem-initial ejective alveolar affricate followed by mid or high back vowel. Glottal stops occur in stem-final position in some cases. Tolowa /ʦ'u:ʔ/ exemplifies this pattern. The semantic value of this form has been identified as pointed following the glossing for the Koyukon reflex, /ts'ʊq/ (Jetté and Jones 2000: 675), of this cognate pattern.

Table 37. Breast

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	mam	1	INTERIOR CANADA	Hare	t’õj	2
	Koyukon	t’ʊk	2		Mountain	t’óʔ	2
	Dena’ina (Iliamna)	mam	1		Bearlake	t’ó	2
	Dena’ina (Inland)	mam	1		Tłı̨chǫ	t’ò:	2
	Dena’ina (OCI)	mam	1		South Slavey	t’ô:	2
	Dena’ina (UCI)	mam	1		Dene Sųłiné	tθ’u	3
	Ahtna	pɑ:ʔ	1		Dene Dháh	-	
	Holikachuk	mà:ʔ	1		Beaver	-	
	Gwich’in (Teetl’ıt)	mà:ʔ	1	BRITISH COLUMBIA	Carrier	ʦ’uʔ	3
	Gwich’in (Gwıchya)	mam	1		Witsuwit’en	ʦ’o	3
	Hän	t’ǒ:ʔ	2		Sekani	t’òʧ	2
	Lower Tanana	-			Ts’ets’aut	t’ɔ	2
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	t’u:ʔ	2	PACIFIC COAST	Hupa	ʦ’o:ʔ	3
	Tanacross	t’uʔ	2		Galice	ʦ’ɑw	3
YUKON	Northern Tutchone	t’ók	2		Kato	-	
	Southern Tutchone	ʧ’u	3		Tolowa	ʦ’u:ʔ	3
	Kaska (DL)	-			Tututni	ʦ’eɣ^{w}	3
	Kaska (FL)	-			Mattole	ʦ’o:ʔ	3
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	beʔ	1
	Kaska (P)	t’u	2		Western A.	-	
	Kaska (RR)	-			S. Carlos A.	beʔ	1
	Tagish	t’ú	2		Jicarilla A.	bẽʔ	1
	Tahltan	-			Kiowa A.	bèʔ	1
					Mescalero A.	pe:	1
	Tsuut’ina	ʦ’ùw	3		Lipan A.	-	



(1) BREAST$_1$ | (2) SUCK | (2) POINTED

Figure 48. Distributions of terms for ‘breast’

3.3.7 Heart

There are six different lexicalization patterns for the referent ‘heart’, but the majority of the languages in the sample have terms belonging to the same cognate set.

(1) HEART$_1$: The cognate consists of a monomorphemic stem characterized by an alveolar or alveo-palatal affricate in stem-initial position. This is followed by a front mid or high vowel, and in many cases especially among languages spoken in the north, a palatal approximant in stem-final position, such as in the case of Holikachuk /tsaj/.

(2) ROUND.OBJECT.INSIDE: The dialects of Dena’ina (Inland, Outer Cook Inlet, Upper Cook Inlet) lexicalize the position of the heart relative to the body, albeit non-cognate morphological forms. The lexicalization patterns have been designated INSIDE$_1$ and INSIDE$_2$ respectively. The other two dialects of Dena’ina for which data were available the innovative forms /kʰuz-ʔin/ and /kʰuj-ʔin/ innovated forms that are glossed as ‘object inside’ (Kari 2007: 95). The constructions are semantically similar to the form found in Hupa /kʲʌn-sa-ʔaːn/ which is glossed as ‘insides (round object) lies there’ (Hoopa Valley Tribe 1996: 45). Consequently, all three forms have been assigned the semantic value ROUND.OBJECT.INSIDE.

(3) INSIDE: Both the Iliamna and the Outer Cook Inlet dialects of Dena’ina lexicalize ‘heart’ through the locational element /qʼti/ INSIDE (Kari 2007: 95).

(4) HEART$_1$-EYE$_1$: Tsuut’ina diverges from the other Athapaskan languages in lexicalizing ‘heart’ through the morphologically complex expression /dzá-nāx/. In Tsuut’ina the submorphemic element /dzá/ is found in expressions lexicalizing both ‘heart’ and ‘lungs’ (see Section 3.3.8) motivating the identification of this morpheme as CHEST.AREA. The phonological form of this morpheme indicates that it is a reflex of HEART$_1$. Since, unlike its etymological relatives in other Athapaskan languages, /dzá/ cannot lexicalize the referent ‘heart’ on its own anymore, the older meaning-form association must have been lost in Tsuut’ina, with the morpheme surviving only as a submorphemic element in compounds. The second component of the lexicalization pattern for ‘heart’ in Tsuut’ina is a cognate of EYE$_1$ (see Section 3.2.5), giving the pattern: HEART$_1$-EYE$_1$.

(5) HEART$_2$: Ts’ets’aut has a unique lexicalization for the referent ‘heart’: /vɛ́ːʔ/.

(6) HEART$_3$: Deg Xinag has a unique, possibly morphologically complex, lexicalization for the referent ‘heart’: /jeqʼit/, a lexicalization pattern simply designated HEART$_3$.

Table 38. Heart

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	jeq’it	6	INTERIOR CANADA	Hare	ʦi	1
	Koyukon	ʦax, ʦaj	1		Mountain	-	
	Dena’ina (Iliamna)	q’ti	3		Bearlake	ʦé:	1
	Dena’ina (Inland)	kʰuzʔin	2		Tłı̨chǫ	ʣè:	1
	Dena’ina (OCI)	kʰuzʔin / qti	2/3		South Slavey	ʦɛ:	1
	Dena’ina (UCI)	kʰujʔin	3		Dene Sųłiné	ʦi	1
	Ahtna	ʦaj	1		Dene Dháh	ʦe:ʔ	1
	Holikachuk	ʦaj	1		Beaver	ʧɛʔ	1
	Gwich’in (Teetl’ıt)	dʳì:ʔ	1	BRITISH COLUMBIA	Carrier	ʦi	1
	Gwich’in (Gwıchya)	dʳì:ʔ	1		Witsuwit’en	ʦi	1
	Hän	dʳê:ʔ	1		Sekani	ʦěʔ	1
	Lower Tanana	dʳaj	1		Ts’ets’aut	bvɛ́:ʔ	1
	Upper Kuskokwim	dʳaj	1		Chilcotin	ʣí	1
	Upper Tanana	ʣêjʔ	1	PACIFIC COAST	Hupa	kʲʰʌnsaʔa:n	3
	Tanacross	ʦejʔ	1		Galice	si:j	1
YUKON	Northern Tutchone	ʦíʔ	1		Kato	ʧi	1
	Southern Tutchone	ze	1		Tolowa	sriʔ	1
	Kaska (DL)	ʦěʔ	1		Tututni	sreʔ	1
	Kaska (FL)	ʦěʔ	1		Mattole	ʧí:j	1
	Kaska (GHL)	ʦěʔ	1		Wailaki	-	
	Kaska (L)	ʦěʔ	1		Kwa-Clat	ʦéi	1
	Kaska (LL)	ʦěʔ	1	APACHEAN	Navajo	ʧeí	1
	Kaska (P)	ʦěʔ	1		Western A.	ʧí:	1
	Kaska (RR)	ʦěʔ	1		S. Carlos A.	ʧı̄:ʔ	1
	Tagish	ʧɛ́, ʣe	1		Jicarilla A.	ʧe:	1
	Tahltan	ʦɛ:ʔ	1		Kiowa A.	ʤè:	1
					Mescalero A.	ʧé	1
	Tsuut’ina	ʣánāɣ	4		Lipan A.	ʧʰi	1

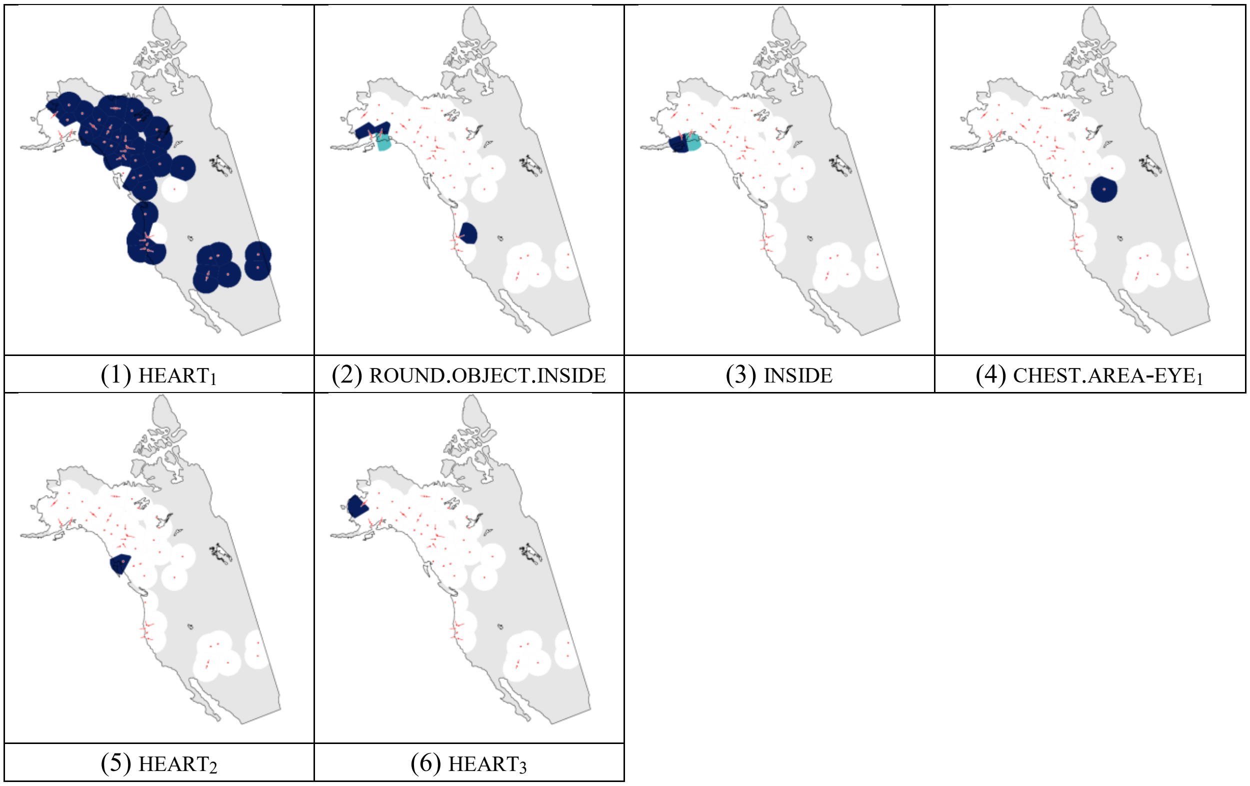


Figure 49. Distributions of terms for ‘heart’

3.3.8 Lungs

The set of lexicalization patterns found to encode the referent ‘lungs’ among Athapaskan languages ranks among the most heterogeneous with 22 individual patterns being recorded. Some of these patterns (especially numbers 11-15) show indications of sharing cognate morphemes, but the overall data are too scarce to definitively confirm these hypothetical connections. There are, however, more discernible similarities shared across multiple patterns. One of the more prominent semantic elements occurring in the lexicalizations of the referent-concept ‘lungs’ in Athapaskan languages is PIPE.LIKE.OBJECT, perhaps motivated by the hollowness of the lungs. The ‘heart’ also forms part of many lexicalization patterns, for the simple reason that the heart and the lungs are located very close to each other as can be seen from Figure 51.

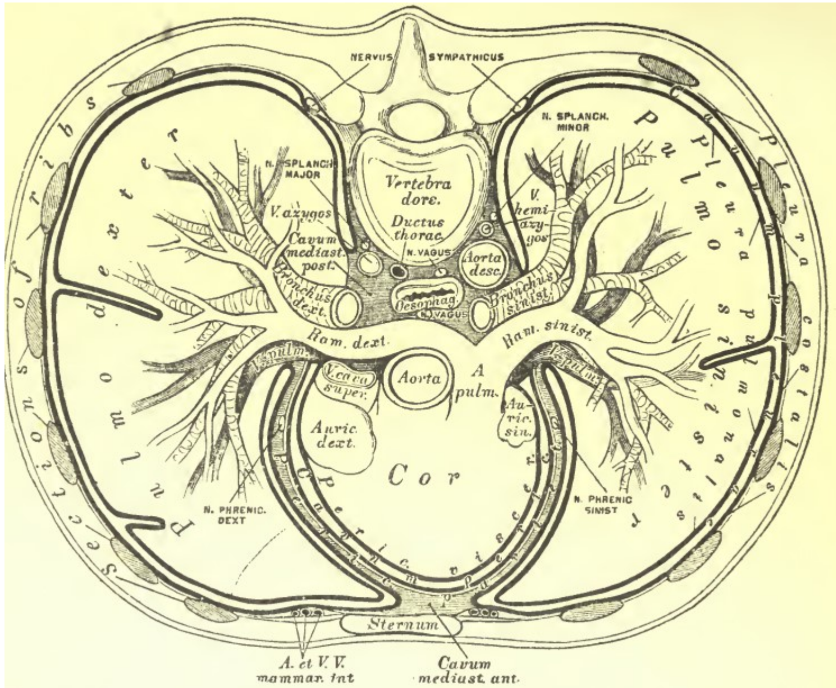


Figure 50. Horizontal section of the thorax, showing the relative position

(1) HEART$_1$-PIPE.LIKE.OBJECT: Among the dialects of Kaska as well as Dene Dháh, the 'lungs' are lexicalized through a point of reference, HEART, and the resemblance of the lungs to a hollow, pipe-like container resulting in the lexicalization pattern HEART$_1$-PIPE.LIKE.OBJECT, as in the case of Frances Lake Kaska /ʥẽ́:-sũ/.

(2) HEART$_1$-THINGS.NEXT.TO.IT: Koyukon, Deg Xinag, and Lower Tanana share the lexicalization pattern HEART$_1$-THINGS.NEXT.TO.IT, in which the second component is expressed by /tiloj/ or /tilɒj/, which is a derived from of the classificatory stem /lɒ/ glossed as 'things next to postpositional object' (Jetté and Jones 2000: 406-407).

(3) HEART-MASS: In Koyukon, Ahtna, Han, Northern Tutchone, Lower Tanana and the Gwich'in dialects, the element HEART encodes the reference point relative to which the lungs are located, but the head of the compound lexicalizing 'lungs' is formed by the stem /toq/ and its cognate forms, glossed as 'clump, tangled mass, thicket', and designated here as MASS. The Koyukon form /ʦaȷ̑-tuq/ exemplifies the lexicalization pattern HEART-MASS.

(4) CHEST-PIPE.LIKE.OBJECT: In the Tsuut'ina expression /ʥá-dá-zūl/ for 'lungs', the elements PIPE.LIKE.OBJECT and CHEST$_1$ are combined with the unidentified element /da/ to render a lexicalization pattern designated CHEST-PIPE.LIKE.OBJECT.

(5) CHEST-CAVITY: In Iliamna Dena'ina and Upper Kuskokwim, the referent 'lungs' is lexicalized through the forms /ʥas-q'a/ and /ʥos-k'aʔ/ respectively. The first elements in these forms are reflexes of CHEST_1 (see Section 3.3.5). The second element is designated CAVITY here, since this morpheme also occurs in many expressions for 'eye-socket' across the Athapaskan languages[29]. Therefore, in each language, the form as a whole lexicalizes the pattern CHEST-CAVITY.

(6) PIPE.LIKE.OBJECT: Among the Apache languages Jicarilla, Mescalero and Lipan, 'lungs' is lexicalized through the forms /zõl/, /zúl/, and /sɔl/ respectively. Clearly cognate, these forms appear in the lexicalization patterns of body parts which feature hollow enclosed spaces, such as the 'throat' (see Section 3.2.17) and 'lungs'. The cognate of this form in Koyukon is glossed as 'pipe-like object' (Jetté and Jones 2000: 422) motivating the designation used here: PIPE.LIKE.OBJECT.

(7) $\textbf{HEART}_1$-ACROSS: In the languages Hare, Bearlake, Tłı̨chǫ, and South Slavey, the 'lungs' are lexicalized through the salient reference point encoded by HEART_1 /ʥʰeh/ and the postpositional element ACROSS /téʔ/ (K.Rice 1989: 283). The motivation for this particular lexicalization pattern can be easily discerned from Figure 51.

(8) $\textbf{HEART}_1$-IN.FRONT.OF.IT: In Mountain Slavey, the referent 'lungs' is encoded through the expression /ʥih-fu/, which combines the semantic elements HEART_1 and IN.FRONT.OF.IT (K.Rice 1989: 279).

(10) $\textbf{HEART}_1$: Ts'ets'aut co-lexicalizes 'heart' and 'lungs' under the same form /bveːʔ/. The form is here treated as a reflex of HEART_1, which implies that the 'lungs' term has arisen through the patterns of polysemic extension [/bveːʔ/ HEART_1 'heart'] > ℙ > [/bveːʔ/ HEART_1 'heart, lungs'].

(11) $\textbf{LUNGS}_1$: The form /tʌs/ for 'lungs' is unique to Central Carrier, and is simply designated LUNGS_1. There are however, several potential cognates in Dene Sųłiné, Hupa, and Kato.

(12) $\textbf{HEART}_1$-$\textbf{LUNGS}_1$: The form /ʥí-tíθ/ is unique to Dene Sųłiné. The morphologically complex expression is made up of the elements HEART_1, and LUNGS_1 (see pattern 11 above).

(13) $\textbf{LUNGS}_1$-CAVITY: The form /tɪs-q'eʔ/ is unique to Hupa. The morphologically complex expression is made up of the elements LUNGS_1 (see pattern 11 above) and CAVITY (see pattern 5 above).

(14) $\textbf{LUNGS}_2$: The form /tes-ʦol/ for 'lungs' is unique to Chilcotin, and is simply designated LUNGS_2. There form /tes/ is potentially cognate with the LUNGS_1 forms.

(15) $\textbf{LUNGS}_3$: The form /tɛs-kʰɛʔ/ for 'lungs' is unique to Kato, and is simply designated LUNGS_3. There form /tɛs/ is potentially cognate with the LUNGS_1 forms.

(16) $\textbf{LUNGS}_4$: The form /tʃi-ʃiʃ-teʔ/ for 'lungs' is unique to Kato, and is simply designated LUNGS_4.

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[29] See for example Deg Xinag /na-q'at/, Koyukon /nɒ-q'ʊt/, Ahtna /nɑ-k'a/.

(17) LUNGS$_5$: The form /zə-ʧe/ for ‘lungs’ is unique to Southern Tutchone, combines the form designated HEART$_1$ with an unidentified element, possibly related to forms identified as ACROSS in pattern 7 above. This pattern is unique to Upper Tanana, and is simply designated LUNGS$_5$.

(18) LUNGS$_6$: The form /set/ for ‘lungs’ is unique to Tolowa, and is simply designated LUNGS$_6$.

(19) LUNGS$_7$: The form /ʥeh-ʔòk/ for ‘lungs’, combines the form designated HEART$_1$ with an unidentified element. This pattern is unique to Upper Tanana, and is simply designated LUNGS$_7$.

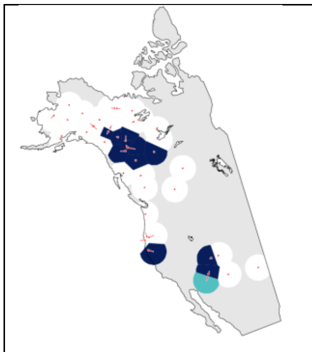
(20) LUNGS$_8$: The form /kʰɑs-t’ɛiʔ/ for ‘lungs’, is unique to Galice, and is simply designated LUNGS$_8$.

(21) LUNGS$_9$: The form /koɬil/ for ‘lungs’, is unique to Deg Xinag, and is simply designated LUNGS$_8$.

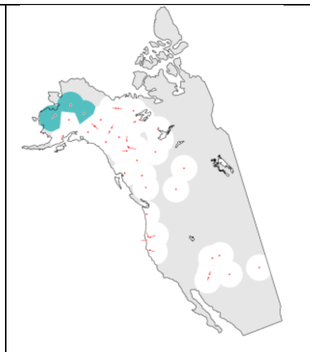
(22) LUNGS$_{10}$: The form /ʧí:ʔ-t’ā́/ for ‘lungs’, is unique to San Carlos Apache. It is comprised of the reflex of HEART$_1$ and a form resembling the postpositional element /t’ah/ or the lexical morpheme expressing ‘feather’. However, the latter interpretation seems unlikely, while the former is phonologically too distant. In the absence of further evidence, this form has been designated simply LUNGS$_1$.

Table 39. Lungs

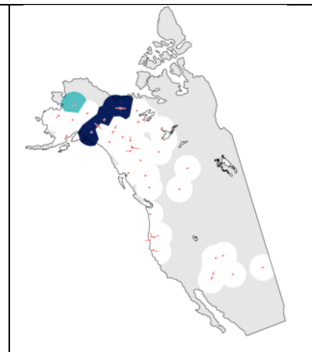
	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	koɬil / dʳoteloj	21/9	**INTERIOR CANADA**	Hare	ʦʰehtéʔ	7
	Koyukon	ʦaj̊tuq / ʦatilɒj	3/9		Mountain	ʦihfu	8
	Dena’ina (Iliamna)	ʦasq’a	5		Bearlake	ʦehté:	7
	Dena’ina (Inland)	-			Tłı̨chǫ	ʣehdè:	7
	Dena’ina (OCI)	-			South Slavey	ʦɛ:tɛ:	7
	Dena’ina (UCI)	-			Dene Sų̀łiné	ʦítíθé	12
	Ahtna	ʦəɬtoq	3		Dene Dháh	ʦe:dðuiʔ, ʣe:ðul	
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	dʳehtok	3	**BRITISH COLUMBIA**	Carrier	tʌs	11
	Gwich’in (Gwıchya)	dʳihtok	3		Witsuwit’en	-	
	Hän	trehtôʔ	3		Sekani	ʦèhsuɬ	
	Lower Tanana	dʳaj̊dʌk / dʳadiloy	3/9		Ts’ets’aut	bve:ʔ	10
	Upper Kuskokwim	ʣosk’aʔ	5		Chilcotin	tesʦol	14
	Upper Tanana	ʣehʔòk	19	**PACIFIC COAST**	Hupa	tɪsq’eʔ	13
	Tanacross	ʦehtokʔ	3		Galice	kʰɑst’ɛiʔ	20
YUKON	Northern Tutchone	ʦɑtʲák	3		Kato	tɛskʰɛʔ / tʃiʃiʃteʔ	15/16
	Southern Tutchone	zəʧe	17		Tolowa	set	18
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	ʣɛ̃́:sū	1		Mattole	-	
	Kaska (GHL)	ʣɛ́:zūl	1		Wailaki	-	
	Kaska (L)	ʣɛ́:zūl	1		Kwa-Clat	tsˣótsol	1
	Kaska (LL)	ʣẽ:su:l	1	**APACHEAN**	Navajo	ʧéí jilzól	1
	Kaska (P)	ʣɛ̃́:sū, ʣɛ̃́:zūl	1		Western A.	ʧí:ʔizól	1
	Kaska (RR)	ʣɛ̃́:sū	1		S. Carlos A.	ʧī:ʔizólé / ʧī:ʔt’ɑ̃́	1/22
	Tagish	-			Jicarilla A.	zõl	6
	Tahltan	-			Kiowa A.	-	
					Mescalero A.	zúl	6
	Tsuut’ina	ʣádázūl	4		Lipan A.	sɔl	6



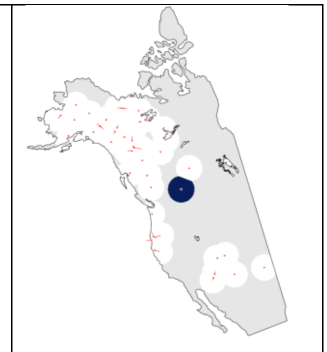
(1) HEART$_1$-PIPE.LIKE.OBJECT



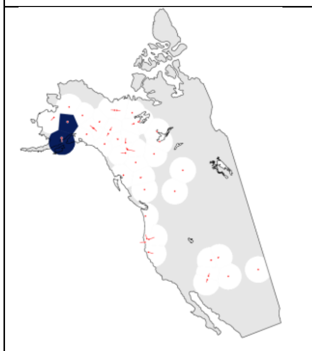
(2) HEART$_1$-THINGS.NEXT.TO.IT



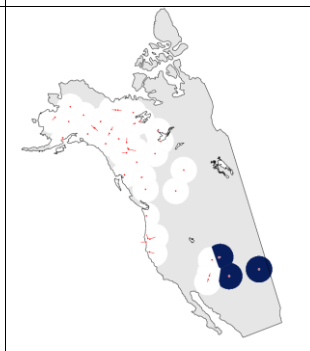
(3) HEART-MASS



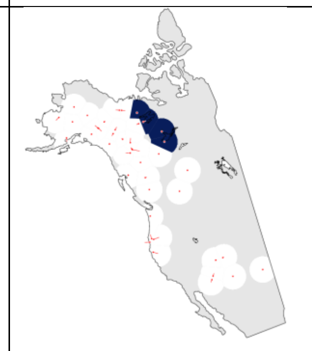
(4) CHEST-PIPE.LIKE.OBJECT



(5) CHEST-CAVITY

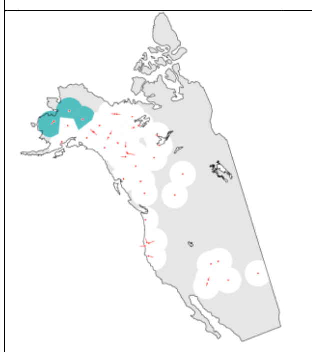


(6) PIPE.LIKE.OBJECT

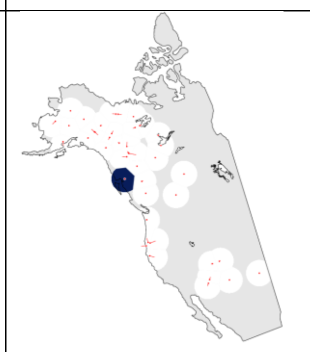


(7) HEART$_1$-ACROSS

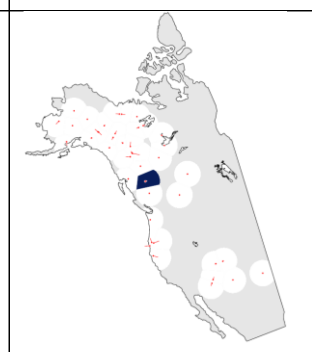
(8) HEART$_1$-IN.FRONT.OF.IT



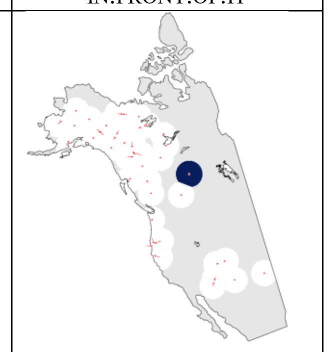
(9) HEART$_1$-THINGS.NEXT.TO.IT



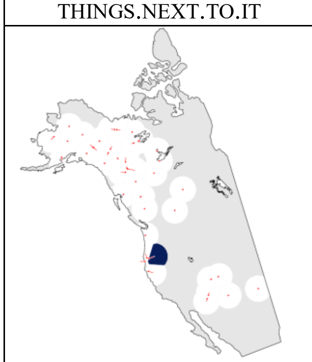
(10) HEART$_1$



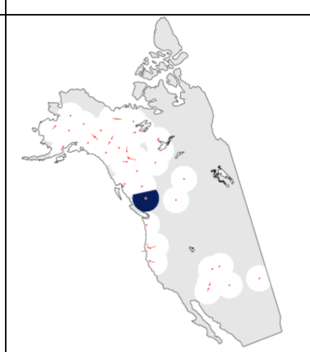
(11) LUNGS$_1$



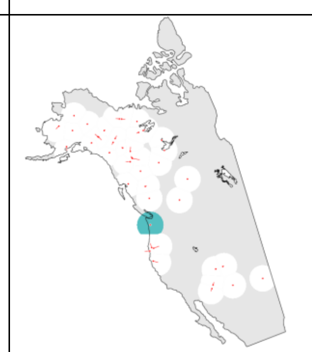
(12) HEART$_1$-LUNGS$_1$



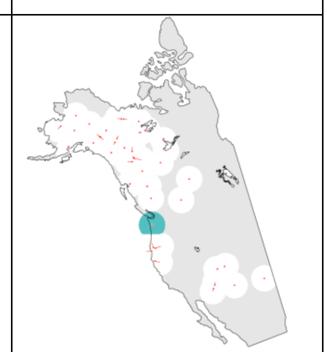
(13) LUNGS$_1$-CAVITY



(14) LUNGS$_2$



(15) LUNGS$_3$



(16) LUNGS$_4$

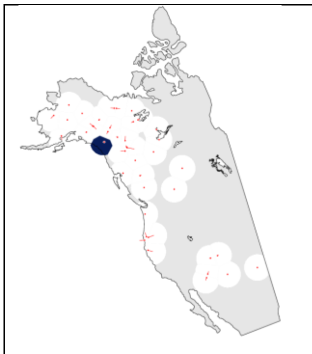
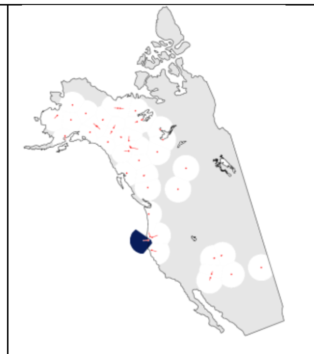
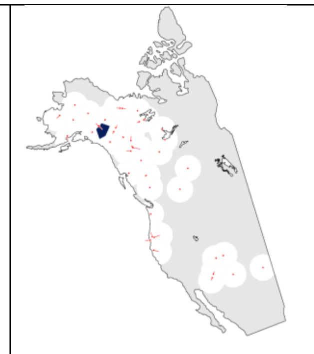
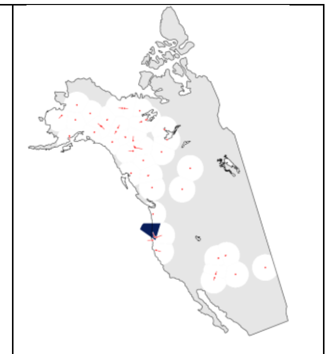
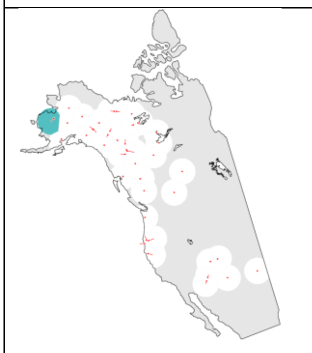
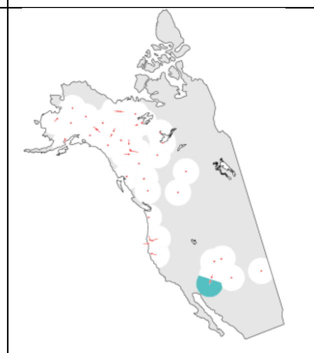
			
(17) LUNGS$_5$	(18) LUNGS$_6$	(19) LUNGS$_7$	(20) LUNGS$_8$
			
(21) LUNGS$_9$	(22) LUNGS$_{10}$		

Figure 51. Distributions of terms for ‘lungs’

3.3.9 Liver

The terms for the referent-concept ‘liver’ represent one of the most homogenous sets in the sample, with 37 of the 45 languages for which data were available sharing a cognate form. Five languages diverge from this overall trend.

(1) LIVER$_1$: The dominant lexicalization pattern for the referent ‘liver’ is a monomorphemic stem characterized by a stem-initial alveolar fricative, dental fricative, palatal approximant or labio-velar approximant (in one case a dental affricate) followed by a front vowel and in many cases an alveolar plosive in stem-final position, as for example in Dena’ina (Outer Cook Inlet dialect) /zət’/.

(2) ABDOMEN-OBJECT: In Koyukon, ‘liver’ is lexicalized through the pattern ABDOMEN-OBJECT, morphologically formed by the noun for ABDOMEN.INNER followed by a classificatory verb stem glossed as ‘compact round object’ /-ʔɒn/ (Jetté and Jones 2000: 299).

(3) LIVER$_2$: Two languages from the Pacific Coast region, Galice and Mattole share the similar but opaque patterns /sɑʔɬ/ and /ʦʰíʔɬ/. These are classified as cognates of each other on the grounds of the shared syllable coda, as well as the possibility that both /s/ and /tsʰ/ could be reflexes of Proto-Athapaskan *ts in these languages (Hoijer 1963: 10).

(4) BLOOD$_1$: In Kato 'liver' is lexicalized through the form /tʰɛl/ indicating a pattern of polysemic extension [/tʰɛl/ BLOOD 'blood'] > ℙ > [/tʰɛl/ LIVER 'liver'].

(5) ABDOMINAL-BLOOD-CLOT: A complex nominalized form occurs in Kiowa Apache that is glossed in the source as "that abdominal visceral blood clot" (Bross 1971: 16).

(6) LIVER$_3$: The lexicalization /ʧ'eː-set/ for 'liver' is unique to Tolowa.

(7) LIVER$_4$: Deg Xinag lexicalizes 'liver' through the classificatory stem /-ʔon/ cognate with the Koyukon stem in (2) above. However, the remaining elements in the Deg Xinag form could not be identified and the pattern is therefore simply described as LIVER$_4$.

(8) LIVER$_5$: Holikachuk lexicalizes 'liver' through the classificatory stem /-ʔon/ cognate with the Koyukon stem in (2) above. However, the remaining elements in the Deg Xinag form could not be identified and the pattern is therefore simply described as LIVER$_5$.

Table 40. Liver

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tr’iɣiðiʔon	7	INTERIOR CANADA	Hare	wéʔ	1
	Koyukon	kɒlʔɒn	2		Mountain	-	
	Dena’ina (Iliamna)	-			Bearlake	wé	1
	Dena’ina (Inland)	zət’	1		Tłı̨chǫ	wò	1
	Dena’ina (OCI)	zət’	1		South Slavey	ðé	1
	Dena’ina (UCI)	jət’	1		Dene Sųłiné	tθár	1
	Ahtna	zət’	1		Dene Dháh	ðé	1
	Holikachuk	kʰaðiʔon	8		Beaver	zʌt’	1
	Gwich’in (Teetl’ıt)	ðat	1	BRITISH COLUMBIA	Carrier	z̠ʌt	1
	Gwich’in (Gwıchya)	ðat	1		Witsuwit’en	zət	1
	Hän	ðàt, ðə̀t	1		Sekani	zàt	1
	Lower Tanana	-			Ts’ets’aut	srɛ’	1
	Upper Kuskokwim	zit’	1		Chilcotin	zɛ́t	1
	Upper Tanana	ðə̀t	1	PACIFIC COAST	Hupa	sɪt’	1
	Tanacross	ðɛt	1		Galice	sɑʔɬ	3
YUKON	Northern Tutchone	ðát	1		Kato	tʰɛl	4
	Southern Tutchone	ðə̀t	1		Tolowa	ʧ’e:set	5
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	zét	1		Mattole	ʦʰíʔɬ	3
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	zit	1
	Kaska (P)	zét	1		Western A.	zik	1
	Kaska (RR)	zét	1		S. Carlos A.	zit, ʒit	1
	Tagish	ʒìt	1		Jicarilla A.	zi	1
	Tahltan	-			Kiowa A.	ʧã́:tíɬkʰõ̀:sé:	6
					Mescalero A.	zit	1
	Tsuut’ina	zí	1		Lipan A.	sɛ	

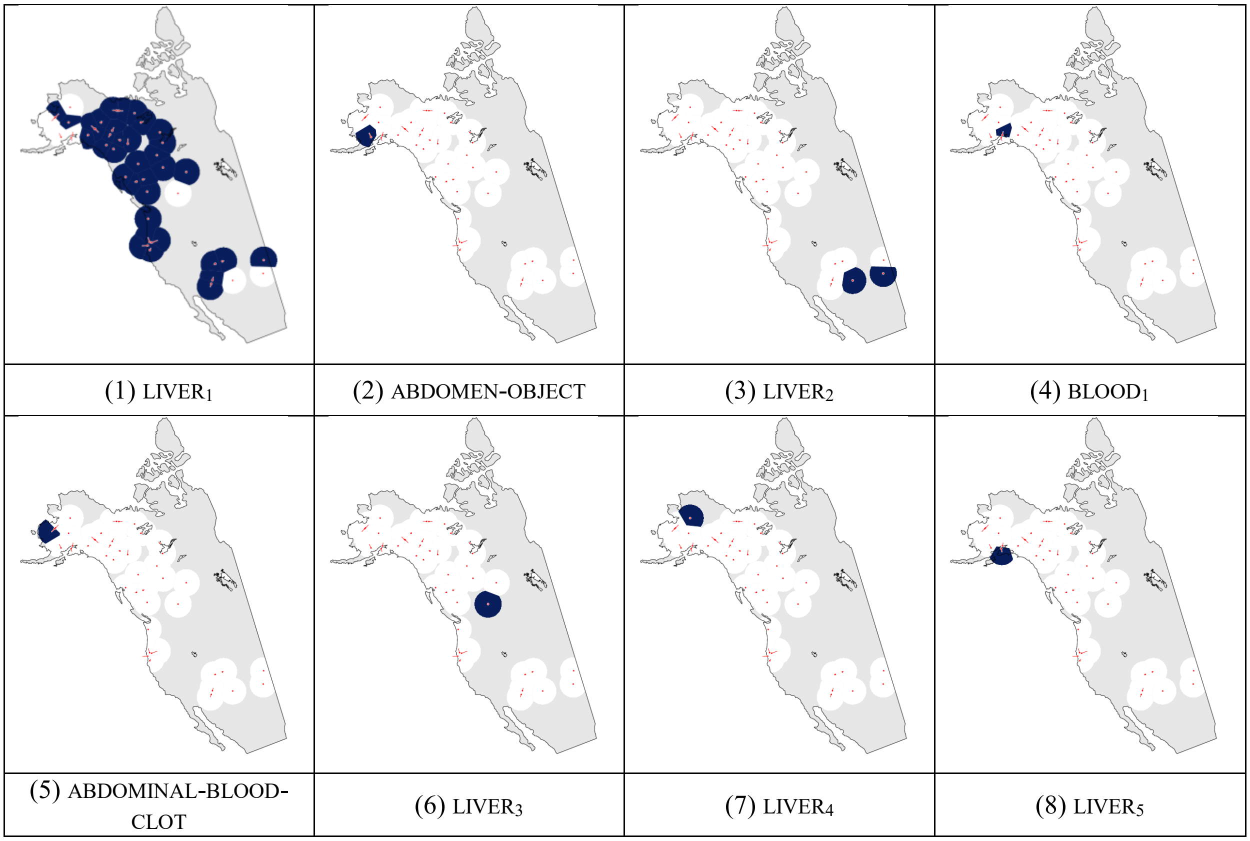


Figure 52. Distributions of terms for 'liver'

3.3.10 Intestines

The referent 'intestines' (in the sense of 'entrails' or 'guts', not the more specific 'portion of the digestive tract') is lexicalized through four distinct patterns, with one being clearly dominant.

(1) INTESTINES$_1$: The majority of the terms lexicalizing the referent-concept 'intestines' form part of the same cognate set, based on a stem-initial ejective alveolar affricate, a mid or high front vowel and in some cases a final velar or glottal plosive, as for example in Koyukon /ts'ik/.

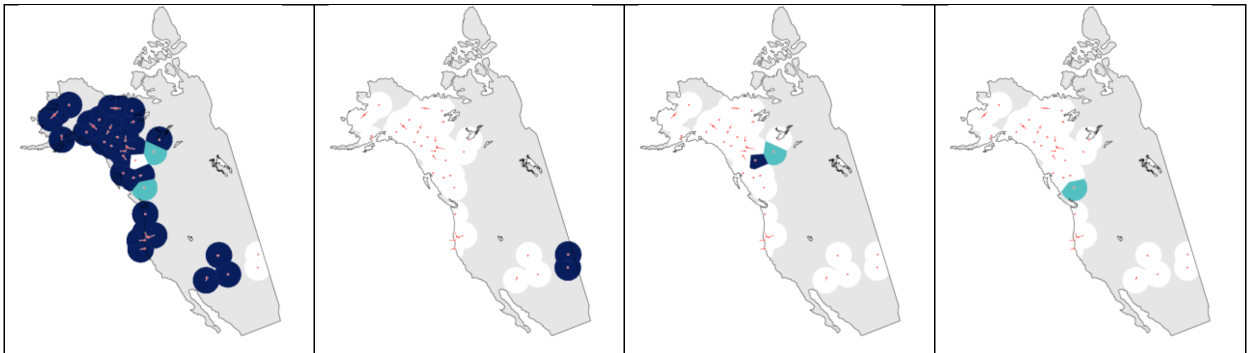
(2) INTESTINES$_2$: The forms in Kiowa Apache /ʧéʔ/, Lipan Apache /ʤiɛ/, and Kato/ʧik'/ differ from the other forms in the set in that the stem-initial consonant is not ejectivized. They are potentially cognate forms, but since sound changes from ejective to non-ejective consonants are rare in the dataset, more evidence would be required to properly include them. They are therefore treated as belonging to a different cognate set here.

(3) ABDOMINAL.VISCERA: In Dene Dháh, a second form /tʃʰohí/ also lexicalizes 'intestines'. This latter form originates from a term for 'inner abdomen, viscera' (see Section 3.3.2 Abdomen, Ribs), indicating a semantic shift [/tʃoh/ ABDOMINAL.VISCERA ‘viscera’] > ℙ > [/tʃoh/ INTESTINES ‘intestines’]. In Sekani, this polysemy pattern has developed into a completed semantic change with the form /ʧʰõhĩ/, etymologically ABDOMEN.INNER, being recorded in the lexicographic source material as a term encoding the referent-concept ‘intestines’: [/tʃoh/ *ABDOMINAL.VISCERA ‘viscera’] > § > [/tʃoh/ INTESTINES ‘intestines’].

(4) STOMACH.OUTER: In Chilcotin, ‘intestines’ is also encoded through a form originating with a polysemic extension. In this case, the source is the form lexicalizing the semantic element stomach: [/bɛ́t/ STOMACH.OUTER ‘outer stomach’] > ℙ > [/bɛ́t/ STOMACH.OUTER ‘outer stomach, intestines’].

Table 41. Intestines

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʦ’ek	1	INTERIOR CANADA	Hare	ʦ’i	1
	Koyukon	ʦ’ik	1		Mountain	ʦ’i	1
	Dena’ina (Iliamna)	ʧ’ik’	1		Bearlake	-	
	Dena’ina (Inland)	-			Tłįchǫ	-	
	Dena’ina (OCI)	-			South Slavey	ʦ’ı	1
	Dena’ina (UCI)	-			Dene Sųłiné	-	
	Ahtna	ʦ’i:k	1		Dene Dháh	ʦ’íé / ʧʰohi	1/3
	Holikachuk	ʦ’ek	1		Beaver	-	
	Gwich’in (Teetl’ıt)	ʦ’ìk	1	BRITISH COLUMBIA	Carrier	ʦ’i	1
	Gwich’in (Gwıchya)	ʦ’ìk	1		Witsuwit’en	ʦ’ec	1
	Hän	ʦ’û:ʔ	1		Sekani	ʧʰõhĩ	3
	Lower Tanana	-			Ts’ets’aut	ʦ’é:ʔ	1
	Upper Kuskokwim	-			Chilcotin	ʦ’i / bɛ́t	1
	Upper Tanana	ʦ’î:k	1	PACIFIC COAST	Hupa	ʧ’e:k’	1
	Tanacross	ʦ’ikʔ	1		Galice	ʧ’i:ʧ’	1
YUKON	Northern Tutchone	ʦ’ik	1		Kato	ʧik’	2
	Southern Tutchone	ʦ’i	1		Tolowa	tr’i:k’	1
	Kaska (DL)	ʦ’i	1		Tututni	ʦr’ik’	1
	Kaska (FL)	ʦ’i	1		Mattole	-	
	Kaska (GHL)	ʦ’i	1		Wailaki	-	
	Kaska (L)	ʦ’i	1		Kwa-Clat	-	
	Kaska (LL)	ʦ’i	1	APACHEAN	Navajo	-	
	Kaska (P)	ʦ’i	1		Western A.	-	
	Kaska (RR)	ʦ’i	1		S. Carlos A.	ʧ’íʔ	1
	Tagish	ʦ’i	1		Jicarilla A.	ʧ’ẽ́	1
	Tahltan	-			Kiowa A.	ʧéʔ	2
					Mescalero A.	ʧ’íi	1
	Tsuut’ina	-			Lipan A.	dʒi	2



(1) INTESTINES$_1$	(2) INTESTINES$_2$	(3) ABDOMINAL.VISCERA	(4) STOMACH.OUTER

Figure 53. Distributions of terms for 'intestines'

3.3.11 Gallbladder

Almost all the forms that lexicalize the referent-concept 'gallbladder' in Athapaskan language involve either the semantic element GALL$_1$ (see Section 3.4.7 Gall) or the semantic element BLOOD$_1$ (see Section 3.5.1 Blood). The sole exception is Upper Tanana, which has lexicalized 'gallbladder' through a unique innovation.

(1) GALL$_1$: Most languages co-lexicalize 'gallbladder' with the same term used for 'gall' (described further in Section 3.5.6), GALL$_1$, as exemplified by Southern Tutchone /tɬ'ɨr/. Since, the association between /tɬ'ò:/ and its cognates with the meaning GALL$_1$ is more frequent than with GALLBLADDER, the directionality of this polysemic extension is identified as [/tɬ'ò:/ GALL 'gall'] > ℙ > [/tɬ'ò:/ GALLBLADDER 'gallbladder'].

(2) GALL$_1$-SKIN: The second most common lexicalization pattern has the form GALL$_1$-SKIN$_1$. This pattern is found exclusively among the Kaska dialects, as for example in the Ross River Kaska form /tɬ'édzé-zés/, which is composed of the stems /tɬ'édzé/ GALL$_1$ (see Section 3.5.6 'Gall') and /zés/ SKIN$_1$ (see Section 3.1.3 'Skin').

(3) GALLBLADDER$_1$: The Outer and Upper Cook Inlet dialects of Dena'ina, in addition to the GALL$_1$ lexicalization path, also encode the referent 'gallbladder' through the semantically opaque form /tiɬ-tʰin/, here identified as GALLBLADDER$_2$.

(4) BLOOD$_1$: Bearlake encodes the referent 'gallbladder' through the element BLOOD$_1$. Since the BLOOD$_1$ pattern of cognates is firmly established (see Section 3.5.1), the lexicalization of 'gallbladder' under this term must have arisen through the polysemic extension: [/tʰe:l/ BLOOD$_1$ 'blood'] > ℙ > [/tʰe:l/ GALLBLADDER 'gallbladder']. Though no separate lexical term for 'gall' is recorded in the lexicographic sources for Bearlake /tʰe:l/, an intermediary stage where was associated with 'gall' is likely to have preceded the extension to 'gallbladder'. In that case, the polysemic extension of referential reach from 'blood' to 'gallbladder' would arise straightforwardly through a CONTAINER FOR CONTENTS metonymy.

(5) GALLBLADDER$_2$: Upper Tanana lexicalizes the referent-concept 'gallbladder' through a morphologically complex expression based on the semantic element BLOOD$_1$: /dəʤ nʒît nîːha/.

Table 42. Gallbladder

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		INTERIOR CANADA	Hare	-	
	Koyukon	tɬ'əʦ	1		Mountain	tɬ'óv	1
	Dena'ina (Iliamna)	tɬ'əʧ'	1		Bearlake	tʰeːl	4
	Dena'ina (Inland)	tɬ'əʧ'	1		Tłįchǫ	tɬ'òː	1
	Dena'ina (OCI)	tɬ'əʧ' / tiɬtʰin	1/3		South Slavey	tʰɬ'éz	1
	Dena'ina (UCI)	tɬ'əʧ' / tiɬtʰin	1/3		Dene Sųłiné	-	
	Ahtna	-			Dene Dháh	tɬʰéʦ	1
	Holikachuk	-			Beaver	-	
	Gwich'in (Teetl'ıt)	-		BRITISH COLUMBIA	Carrier	-	
	Gwich'in (Gwıchya)	-			Witsuwit'en	-	
	Hän	tɬ'ôʔ	1		Sekani	tɬ'aʦ	1
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	tɬ'iʦ'	1		Chilcotin	-	
	Upper Tanana	dəʤ nʒît nîːha	5	PACIFIC COAST	Hupa	-	
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	tɬ'óʔ	1		Kato	-	
	Southern Tutchone	tɬ'ɨr	1		Tolowa	-	
	Kaska (DL)	tɬ'édzézés	2		Tututni	-	
	Kaska (FL)	tɬ'édzézés	2		Mattole	-	
	Kaska (GHL)	tɬ'edzézés	2		Wailaki	-	
	Kaska (L)	tɬ'ádzézás	2		Kwa-Clat	-	
	Kaska (LL)	tɬ'ádzézás	2	APACHEAN	Navajo	-	
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	tɬ'édzézés	2		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut'ina				Lipan A.	-	

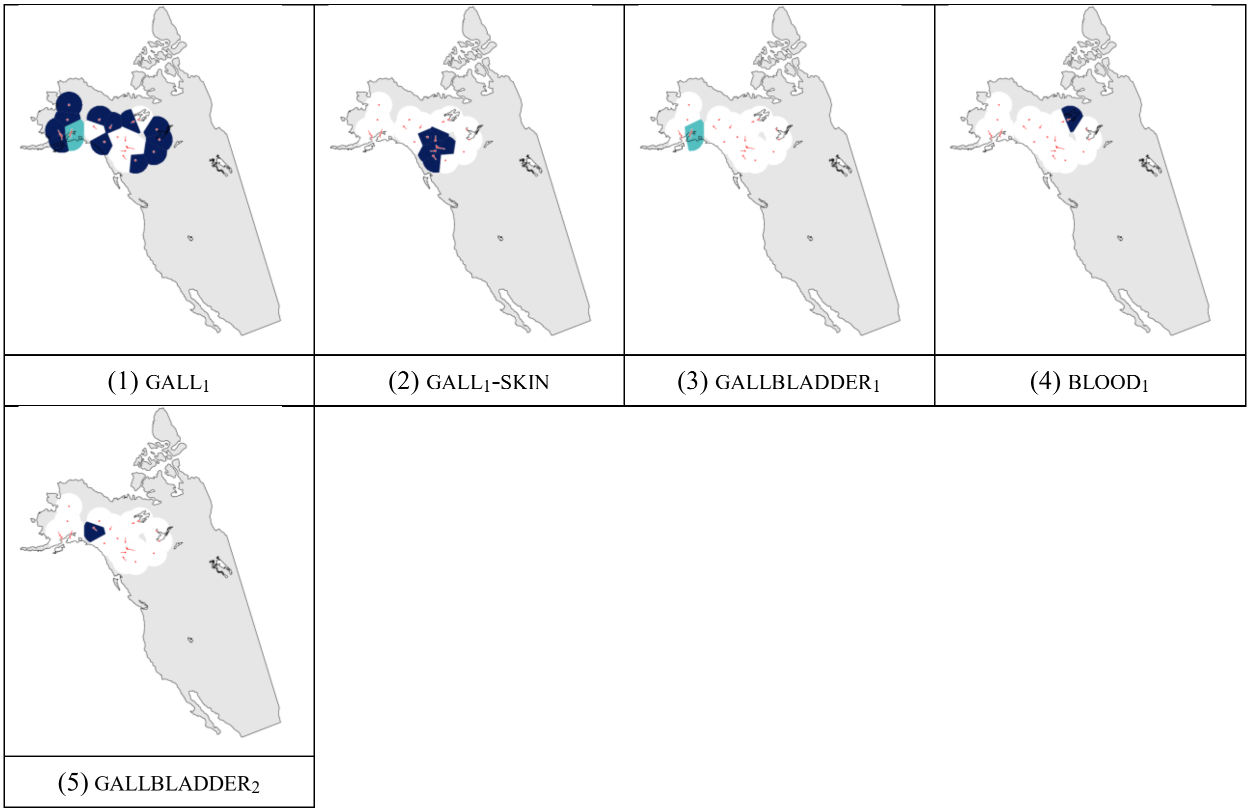


Figure 54. Distributions of terms for 'gallbladder'

3.3.12 Hip

There are 5 lexicalization patterns for the referent 'hip', two of which are clearly dominant.

(1) V.SHAPE: The dominant pattern lexicalizing 'hip' is constituted by a monomorphemic stem characterized by a velar or uvular ejectivized plosive in stem-initial position and a palatal approximant (in Apachean a high front vowel) in stem-final position, as for example in Koyukon /qʼɔj/. The Koyukon form is glossed as 'hip, hipbone, pelvis, thigh, groin, v-shaped object, narrow gap' (Jetté and Jones 2000: 371). A similarly wide range of referents is also recorded for Hupa: 'hip, thigh, inside of my leg' (Hoopa Valley Tribe 1996: 46). Since this term occurs in non-anatomical domains too, as for example in Koyukon terms denoting the bow or the "pointed ends of a canoe" (Jetté and Jones 2000: 372), the semantic value of this morpheme can be aptly described as V.SHAPE.

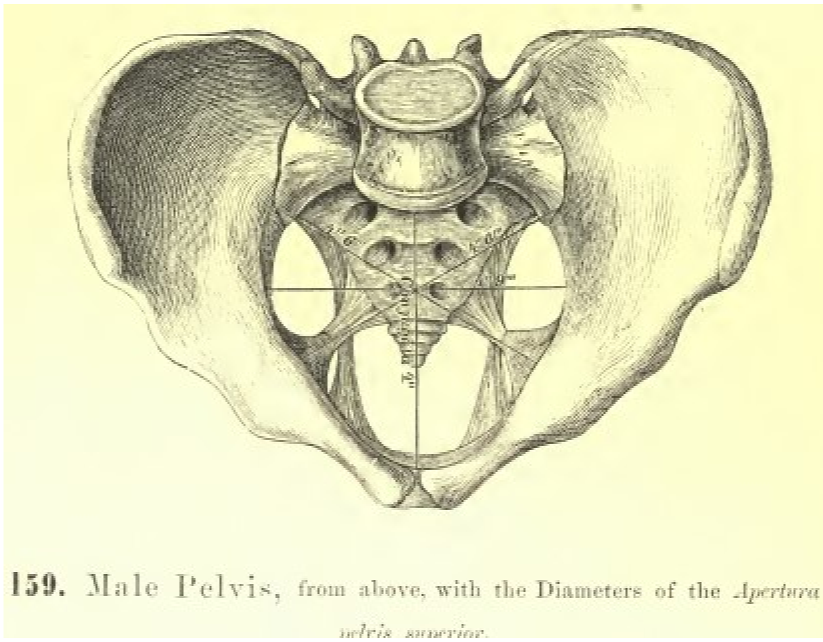


Figure 55. ‘Male pelvis’ (Heitzmann 1887: 116)

The Mescalero Apache form /k’al/ is tentatively included in this cognate set, even though the stem-final segment is /l/.

(2) HIP$_1$: The second most widespread pattern in the lexicalization of the referent ‘hip’ is also expressed through a monomorphemic stem characterized by a stem-initial glottal plosive and/or a low front vowel. Dental fricatives, dental and alveolar affricates or labio-velar approximant occur in stem-final position, as for example in Hare /ʔáw/.

(3) LEG$_1$-KNEE: In Tututni the term used to denote ‘hip’ can be glossed as ‘leg-bone’ /ʃa-gʷet/ but the pattern of lexicalization is formed by LEG$_1$-KNEE$_1$, to indicate the etymological origins of this morpheme. This is the result of polysemic extension in Tututni, where the term exhibits the pattern [/gwət/ KNEE ‘knee’] > ℙ > [/gʷət/ BONE ‘knee, bone’].

(4) HIP$_2$: The language Tolowa lexicalizes ‘hip’ with the term /teːʦ’/ which remains opaque, but is parallel to the second term used to lexicalize ‘hip’ in Hupa[30] /qeːʧ’/.

(5) HIP$_3$: The lexicalization pattern /ʦʰiːʦʰi/ is unique to Tsuut’ina.

[30] There are further terms listed for Hupa: /ʦ’ɪ-ta-qɪ-jaːŋ-ʔaj/ glossed as ‘my-upside-down-it-sits’ (Hupa Language Dictionary 1996: 46), as well as /tɬ’aʔ-ʦ’ɪŋʔ/ BUTTOCKS-BONE. Both patterns are innovations unique to Hupa and are therefore not mapped individually.

Table 43. Hip

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʔodð	2	INTERIOR CANADA	Hare	ʔáw	2
	Koyukon	q’ɔj	1		Mountain	k’àj	1
	Dena’ina (Iliamna)	q’əj	1		Bearlake	-	
	Dena’ina (Inland)	-			Tłı̨chǫ	ʔà:	2
	Dena’ina (OCI)	ʔuʦ	2		South Slavey	ʔáð	2
	Dena’ina (UCI)	ʔuʦ	2		Dene Sų̨łiné	ʔáð	2
	Ahtna	ʔɑ:ʦ	1		Dene Dháh	á:dð	2
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	-		BRITISH COLUMBIA	Carrier	k’i	1
	Gwich’in (Gwıchya)	-			Witsuwit’en	q’əj	1
	Hän	-			Sekani	k’ǎj	1
	Lower Tanana	-			Ts’ets’aut	aa:ʔ	2
	Upper Kuskokwim	ʔoʦ	2		Chilcotin	-	
	Upper Tanana	k’ǎ̰jʔ	1	PACIFIC COAST	Hupa	q’ajʔ / qe:ch’	1/4
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	k’ɑ́jʔ	1		Kato	-	
	Southern Tutchone	-			Tolowa	te:ʦ’aʔ	4
	Kaska (DL)	k’áj	1		Tututni	ʃagwət	3
	Kaska (FL)	k’áj	1		Mattole	-	
	Kaska (GHL)	k’ā́j	1		Wailaki	-	
	Kaska (L)	k’ā́j	1		Kwa-Clat	-	
	Kaska (LL)	k’áj	1	APACHEAN	Navajo	k’aiʔ	1
	Kaska (P)	k’áj	1		Western A.	k’ai	1
	Kaska (RR)	k’áj	1		S. Carlos A.	k’ai	1
	Tagish	-			Jicarilla A.	-	
	Tahltan	k’ɑj	1		Kiowa A.	-	
					Mescalero A.	k’al	1
	Tsuut’ina	ʦʰi:ʦʰi	5		Lipan A.	-	

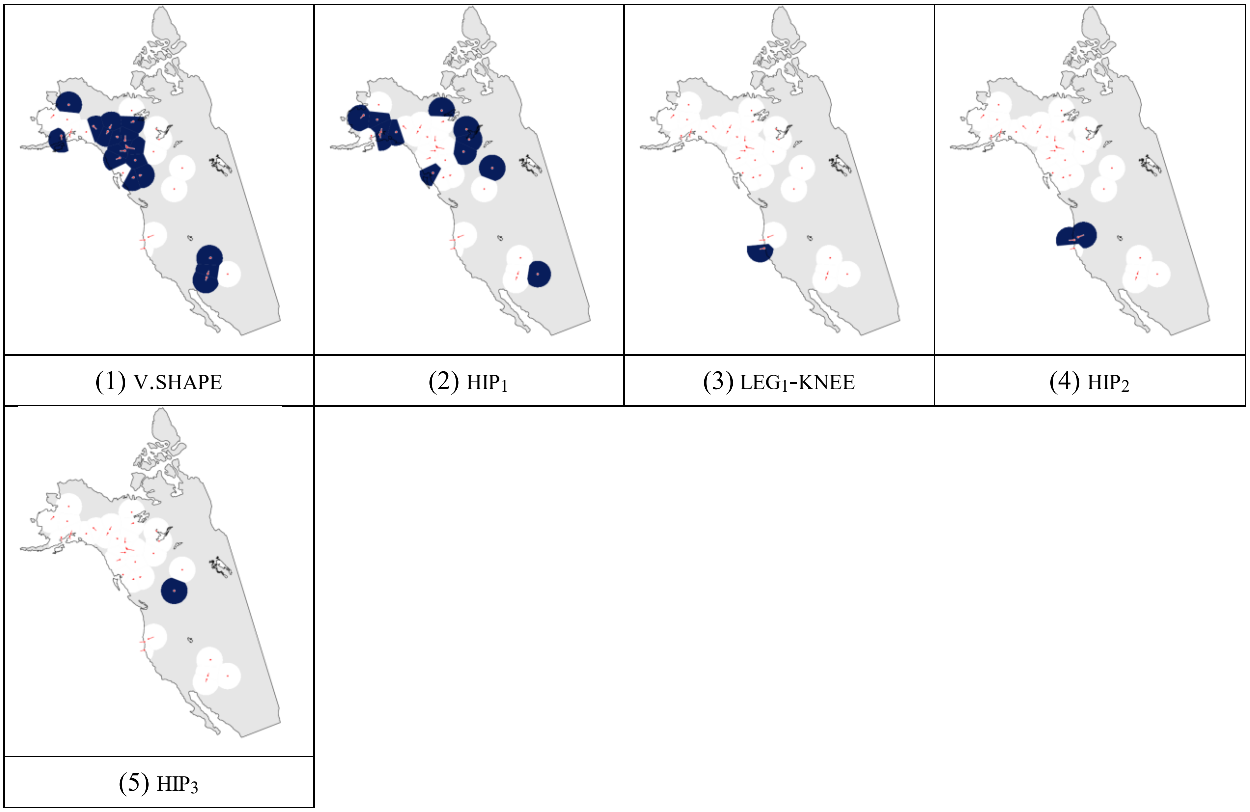


Figure 56. Distributions of terms for 'hip'

3.3.13 Buttocks

There are three patterns in the lexicalization of the referent 'buttocks' among the Athapaskan languages in the sample. This form is also notable since in languages from all major Athapaskan geographical regions, it undergoes semantic extension to express the locational meaning AT.BOTTOM.OF[31]. For example the forms /tɬʼuh/ 'on the bottom', 'rear' and 'after' among the Dena'ina dialects (Kari 2007: 332), /tɬʼɑx/ or /tɬʼɑx/ 'bottom of' in Ahtna (Kari 1990: 358), 'after, following) /tɬʼɑ̃́ɣɛ/ in Dene Sųłiné (Elford and Elford 1998: 363), /tɬʼɑ/ 'the bottom of something' in Hupa (Hoopa Valley Tribe 1996: 78), /tɬʼɑ́/ 'at its bottom' in Mescalero Apache (Breuninger et al. 1982: 26).

(1) BUTTOCKS: The dominant pattern, occurring in 43 of the 45 languages for which data were available, is characterized by a stem-initial ejective alveolar affricate followed by a low front vowel, and occasionally, glottal plosives in stem-final positions.

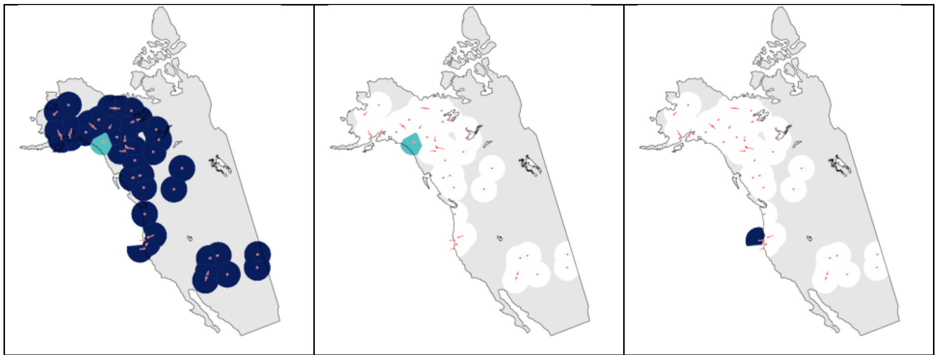
[31] The semantic identifier AT.BOTTOM.OF seems to best describe the majority of glosses found for this term, although other descriptions such as UNDER, AT.REAR.OF and AFTER are also possible.

(2) LEG.LOWER-FLESH: In Southern Tutchone, a second term lexicalizing ‘buttocks’ is available. This form, /ʃə̀-θə̀n/ is composed of the elements LEG.LOWER (see Section 3.4.9) and FLESH (see Section 3.1.2), resulting in: LEG.LOWER-FLESH.

(3) BEHIND: In Tolowa the referent ‘buttocks’ is lexicalized through the postpositional element BEHIND.

Table 44. Buttocks

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		INTERIOR CANADA	Hare	tɬ’a	1
	Koyukon	tɬ’ɒʔ	1		Mountain	tɬ’áʔ	1
	Dena’ina (Iliamna)	tɬ’u	1		Bearlake	tɬ’á	1
	Dena’ina (Inland)	tɬ’u	1		Tłı̨chǫ	tɬ’à	1
	Dena’ina (OCI)	tɬ’u	1		South Slavey	tɬ’ah	1
	Dena’ina (UCI)	tɬ’u	1		Dene Sųłiné	tɬ’á	1
	Ahtna	tɬ’ɑʔ	1		Dene Dháh	tɬ’á	1
	Holikachuk	tɬ’oʔ	1		Beaver	-	
	Gwich’in (Teetl’ıt)	tɬ’eʔ	1	BRITISH COLUMBIA	Carrier	tɬ’ɑ	1
	Gwich’in (Gwıchya)	tɬ’iʔ	1		Witsuwit’en	tɬ’a	1
	Hän	tɬ’ɑ̀ʔ	1		Sekani	tɬ’a̱ʔ	1
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	tɬ’æ	1
	Upper Tanana	tɬ’âːʔ	1	PACIFIC COAST	Hupa	tɬ’aʔ	1
	Tanacross	tɬ’aʔ	1		Galice	-	
YUKON	Northern Tutchone	tɬ’éʔ	1		Kato	tɬ’ɑ	1
	Southern Tutchone	tɬ’ɑ̀ / ʃə̀θə̀n	1/2		Tolowa	t’aʔ	3
	Kaska (DL)	-			Tututni	tɬ’aʔ	1
	Kaska (FL)	tɬ’áʔ	1		Mattole	tɬ’ɑ́ʔ	1
	Kaska (GHL)	tɬ’áʔ	1		Wailaki	-	
	Kaska (L)	tɬ’áʔ	1		Kwa-Clat	-	
	Kaska (LL)	tɬ’áʔ	1	APACHEAN	Navajo	tɬʰaːʔ	1
	Kaska (P)	tɬ’áʔ	1		Western A.	tɬ’aː	1
	Kaska (RR)	tɬ’áʔ	1		S. Carlos A.	tɬ’aːʔ	1
	Tagish	-			Jicarilla A.	tɬ’aː	1
	Tahltan	-			Kiowa A.	tɬ’àː	1
					Mescalero A.	tɬ’aː	1
	Tsuut’ina	tɬ’ò	1		Lipan A.	tɬ’a	1



(1) BUTTOCKS	(2) LEG.LOWER-FLESH	(3) BEHIND

Figure 57. Distributions of terms for 'buttocks'

3.4 Terms for the limbs

This section describes the lexicalization patterns and potential cognate sets found among the terms for the upper and lower limbs and extremities. The terms in this section show evidence of systematic properties. This can be observed when a semantic change for one part of the limb anatomy affects the terms for other functionally or anatomically proximate terms, and is particularly evident in the terms for the upper leg ('thigh') and lower leg.

3.3.1 Arm

The referent 'arm' is predominantly lexicalized through a monomorphemic stem. Only three lexicalization patterns diverge from this general trend

(1) ARM: The referent-concept 'arm' is encoded with a monomorphemic form whose meaning is simply and unanalizably given as ARM. This form is dominated by a cognate set that shares a syllable-initial velar or uvular plosive and a syllable final nasal. In Dene Sųłiné, the initial consonant has become a palatal affricate, while in Witsuwit'en the corresponding segment is a palatal plosive. The Tolowa form /kʷʼaːn/ for 'arm' suggests sound correspondence k = kʷʼ; this pairing needs to be treated with some caution, however, since correspondences between ejectivized and non-ejectivized segments are otherwise absent from among the data in the sample. However, Tolowa also has an ejectivized velar plosive corresponding to velar and uvular plosives in other Athapaskan languages in the terms for 'fingernail' /kʷʼən-juʔ/ (see Section 3.4.7) and 'knee' /kʷʼet/ (see Section 3.3.10).

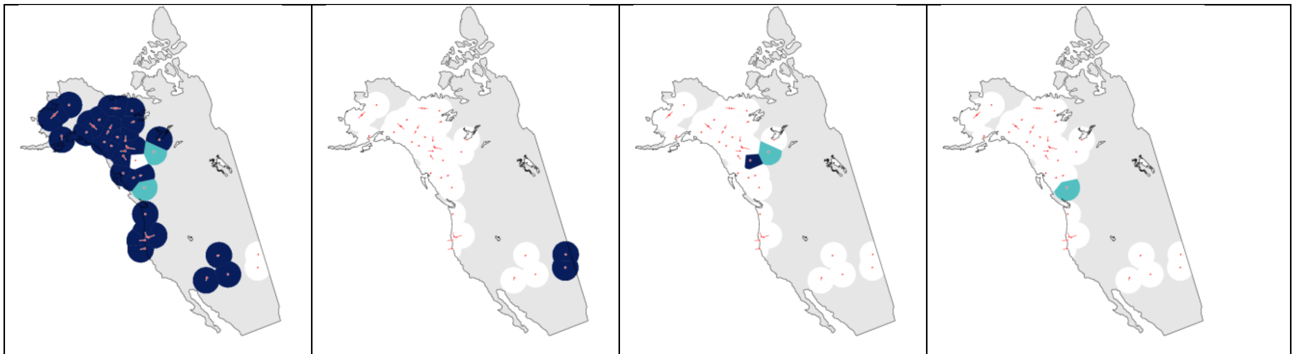
(2) BASE: In Dene Sųłiné and Witsuwit'en, the forms encoding 'arm' are /tʃen/ and /cən/ respectively. These forms are cognate with terms encoding BASE (see discussion in Chapter 4).

(3) HAND: The data on Kwalhioqua-Clatskanie are sparse; the glossing appears to associate the form /laː/ with the meaning 'arm', indicating a polysemy pattern [/laː/ HAND 'hand'] > ℙ > [/laː/ ARM 'arm'].

(4) IT.XTENDS.AWAY: Hupa has re-lexicalized the referent-concept 'arm' in the form /kʲ'aːŋ-ʔaj/ which is glossed as 'it extends away' (Hoopa Valley Tribe 1996: 5). However, reflex of the ARM cognate can still be found in the Hupa term for 'shoulder' which is /qʌn-tʰʌq/ (Hoopa Valley Tribe 1996: 84).

Table 45. Arm

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	qon	1	INTERIOR CANADA	Hare	kón	1
	Koyukon	qɒn	1		Mountain	kón	1
	Dena'ina (Iliamna)	qun	1		Bearlake	kő̃n	1
	Dena'ina (Inland)	-			Tłı̨chǫ	gǒ̃:	1
	Dena'ina (OCI)	-			South Slavey	kő̃	1
	Dena'ina (UCI)	-			Dene Sųłiné	ʧʰẽn	2
	Ahtna	qɑːn	1		Dene Dháh	kón	1
	Holikachuk	-			Beaver	-	
	Gwich'in (Teetl'ıt)	kʲìn	1	BRITISH COLUMBIA	Carrier	kɑn	1
	Gwich'in (Gwıchya)	kʲìn	1		Witsuwit'en	cən	2
	Hän	kàn̥ʔ	1		Sekani	kòn	1
	Lower Tanana	kàn̥ʔ	1		Ts'ets'aut	gáːʔ	1
	Upper Kuskokwim	kàn̥ʔ	1		Chilcotin	gǽn	1
	Upper Tanana	kâːnʔ	1	PACIFIC COAST	Hupa	kʲ'aːŋʔaj	4
	Tanacross	kàn̥ʔ	1		Galice	kɑːn	1
YUKON	Northern Tutchone	káːnʔ	1		Kato	kʷan	1
	Southern Tutchone	kàn	1		Tolowa	kʷ'aːn	1
	Kaska (DL)	kấːn	1		Tututni	kan	1
	Kaska (FL)	kő̃ːn	1		Mattole	kɑ́ːn	1
	Kaska (GHL)	kő̃ːn	1		Wailaki	-	
	Kaska (L)	kő̃ːn	1		Kwa-Clat	kʰaːn / lâ	1/3
	Kaska (LL)	kő̃ːn	1	APACHEAN	Navajo	kaːn	1
	Kaska (P)	kấːn	1		Western A.	kan	1
	Kaska (RR)	kấːn	1		S. Carlos A.	kan	1
	Tagish	kʰàn	1		Jicarilla A.	kə̃n	1
	Tahltan	gʌːn	1		Kiowa A.	kằ:	1
					Mescalero A.	kan	1
	Tsuut'ina	kʰòn	1		Lipan A.	-	



(1) ARM	(2) BASE	(3) HAND	**(4)** IT.XTENDS.AWAY

Figure 58. Distributions of terms for 'arm'

3.3.2 Forearm

The referent 'lower arm' is encoded through eight different patterns, of which the first, FOREARM$_1$, is clearly dominant.

(1) FOREARM$_1$: The most frequent pattern among the lexicalizations of 'forearm' is found in Dena'ina (all dialects), Koyukon, Ahtna, Lower Tanana, Kaska (Lower Liard) and Hupa, where 'lower arm' is encoded through a cognate stem characterized by a syllable-initial ejective alveolar affricate and a lateral approximant in stem-final position, as for example in Dena'ina (Outer Cook Inlet dialect) /ʦ'il/. The cognates in this set exhibit the sound correspondences described in Hoijer's group I.5 (Hoijer 1963), where the stem-initial sounds are identified as reflexes of Proto-Athapaskan *ts'-. This cognate is here identified as the lexicalization pattern FOREARM$_1$.

(2) ARM-BUTTOCKS: In South Slavey, the referent 'forearm' is lexicalized through the compound /kó-tɬ'ah/, semantically ARM-BUTTOCKS. While the etymological meaning /tɬ'ah/ may ultimately reside with the body part, the motivation for its occurrence in this lexicalization pattern is more likely due to some of the polysemic extension that this term has developed, so the more accurate semantic description of this lexicalization pattern would be ARM-AT.BOTTOM.OF. The identifier BUTTOCKS is retained to maintain the link to the etymological root term.

(3) ARM-AREA.UNDER: Mescalero Apache lexicalizes the referent-concept 'forearm' with /kʰans-t'a/, which is made up of the reflex form of ARM$_1$ and the postpositional element UNDER.

(4) FOREARM$_2$: In Dene Dháh the form /kón-é-tθinle/, has the element ARM as a semantic reference point, but combined with unidentified morphemes. It has been designated FOREARM$_2$.

(5) FOREARM$_3$: In Dene Dháh the form /tθien/ also lexicalizes the referent ‘forearm’, a pattern that is found nowhere else in the sample.

(6) FOREARM$_4$: The Navajo form /kãːn-lóːʔ/ contains the element ARM, but with an unidentified suffix.

(7) ARM-MUSCLE: In Upper Tanana the referent ‘forearm’ is lexicalized as ARM-MUSCLE: /kâːnʔ-ʦ’ɯːʔ/. This form co-lexicalizes ‘biceps muscle’, and the stem /ʦ’ɯ̂ː/ occurs in many lexicalizations of muscle-related terms (John 1997: 11, 14, 16).

(8) ARM-NARROW: The Tsuut’ina form /kònàʧʰū jāɣā/ is glossed as the ‘narrow part of my arm’ (Starlight and Donovan 2004: 953).

Table 46. Forearm

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		**INTERIOR CANADA**	Hare	-	
	Koyukon	tɬ’iɬ	1		Mountain	-	
	Dena’ina (Iliamna)	ʦ’il	1		Bearlake	-	
	Dena’ina (Inland)	ʦ’il	1		Tłı̨chǫ	-	
	Dena’ina (OCI)	ʦ’il	1		South Slavey	kótɬ’ah	2
	Dena’ina (UCI)	ʦ’il	1		Dene Sųłiné	-	
	Ahtna	tɬ’iːɬ	1		Dene Dháh	kónétθinle / tθien	4/5
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	-		**BRITISH COLUMBIA**	Carrier	-	
	Gwich’in (Gwıchya)	-			Witsuwit’en	-	
	Hän	-			Sekani	-	
	Lower Tanana	tθ’iɬ	1		Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	kâːnʔʦ’ɯːʔ	7	**PACIFIC COAST**	Hupa	ʦ’eːlʔ	1
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	tθʲ’ánʔ	1		Kato	-	
	Southern Tutchone	tθ’èn	1		Tolowa	-	
	Kaska (DL)	ʦ’ı̋ntɬéʔ	1		Tututni	-	
	Kaska (FL)	ʦ’ı̋ntɬéʔ	1		Mattole	-	
	Kaska (GHL)	ʦ’ı̋ntɬéʔ	1		Wailaki	-	
	Kaska (L)	ʦ’ı̋ntɬéʔ	1		Kwa-Clat	-	
	Kaska (LL)	ʦ’ı̋l	1	**APACHEAN**	Navajo	kaːnlóːʔ, kãːnlóːʔ	6
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	-			S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	-	
					Mescalero A.	kʰanst’a	3
	Tsuut’ina	kònàʧʰū jāɣā	8		Lipan A.		

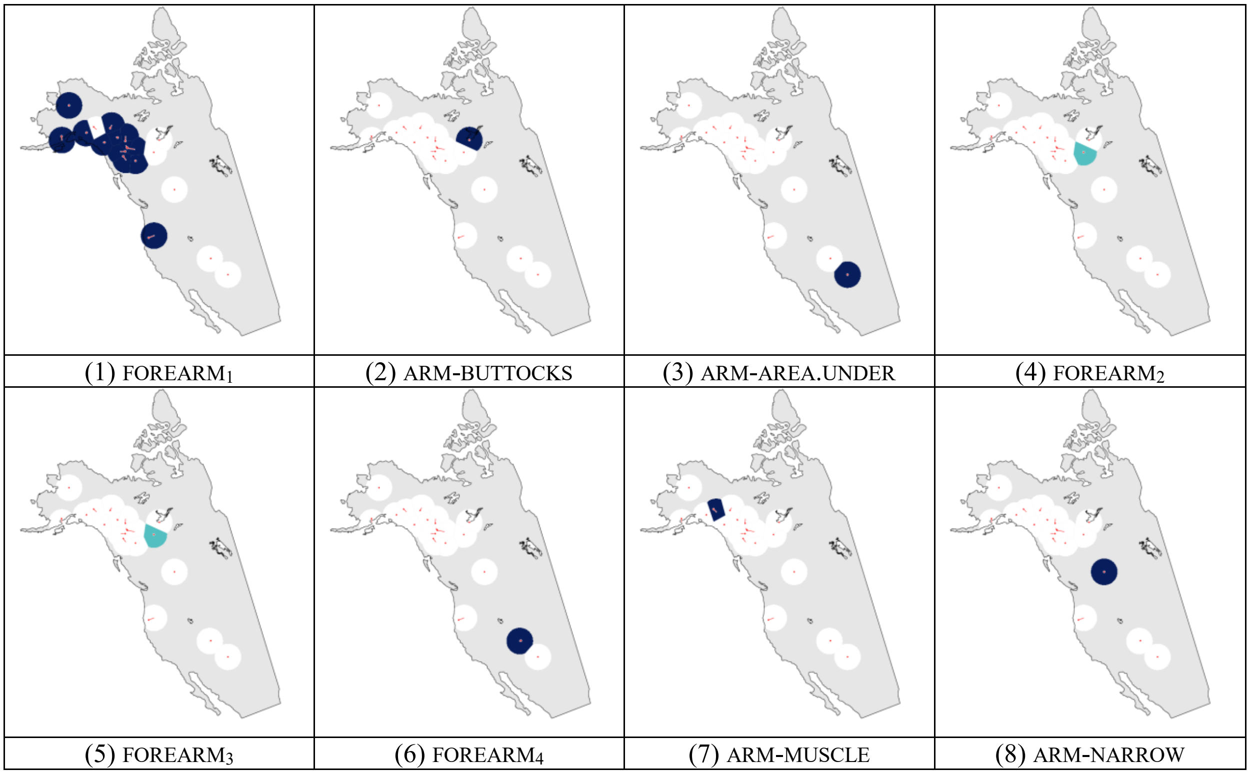


Figure 59. Distributions of terms for 'forearm'

4.3.3 Elbow

There are 11 patterns lexicalizing the referent 'elbow' across Athapaskan languages. There is some overlap among these terms and the terms identified as FOREARM$_1$ (see Section 3.3.2). Furthermore, the cognate designated ELBOW$_1$ (see pattern 1 below), and FOREARM$_1$ are phonologically quite similar. Nonetheless, they are distinct forms as can be clearly seen in Hupa which encodes 'elbow' as /ʧ'ɪʧ'/ and 'forearm' as /ʦ'e:lʔ/.

(1) ELBOW$_1$: The dominant patterns among terms for 'elbow' consists of a monomorphemic stem with an ejectivized affricate in stem-initial position and a fricative, stop, or ejectivized affricate in final position, as for example in Upper Kuskokwim /ʦ'is/. This term is identified as ELBOW$_1$.

(2) FOREARM$_1$: Central Carrier, Tolowa, Tututni and Kiowa Apache, lexicalize 'elbow' through forms cognates with Central Carrier /t̠s̠'il/. This cognate set more commonly occurs in association with the referent 'forearm' and has been identified as FOREARM$_1$ (see Section 4.3.3). For the languages exhibiting the pattern described here, no terms for 'forearm' were listed in the lexicographic sources. Therefore, the association of this cognate and the meaning ‘elbow’ is inferred to have arisen through the semantic change [/t̪s̪’il/ FOREARM ‘forearm’] > § > [/t̪s̪’il/ ELBOW ‘elbow’].

(3) ELBOW$_1$-HAND: This pattern is found only among the Apachean languages Navajo, Jicarilla Apache, and Mescalero Apache. The pattern contains the reflex of ELBOW$_1$ as well as /laː/ or /laːʔ/ which appear to be related to terms denoting ‘hand’, and here likely have an extended meaning, which, however, remains unclear. The pattern, exemplified by Navajo /ʧ’oːʒ-laːʔ/, is identified as ELBOW$_1$-HAND.

(4) KNEE$_1$: In Tłı̨chǫ, Bearlake and Hare, the referent ‘elbow’ is lexicalized through the stem form /go/, /go/, or /gő̃/ respectively. The expressions in Hare and Tłı̨chǫ carry “derivational prefixes” (K.Rice 1989: 167) of uncertain import, but the stem form is clearly shared. These forms are associated with the referent ‘knee’ (see Section 3.3.10). This form-meaning association likely arises through the polysemic extension [/gò/ KNEE ‘knee’] > ℙ > [/gò/ KNEE ‘knee, joint, elbow’].

(5) ARM-MUSCLE: In Upper Tanana, the referent ‘elbow’ (also ‘forearm’) is lexicalized as ARM-MUSCLE: /kâːnʔ-ʦ’ɯːʔ/. This form co-lexicalizes ‘biceps muscle’, and the stem /ʦ’ɯ̂ː/ occurs in many lexicalizations of muscle-related terms (John 1997: 11, 14, 16).

(6) ARM-REVOLVES.ON.ITSELF: In Western Apache, ‘elbow’ is lexicalized through the nature of the movement which it makes possible. The form /ɣan iɬhatit’ãː/ is a morphologically complex form made up of the element HAND and a verb stem identified as REVOLVES.ON.ITSELF in analogy to the form for ‘wrist’ in Dene Sųłiné (see Section 3.4.4, as well as S. Rice Field Notes 2011). This patterns is identified as ARM-REVOLVES.ON.ITSELF

(7) ELBOW$_1$-KNEE$_1$: In Tahltan, the form /ʦ’ɛs-kot/ contains the components ELBOW$_1$ (see pattern 1 above) as well as a reflex of the KNEE$_1$ form (see Section 3.3.10). A likely interpretation of this term is that it denotes ‘elbow joint’ specifically, with the concomitant generalization of the Tahltan KNEE$_1$ reflex to include the referent ‘joint’, but there is no other evidence supporting these hypotheses in the Tahltan data.

(8) ELBOW$_1$-KNEE$_2$: Tsuut’ina lexicalizes ‘elbow’ with a unique pattern /ʦ’ìs-dā-kʰūd/. This pattern contains the elements ELBOW$_1$ and KNEE$_1$, but is otherwise unidentified. The pattern co-lexicalizes ‘knee’ (see Section 3.3.10), but since both patterns are equally opaque no directionality for a polysemic extension could be identified.

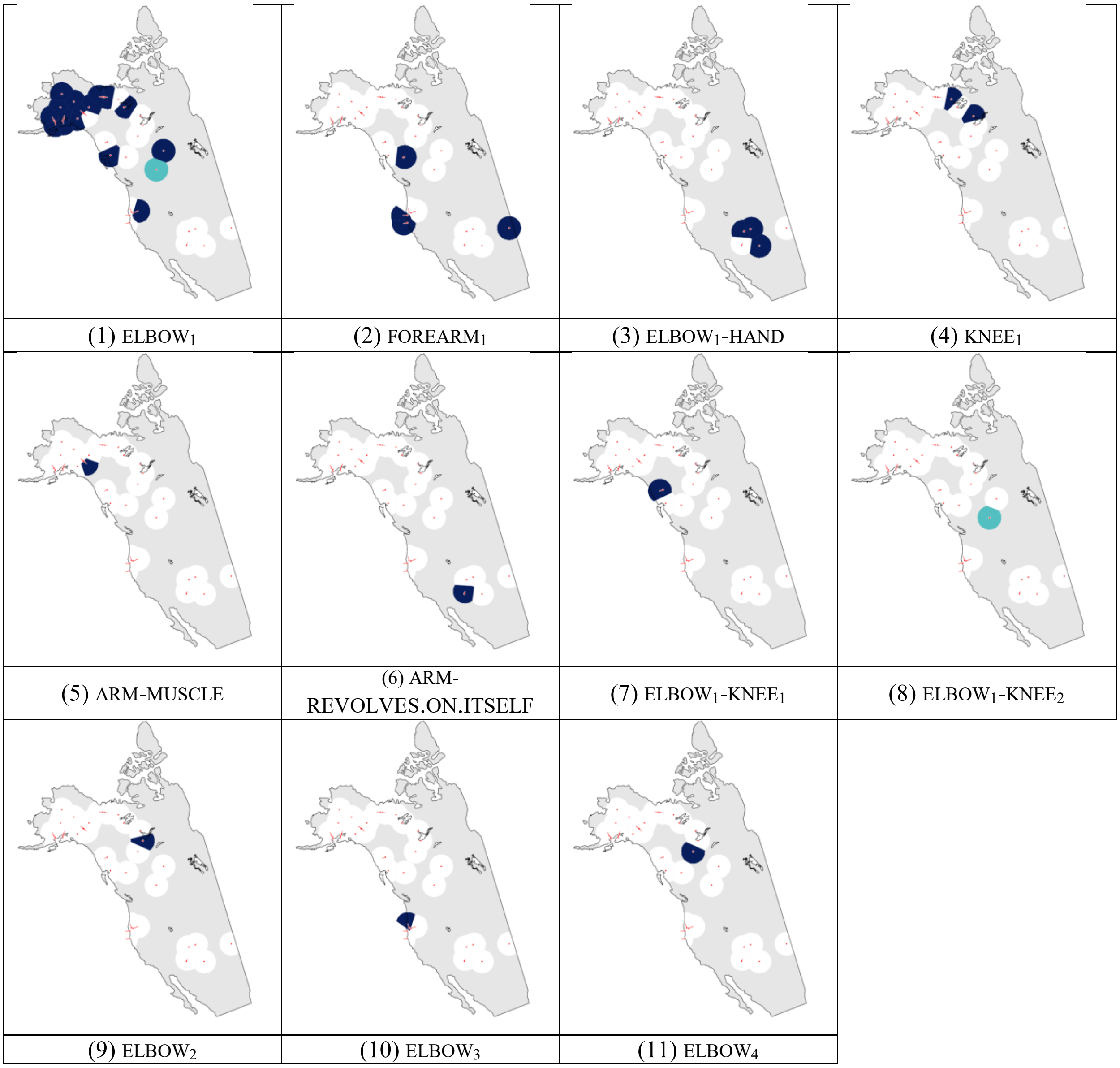
(9) ELBOW$_2$: South Slavey lexicalizes ‘elbow’ with a unique pattern /ʦ’éh-tθ’ẽː/. This pattern contains the element ELBOW$_1$, but is otherwise unidentified. It is designated ELBOW$_2$.

(10) ELBOW$_3$: Galice lexicalizes ‘elbow’ with a unique pattern /kan-ta-wat/. This pattern contains the element ARM$_1$, but is otherwise unidentified. It is designated ELBOW$_3$.

(11) ELBOW$_4$: Dene Dháh lexicalizes ‘elbow’ with a unique pattern /ʦʰoanh-kot/. This pattern contains the element KNEE$_1$, but is otherwise unidentified. It is designated ELBOW$_4$.

Table 47. Elbow

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		INTERIOR CANADA	Hare	jehgőʔ	4
	Koyukon	ʦ’ʊʦ	1		Mountain	-	
	Dena’ina (Iliamna)	ʧ’əʃ	1		Bearlake	kó	4
	Dena’ina (Inland)	ʧ’əʃ	1		Tłįchǫ	ehgo	4
	Dena’ina (OCI)	ʧ’əʃ	1		South Slavey	ʦ’éhtθ’ẽ:	9
	Dena’ina (UCI)	ʧ’əʃ	1		Dene Sųłiné	ʦ’ə́z	
	Ahtna	ʦ’os	1		Dene Dháh	ʦʰoanhkot	11
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	ʦ’òh	1	BRITISH COLUMBIA	Carrier	t̠s̠’il	2
	Gwich’in (Gwıchya)	ʦ’òh	1		Witsuwit’en	-	
	Hän	ʦ’ȍh	1		Sekani	-	
	Lower Tanana	ʦ’es	1		Ts’ets’aut	ʦ’éʔ	1
	Upper Kuskokwim	ʦ’is	1		Chilcotin	-	
	Upper Tanana	kâ:nʔʦ’ɯ:ʔ	5	PACIFIC COAST	Hupa	ʧ’ɪʧ’	
	Tanacross	ʦ’ɛs	1		Galice	kɑntɑwɑt	10
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	ʦ’i:l	2
	Kaska (DL)	-			Tututni	ʦ’il	2
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	ʧ’o:ʒla:ʔ	3
	Kaska (P)	-			Western A.	ɣan iɬhatit’ã:	6
	Kaska (RR)	-			S. Carlos A.	-	
	Tagish	-			Jicarilla A.	ʧ’õ:ʃtɬa:	3
	Tahltan	ʦ’ɛskot	7		Kiowa A.	ʦ’ȉɬ	2
					Mescalero A.	ʧ’û:ʃla:ʔí	3
	Tsuut’ina	ʦ’is / ʦ’ìsdākʰūt	1/8		Lipan A.	-	



(1) ELBOW$_1$ | (2) FOREARM$_1$ | (3) ELBOW$_1$-HAND | (4) KNEE$_1$
(5) ARM-MUSCLE | (6) ARM-REVOLVES.ON.ITSELF | (7) ELBOW$_1$-KNEE$_1$ | (8) ELBOW$_1$-KNEE$_2$
(9) ELBOW$_2$ | (10) ELBOW$_3$ | (11) ELBOW$_4$

Figure 60. Distributions of terms for 'elbow'

3.4.4 Wrist

The referent 'wrist' is lexicalized through nine distinct patterns, all but one of which are represented by morphologically complex forms, predominantly compounds.

(1) HAND-BASE: The most commonly occurring lexicalization pattern for 'wrist' is HAND-BASE, as for example in Bearlake /la-ʧʰin/ (see Section 3.3.5 and the discussion of BASE in Chapter 5). In three languages this lexicalization pattern is supplemented with a further morpheme in final position. In Kiowa Apache this element has the form /tã̀/, in Mescalero Apache /ʃí/, and in Kaska (Ross River) /ki/.

(2) ANATOMICAL-BASE: Three languages lexicalize the referent 'wrist' through the form identified as BASE. However, this form additionally carries a gender prefix marking "anatomical" objects (Jetté and Jones 2000: 460), as for example in Koyukon /nə-kʰən/.

(3) HAND-BONE$_1$: In Tututni and San Carlos Apache the referent 'wrist' is lexicalized through the forms /la-ʦ'ən/ and /lá-ʦ'in/ respectively. These forms encode the pattern HAND-BONE (see Sections 3.3.5 and 3.1.4).

(4) HAND-KNEE$_1$: In Mattole, 'wrist' is lexicalized through the form /laʔ-kʷó:xʷ/. This form is glossed as 'hand-joint', but the phonological shape suggests that its etymology lies with the terms for 'knee' (Section 3.3.10). The pattern of associations giving rise to the configuration of semantic features KNEE/WRIST-JOINT-BONE IS not uncommon in Athapaskan: Bross, for example, notes that 'The wrist is considered to be a bone as well as a joint' (Bross 1971: 9). Therefore, the Mattole form is identified as HAND-KNEE$_1$.

(5) HAND-REVOLVES.ON.ITSELF: In Tanacross and Dene Sų̨łiné the 'wrist' is lexicalized through the nature of the movement which it makes possible. For example, the Dene Sų̨łiné /lá əɬhanarət'a/ is a morphologically complex form made up of the element HAND and a nominalized verb stem glossed as 'revolves around itself' (S. Rice Field Notes 2011). These patterns are identified as HAND-REVOLVES.ON.ITSELF.

(6) BONE$_1$: In Hän, 'wrist' is encoded through a monomorphemic form that also co-lexicalizes BONE. Given the strength of the association of forms cognate with /tθ'ìn̥ʔ/ with the meaning BONE (see Section 3.1.4), this particular meaning-form association found in Hän can be said to have come about as the result of a polysemic extension [/tθ'ìn̥ʔ/ BONE 'bone'] > ℙ > [/tθ'ìn̥ʔ/ WRIST 'bone, wrist'].

(7) HAND-ELBOW: Tolowa lexicalizes 'wrist' with a unique pattern /la:-ʦ'e:l/. This pattern contains the element HAND, in the modifying position of the compound. The stem in the head of the compound is phonologically similar to the term for 'elbow' (see Section 4.3.3). This pattern is therefore identified as HAND-ELBOW. The semantic oddness of this pattern is mitigated if the possibility is considered that /ʦ'e:l/ has undergone polysemic extension: [/ʦ'e:l/ ELBOW 'elbow'] > ℙ > [/ʦ'e:l/ ELBOW 'elbow, joint'].

(8) WRIST$_1$: Among the two Gwich'in dialects, the referent-concept 'wrist' is lexicalized through a monomorphemic stem not found among other Athapaskan languages. This form, /ʧʲ'à:ʔ/ has therefore been assigned the semantic value WRIST$_1$.

(9) BONE-KNEE: Northern Tutchone lexicalizes ‘wrist’ with a unique pattern /ʦ’án-kʷát/. This pattern contains the element KNEE, whose occurrence is probably motivated through an extended meaning of [/kʷát/ KNEE, JOINT]. This pattern is unique to Northern Tutchone and is identified as BONE-KNEE.

Table 48. Wrist

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	an̥ʧʰin	2	INTERIOR CANADA	Hare	laʃén	1
	Koyukon	nəkʰən	2		Mountain	laʧʰin	1
	Dena’ina (Iliamna)	lukʰən	1		Bearlake	laʧʰin	1
	Dena’ina (Inland)	-			Tłı̨chǫ	laʧĩ̀ː	1
	Dena’ina (OCI)	-			South Slavey	laʧʰĩē	1
	Dena’ina (UCI)	-			Dene Sų̨łiné	lá əɬhanarət’a	5
	Ahtna	nɪkʰən	2		Dene Dháh	laʧʰin	1
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	ʧʲ’àːʔ	8	BRITISH COLUMBIA	Carrier	lɑʧʌnoh	1
	Gwich’in (Gwıchya)	ʧʲ’àːʔ	8		Witsuwit’en	-	
	Hän	tθ’in̥ʔ	6		Sekani	lāʧʰèʔ	1
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	lǽʧɛn	1
	Upper Tanana	laːʧʰìnʔ		PACIFIC COAST	Hupa	laʔkɪnʔ	1
	Tanacross	ɬaːʔ ɣaːtɛtʔaːteh	5		Galice	-	
YUKON	Northern Tutchone	ʦ’ánkʷátʰ	9		Kato	-	
	Southern Tutchone	lɑʃən	1		Tolowa	laːʦ’eːl	7
	Kaska (DL)	-			Tututni	laʦ’ən	3
	Kaska (FL)	la:ʧʰen	1		Mattole	laʔkʷóːxʷɛʔ	4
	Kaska (GHL)	la:ʧʰen	1		Wailaki	-	
	Kaska (L)	la:ʧʰen	1		Kwa-Clat	-	
	Kaska (LL)	la:ʧʰen	1	APACHEAN	Navajo	láʦʰíːn	1
	Kaska (P)	-			Western A.	láʦʰin	1
	Kaska (RR)	la:ʧʰĩki	1		S. Carlos A.	láʦ’in	3
	Tagish	-			Jicarilla A.	lə̃ʦʰin	1
	Tahltan	lɑʧʰin	1		Kiowa A.	làːhʧĩ́ːtə̃̀ʔ	1
					Mescalero A.		
	Tsuut’ina	lóʧʰīn	1		Lipan A.	-	

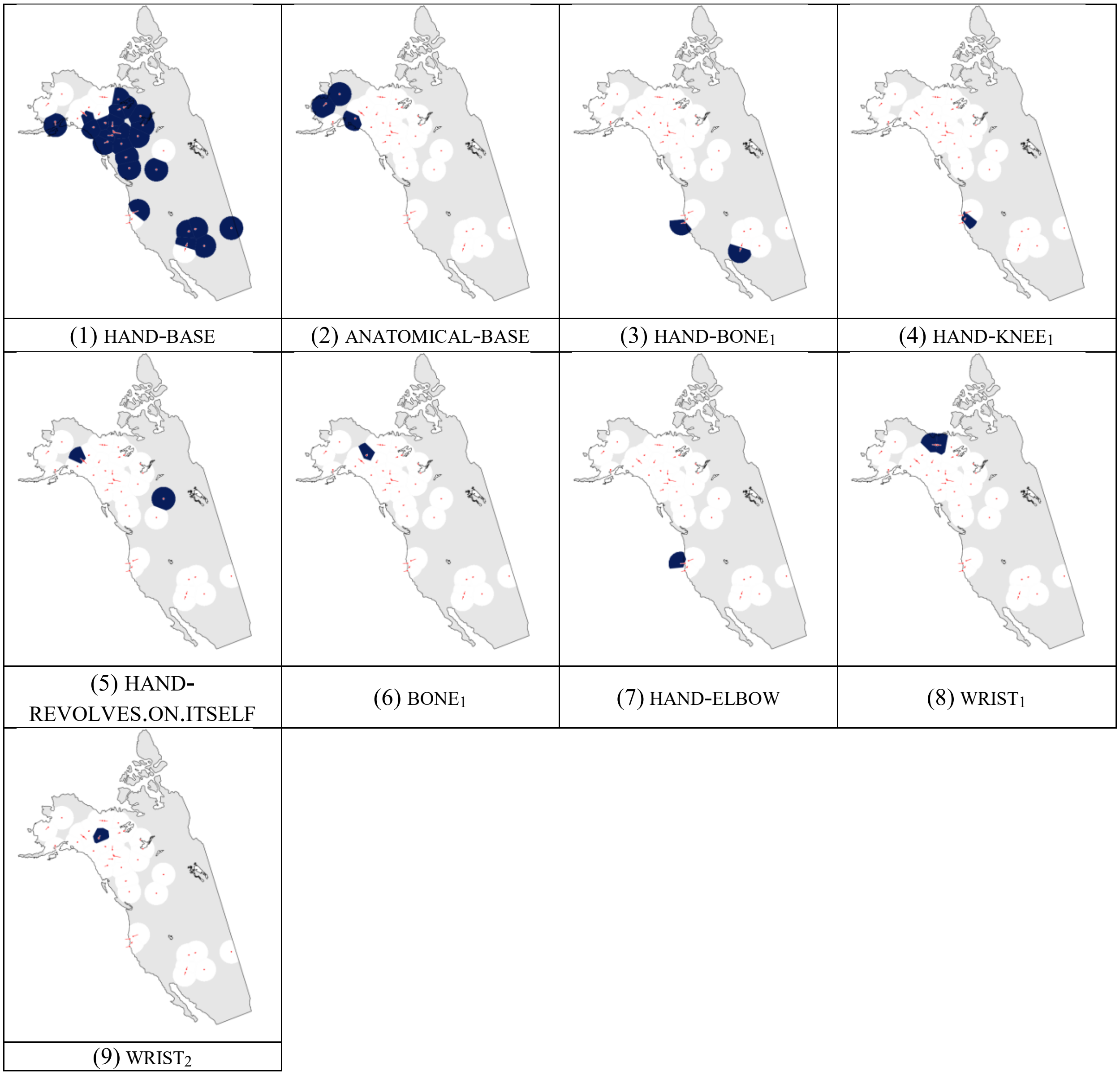


Figure 61. Distributions of terms for 'wrists'

3.3.5 Hand

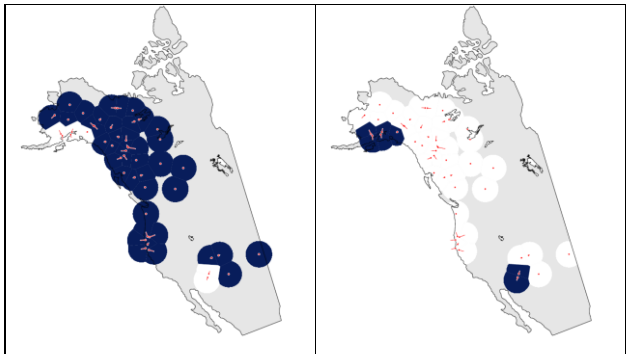
The terms for 'hand' are almost uniformly cognate across the language family, with the only exceptions coming about as a result of polysemic extension among Dena'ina dialects and two Apachean languages.

(1) HAND: The dominant lexicalization pattern is constituted by a monomorphemic stem characterized by stem-initial lateral approximant followed by a low vowel, as for example in Deg Xinag /loʔ/. Upper Tanana offers an exception to this pattern, having the syllable onset formed by a voiceless lateral approximant instead.

(2) ARM: Among all the dialects of the Alaskan language Dena'ina takes for its term for 'hand', the same form as it does for 'arm' /qun/ (see Section 3.3.1). Given the widespread occurrence of the cognate term for HAND as well as the cognate forms for ARM (see Section 3.3.1) it can be surmised that the Dena'ina terms arisen through a pattern of polysemic extension whereby the ARM term has come to denote HAND as well: [/kan/ ARM 'arm'] > ℙ > [/kan/ HAND 'hand']. A similar pattern can be observed for San Carlos and Western Apache, in contrast to the other Apachean languages which exhibit the more common cognate HAND: Jicarilla Apache /là:h/, Kiowa Apache /la:/, Navajo /laʔ/, and Mescalero Apache /lɑ/.

Table 49. Hand

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	loʔ	1	INTERIOR CANADA	Hare	láʔ	1
	Koyukon	lɒʔ	1		Mountain	láʔ	1
	Dena'ina (Iliamna)	qun	2		Bearlake	lá	1
	Dena'ina (Inland)	qun	2		Tłįchǫ	là	1
	Dena'ina (OCI)	qun	2		South Slavey	la	1
	Dena'ina (UCI)	qun	2		Dene Sųłiné	la	1
	Ahtna	lɑʔ	1		Dene Dháh	la	1
	Holikachuk	lèʔ	1		Beaver	la	1
	Gwich'in (Teetl'ıt)	lèʔ	1	BRITISH COLUMBIA	Carrier	lɑ	1
	Gwich'in (Gwıchya)	làʔ	1		Witsuwit'en	le	1
	Hän	loʔ	1		Sekani	làʔ	1
	Lower Tanana	laʔ	1		Ts'ets'aut	ɬa	1
	Upper Kuskokwim	loʔ	1		Chilcotin	lǽ	1
	Upper Tanana	ɬaʔ	1	PACIFIC COAST	Hupa	laʔ	1
	Tanacross	loʔ	1		Galice	lɑʔ	1
YUKON	Northern Tutchone	léʔ	1		Kato	laʔ	1
	Southern Tutchone	là	1		Tolowa	laʔ	1
	Kaska (DL)	láʔ	1		Tututni	lɑʔ	1
	Kaska (FL)	láʔ	1		Mattole	lɑʔ	1
	Kaska (GHL)	láʔ	1		Wailaki	la	1
	Kaska (L)	láʔ	1		Kwa-Clat	laʔ	1
	Kaska (LL)	láʔ	1	APACHEAN	Navajo	kan	2
	Kaska (P)	láʔ	1		Western A.	kan	2
	Kaska (RR)	láʔ	1		S. Carlos A.	la	1
	Tagish	lá	1		Jicarilla A.	lə	1
	Tahltan	lɑʔ	1		Kiowa A.	là:h	1
					Mescalero A.	lɑ:	1
	Tsuut'ina	lo	1		Lipan A.	-	



(1) HAND	(2) ARM

Figure 62. Distributions of terms for ‘hand’

3.4.6 Finger

There are 13 different lexicalization patterns used to encode the referent-concept ‘finger’ in Athapaskan languages. With the exception of the pattern found in Ts’ets’aut, they are all formed on the basis of the semantic element HAND.

(1) HAND: In 11 languages, the referent-concept ‘finger’ is lexicalized with the same morpheme that also encodes HAND, without further morphological modification. Since the distribution of the terms for HAND is far more homogenous, these languages are analyzed as exhibiting a polysemy patterns parallel to Sekani: [/là/ HAND ‘hand’] > ℙ > [/là/ FINGER ‘hand, finger’]. This lexicalization pattern is absent from Alaska, but is found among the Kaska dialects, Sekani and Chilcotin, as well as more frequently among the Apachean languages and on the Pacific Coast.

(2) ARCH: The second most frequent pattern combines the semantic element HAND with a form characterized by a stem-initial ejective affricate and syllable-final velar fricative or plosive, as for example in Hän /lə-tθ’òʔ/. This form is exemplified by Koyukon /tɬ’əx/ where is glossed simply as ‘finger’ (Jetté and Jones 2000: 598, and where it is one of two forms[32]. In Koyukon the same form also occurs as a verb stem with the meaning ‘to accumulate, heap up’, as well as part of the word *tl’ekk’aadeeltone* glossed as ‘curved knife, wood-carving knife with curved blade’. These seemingly disparate terms are united by the shared reference to objects exhibiting a curved or arched shape. The fingers too, in a relaxed position, are not straight but slightly arched. Further evidence that /tɬ’əx/ has the semantic value ARCH comes from Ahtna /ts’əx/ which is glossed as ‘concave’ and which occurs in terms for ‘arch of the foot’, as well as ‘armpit’ (Kari 1990: 402). This form also occurs in terms for ‘toe’ (see Section 3.3.15), but describing these

[32] Further terms for finger can be found as incorporated forms, and for more specific fingers, see Jetté and Jones 2000: 906).

senses as DIGIT, a seemingly equally good alternative, fails to capture the wider pattern that this morpheme encodes, at its core, a shape-based idea. The stem-initial sounds in these terms form Ahtna and Koyukon correspond to Hoijer's (1963) group I.4 reconstructed as Proto-Athapaskan *ts'-.

(3) HAND-ARCH: In Hän, the sound corresponding to PA *ts'- is tθ'- which occurs in the form /lə-tθ'òʔ/ mentioned above. This form can now be analyzed as expressing the lexicalization pattern HAND-ARCH, which also occurs in Gwich'in (Teetl'ıt), Upper Tanana, Tanacross, Northern Tutchone, Southern Tutchone, Tahltan, and Dene Sųłiné.

(4) HAND-BONE: The lexicalization pattern HAND-BONE, exemplified by Bearlake /la-w'én/ (see Sections 3.3.5 and 3.1.4 respectively) is found exclusively in the languages of the Canadian interior: Hare, Tłįchǫ, South Slavey and Dene Dháh.

(5) ARM: In Western Apache, the form /kan/ identified as ARM (see Section 3.3.1), has undergone polysemic extension to also denote 'finger': [/kan/ ARM 'arm'] > ℙ > [/kan/ ARM 'ARM, finger']. This polysemic extension has likely passed through an intermediary stage in which /kan/ referred to 'hand', as described in Section 3.3.5. Therefore, a better representation of the polysemy pattern would be [/kan/ ARM 'arm'] > ℙ > [/kan/ ARM 'arm, hand, finger'], with the order of the three referents representing successive stages in an extending polysemy pattern: 'arm' > 'hand' > 'finger'.

(6) HAND-DRY: Western Apache is recorded as lexicalizing the referent 'finger' through a second pattern /la-kan/. This form co-lexicalizes the referent 'fingernail', representing an instance of the most widespread lexicalization of 'fingernail' among the Athapaskan languages in the sample. This pattern is identified as HAND-DRY in Section 3.4.7. This implies that the lexicalization of the referent 'finger' has arisen through a polysemic extension [/la-kan/ HAND-DRY 'fingernail'] > ℙ > [/la-kan/ HAND-DRY 'fingernail, finger'], which is unique to Western Apache.

(7) HAND-PHALANGE$_1$: In Koyukon, the referent 'The middle three fingers, exclusive of the little finger' is lexicalized by two similar forms /ən-lo-ʁʊɬ/ and /ən-lo-ʁak/ (Jetté and Jones 2000: 261, 264). These morphologically complex forms are composed of a gender-marking prefix (cf. Jetté and Jones 2000: 460), the form expressing HAND (see Section 3.3.5), and a stem. In the case of /ən-lo-ʁak/ the stem form is glossed as 'parallel bones'. Already Jetté suspected an etymological link with /ʁuʔ/ 'teeth' (Jetté and Jones 2000: 261). This connection is equally possible for the stem in /ən-lo-ʁʊɬ/. The contrast in final sounds is therefore treated as a variation without semantic consequences here. Both forms are treated as expressing the same lexicalization pattern, which, following the western anatomical designation for this body part, has been designated HAND-PHALANGES$_1$. The form /ən-lo-ʁʊɬ/ has a cognation Ross River Kaska /la:-ɣol/, while a form related to /ən-lo-ʁak/ can be observed in Deg Xinag /lo-ɣek/. A further variation on this pattern can be seen in the Liard and Lower Liard Kaska forms /la-s-ɣõʥ/ and /la:-s-ɣoʥ/. All these patterns are also analyzed as HAND-PHALANGES$_1$.

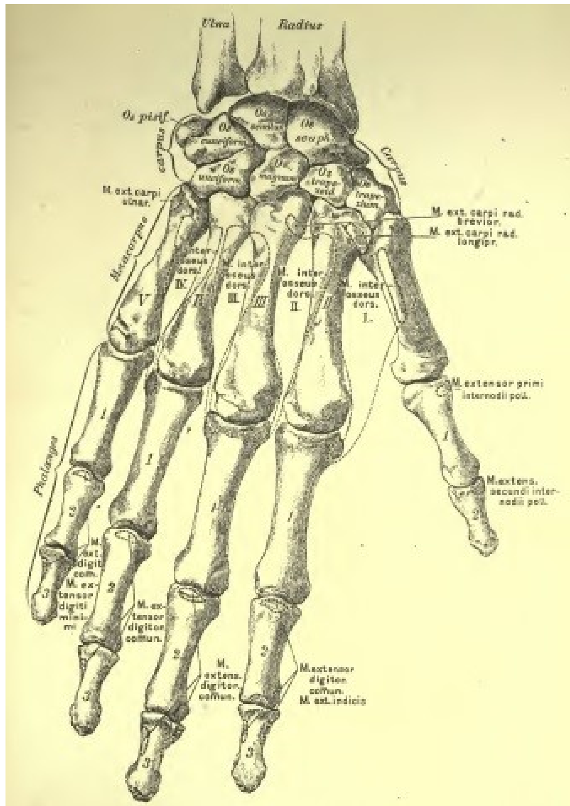


Figure 63. Bones of the right hand (Heitzmann 1877: 107)

(8) HAND-PHALANGE$_2$: A pattern very similar to the one described as HAND-PHALANGES$_1$ is found in Ahtna. The Ahtna form /lɑ-ʦ'ɪ-ʁos/ contains the elements HAND and PHALANGES, but additionally features the morpheme /ʦ'ɪ/. The exact meaning of this form could not be identified, but it is possibly related to the ARCH elements described above. This pattern, identified as HAND-PHALANGE$_2$, is unique to Ahtna.

(9) HAND-IT.IS.SMALL: In Galice Athapaskan, the referent 'finger' is lexicalized through the form /lɑʔ-ɪst'ɑmʔ/, which contains the stem form for HAND and the deverbal element 'it is small, little' (Hoijer 1973: 66). The lexicalization pattern is identified as HAND-IT.IS.SMALL.

(10) HAND-DIGIT$_1$: In Dena'ina (Iliamna, Outer Cook Inlet, and Upper Cook Inlet dialects) and Tagish the referent-concept 'finger' is lexicalized through the combination of the HAND element with an unidentified term which takes one of three forms: either /lu-ʧuk'/ or /lu-ʧək/ around the Cook Inlet and /lá-ʃ-ʧə́k/ in Tagish. This pattern is identified as HAND-DIGIT$_1$.

(11) HAND-DIGIT$_2$: The Outer Cook Inlet and Iliamna dialects of Dena'ina share a further lexicalization pattern for the referent 'finger', with the Pacific Coast languages Tolowa and Tututni. This pattern, exemplified by Tututni /la-sək’/, combines the element HAND with an unidentified, but likely cognate stem. The pattern is designated HAND-DIGIT$_2$.

(12) HAND-DIGIT$_3$: Central Carrier lexicalizes ‘finger’ through the unique form /la-s-ka/. This pattern includes the element HAND, and may be related to the HAND-DRY forms described above (pattern 6). However, the exact relationship between these stems remains unclear and the pattern is identified simply as HAND-DIGIT$_3$.

(13) FINGER$_1$: Ts’ets’aut lexicalizes ‘finger’ through the unique form /ne:ɬʦ’a’ə/, identified only as FINGER$_1$.

Table 50. Finger

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	loɣek	7	INTERIOR CANADA	Hare	law’én	4
	Koyukon	tɬ’əx / ənloʁʊl, ənloʁak	2/7		Mountain	láʔ	1
	Dena’ina (Iliamna)	luʧek / luʒəh	10/11		Bearlake	lakʷ’en	4
	Dena’ina (Inland)	-			Tłı̨chǫ	lakʷ’õ:	4
	Dena’ina (OCI)	luʧuk’ / luʒəh	10/11		South Slavey	latθ’en	4
	Dena’ina (UCI)	luʧək	10		Dene Sųłiné	latθ’aɬ	3
	Ahtna	lɑʦ’ɪʁos	8		Dene Dháh	la:tθ’en	4
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	le:tθ’ak	3	BRITISH COLUMBIA	Carrier	lɑska	12
	Gwich’in (Gwıchya)	-			Witsuwit’en	-	
	Hän	lətθ’òʔ	3		Sekani	là	1
	Lower Tanana	loʦ’iɬ, loʦ’uɬ	3		Ts’ets’aut	ne:ɬʦ’a’ə	13
	Upper Kuskokwim	loʦ’el	3		Chilcotin	lǽ	1
	Upper Tanana	la:ʦ’ô:ʔ	3	PACIFIC COAST	Hupa	laʔ	1
	Tanacross	tɬa:ʦ’oɣ	3		Galice	lɑʔɪst’ɑmʔ	9
YUKON	Northern Tutchone	lɑtθ’óʔ	3		Kato	-	
	Southern Tutchone	lɑtθ’əw	3		Tolowa	la:sak’	11
	Kaska (DL)	-			Tututni	lasək’	11
	Kaska (FL)	láʔ	1		Mattole	lɑʔ	1
	Kaska (GHL)	láʔ	1		Wailaki	-	
	Kaska (L)	lasɣõʦ	7		Kwa-Clat	láχ	1
	Kaska (LL)	la:sɣoʦ	7	APACHEAN	Navajo	laʔ	1
	Kaska (P)	-			Western A.	lakan / kan	6/5
	Kaska (RR)	la:ɣol	7		S. Carlos A.	-	
	Tagish	láʃʧək	10		Jicarilla A.	-	
	Tahltan	lɑtθ’ɛk	4		Kiowa A.	-	
					Mescalero A.	la:	1
	Tsuut’ina	lò	1		Lipan A.	-	

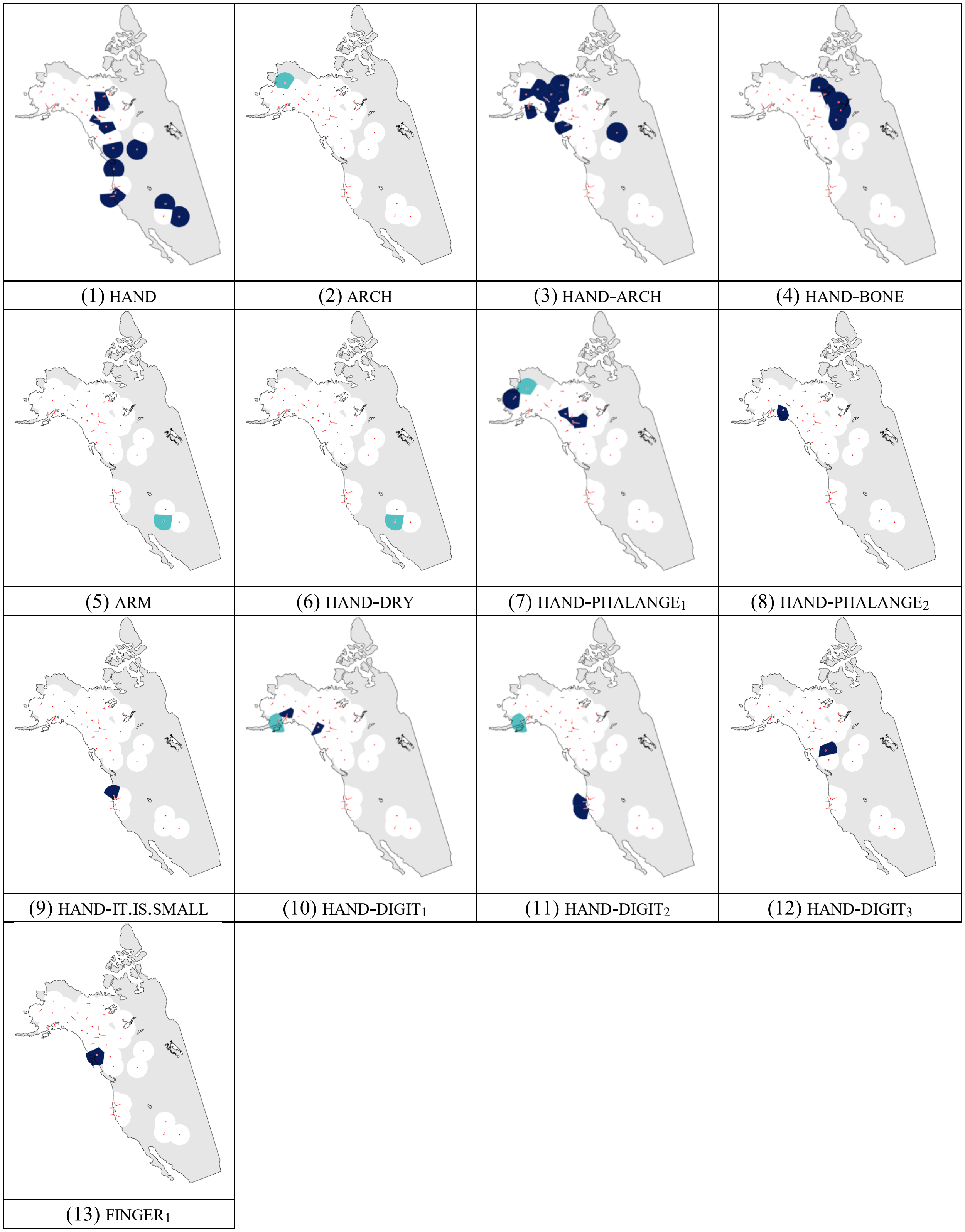


Figure 64. Distributions of terms for 'finger'

3.4.7 Fingernail

There are seven patterns that lexicalize ‘fingernail’ across the Athapaskan languages, but the distribution of variant patterns is limited to specific geographical areas.

(1) HAND-DRY: The predominant pattern among the terms for ‘fingernail’ is constituted by the semantic elements HAND and DRY. This analysis[33] for the term /qiŋ/ or /gãĩ:/ and their cognates as meaning DRY is supported by the considerations of the term ‘dry meat’. In Gwich’in this term is /nili: gãĩ:/ (Firth 2005: 152) and in Deg Xinag /nelaŋ qiŋ/ (Kari 1978: 80). Cognates of terms encoding the semantic feature DRY can be found for many Athapaskan languages.

(2) ANATOMICAL-HAND-DRY: Koyukon also exhibits the pattern designated HAND-DRY, but the form expressing it additionally carries a gender-marking prefix: /ən-lɒ-qʊn/ (see Jetté and Jones 2000: xciii). Therefore, this lexicalization pattern is designated: ANATOMICAL-HAND-DRY.

(3) HAND-NAIL: Mattole, Hupa, and Kiowa Apache share a lexicalization pattern identified as HAND-NAIL following the glossing in the lexicographic sources (Hoopa Valley Tribe 1996: 35; Bross 1971: 10). The pattern is exemplified by Hupa /laʔ-kʰeʔʦ’/.

(4) HAND-FINGERNAIL$_1$: Tututni shares the geographically restricted form /gʷən-juʔ/, but it is found as part of a compound with HAND as the first element resulting in the pattern HAND-FINGERNAIL:/la-gʷən-juʔ/.

(5) FINGERNAIL$_1$: The Pacific Coast languages, Galice and Tolowa, lexicalize ‘fingernail’ through two phonologically similar forms that are here analyzed as lexicalizing the same semantic pattern designated fingernail1. Treating the Galice form /kɑn-juʔ/ and the Tolowa form /kʷ’ən-juʔ/ as cognates implies the otherwise unattested sound correspondence k = k^{w}’; correspondences between ejectivized and non-ejectivized segments are absent from among the data in the sample (see also Section 3.3.1 ‘Arm’). However, Tolowa has an ejectivized velar plosive corresponding to velar and uvular plosives in other Athapaskan languages also in the terms for ‘arm’ /kʷ’a:n/ and ‘knee’ /kʷ’et/. Furthermore, the unusual morpheme /juʔ/ following the stem in these lexicalizations creates a pattern found only among three, geographically close languages (also see the discussion of the Tututni term below) makes it seem probable that these patterns are in fact related.

(6) FINGERNAIL$_2$: The form /xoaisultsúl/ is found uniquely in Kwalhioqua-Clatskanie, and remains unanalyzed, designated only as FINGERNAIL$_2$.

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[33] Identified by Sally Rice.

(7) FINGERNAIL$_3$: Ts'ets'aut encodes the referent-concept 'fingernail' with the term /nelgo'n/, which appears to contain a reflex of the cognate element DRY, but given the scarcity of data on this language, the analysis remains uncertain, and the pattern is simply designated as FINGERNAIL$_3$.

Table 51. Fingernail

	Language	**BEET**	#		**Language**	**BEET**	#
ALASKAN	Deg Xinag	liqiŋ	1	**INTERIOR CANADA**	Hare	lakón	1
	Koyukon	ənlɒqʊn	1		Mountain	lakon	1
	Dena'ina (Iliamna)	luqən	1		Bearlake	lakon	1
	Dena'ina (Inland)	luqən	1		Tłı̨chǫ	lagõ:	1
	Dena'ina (OCI)	luqən	1		South Slavey	lā̃kõ̋n	1
	Dena'ina (UCI)	luqən	1		Dene Sųłiné	lakan	1
	Ahtna	lɑqɑn	1		Dene Dháh	la:kon	1
	Holikachuk	-			Beaver	lagon	1
	Gwich'in (Teetl'ıt)	le:gãĩ:ʔ	1	**BRITISH COLUMBIA**	Carrier	lɑki	1
	Gwich'in (Gwıchya)	le:gãĩ:ʔ	1		Witsuwit'en	leqi	1
	Hän	ləkɑ̨̀j̊ʔ	1		Sekani	lākȍʔ	1
	Lower Tanana	-			Ts'ets'aut	nelgo'n	6
	Upper Kuskokwim	logʷnaʔ	1		Chilcotin	-	
	Upper Tanana	la:kɑ̂̃jʔ	1	**PACIFIC COAST**	Hupa	laʔkʰeʔʦ'	3
	Tanacross	la:kɛ̃ĩʔ	1		Galice	kɑnjuʔ	4
YUKON	Northern Tutchone	lɑkánʔ	1		Kato	-	
	Southern Tutchone	lɑkən	1		Tolowa	kʷ'ənjuʔ	4
	Kaska (DL)	la:kan	1		Tututni	lagʷənjuʔ	2
	Kaska (FL)	la:kan	1		Mattole	lɑʔʧɛ́ʔs	3
	Kaska (GHL)	la:kon	1		Wailaki	-	
	Kaska (L)	la:kon	1		Kwa-Clat	xoaisultsúl	5
	Kaska (LL)	la:kon	1	**APACHEAN**	Navajo	láʃka:n	1
	Kaska (P)	la:kon	1		Western A.	lakan	1
	Kaska (RR)	la:kǫ̂ʔ	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	lə̃ʃkə̃n	1
	Tahltan	lɑkɑn	1		Kiowa A.	là:ʃkə̃̀:ʃ	3
					Mescalero A.	la:ʃkan	1
	Tsuut'ina	lakʰon	1		Lipan Apache	laʃkʰa	1

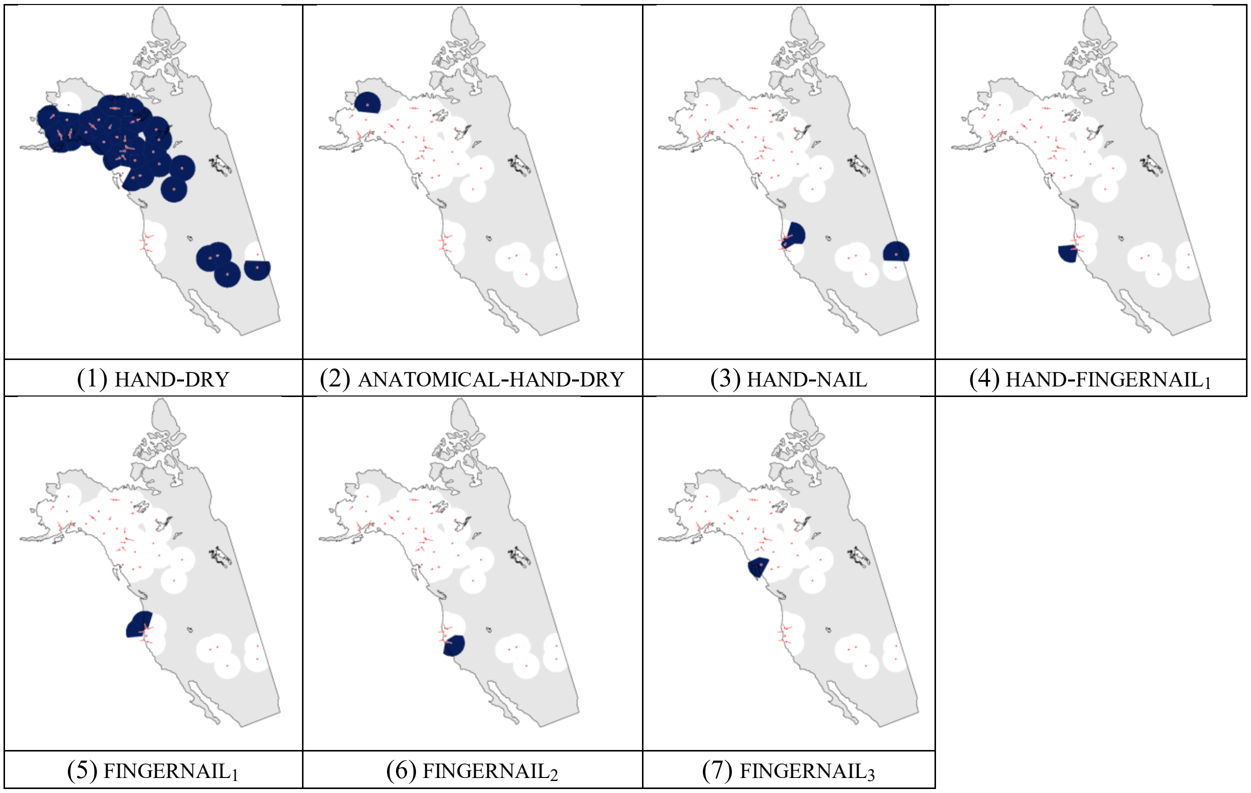


Figure 65. Distributions of terms for 'fingernail'

3.4.8 Thigh

There are 13 patterns lexicalizing the referent 'thigh'. The thigh forms part of the larger structure lexical semantic and referent-conceptual of the leg, as evidenced by the patterns of semantic shift described in this section and in Section 3.4.9.

(1) UPPER.LEG: The most common pattern is represented by a monomorphemic cognate set with a stem-initial consonant that is typically a velar fricative, and a stem-final glottal, palatal or dental fricative, as exemplified by the Deg Xinag form /ɣuθ/. The stem-initial fricative has the predictable corresponding sounds: /w/, /r/ or /r/. This form has been glossed as UPPER.LEG, since it contrast with two other forms that all serve to denote the long parts of the lower limb each of which has been identified with the meaning BONE and LEG.LOWER. Consequently cognates of /ɣuθ/ have been identified with the semantic value LEG.UPPER. The form also occurs with the denotation 'leg' in some languages (Tanacross, Liard Kaska, and Tsuut'ina), but since the association with 'thigh (or 'upper leg')' is far more frequent it has been taken as the core meaning; Tanacross /ɣolʔ/, Tsuut'ina /wus/, and Kaska (Liard) /ɣos/ have therefore arisen through a semantic change [{/ɣos/, /wūs/, /ɣʷos/} UPPER.LEG 'thigh'] > § > [{/ɣos/, /wūs/, /ɣʷos/} LEG 'leg'].

(2) UPPER.LEG-BIG: In three languages, Kaska (Liard), Tsuut'ina and Sekani, the referent-concept 'thigh' is lexicalized through the pattern UPPER.LEG-BIG, where the latter semantic component is expressed through the qualifying element /ʧʰoː/ or its cognates. These forms, such as Kaska /ɣosʧʰoː/, appear to combine the form glossed as UPPER.LEG with the modifier BIG, while denoting the same referent-concept that many other Athapaskan languages express through UPPER.LEG-forms alone. The necessity of adding the modifier big to the form meaning UPPER.LEG most likely arose through the loss of the association of UPPER.LEG-cognates with the referent-concept 'thigh': The three languages that lexicalize 'thigh' through the pattern UPPER.LEG-BIG, have undergone a semantic change [{/ɣos/, /wūs/, /ɣʷos/} UPPER.LEG 'thigh'] > § > [{/ɣos/, /wūs/, /ɣʷos/} LEG 'leg']. A similar semantic change also appears to have occurred in Tanacross (see Section 3.4.9), but no form for the referent-concept 'thigh' was recorded in the lexicographic sources. In Sekani, the form /ɣʷos/ UPPER.LEG, no longer exists independently, and the referent-concept 'leg' is encoded by BONE (see Sections 3.1.1 and 3.3.10). This may indicate the shift [/ɣʷos/ UPPER.LEG 'thigh'] > § > [/ɣʷos/ LEG 'leg'] occurred prior to the shift [/ʦ'ầʔ/ BONE 'bone'] > ℙ > [/ʦ'ầʔ/ LEG 'leg']. In Kaska (Liard), both the form /ɣos/, the monomorphemic cognate, and /ɣos-tʃow/ the morphologically complex form are recorded for 'thigh'.

(3) UPPER.LEG-BASE: Ahtna and Dena'ina (Iliamna) lexicalize 'thigh' through the forms /ʁos-kʰən/ and /ʁəs-kʰən/ respectively. The first element in these compounds corresponds to the morphemes already identified as UPPER.LEG (see above), while the second represents the element BASE. Hence, these forms share a lexicalization pattern: UPPER.LEG-BASE.

(4) BASE: Upper Tanana also makes use of the notion BASE in lexicalizing the referent-concept 'thigh', but it does so directly, without further derivation: /ʧʰìn/. This indicates a pattern of polysemic extension: [/ʧʰìn/ BASE 'base'] > ℙ > [/ʧʰìn/ BASE 'base, thigh'].

(5) LOWER.LEG: In Mountain Slavey, the form associated with LOWER.LEG directly lexicalizes 'thigh' as a result of a polysemic extension [/ʣat/ LOWER.LEG 'lower leg'] > ℙ > [/ʣat/ THIGH 'leg, thigh'] (see Section 3.4.9 'Leg').

(6) CALF.OF.THE.LEG: A further polysemic extension of a term denoting the lower part of the leg to a higher part of the leg is found in Western Apache which lexicalizes the referent-concept 'thigh' through the form for 'calf of the leg'[34]: [/ʧ'oʒ/ CALF.OF.THE.LEG 'calf of the leg'] > ℙ > [/ʧ'oʒ/ THIGH 'thigh'].

[34] That /ʧ'oʒ/ belongs to a cognate set associated with the referent 'calf of the leg' can be observed by comparioson to terms for this referent in other Athapaskan langauges: Gwich'in (Gwıchya) /tʳ'òːʔ/, Gwich'in (Teetl'ıt) /tʳ'òːʔ/, Hän /tʳ'orr/, Northern Tutchone /ʦ'óʔ/, Hare /ʦ'ṓʔ/, Bearlake /ʦ'ó/, Ts'ets'aut /pf'úː/, Navajo /ʧ'oʒ/, Western Apache /ʧ'oʒ/, and Lipan Apache /ʧʰoʧ/.

(7) THAT.INSIDE: Kiowa Apache is wholly innovative and divergent from the other languages in the sample by lexicalizing 'thigh' through the form /ʒàɣ/ which has the semantic value THAT.INSIDE (Bross 1971: 11).

(8) LOWER.LEG-WIDE: Witsuwit'en lexicalizes 'thigh' through the form /ʥustʰɛl/ glossed as 'lap wide' (Hargus 2007: 322). It seems possible, however, that /ʥus/ is a reflex of the LOWER.LEG cognate (see Section 3.4.9). Leaving the question open whether /ʥus/ has semantically shifted to acquire the referent 'lap', the form is analyzed as LOWER.LEG-WIDE here.

(9) THIGH$_1$: In Tahltan and Ts'ets'aut, the referent 'thigh' is lexicalized through the likely cognate forms /kɛh/ and /xɛ́ʔ/ respectively. This pattern is found only among these two languages, however, and is simply designated THIGH$_1$.

(10) THIGH$_2$: In the Upper Cook Inlet dialect of Dena'ina, the referent 'thigh' is lexicalized through the unique form /q'əs-tʰal/. The exact meaning of this form could not be identified, and it is therefore designated only as THIGH$_2$. Nonetheless there are some indications as to the meanings of these forms, although rather speculative. The first syllable in this form /q'əs/ resembles the locational element /q'əs/ glossed as 'alongside, beside' (Kari 2007: 331), while the latter bears resemblance to the Witsuwit'en form /tʰɛl/ glossed as 'wide' (Hargus 2007: 322).

(11) THIGH$_3$: Mescalero Apache lexicalizes the referent 'thigh' through the complex lexicalization /ʧáte nʦʰa:zí/. The exact meaning of this form is unclear, but it contains the element LOWER.LEG. In this respect it is similar to the expression for 'thigh' found in Navajo.

(12) THIGH$_4$: Navajo lexicalizes the referent 'thigh' through the complex lexicalization /ʧá:t bitˣaʔ sitˣání/. The exact meaning of this form is unclear, but it contains the element /ʧá:t/ LOWER.LEG and the postpositional phrase /bitˣaʔ/ 'between them'. In lexicalizing LOWER.LEG as part of the expression for 'thigh', Navajo is similar to Mescalero Apache.

(13) THIGH$_5$: The Teetl'it dialect of Gwich'in lexicalizes 'thigh' through the unique form /toh-ɣʷà:ʔ/, here simply identified as THIGH$_5$.

(14) THIGH$_6$: Tolowa lexicalizes 'thigh' through the unique from /se:s/, here simply identified as THIGH$_6$.

Table 52. Thigh

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ɣuθ	1	INTERIOR CANADA	Hare	ɣoh	1
	Koyukon	ʁʊɬ	1		Mountain	ʦat	5
	Dena'ina (Iliamna)	ʁəskʰən	3		Bearlake	ɣoh	1
	Dena'ina (Inland)	-			Tłı̨chǫ	ɣo	1
	Dena'ina (OCI)	-			South Slavey	ɣoð	1
	Dena'ina (UCI)	q'əstʰala	10		Dene Sų̨łiné	wo	1
	Ahtna	ʁoskʰən	3		Dene Dháh	wous	1
	Holikachuk	ɣuθ	1		Beaver	ɣoh	1
	Gwich'in (Teetl'ıt)	tohɣʷà:ʔ	13	BRITISH COLUMBIA	Carrier	wʌz	1
	Gwich'in (Gwıchya)	-			Witsuwit'en	ʥustʰɛl	8
	Hän	-			Sekani	ɣʷosʧʰow	2
	Lower Tanana	-			Ts'ets'aut	xɛ́:ʔ	9
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ʧʰìn	4	PACIFIC COAST	Hupa	-	
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	se:s	14
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	ɣos	1		Mattole	-	
	Kaska (GHL)	ɣos	1		Wailaki	-	
	Kaska (L)	ɣos / ɣosʧʰo:	1/2		Kwa-Clat	rús	1
	Kaska (LL)	ɣos	1	APACHEAN	Navajo	ʧá:t bitxaʔ sitˣání	12
	Kaska (P)	ɣos	1		Western A.	ʧ'oʒ	6
	Kaska (RR)	ɣos	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	kɛh	9		Kiowa A.	ʒàɣ	7
					Mescalero A.	ʧáte nʦʰa:zí	11
	Tsuut'ina	wūsʧʰū	2		Lipan A.	wūsʧʰū	2

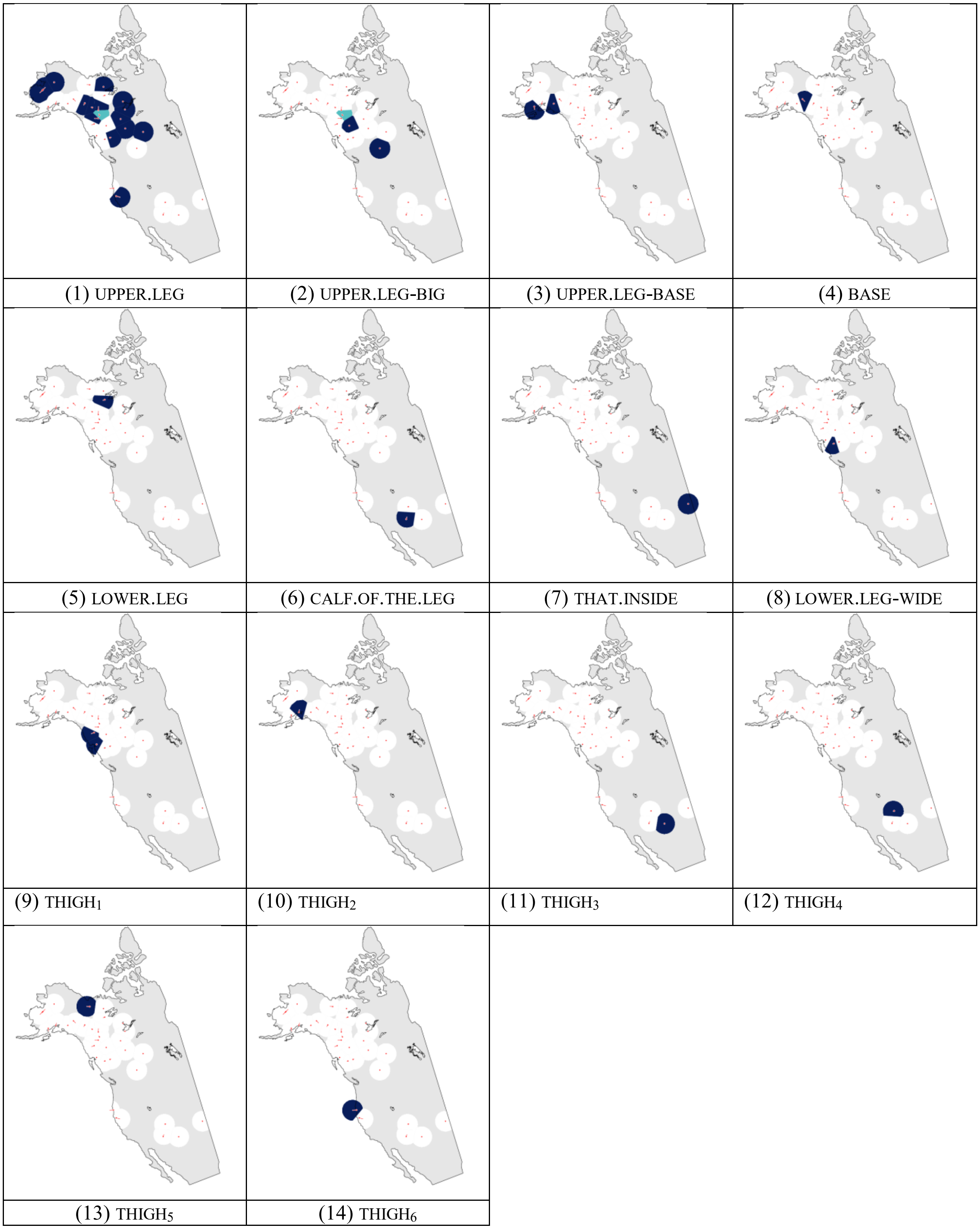


Figure 66. Distributions of terms for 'thigh'

3.4.9 Leg

This section covers the terms for two onomasiological referents ‘leg’ and ‘lower leg’. These two terms are not listed in all lexicographic sources, but from those that do provide data, it is clear that the terms used to denote either referent can easily shift to denote the other. The relationships among these forms and their meanings is rendered even more complex by the frequent polysemic extensions and semantic shifts that occur between two further referent-concepts: ‘thigh’ and ‘shin’. The long sections of the lower limb (not the joints or extremities) stand in relationships of mutual semantic association, and consequently shifts in one of the terms can trigger shifts among the others.

(1) BONE: The most common form meaning association is to be found in the terms for leg that are identical with the forms denoting the referent-concept ‘bone’ (see Section 3.1.4). Since the terms for ‘bone’ are more homogenous in the form-meaning associations, it can be inferred that the dominant pattern found for the referent-concept ‘leg’ has emerged through a polysemic extension: [/tθ’in/ BONE ‘bone’] > ℙ > [/tθ’inʔ/ BONE ‘bone, leg’] here exemplified by Holikachuk.

(2) LOWER.LEG: The second most common form lexicalizing the referent ‘leg’ is a monomorphemic cognate with a stem-initial alveolar or post-alveolar affricate and stem-final alveolar stop, glottal stop, glottal fricative or compensatory lengthening of the vowel, as in Mountain Slavey /ʥat/ for example. This form is also found with the meaning ‘lower leg’, either directly encoding this referent-concept, as in Sekani /ʥat/ ‘lower leg’, or as part of a morphologically complex expression such as in Dene Sų̨łiné /ʦá-t’áð/. Cognates of /tsat/ also commonly occur in terms for ‘shin’ (see Section 3.3.13). This leads to the conclusion that this form can be accurately identified with the semantic value LOWER.LEG.

(3) UPPER.LEG: The languages Tanacross, Tsuut’ina and Kaska (Liard) all share a pattern by which the form used to denote ‘leg’ is identical with the dominant pattern found for ‘thigh’ and described as UPPER.LEG (see Section 3.4.9). This indicates a semantic change [{/ɣos/, /wūs/, /ɣʷos/} UPPER.LEG ‘thigh’] > § > [{/ɣos/, /wūs/, /ɣʷos/} LEG ‘leg’].

(4) FOOT-BASE: Witsuwit’en and two Dena’ina dialects (Inland and Upper Cook Inlet) share the lexicalization pattern FOOT-BASE for the referent-concept ‘leg’, as for example in Dena’ina (Inland) /qa-kʰən/. Central Carrier also follows in this pattern, but lexicalizes ‘leg’ through the form LOWER.LEG as well.

(5) LEG_1: The Iliamna and the Outer Cook Inlet Dena’ina dialects share the form /qa-tɬ’na/ for the referent-concept ‘leg’. The first part of this form likely denotes FOOT, the remainder of the expression is more difficult to associate with a distinct meaning. Kari describes this form as an ‘elite replacement’ (2007: 93); the form is designated LEG_1 here.

(6) LEG$_2$: Tagish and Upper Kuskokwim lexicalize 'leg' through the forms /ʒíʒ/ and /dʳodʳ/ respectively. These forms appear to be good candidates for cognates since /ʒ/ and /dʳ/ correspond to each other also in 'day': Tagish /ʒén/ and /dʳan̥/ (Krauss 2005: 82). This stem is found nowhere else among the languages of the sample, and is therefore designated only as LEG$_2$.

(7) LEG$_3$: Ts'ets'aut lexicalizes the 'leg' through the unique form /xáʔ/ and is designated simply as LEG$_3$.

Table 53. Leg

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tθ'in	1	INTERIOR CANADA	Hare	w'én	1
	Koyukon	tɬ'ən	1		Mountain	dzat	2
	Dena'ina (Iliamna)	qatɬ'na	5		Bearlake	-	
	Dena'ina (Inland)	qakʰəna	4		Tłįchǫ	kʷ'ȍ:	1
	Dena'ina (OCI)	qatɬ'na	5		South Slavey	ʦa:	2
	Dena'ina (UCI)	qakʰəna	4		Dene Sųłiné	tθ'ẽn	1
	Ahtna	ʦ'ən	1		Dene Dháh	ʦat / tθ'en	2/1
	Holikachuk	tθ'in	1		Beaver	ʦ'ʌn	1
	Gwich'in (Teetl'ıt)	tθ'ànʔ	1	BRITISH COLUMBIA	Carrier	ʦɑt	2
	Gwich'in (Gwıchya)	-			Witsuwit'en	qʰecən	4
	Hän	tθ'ənʔ	1		Sekani	ʦ'ȁʔ	1
	Lower Tanana	-			Ts'ets'aut	xá'	7
	Upper Kuskokwim	dʳodʳ	6		Chilcotin	tθ'ɛ́n	1
	Upper Tanana	tθ'ənʔ	1	PACIFIC COAST	Hupa	ʦ'ɪŋʔ	1
	Tanacross	ɣolʔ	3		Galice	ʦ'ɑt / ʃa:t	1/2
YUKON	Northern Tutchone	tθ'ánʔ	1		Kato	ʦ'ɪn	2
	Southern Tutchone	tθ'ən	1		Tolowa	ʦ'e:n	2
	Kaska (DL)	-			Tututni	ʦ'ən	2
	Kaska (FL)	ʦ'en	1		Mattole	ʧɑ:t	2
	Kaska (GHL)	ʦ'en	1		Wailaki	-	
	Kaska (L)	ɣos	3		Kwa-Clat	tʃā:t	2
	Kaska (LL)	-		APACHEAN	Navajo	ʧá:t	2
	Kaska (P)	-			Western A.	ʧát	2
	Kaska (RR)	-			S. Carlos A.	ʧátʔ	2
	Tagish	ʒíʒ	6		Jicarilla A.	ʧə̃́t	2
	Tahltan	tθ'ɛn	1		Kiowa A.	dʒà:h	2
					Mescalero A.	ʧáte ntsʰa:zí	
	Tsuut'ina	wus	3		Lipan A.	ʧʰat	2

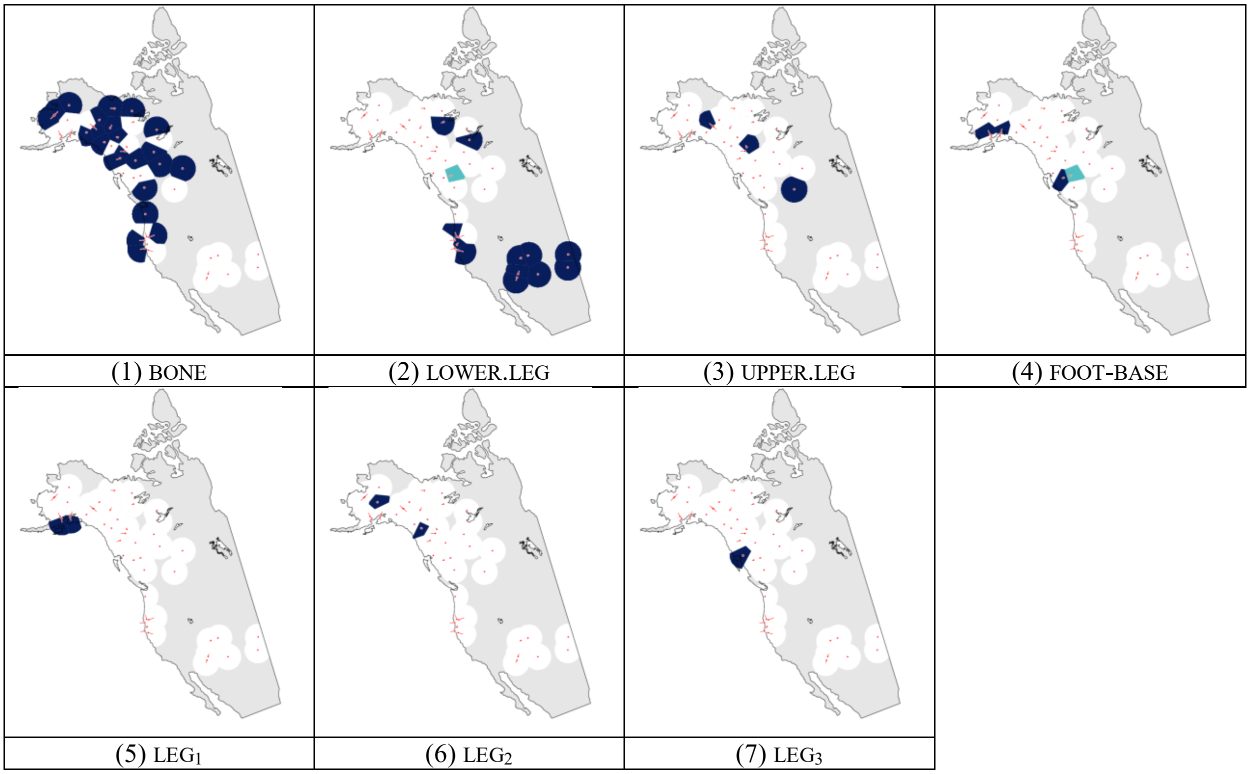


Figure 67. Distributions of terms for 'leg'

3.3.10 Knee

There are 9 lexicalization patterns for the referent 'knee' among the languages in the sample. There are several instances in which a likely polysemic extension of the term for 'knee' to the more general 'joint', but the evidence for this is largely circumstantial. While these possibilities are noted in the descriptions of the individual patterns below, they are not treated as established patterns of polysemic extension, except in the case of Tłı̨chǫ where the term /ehgò/ is glossed both as 'knee' and as 'joint' in the lexicographic source (Dogrib Divisional Board of Education 1996: 26), and Bearlake

(1) KNEE$_1$: The dominant pattern among the lexicalizations of the referent-concept 'knee' among the languages in the sample is represented by a cognate set based on a monomorphemic form with a stem-initial velar, labio-velar or uvular plosive followed by a back vowel and a plosive or fricative in final position, as in the case of Western Apache /kot/. This root is related to a verbal root with the meaning POKE also glossed as 'stab', such as in Koyukon /qat/ or /qʊt/ (Jetté and Jones 2000: 200), or Lower Tanana /kʌt/, /kat/ (Kari 1994: 107). The Tolowa form /kʷʼet/ also belongs to this set, since the stem-initial ejectivized plosive corresponds regularly to non-ejectivized velar and uvular segments in other Athapaskan languages not just in the terms for 'knee', but also 'fingernail' /kʷ'ən-juʔ/ (see Section 3.4.7), and 'arm' /kʷ'aːn/ (see Section 3.3.1).

(2) KNEE₂: A second and unrelated root also lexicalizes the referent-concept 'knee' in Koyukon /tɬɒq/. Identified as KNEE₂, this form has a cognate in Holikachuk /tθoːq/, and Dena'ina (Inland and Outer Cook Inlet) /tʃʰiʃ/.

(3) LOWER.LEG-KNEE₁: In Dene Sųłiné and Lipan Apache a reflex of the cognate identified as KNEE₁ above is combined with the reflexes of the form encoding LOWER.LEG (see Section 3.4.9), resulting in the lexicalization pattern LEG.LOWER-KNEE₁, as for example in Lipan /tsas-kʰo/. Although there is no direct evidence to support this, the occurrence of KNEE₁ reflexes as part of a compounded form could be taken to indicate that the association of /kʰo/ with the referent 'knee' among these three languages has given way to an association with 'joint'. This has occurred in Tłįchǫ where the cognate form /eh-gò/ is found to encode precisely this meaning (Dogrib Divisional Board of Education 1996: 26): [/ehgò/ KNEE 'knee'] > ℙ > [/ehgò/ KNEE 'knee, joint'].

(4) LOWER.LEG: The root /srat/, a reflex of the LEG.LOWER form lexicalizes 'knee' in Tututni indicating a semantic change [/srat/ LOWER.LEG 'lower leg'] > § > [/srat/ LOWER.LEG 'knee'].

(5) ELBOW₁: In Dena'ina (Upper Cook Inlet) and Tsuut'ina. In both cases the form denoting 'knee' also co-lexicalizes 'elbow'. Since those forms are widely associated with the semantic value ELBOW, this indicates a polysemic extension [{/ʧ'əʃ/,/ʦ'ìs/} ELBOW 'elbow'] > ℙ > [{/ʧ'əʃ/,/ʦ'ìs/} ELBOW 'elbow, knee'].

(6) ELBOW₁-KNEE₁: A more complex morphological form is also found lexicalizing 'knee' in Tsuut'ina: /ʦ'ìs-dā-kʰūd/. This form contains /ʦ'ìs/, ELBOW, and /kʰūd/ a reflex of KNEE₁, as well as the unidentified particle /dā/. This entire form co-lexicalizes 'elbow', and is glossed as 'my curved joint' (Starlight and Donovan 2008: 226). However, the semantic analysis suggested by this gloss finds little support among the other terms in the sample, with the exception of the association of reflexes of KNEE₁ with the referent 'joint', as in the case of Tłįchǫ noted in the description of pattern 3 above.

(7) KNEE₃: Kiowa Apache lexicalizes 'knee' through the form /sı̋ːs-kȍːt/, which appears to contain the element KNEE₁. Bross notes: "This can mean the joint or the bone. The bone of the knee probably includes more than the patella" (Bross 1971: 11). This is a further indication of polysemic extension from 'knee' to 'joint'. The meaning of the form /sı̋ːs/ could not be identified. The form is similar to the lexicalization of 'knee' found in Chilcotin /ʦi-gʷέt/, and both patterns are here identified as KNEE₄. It seems possible that both /sı̋ːs/ and /ʦi/ relate to Dena'ina /ʧʰiʃ/, as well as the /ʦʰis/ found in the Deg Xinag terms described below.

(8) KNEE$_5$ & (9) KNEE$_6$: Deg Xinag lexicalizes 'knee' through the form /ʦʰis-to-qijʔ/, which is unique to this language contains the element /ʦʰis/, possibly related to both Kiowa Apache /sɪ̃́:s/, Chilcotin /ʦi/, and Dena'ina /ʧʰiʃ/. A second possible expression for 'knee' in Deg Xinag is the closely related /ʦʰis-toq/. These patterns are identified as KNEE$_5$ and KNEE$_6$ respectively.

Table 54. Knee

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ʦʰistoqijʔ / ʦʰistoq	8/9	INTERIOR CANADA	Hare	góʔ	1
	Koyukon	qʊt / tɫɒq	1/2		Mountain	kóʔ	1
	Dena'ina (Iliamna)	-			Bearlake	kó	1
	Dena'ina (Inland)	ʧʰiʃ	2		Tłı̨chǫ	ehgò	1
	Dena'ina (OCI)	ʧʰiʃ	2		South Slavey	kó	1
	Dena'ina (UCI)	ʧ'əʃ	5		Dene Sųłiné	ʦakór	3
	Ahtna	qot'	1		Dene Dháh	kó	1
	Holikachuk	tθo:q	2		Beaver	-	
	Gwich'in (Teetl'ıt)	gʷat	1	BRITISH COLUMBIA	Carrier	kʷʌt	1
	Gwich'in (Gwıchya)	gʷat	1		Witsuwit'en	kʷət	1
	Hän	kòt	1		Sekani	kòt	1
	Lower Tanana	gʌt	1		Ts'ets'aut	kʷɔ́	1
	Upper Kuskokwim	gʌt'	1		Chilcotin	ʦigʷɛ́t	1
	Upper Tanana	kòt	1	PACIFIC COAST	Hupa	qot'	1
	Tanacross	kot	1		Galice	kʷɑi	1
YUKON	Northern Tutchone	kʷát	1		Kato	qoʊt'	1
	Southern Tutchone	kʷàt	1		Tolowa	kʷ'et	1
	Kaska (DL)	-			Tututni	srat	4
	Kaska (FL)	kót	1		Mattole	kʷoʔɬ, kʷó:xʷ	1
	Kaska (GHL)	kót	1		Wailaki	-	
	Kaska (L)	kót	1		Kwa-Clat	kʷ'ît	1
	Kaska (LL)	kót	1	APACHEAN	Navajo	kot	1
	Kaska (P)	kót	1		Western A.	kot	1
	Kaska (RR)	kót	1		S. Carlos A.	kot	1
	Tagish	kʰùt, kut	1		Jicarilla A.	kõh	1
	Tahltan	kot	1		Kiowa A.	sɪ̃́:skõ̌:t	7
					Mescalero A.	kut	1
	Tsuut'ina	ʦ'ìs / ʦ'ìsdākʰūd	5/6		Lipan A.	ʦʰaskʰo	3

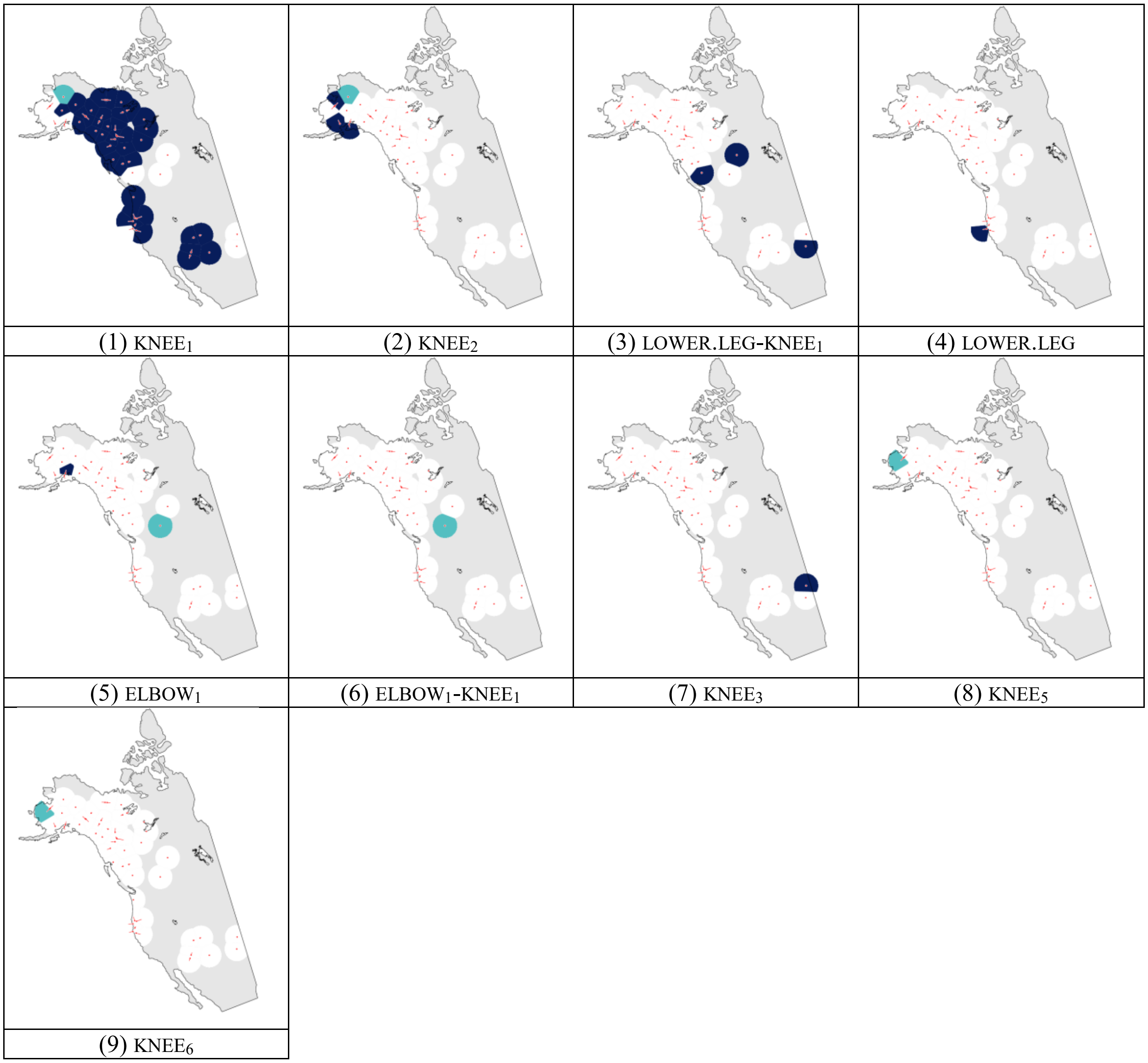


Figure 68. Distributions of terms for 'knee'

3.3.11 Shin

There are 10 patterns lexicalizing the referent 'shin' among the languages of the sample. The majority of the terms expressing the referent-concept 'shin' in Athapaskan languages are morphologically complex constructions.

(1) LOWER.LEG: Deg Xinag, Upper Tanana, Southern Tutchone, Kaska (Ross River), and Tolowa lexicalize 'shin' through the form identified as LOWER.LEG (see Section 3.4.9), as exemplified by Upper

Tanana /ʥâːt/. Since the association of that form with the referent 'leg' is more firmly established across the Athapaskan languages, its use in terms for 'shin' must have arisen through the semantic change: [/ʦaːt/ LOWER.LEG 'lower leg'] >§> [/ʦaːt/ LOWER.LEG 'shin'], exemplified by Ross River Kaska.

(2) LOWER.LEG-BONE: Three Dena'ina dialects (Inland, Outer Cook Inlet and Upper Cook Inlet) as well as Kiowa Apache and Koyukon lexicalize 'shin' though the a combination of the elements LOWER.LEG (see Section 3.4.9) and BONE (see Section 3.1.4), as exemplified by Koyukon /ʥɒt-ə-tɬ'ən/, resulting in the pattern: LOWER.LEG-BONE.

(3) LOWER.LEG-BLADE: In Ahtna, the referent 'shin' is lexicalized through the form /ʥa-k'a'/, which is glossed as 'lower leg blade'[35] (Kari 1990: 166). The element /ʥa/ corresponds to the LOWER.LEG cognate set identified in Section 3.4.9. Related forms can be found in Witsuwit'en and Central Carrier. All three languages are analyzed as exemplifying the lexicalization pattern LOWER.LEG-BLADE.

(4) LOWER.LEG-BASE: In Gwıchya Gwich'in, the referent 'shin' is lexicalized through the form /dˠeː-ʧʰàn/, which combines the elements LOWER.LEG (see Section 3.4.9) and BASE to the lexicalization pattern: LOWER.LEG-BASE.

(5) BONE-RIDGE: In Hupa, 'shin' is lexicalized through the form /ʦ'ɪnʔ-tɪ-q'aːn/, composed of the elements RIDGE (or 'mountain ridge', Golla 1996: 63) and BONE (see Section 3.1.4).

(6) LOWER.LEG-ON: In Tahltan, the 'shin' is lexicalized through the form /ʥɑːs-kɛh/, composed of the element LOWER.LEG and /ʥa/. The latter form is a postpositional element indicating the relation IN; the cognate /kʰɛ/ in Slavey is described as specifying "a location on an object where the object is not physically separable from the reference point or is perceived to be in the reference point." (K.Rice 1989: 276).

(7) LOWER.LEG-OVER: The Navajo term /ʥás-tˣis/ is composed of the elements LOWER.LEG (see Section 3.4.9) and the postpositional element OVER (Young and Morgan 1972: 31), resulting in the path LOWER.LEG-OVER.

(8) OVER: In Kaska (Liard and Lower Liard dialects) as well as Sekani, 'shin' is lexicalized through the locational element OVER (compare the Navajo form described in pattern 7), as exemplified by Sekani /tʰàs/.

(9) SHIN$_1$: Tłı̨chǫ lexicalizes 'shin' through the form /ʥa-xȍː/, which contains the element LOWER.LEG (see Section 3.4.9). The other part of this compound is not found among other Athapaskan languages and could not be identified. The pattern is simply designated SHIN$_1$.

(10) SHIN$_2$: Tsuut'ina lexicalizes 'shin' through the form /wūs-ʦ'ìs-k'ōn/, which contains the elements THIGH$_1$ (see Section 3.4.8), and shares /ʦ'ìs/ with the lexicalization of 'elbow'. The other part of this

[35] The same form given the literal gloss "leg edge" elsewhere in the dictionary (Kari 1990: 251).

compound is not found among other Athapaskan languages, and the form as a whole remains difficult to analyze semantically. The pattern is simply designated SHIN2.

Table 55. Shin

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	droθ	2	INTERIOR CANADA	Hare	-	
	Koyukon	ʦɒtətɬ’ən	1		Mountain	-	
	Dena’ina (Iliamna)	ʧat / ʧaʦ’en	2/1		Bearlake	-	
	Dena’ina (Inland)	ʧaʦ’ən	1		Tłįchǫ	ʥaxǒ̀ː	9
	Dena’ina (OCI)	ʧaʦ’ən	1		South Slavey	-	
	Dena’ina (UCI)	ʧaʦ’ən	1		Dene Sųłiné	-	
	Ahtna	ʦak’a’	3		Dene Dháh	-	
	Holikachuk	ʦatʰinʔ	8		Beaver	-	
	Gwich’in (Teetl’ıt)	-		BRITISH COLUMBIA	Carrier	ʦɑsk’ɑʔ	3
	Gwich’in (Gwıchya)	dʳeːʧʰàn	4		Witsuwit’en	ʦesq’aʔ	3
	Hän	-			Sekani	tʰàs	8
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ʥâːt	2	PACIFIC COAST	Hupa	ʦ’ɪnʔtɪq’aːn	5
	Tanacross	zɑt	2		Galice	-	
YUKON	Northern Tutchone				Kato	-	
	Southern Tutchone	-			Tolowa	sraːt	2
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	tʰés	8		Kwa-Clat	-	
	Kaska (LL)	tʰés	8	APACHEAN	Navajo	ʦástˣis	7
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	ʦaːt	2		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	ʦɑːskɛh	6		Kiowa A.	sá̃ːsʦ’ḯː	1
					Mescalero A.		
	Tsuut’ina	wūsʦ’ìsk’ōn	10		Lipan A.	-	

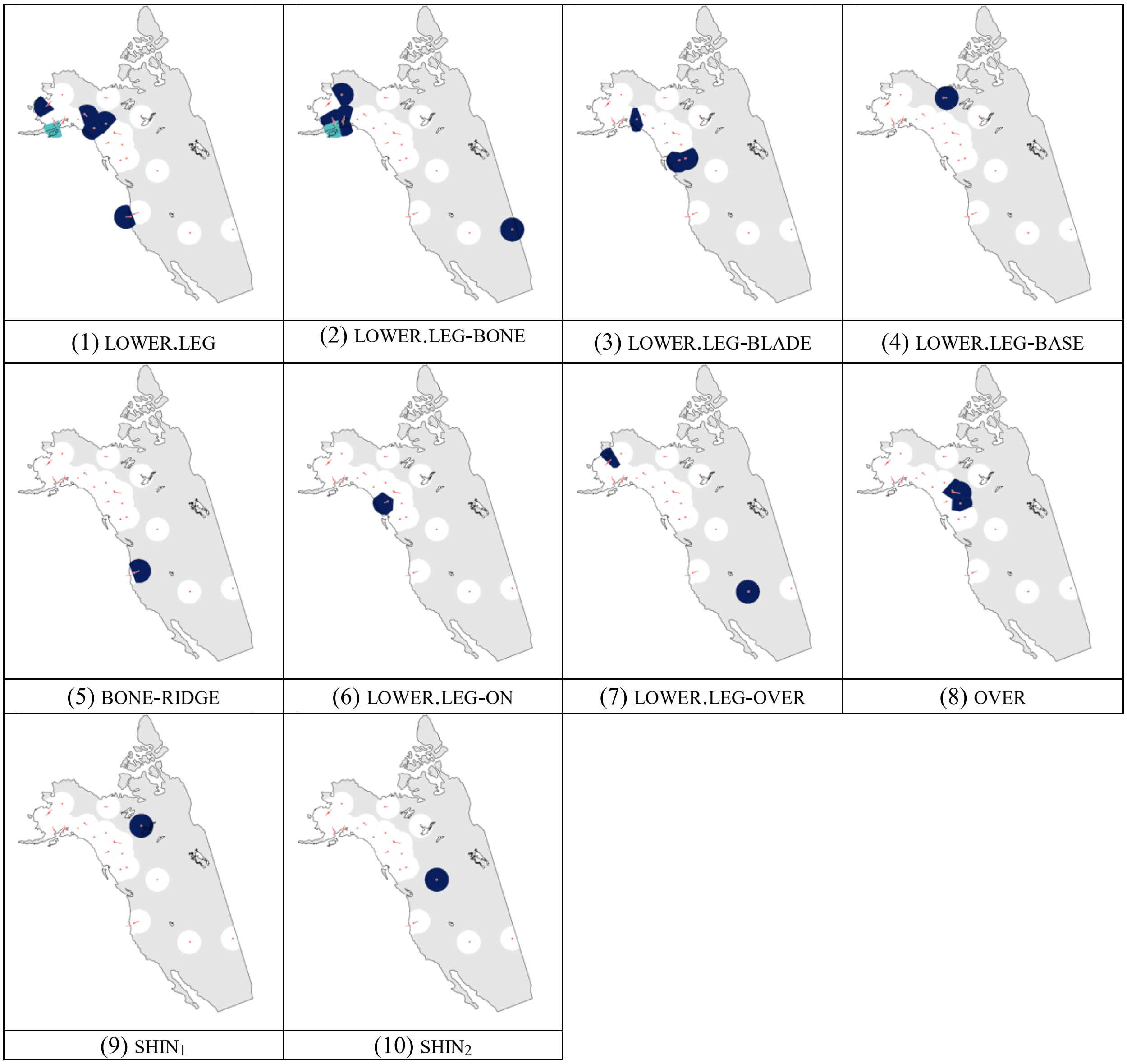


Figure 69. Distributions of terms for 'shin'

3.3.12 Ankle

There are 11 lexicalization patterns for the referent 'ankle'. All but one of these involve the morphological and semantic element FOOT. The exception is found in Jicarilla Apache, which encodes 'ankle' with the monomorphemic stem /ʦʰáːs/. Among the other ten patterns, the dominant lexicalization pattern is FOOT-BASE, which parallels the dominant pattern found for 'wrist': HAND-BASE (see Section 3.4.4). The patterns HAND-BONE, HAND-KNEE, and HAND-REVOLVES.ON.ITSELF lexicalizing 'wrist' are also found in the corresponding patterns for ‘ankle’: FOOT-BONE, FOOT-KNEE, and FOOT-REVOLVES.ON.ITSELF. Overall, the lexicalization of ‘ankle’ is more heterogeneous than for ‘wrist’.

(1) FOOT-BASE$_1$: The predominant lexicalization takes the form FOOT-BASE, as for example in the Gwɪchya Gwich’in term /kʰaiː-ʧàn/.

(2) FOOT-BASE$_2$: In Kiowa Apache a semantically identical pattern is found, at least following the glossing provided by Bross (1971: 11). However, the Kiowa Apache form contains an additional morpheme in the final position of the construction, whose meaning is not easily identified: /ʃéː-ʧĩ̀ː-tã̀ʔ/.

(3) FOOT-BONE: Western and San Carlos Apache as well as Tututni, share the lexicalization pattern FOOT-BONE for the referent ‘ankle’, as exemplified by San Carlos Apache /kʰé-ʦʼin/ (cf. Sections 3.3.13 and 3.1.4).

(4) FOOT-KNEE: In Witsuwit’en, Mattole, and Ts’ets’aut ‘ankle’ is lexicalized through the pattern FOOT-KNEE, as exemplified by Ts’ets’aut /kˣɛʔ-gʷóːxʷ/.

(5) FOOT-MUSCLE: In Upper Tanana, ‘ankle’ is lexicalized through the compound /keː-ʦʼɯ̀ːʔ/, which is composed of the elements FOOT (see Section 3.3.13) and MUSCLE (see Section 4.3.3), realizing the pattern FOOT-MUSCLE.

(6) FOOT-LEG.LOWER-BALL: In Hupa, ‘ankle’ is lexicalized through the form /qeː-ʧɪ-wolʔ/. This form is glossed as ‘leg-ball’ (Hoopa Valley Tribe 1996: 4). However, there is no entry in the dictionary that would associate /qeː/ with the referent ‘leg’. As can be seen from the other patterns described in this sections, the lexicalization of LEG as part of a pattern with the target ‘ankle’ does not occur anywhere among the Athapaskan languages in the sample. The lexicalization of FOOT, in contrast, is very common. It stands to reason that the morpheme found in the Hupa construction is actually FOOT, with Proto-Athapaskan *q- preserved in the compound (Krauss 2005: 94), while the non-compounded form has developed a stem-initial fricative: /xe/ (see Section 3.3.12). In the parallel form in Tolowa /xʷeʔ-srəsr-weːl/ the fricated form for FOOT is found in the corresponding position. While the glossing provided for the Hupa form suggests a compound consisting of two roots, the Hupa expression itself is tri-syllabic, and hence suggestive of a compound with three morphological elements. The bi-syllabic term /ʧɪ-wolʔ/ in Hupa is glossed as though ‘ball, round object’ (Hoopa Valley Tribe 1996: 8). Comparing the Hupa and Tolowa terms makes it appear as a bi-morphemic compound composed of the semantic element /wolʔ/ ROUND.OBJECT, and /ʧɪ/. This last element is here analyzed as corresponding to a cognate set designated LEG.LOWER (see Section 3.4.9) by way of the correspondence tʃ = sr = dz found in the terms for ‘heart’ and ‘ear’. For example: Tolowa /sriʔ/ ‘heart’, Mattole /tʃíːj/ ‘heart’, Hare /dzi/; Tolowa /məʔ-srɣeʔ/ ‘ear’, Mattole /tʃíːɣ/ ‘heart’, Hare /dzí/. This leads to conclusion that the semantic structure of the ‘ankle’ terms in Hupa and Tolowa is FOOT-LEG.LOWER-BALL.

(7) FOOT-STOMPER: In Lipan Apache, ‘ankle’ is lexicalized through the form /kʰɛ-ta/. This form has cognate patterns in the lexicalization of ‘heel’ (see Section 3.3.14), and the form /tʰa/ is therefore analyzed as a deverbal form with the meaning STOMP, giving rise to the lexicalization pattern FOOT-STOMPER. Since that pattern is more widely associated and felicitously with ‘heel’, the Lipan form for ‘ankle’ is inferred to have come about as a result of a pattern of polysemic extension [/kʰɛ/ FOOT ⊕/ta/ STOMP ‘heel’] > ℙ > [/kʰɛ/ FOOT ⊕ /ta/ STOMP ‘heel, ankle’].

(8) FOOT-BASE-MUSCLE: In Chilcotin, the referent ‘ankle’ is lexicalized through a tri-partite compound /ke-ʧin-ʧ’í/ expressing the semantic elements FOOT-BASE-MUSCLE (see Section 3.3.13), BASE, and MUSCLE assuming that /ʧ’í/ is a cognate of Upper Tanana as well as the discussion of /keː-ʦ’ùː?/ (also see the discussion of this term in Section 4.3.3).

(9) FOOT-REVOLVES.ON.ITSELF: In Dene Sųłiné ‘ankle’ is lexicalized through the nature of the movement which it makes possible, paralleling the lexicalization of ‘wrist’ (see Section 3.4.4): the form /kʰé əɬhanarət’a/ is a morphologically complex form made up of the element FOOT and a nominalized verb stem glossed as ‘revolves around itself’ (S. Rice Field Notes 2011). These patterns are identified as FOOT-REVOLVES.ON.ITSELF.

(10) ANKLE$_1$: Dena’ina (Outer Cook Inlet) lexicalizes ‘ankle’ through a unique form: /qa-k’in-ʧəʁ/. This form includes the element FOOT, but is otherwise semantically opaque. The pattern is designated ANKLE$_1$.

(11) LEG.LOWER: Jicarilla Apache lexicalizes ‘ankle’ through a unique form: /ʦʰáːs/. The pattern is designated ANKLE$_3$.

Table 56. Ankle

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	qʰaɬʧin	1	**INTERIOR CANADA**	Hare	keʃén	1
	Koyukon	qʰɑkʰən	1		Mountain	-	
	Dena’ina (Iliamna)	-			Bearlake	ke:ʧʰin	1
	Dena’ina (Inland)	-			Tłįchǫ	keʧĩ̀:	1
	Dena’ina (OCI)	qak’inʧəʁ	10		South Slavey	kʰeʧʰĩế	1
	Dena’ina (UCI)	-			Dene Sųłiné	kʰé eɬhánatet’ai	9
	Ahtna	qʰɛkʰɛn	1		Dene Dháh	kʰe:ʧʰin	1
	Holikachuk	qʰakʰin	1		Beaver	-	
	Gwich’in (Teetl’ıt)	kʰai:ʧàn		**BRITISH COLUMBIA**	Carrier	kʰeʧʰʌnoh	1
	Gwich’in (Gwıchya)	kʰai:ʧàn			Witsuwit’en	qʰenkʷət	4
	Hän	-			Sekani	kʰeʧʰèʔ	1
	Lower Tanana	-			Ts’ets’aut	kʲakɔ́	4
	Upper Kuskokwim	-			Chilcotin	ke ʧinʧ’í	8
	Upper Tanana	ke:ʦ’ù̜:ʔ	5	**PACIFIC COAST**	Hupa	qe:ʧɪwolʔ	6
	Tanacross	kʰɛʧʰɛnʔ	1		Galice	-	
YUKON	Northern Tutchone	-			Kato	-	
	Southern Tutchone	-			Tolowa	xweʔsrəsrwe:l	6
	Kaska (DL)	-			Tututni	xeʦ’ən	3
	Kaska (FL)	-			Mattole	kˣɛʔgʷó:xʷ	4
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	-			Kwa-Clat	-	
	Kaska (LL)	-		**APACHEAN**	Navajo	kˣéʦʰí:n	1
	Kaska (P)	-			Western A.	kʰeʦ’in	3
	Kaska (RR)	-			S. Carlos A.	kʰéʦ’in	3
	Tagish	-			Jicarilla A.	ʦʰá:s	11
	Tahltan	kɛʧin	1		Kiowa A.	ʃé:ʧĩ̀:tầʔ	2
					Mescalero A.	kʰéʦʰín	1
	Tsuut’ina	kʰaʧʰin	1		Lipan A.	kʰɛtaɛ	7

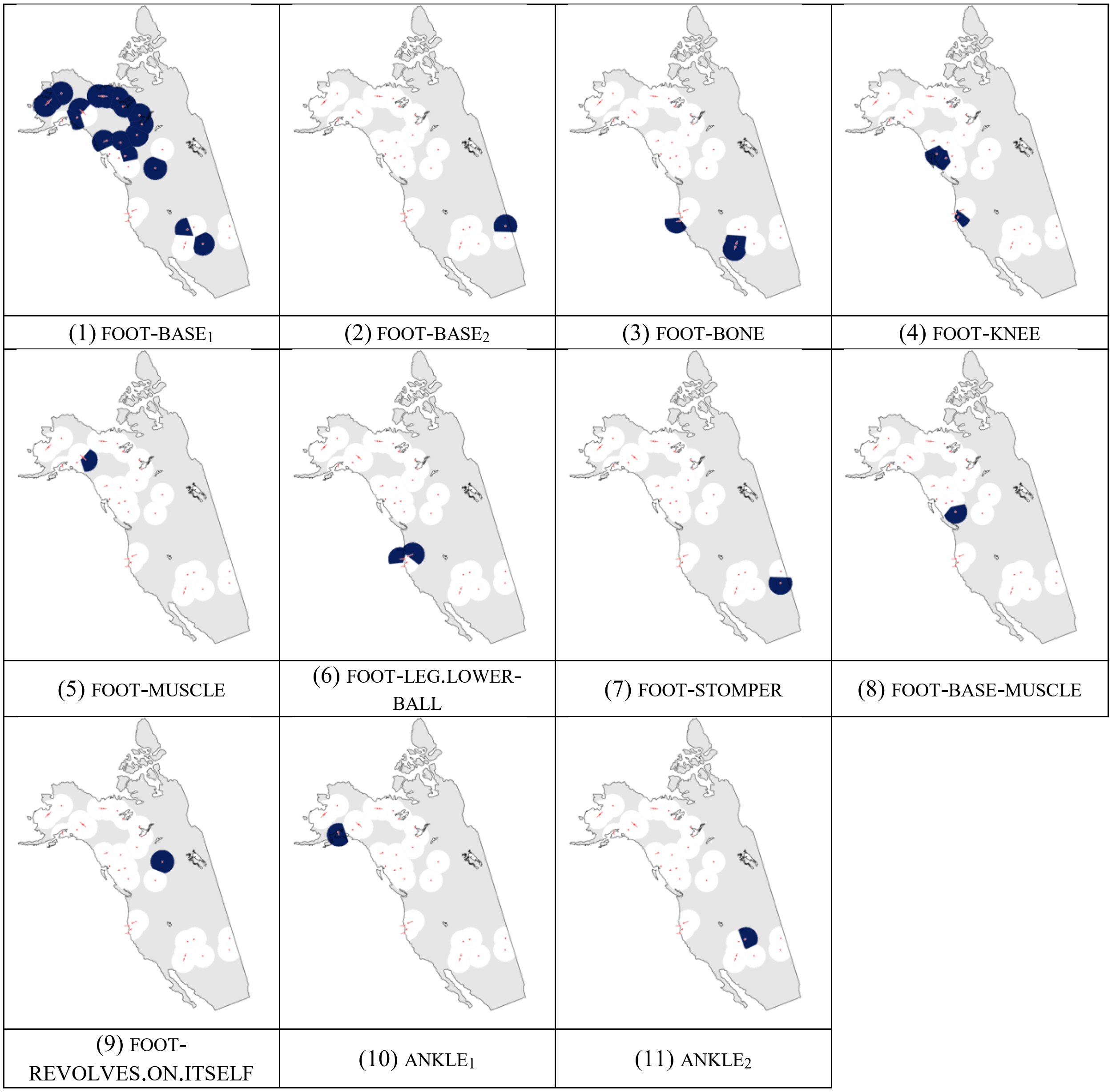


Figure 70. Distributions of terms for 'ankle'

3.3.13 Foot

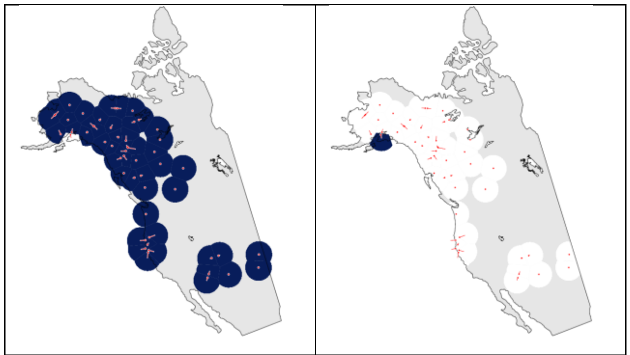
The terms lexicalizing the referent-concept 'foot' in the sample are all formed on the basis of the same root. This set of patterns is highly homogenous, with only one language showing a divergent lexicalization.

(1) FOOT: The dominant pattern takes the form of a monomorphemic stem characterized by an initial velar or uvular stop and followed by a front vowel, as in Tahltan /kʰɛ/.

(2) FOOT-STOMPER: The only diverging language is Dena’ina (Outer Cook Inlet) with the form /qa-tɬ’na/ which has likely resulted from a polysemic extension [/qa/ FOOT ⊕ /tɬ’na/ STOMP ‘heel’] > ℙ > [/qa/ FOOT ⊕/tɬ’na/ STOMP ‘foot’] and processes of phonological reduction (see Section 3.3.16).

Table 57. Foot

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	qʰaʔ	1	**INTERIOR CANADA**	Hare	kie	1
	Koyukon	qa	1		Mountain	kʰéʔ	1
	Dena’ina (Iliamna)	-			Bearlake	kʰé:ʔ	1
	Dena’ina (Inland)	qa	1		Tłı̨chǫ	kè	1
	Dena’ina (OCI)	qatɬ’na	2		South Slavey	kʰé	1
	Dena’ina (UCI)	qa	1		Dene Sųłiné	kʰe	1
	Ahtna	k’aʔ	1		Dene Dháh	kʰé	1
	Holikachuk	qʰaʔ	1		Beaver	kʰɛʔ	1
	Gwich’in (Teetl’ıt)	kʰaiʔ	1	**BRITISH COLUMBIA**	Carrier	kʰe	1
	Gwich’in (Gwıchya)	kʰaiʔ	1		Witsuwit’en	qʰe	1
	Hän	kʰèʔ	1		Sekani	kʰèʔ	1
	Lower Tanana	kʰaʔ	1		Ts’ets’aut	kʲa	1
	Upper Kuskokwim	kʰaʔ	1		Chilcotin	ké	1
	Upper Tanana	kʰèʔ	1	**PACIFIC COAST**	Hupa	xeʔ	1
	Tanacross	kʰeʔ	1		Galice	-	
YUKON	Northern Tutchone	kʰíʔ	1		Kato	kʷɛʔ	1
	Southern Tutchone	kʰè	1		Tolowa	xʷeʔ	1
	Kaska (DL)	kʰéʔ	1		Tututni	xeʔ	1
	Kaska (FL)	kʰéʔ	1		Mattole	kˣɛʔ	1
	Kaska (GHL)	kʰéʔ	1		Wailaki	kʰéh	1
	Kaska (L)	kʰéʔ	1		Kwa-Clat	kʷɛʔ	1
	Kaska (LL)	kʰéʔ	1	**APACHEAN**	Navajo	kˣe:ʔ	1
	Kaska (P)	kʰéʔ	1		Western A.	kʰeeʔ	1
	Kaska (RR)	kʰéʔ	1		S. Carlos A.	kʰe:ʔ	1
	Tagish	kíʔ	1		Jicarilla A.	kʰế, kʰe:	1
	Tahltan	kʰɛʔ	1		Kiowa A.	ʧè:	1
					Mescalero A.	kʰe:	
	Tsuut’ina	kʰà	1		Lipan A.	kʰɛ	1



(1) FOOT	(2) FOOT-STOMPER

Figure 71. Distributions of terms for 'foot'

3.3.14 Heel

There are 5 patterns lexicalizing the referent 'heel' among the languages in the sample. All the terms lexicalizing the referent-concept 'heel' are morphologically complex forms. All terms also share the semantic element FOOT (See Section 3.415 Foot). The majority of Athapaskan languages lexicalize 'heel' through the associated action of kicking or stomping. The remaining patterns lexicalize the position of the heel relative to the foot. Different morphological forms are employed in these lexicalizations however, resulting in distinct lexicalization patterns.

(1) FOOT-STOMPER: The term for 'foot' acts as a modifier in four different lexicalization patterns. The most common of these is exemplified by Tanacross /kʰe-tʰɛtɬ/. The form /tʰɛtɬʼ/ and its cognates, such as Ahtna /tɑtɬʼ/, are also found as verb stems. In the case of Ahtna, this form is glossed as 'kick, burst' (Kari 1990: 323), but also forms part of constructions with meaning such as 'shove with the sole of the foot' (ibid.). The Hupa compound /xe:-tʰʌlʔ/ is glossed as 'foot-stomper' (Hoopa Valley Tribe 1996: 45). Consequently the lexicalization pattern has been assigned the designation FOOT-STOMPER. Among the Athapaskan languages of the Mackenzie drainage Hare, Bearlake, Tłı̨chǫ and South Slavey the stem denoting STOMPER have lost their coda consonants, as for example in Tłı̨chǫ /nà-je:-tʰà/ 'kick' (Dogrib Divisional Board of Education 1996: 181).

(2) FOOT-BUTTOCKS$_1$: In the second most common pattern, the position of the heel relative to the rest of the foot is lexicalized. This location is encoded through the semantic element BUTTOCKS (see Section 3.3.13), which frequently occurs in lexicalization patterns for body parts which can be conceptualized as residing at back or bottom positions relative to other more salient parts of the anatomy. This pattern is exemplified by Northern Tutchone /kʰen-tɬʼéʔ/. It is noteworthy that all the compounds encoding the lexicalization pattern FOOT-BUTTOCKS contain a linking element between the two main meaning bearing elements. In Northern Tutchone this element takes the form /n/, but /s/ also occurs, especially among the Kaska dialects.

(3) FOOT-BUTTOCKS$_2$: In Tututni, the lexicalization pattern for 'heel' parallels the forms described as FOOT-BUTTOCKS$_1$ above. However, the term in Tututni is supplemented with an additional morpheme taking the form /ʧʰiʃ/, which has possible parallels in the Dena'ina (Inland and Outer Cook Inlet dialects) terms for 'knee' (see Section 3.3.10), but otherwise remains unidentified.

(4) FOOT-BEHIND: In Tolowa /xʷeː-tʼaʔ/ the rearward position of the heel presents the locus of lexicalization. This is expressed through the postpositional element BEHIND, resulting in the lexicalization pattern FOOT-BEHIND.

(5) FOOT-REAR: In Tsuut'ina, 'heel' can also be expressed by the form /kʰa-ʧʼit/. The morpheme is /ʧʼit/, which lacks parallels among the other Athapaskan languages but is glossed with 'rear' in the lexicographic source materials (Starlight and Donovan 2008: 9554), therefore the lexicalization pattern is identified as FOOT-REAR.

Table 58. Heel

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	qʰaɬtitɬ	1	INTERIOR CANADA	Hare	kéhtáʔ	1
	Koyukon	qatɬʊtɬ	1		Mountain	kʰetɬ'áʔ	2
	Dena'ina (Iliamna)	-			Bearlake	kʰe:tʰá	1
	Dena'ina (Inland)	qantʰətɬ'	1		Tłı̨chǫ	kèhtà	1
	Dena'ina (OCI)	qatʰətɬ' / qatɬ'uh	1/2		South Slavey	kʰehtʰá	1
	Dena'ina (UCI)	qatʰətɬ' / qatɬ'ah	1/2		Dene Sųłiné	kʰiɬtʰaɬ / kə̃ltʰə́ɬ	
	Ahtna	kʰɛtɑtɬ'	1		Dene Dháh	kʰetɬ'á	2
	Holikachuk	qʰaltʰutɬ	1		Beaver	-	
	Gwich'in (Teetl'ıt)	kʰaihtàlʔ	1	BRITISH COLUMBIA	Carrier	kʰent̪s̪ʌl	1
	Gwich'in (Gwıchya)	kèhtʰà:l	1		Witsuwit'en	-	
	Hän	kʰehtʰə̀w	1		Sekani	-	
	Lower Tanana	kʰatʌtɬ	1		Ts'ets'aut	kʲatˣaʔ	1
	Upper Kuskokwim	kʰaltwtɬ'	1		Chilcotin	-	
	Upper Tanana	kʰeɬtə̀ɬ	1	PACIFIC COAST	Hupa	xe:tʰʌlʔ	1
	Tanacross	kʰetʰɛtɬ	1		Galice	-	
YUKON	Northern Tutchone	kʰentɬ'éʔ	2		Kato	-	
	Southern Tutchone	kʰəntɬ'ɑ̀	2		Tolowa	xwe:t'aʔ	4
	Kaska (DL)	kʰe:stɬ'áʔ	2		Tututni	xetʃʰiʃtɬ'aʔ	3
	Kaska (FL)	kʰe:stɬ'áʔ	2		Mattole	-	
	Kaska (GHL)	kʰestɬ'áʔ	2		Wailaki	-	
	Kaska (L)	kʰestɬ'áʔ	2		Kwa-Clat	-	
	Kaska (LL)	kʰe:stɬ'áʔ	2	APACHEAN	Navajo	kˣétˣahl	1
	Kaska (P)	-			Western A.	kʰétʰal	1
	Kaska (RR)	kʰe:stɬ'áʔ	2		S. Carlos A.	kʰétʰal	1
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	ʃé:kʰàɬ	1
					Mescalero A.	kʰétʰa:ɬ	1
	Tsuut'ina	kʰastɬ'a / kʰatʃ'it	1/5		Lipan A.	-	

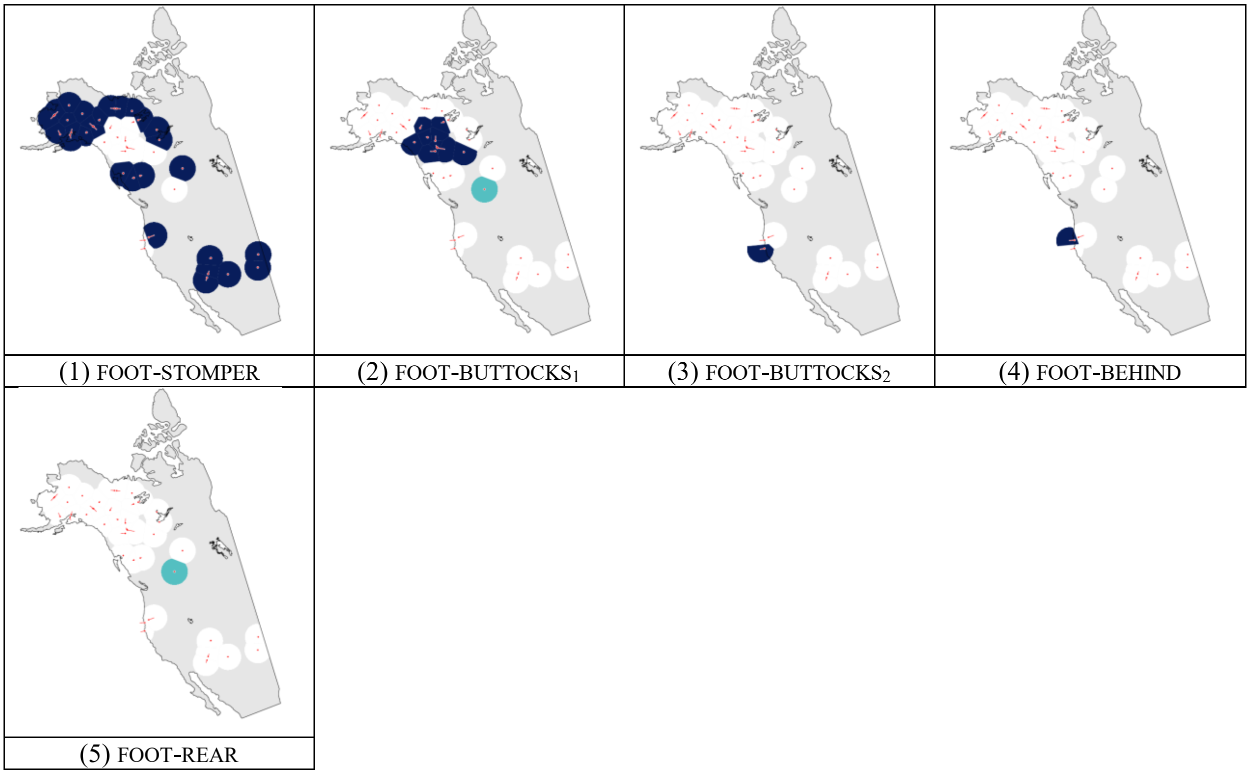


Figure 72. Distributions of terms for 'heel'

3.3.15 Toe

The similarities between the 'fingers' and the 'toes' are reflected in parallelisms between lexicalization patterns of the two referent-concepts, especially as regards the image of multiple parallel elements (patterns (1) and (2)) and the curvature of the toes (pattern (12)). The referent-concept 'toes' is lexicalized through 13 different patterns, and therefore constitutes one of the more heterogeneous referents in the sample. However, all patterns make reference to the 'foot'.

(1) FOOT-PHALANGE: The most widespread pattern lexicalizes the digits of the foot through a stem with the meaning PHALANGE. In Navajo, for example, the form /kˣé-ʒoːʒ/, the stem form is glossed as 'to lie parallel, assume a parallel position' (Young and Morgan 1987: 356). In the Kiowa Apache form this stem is glossed as 'branches', but the stem is phonologically similar enough to make its etymological relationship to the Navajo stem likely, as is also the case with Lipan /kʰɛ-ʤoʤ/. This pattern, FOOT-PHALANGE is also found in Koyukon Holikachuk Kaska (Ross River, Liard and Lower Liard dialects), Tahltan, Dene Dháh, Mescalero Apache, and Lipan Apache.

(2) FOOT-BONE: Many of the languages of the Canadian interior Hare, South Slavey, and Tłįchǫ have encoded 'toes' through the lexicalization pattern FOOT-BONE, as exemplified by South Slavey /kʰe-tθ’en/.

(3) FOOT: In Mountain Slavey the form /kʰeʔ/ carries both the semantic values FOOT and TOE. A similar pattern is also found in Kwalhioqua-Clatskanie. Since the FOOT terms represent one of the strongest meaning-form associations among the Athapaskan languages in the sample, the possibility of using this term to refer to 'toe' must have emerged as a result of the polysemic extension: [/kʰe/ FOOT 'foot'] > ℙ > [/kʰe/ FOOT 'foot, toe'].

(4) FOOT-BIG: For Northern and Southern Tutchone, Kaska (Good Hope Lake) and Ts'ets'aut the lexicographic source materials offer terms for 'toe' that can be analyzed as FOOT-BIG, indicating a semantic shift by which a term denoting the more specific 'big toe' has come to denote any or all of the toes [/kʰe/ FOOT ⊕ /ʧʰúʔ/ BIG 'big toe'] > ℙ > [/kʰe/ FOOT ⊕/ʧʰúʔ/ BIG 'toe'].

(5) FOOT-ITS.LITTLE.THING: Hupa diverges from all the other Athapaskan languages in the sample in lexicalizing 'toe' with the form /xeʔ-mɪ-mɪs-qɪj-eʔ/ which encodes the pattern FOOT-ITS.LITTLE.THING (Hoopa Valley Tribe 1996: 87, 98).

(6) FOOT-DIGIT$_1$: In Hän and Tsuut'ina, the referent-concept 'toe' is lexicalized through the combination of the HAND element with a stem identified in Section 3.4.6 as DIGIT$_1$, resulting in the pattern FOOT-DIGIT$_1$, as exemplified in Hän /kʰe-ʧʰət/.

(7) FOOT-HAND-DIGIT$_1$: In Chilcotin and the Outer Cook Inlet dialect of Dena'ina, the referent-concept 'toe' is lexicalized through the combination of the HAND element with a stem identified in Section 3.4.6 as DIGIT$_1$, resulting in the pattern FOOT-HAND-DIGIT$_1$.

(8) FOOT-HAND-DIGIT$_2$: The Outer Cook Inlet and Inland dialects of Dena'ina share a lexicalization pattern for the referent 'toe', /qa-lu-ʒəh/, which parallels the term for 'finger' (see Section 3.4.6) in these languages. The FOOT term is added to the beginning of the expression, however, resulting in the lexicalization pattern FOOT-HAND-DIGIT$_2$.

(9) FOOT-DIGIT$_2$: In Tolowa and Tututni, 'toe' is lexicalized through patterns parallel in their terms for 'finger' (see Section 3.4.6 'Finger'). For example, Tututni /la-sək'/ 'finger' has a parallel structure to /xe-sək'/ 'toe'. Consequently, this pattern is designated FOOT-DIGIT$_2$.

(10) FOOT-DIGIT$_3$: Among the Gwich'in dialects, 'toe' is lexicalized through the pattern /kʰaiː-ʦ'at/, which combines the element for FOOT with an unidentified stem. The pattern is designated FOOT-DIGIT$_3$.

(11) FOOT-ARCH: In Upper Kuskokwim, Lower Tanana and Dene Sų̨łiné, 'toe' is lexicalized through the term for FOOT and a stem identified as ARCH (see Section 3.4.6 'Finger', patterns 2 and 3), as exemplified in Dene Sų̨łiné /kʰə̃́-l-ʦ'əɬ/. The pattern is designated FOOT-ARCH.

(12) FOOT-HAND-PHALANGE: A pattern similar to (1), but morphologically more complex, is found in Ahtna /kʰə-lɑ-ʁos/ and Deg Xinag /ki-li-ɣek/. The first two components encode the meanings FOOT and HAND respectively, while the last is a reflex of the PHALANGE cognate.

(13) FOOT-HAND-ARCH: Dena’ina (Upper Cook Inlet and Inland dialects) and Upper Tanana lexicalize ‘toe’ through the patterns /qa-la-ʦ’əq’/ and /kʰe-la:-ʦ’ô:/ respectively. These patterns combine the elements FOOT and HAND with the stem identified as ARCH (see Section 3.4.6, patterns 2 and 3), resulting in the pattern FOOT-HAND-ARCH. This pattern represents a case of parallelism between the ‘finger’ and the ‘toe’ terms in the case of Upper Tanana. Dena’ina, however, relies on a different stem for the lexicalization of ‘finger’: /lu-ʧək/ or /lu-ʧuk/. This suggests that the latter terms are innovative respective to a now disappeared HAND-ARCH pattern for the lexicalization of ‘finger’.

Table 59. Toes

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	kiliɣek	12	INTERIOR CANADA	Hare	kʰew’én	2
	Koyukon	qʰalʁɒχ	1		Mountain	kʰeʔ	3
	Dena’ina (Iliamna)	-			Bearlake	-	
	Dena’ina (Inland)	qalaʦ’əq’ / qaluʒəh	13/8		Tłı̨chǫ	kekʷ’ǒ̀:	2
	Dena’ina (OCI)	qaluʧuk’ / qaluʒəh	8/8		South Slavey	kʰetθ’en	2
	Dena’ina (UCI)	qalaʦ’əq’	13		Dene Sųłiné	kʰə̃́lʦ’əɬ	11
	Ahtna	kʰəlɑʁos	12		Dene Dháh	kʰe:wóʒ	1
	Holikachuk	qʰalɣo:k	1		Beaver	-	
	Gwich’in (Teetl’ıt)	kʰai:ʦ’at	10	BRITISH COLUMBIA	Carrier	-	
	Gwich’in (Gwıchya)	kʰai:ʦ’at	10		Witsuwit’en	-	
	Hän	kʰeʧʰə̀t	6		Sekani	-	
	Lower Tanana	kʰats’il	11		Ts’ets’aut	kʲaʦʰó	4
	Upper Kuskokwim	kʰaʦ’el	11		Chilcotin	kélǽʦi	7
	Upper Tanana	kʰela:ʦ’ô:	13	PACIFIC COAST	Hupa	xeʔmɪmɪsqɪjeʔ	5
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	kʰeʧʰúʔ	4		Kato	-	
	Southern Tutchone	kʰeʃɟ	4		Tolowa	xwe:sa:k’	9
	Kaska (DL)	-			Tututni	xesək’	9
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	kʰesʧʰoʔ	4		Wailaki	-	
	Kaska (L)	kʰe:sɣoʦ	1		Kwa-Clat	kʰatχ	3
	Kaska (LL)	kʰe:sɣoʦ	1	APACHEAN	Navajo	kˣéʒo:ʒ	1
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	kʰe:sɣol	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	kʰɛɣoɬ / kʰɛtθ’ɛk	1		Kiowa A.	ʃé:ʒò	1
					Mescalero A.	kʰéʦʰu	4
	Tsuut’ina	kʰáʦʰìs	6		Lipan A.	kʰɛʤoʤɛ	1

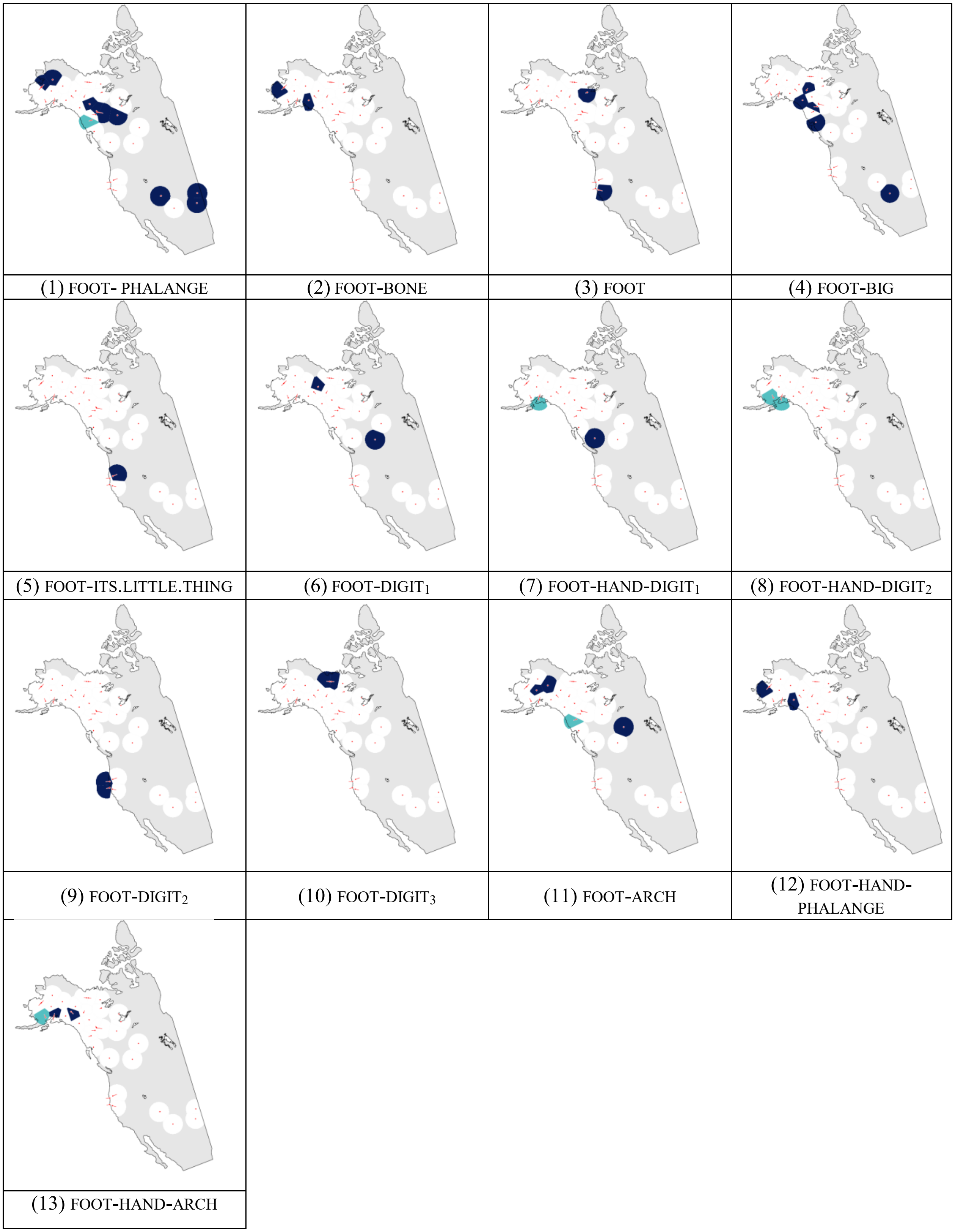


Figure 73. Distributions of terms for 'toe'

3.3.16 Toenail

The referent ‘toenail’ is lexicalized through seven patterns, predominantly multi-morphemic constructions. As with the terms for ‘finger’ and ‘toe’, there is some parallelism between the ‘fingernail’ and ‘toenail’ terms. All but one of the languages in this sample, Kwalhioqua-Clatskanie, involve the element FOOT in their patterns.

(1) FOOT-DRY$_1$: the most common of which, FOOT-DRY, appearing as a clear parallel to terms denoting ‘fingernail’ (see Section 3.4.8 Fingernail). This pattern is found, for example, in Koyukon /qʰa-l-qʊn/ (Jetté and Jones 2000: 219).

(2) FOOT-HAND-DRY: Among the Alaskan Athapaskan languages, Dena’ina (Inland, Outer and Upper Cook Inlet dialects), Deg Xinag, Ahtna and Lower Tanana the term for ‘toenail’ is directly derived from the term for ‘fingernail’ (see Section 3.4.8 Fingernail) by the addition of the term expressing FOOT resulting in the lexicalization pattern FOOT-HAND-DRY.

(3) FOOT-DRY$_2$: In the Pacific Coast Athapaskan languages Tututni and Tolowa the lexicalization pattern FOOT-DRY is supplemented with an additional morpheme /juʔ/, whose meaning remains unclear.

(4) HAND-DRY: In the language Ts’ets’aut, the term for ‘fingernail’, /ɬá-qan/, also lexicalizes ‘toenail’ indicating a pattern of polysemic extension [/ɬá/ HAND ⊕/qan/ DRY ‘fingernail’] > ℙ > [/ɬá/ HAND ⊕/qan/ DRY ‘toenail’].

(5) FOOT-NAIL: In Hupa, ‘toenail’ is lexicalized through the pattern FOOT-NAIL as indicated by the glossing in the lexicographic sources (Hoopa Valley Tribe 1996: 98). This pattern is parallel to the lexicalization of ‘fingernail’ in Hupa (see Section 3.4.7).

(6) TOENAIL$_1$: Kwalhioqua-Clatskanie lexicalizes the referent ‘toenail’ through the form /ku-nā-yu/. The final morpheme expressing this lexicalization pattern is also found as part of the ‘fingernail’-terms in Tolowa and Hupa, but the Kwalhioqua-Clatskanie pattern is otherwise uniquely found in this language. The pattern is identified only as TOENAIL$_1$.

(7) TOENAIL$_2$: The pattern /kʰɛ-ʃai/ is unique to Lipan; it is designated TOENAIL$_2$.

Table 60. Toenail

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	qʰiliqiŋ	2	**INTERIOR CANADA**	Hare	kʰiekón	1
	Koyukon	qʰalqʊn	1		Mountain	kʰekon	1
	Dena’ina (Iliamna)	-			Bearlake	kʰeːkõn	1
	Dena’ina (Inland)	qaqən	2		Tłįchǫ	kegõ̀ː	1
	Dena’ina (OCI)	qaluqən	2		South Slavey	kʰekon	1
	Dena’ina (UCI)	kʰəlɑqan	2		Dene Sųłiné	kʰékan	1
	Ahtna	kʰəlɑqan	2		Dene Dháh	kʰeːkon	1
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	kʰaiːkàiːʔ	1	**BRITISH COLUMBIA**	Carrier	kʰenkiʔ	1
	Gwich’in (Gwıchya)	-			Witsuwit’en	qʰenqi	1
	Hän	kʰekɑ̃̀j̊ʔ	1		Sekani	-	
	Lower Tanana	kʰelagʌn	2		Ts’ets’aut	ɬáqan	4
	Upper Kuskokwim	kʰalgwn	1		Chilcotin	-	
	Upper Tanana	kʰeːkɑ̃̂jʔ	1	**PACIFIC COAST**	Hupa	xeʔkeʔʦʼ	5
	Tanacross	kʰelaːkɛ̃ĩ̄ʔ	1		Galice	-	
YUKON	Northern Tutchone	kʰekánʔ	1		Kato	-	
	Southern Tutchone	kʰekən	1		Tolowa	xweʔkʼwənjuʔ	3
	Kaska (DL)	-			Tututni	xegwənyuʔ	3
	Kaska (FL)	kʰeːkon	1		Mattole	-	
	Kaska (GHL)	kʰeːkon	1		Wailaki	-	
	Kaska (L)	kʰeːkon	1		Kwa-Clat	kunāyu	6
	Kaska (LL)	-		**APACHEAN**	Navajo	kxéʃkaːn	1
	Kaska (P)	kʰeːkan	1		Western A.	kʰékan	1
	Kaska (RR)	kʰeːkan	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	kʰẽ́ʃkə̃n	1
	Tahltan	-			Kiowa A.	kéːʃkàːʃ	1
					Mescalero A.	kʰéʃkan	1
	Tsuut’ina	kʰakʰon	1		Lipan A.	kʰɛʃai	7

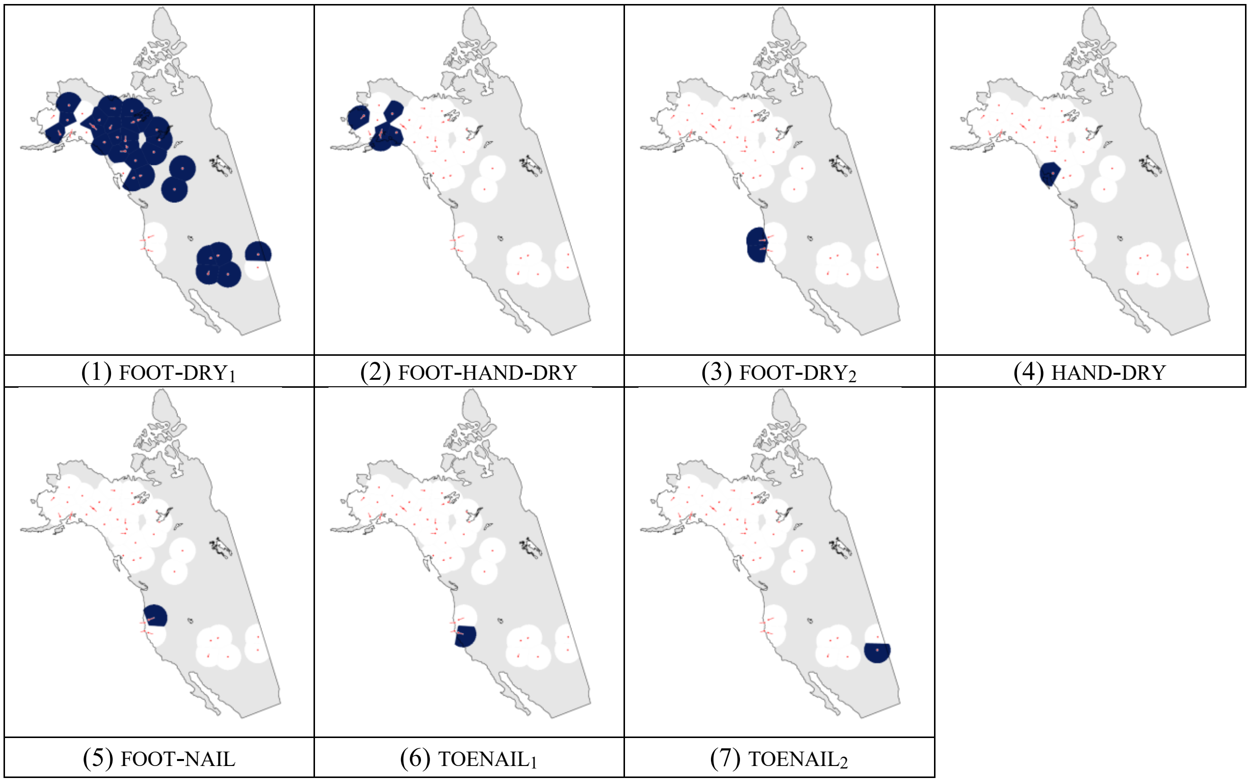


Figure 74. Distributions of terms for ‘toenail’

3.5 Terms for the effluvia

A surprising number of the terms for bodily fluids are fully, or almost fully cognate across the whole family of Athapaskan languages. The effluvia in the sample are represented through the following referent-concepts: ‘blood’, ‘breath, ‘earwax’, ‘excrement’, ‘flatus’, ‘gall’, ‘mother’s milk’, ‘pus’, ‘sweat’, ‘tear’, ‘urine’, and ‘vomit’, ‘scab’, and ‘saliva’.

3.5.1 Blood

The terms for ‘blood’ form a largely homogenous set, with two regionally distributed variant cognates found among languages in British Columbia and the Pacific Coast. Koyukon and Dena’ina have lexically innovated their ‘blood’ terms through morphologically complex expressions.

(1) BLOOD$_1$: The dominant pattern of lexicalization for the referent ‘blood’ is a monomorphemic stem characterized by a stem-initial alveolar plosive followed by a mid vowel and the lateral approximant, a for example in Ahtna /tɛl/.

(2) BLOOD$_2$: The Central Carrier term /s̪kʰɑi/ term and Witsuwit’en term /sqəj/ form a cognate pair not related to any other forms in the sample.

(3) BLOOD$_3$: The Hupa term /ʦʰeːlɪn/ term and Mattole term /ʦʰɛːlín/ form a cognate pair not related to any other forms in the sample.

(4) ENCLOSED.LIQUID: The Outer Cook Inlet and Inland dialects of Dena’ina lexicalize ‘blood’ through the terms /kudaɬtin/ and /kadaɬtin/ respectively. Kari (2007: 96) glosses these terms with ‘this enclosed liquid’ and ‘abdomen liquid’ respectively. Kari recognizes these as innovations and they are unique to this corner of the Athapaskan linguistic world.

(5) THING.IN.VESSEL: The Alaskan Athapaskan language Koyukon also has a term which does not follow the dominant patterns of cognation outlined in (1) above. Instead, the referent-concept ‘blood’ is expressed through the term /lə-qʰɒn/ ‘thing sitting in a receptacle’ (Jetté and Jones 2000: 331)[36].

[36] Two dialects of Koyukon which are not among the languages sampled for this study, Lower and Upper Koyukon, retain the term /deɬ/ which is archaic in the Central koyukon dialect used as the compared language here (2000: 130).

Table 61. Blood.

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tiɬ	1	INTERIOR CANADA	Hare	tél	1
	Koyukon	ləqʰɒn	5		Mountain	tel	1
	Dena'ina (Iliamna)	-			Bearlake	tel	1
	Dena'ina (Inland)	kʰataɬtʰin	4		Tłįchǫ	doː	1
	Dena'ina (OCI)	kutaɬtʰin	4		South Slavey	tel	1
	Dena'ina (UCI)	təl	1		Dene Sųłiné	tel	1
	Ahtna	tɛl	1		Dene Dháh	tel	1
	Holikachuk	tiɬ	1		Beaver	dʌl	1
	Gwich'in (Teetl'ıt)	tah	1	BRITISH COLUMBIA	Carrier	s̠kʰɑi	2
	Gwich'in (Gwıchya)	tah	1		Witsuwit'en	sqəjʔ	2
	Hän	təw	1		Sekani	tal	1
	Lower Tanana	-			Ts'ets'aut	tə́l	1
	Upper Kuskokwim	diɬ	1		Chilcotin	dɛl	1
	Upper Tanana	dəɮ	1	PACIFIC COAST	Hupa	ʦʰeːlɪn	3
	Tanacross	tɛlʔ	1		Galice	tɑɬ	1
YUKON	Northern Tutchone	təl	1		Kato	-	
	Southern Tutchone	tílìʔ	1		Tolowa	-	
	Kaska (DL)	tel	1		Tututni	təɬ	1
	Kaska (FL)	tel	1		Mattole	ʦʰɛːlín	3
	Kaska (GHL)	tal	1		Wailaki	-	
	Kaska (L)	tal	1		Kwa-Clat	til	1
	Kaska (LL)	tal	1	APACHEAN	Navajo	tiɬ	1
	Kaska (P)	tel	1		Western A.	tiɬ	1
	Kaska (RR)	tel	1		S. Carlos A.	tiɬ	1
	Tagish	tíl	1		Jicarilla A.	tiɬ	1
	Tahltan	dɛl	1		Kiowa A.	dìɬ	1
					Mescalero A.		
	Tsuut'ina	tītɬ	1		Lipan A.	tel	1

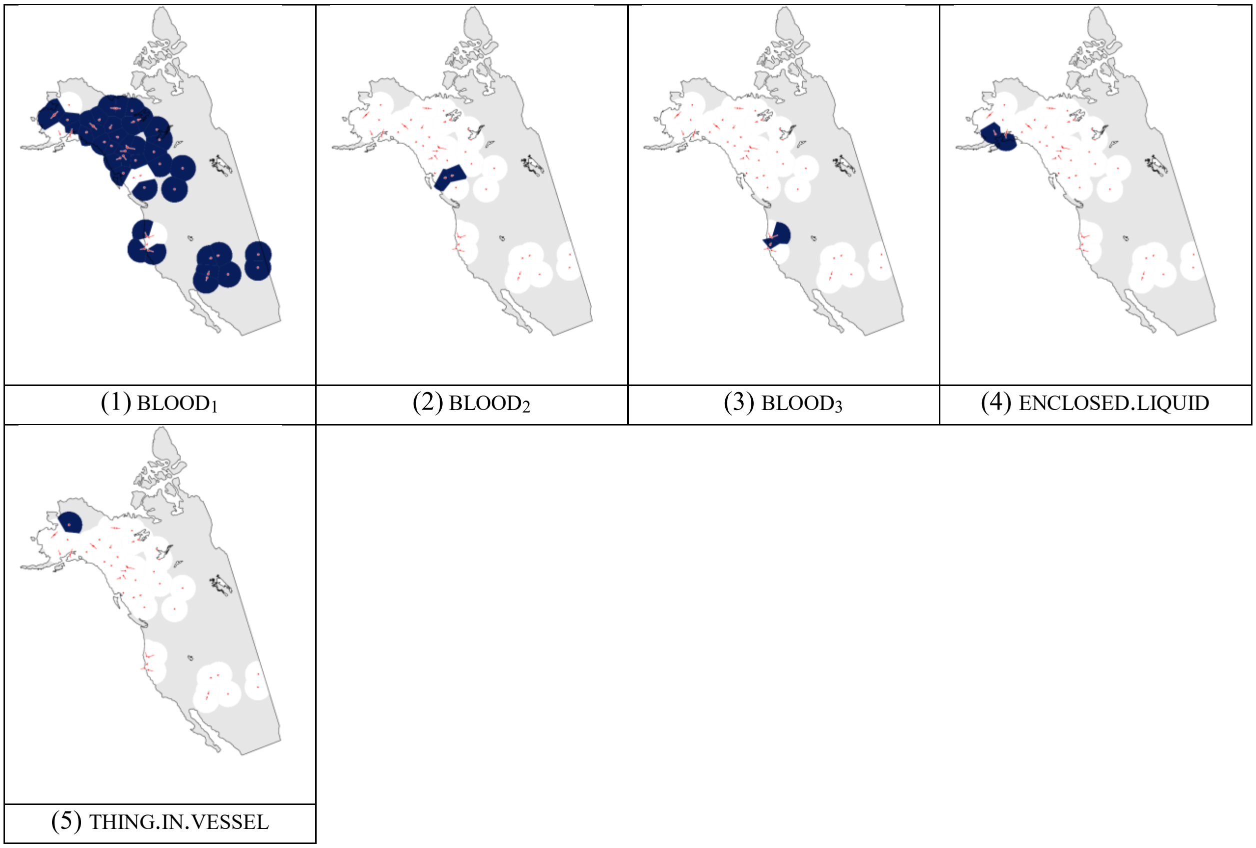


Figure 75. Distributions of terms for ‘blood’

3.5.2 Breath

Two partially related sets of terms dominate the lexicalizations of the referent-concept ‘breath’. Five languages have terms which diverge from these patterns, although only in two cases are these divergent terms the exclusive means of lexicalizing ‘breath’ listed in the lexicographic source materials.

(1) BREATH$_1$: The referent ‘breath’ is most commonly expressed through a monomorphemic cognate form characterized by an initial palatal approximant or post-alveolar fricative, with occasional fricatives in final position, as for example in the case of Chilcotin /jíð/.

(2) BREATH$_2$: In the second most widespread cognate set, the stem described as BREAT$_2$, forms the modifier of a compound whose head is a stem with an alveolar plosive in initial position followed by a low front vowel. This results in forms such as /ta:ju:s/ in Kaska (Dease Lake). The exact meaning of /ta:/ and its cognates is unclear, but it may have originally specified the meaning of the head, /jugs/ BREATH$_1$, to denote the visible condensation of breath in cold air. This meaning is given in the gloss for the Gwich’in (Teetl’ıt) form /te:-ʒìrh/.

(3) BREATH$_3$: Navajo and Western Apache lexicalize the referent breath through the form /jol/, which is unique to these languages.

(4) BREATH$_4$: An additional lexicalization pattern is found in Hupa, /tʃʼe/, but nowhere else among the Athapaskan languages of the sample.

(5) HEART$_1$-MOUTH.OUTER: In Koyukon an additional way of denoting 'breath' is through the lexicalization pattern HEART-MOUTH.OUTER (see Sections 3.3.7 and 3.2.8). It seems likely that the MOUTH.OUTER term has undergone polysemic extension [/to/ MOUTH.OUTER 'outer mouth'] > ℙ > [/to/ MOUTH.OUTER 'outer mouth, opening'] (cf. Jetté and Jones 2000: 570).

(6) BREATHE: Kiowa Apache lexicalizes 'breath' through a deverbal construction glossed as 'to breathe' /hȁ̃:tíʒìʃ/ (Bross 1971: 18).

Table 62. Breath

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	jetr	1	INTERIOR CANADA	Hare	ji, ju	1
	Koyukon	dza:toʔ / jiʦ	5/1		Mountain	-	
	Dena'ina (Iliamna)	-			Bearlake	-	
	Dena'ina (Inland)	-			Tłı̨chǫ	-	
	Dena'ina (OCI)	-			South Slavey	-	
	Dena'ina (UCI)	-			Dene Sųłiné	ji, ʒi	1/1
	Ahtna	ji:ʦʼ	1		Dene Dháh	-	
	Holikachuk	jeʦ	1		Beaver	-	
	Gwich'in (Teetl'ıt)	ʒì:ʔ	1	BRITISH COLUMBIA	Carrier	jiz	1
	Gwich'in (Gwıchya)	te:ʒìrh	2		Witsuwit'en	jiz, jih	1
	Hän				Sekani	-	
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	jiʃ	1		Chilcotin	jíð	
	Upper Tanana	tâ:ʒîɯ	2	PACIFIC COAST	Hupa	je:ʧʼ / ʧʼe	1/4
	Tanacross	jɛjʔ	1		Galice	-	
YUKON	Northern Tutchone	teʐun	2		Kato	-	
	Southern Tutchone	tənsə̀n	2		Tolowa	jeʔsr	1
	Kaska (DL)	ta:ju:s	2		Tututni	-	
	Kaska (FL)	te:ju:s	2		Mattole	-	
	Kaska (GHL)	ta:ju:s	2		Wailaki	-	
	Kaska (L)	te:ju:s	2		Kwa-Clat	-	
	Kaska (LL)	ta:ju:s	2	APACHEAN	Navajo	jih / jol	1/3
	Kaska (P)	te:ju:s	2		Western A.	jol	3
	Kaska (RR)	ta:ju:s	2		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	hȁ̃:tíʒìʃ	6
					Mescalero A.		
	Tsuut'ina	-			Lipan A.	-	

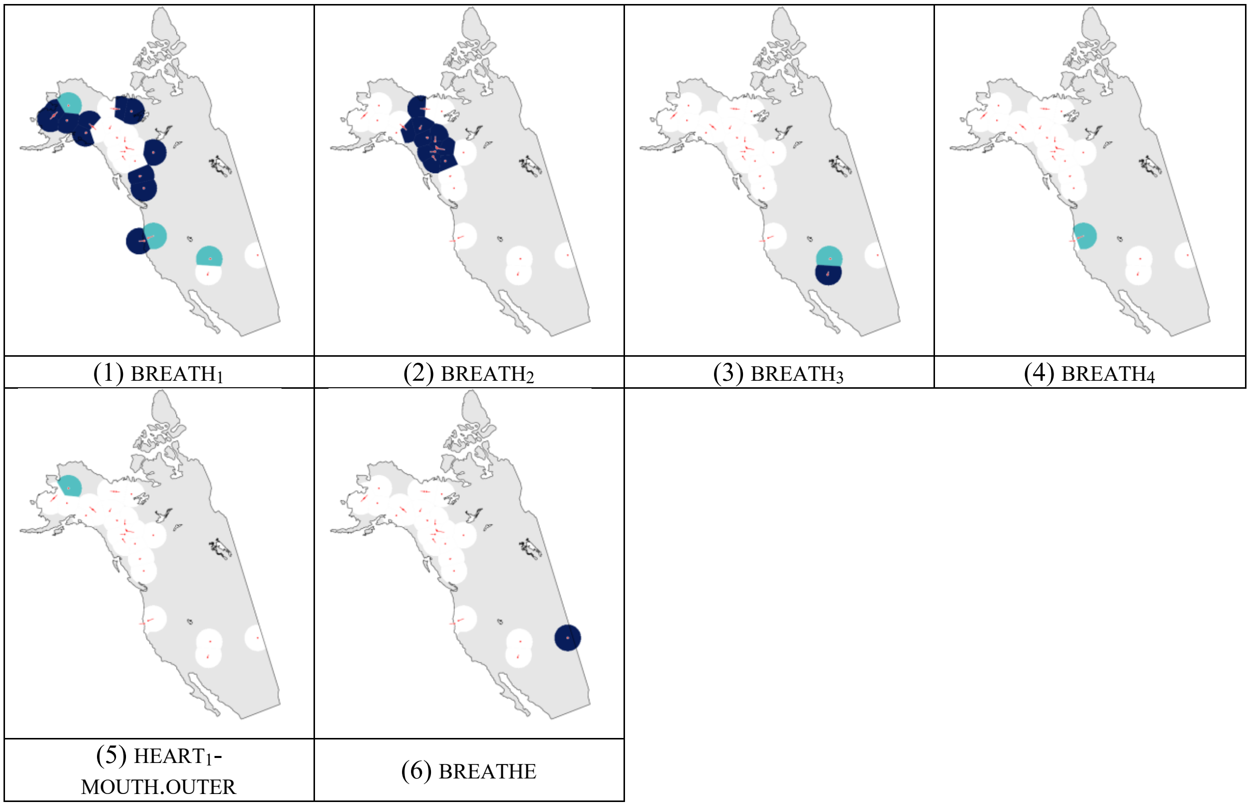


Figure 76. Distributions of terms for 'breath'

3.5.3 Earwax

There are 10 lexicalization patterns for the referent 'earwax', all of which the semantic element EAR.INNER.

(1) EAR-PLUG: The most frequent pattern encodes 'earwax' through the pattern EAR-PLUG, where the latter semantic element is glossed as 'plugged' by in the lexicographic source (Firth 2009: 77) as for example in Gwich'in (Gwɪchya): /ʦiː-tʼòːʔ/, and the former element corresponds to the EAR.INNER pattern (see Section 3.2.4).

(2) EAR-FLAKY: The second most common lexicalization pattern takes the form EAR-FLAKY, with the second element being represented by a deverbal stem, as in Koyukon /ʥəʁ-tʼiz/ (Jetté and Jones 2000: 546).

(3) EAR.INNER-GUNK: The Lower Liard and Liard dialects of Kaska as well a Sekani lexicalize 'earwax' through a compound identified as EAR.INNER-GUNK, since the modifying element corresponds to the cognates set EAR.INNER (see Section 3.2.4) and the head of the compound can be glossed as GUNK following its occurrence in expressions translated as 'eye-jam', 'sleep in eyes', 'soft pitch', or 'pitch gum' (Hargus ms.: 134).

(4) EAR-GREASE: The Dena'ina dialects (except for Iliamna for which no data were available) exhibit the pattern EAR-GREASE, as in the expression found in the Inland dialect: /ʧi-ʁun/ (Kari 2007: 97).

(5) EAR-EXCREMENT: Two languages, employ the lexicalization pattern EAR-EXCREMENT to encode 'earwax': Dene Dháh /ʥietsʰón/ and Dene Sų̨łiné /ʥaɣé-tsʰãn/ (cf. Section 3.5.4).

(6) EAR-GREASE-SCAB: The semantic element GREASE also features in the lexicalization of 'earwax' in found in Ahtna, which, however, adds a component glossed as 'scab' to form the pattern EAR-GREASE-SCAB. The notation SCAB for this semantic element, chosen because of the larger cognate set it belongs to (see Section 3.5.16 Scab), is perhaps slightly misleading for Ahtna, since in that language it also occurs in expression for other bodily secretions, as for example in the term for 'dry nasal mucus' /ənkəs-tʰɑ-luːt/ (Kari 1990: 283), suggesting a path of polysemic extension that has seen a generalization of this term.

(7) EARWAX$_1$: Among Sekani and some dialects of Kaska a second lexicalization pattern is found. This pattern contains the semantic elements EAR.INNER and, possibly, FLATUS (see Section 3.5.5), but the overall meaning of these forms remains obscure and they are identified simply as EARWAX$_1$.

(8) EARWAX$_2$: The lexicalization pattern /ʧʰajɛtoʃ/, identified as EARWAX$_2$, is unique to Lipan Apache.

(9) EARWAX$_3$: The lexicalization pattern /ʥàkmìat/, identified as EARWAX$_3$, is unique to Upper Tanana.

(10) EAR.INNER-INSIDE-EXCREMENT: The Upper Cook Inlet dialect of Dena'ina exhibits a second lexicalization pattern for 'earwax' /ʧi-q'ə-ʃ-ʧʰun/, which has the semantic form EAR.INNER-INSIDE-EXCREMENT.

Table 63. Earwax

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		INTERIOR CANADA	Hare	ʦíʔét’ih	2
	Koyukon	ʦəʁt’iz	2		Mountain	-	
	Dena’ina (Iliamna)	-			Bearlake	ʦíht’óː	1
	Dena’ina (Inland)	ʧiʁun	4		Tłı̨chǫ	ʣîːt’ôː	1
	Dena’ina (OCI)	ʧiqəlʁan	4		South Slavey	-	
	Dena’ina (UCI)	ʧihʁən / ʧiq’əʃʧʰun	4/10		Dene Sųłiné	ʦaɣéʦʰãn	5
	Ahtna	ʦiːʁəluːt	6		Dene Dháh	ʦieʦʰón	5
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	ʦiːt’òːʔ	1	BRITISH COLUMBIA	Carrier	ʦeht’ʌz	2
	Gwich’in (Gwıchya)	ʦiːt’òːʔ	1		Witsuwit’en	-	
	Hän	ʧ’ȅʦìtʰt’ȍrʔ	1		Sekani	ʦitɬ’an / ʣi:kitɬ’o:z	3/7
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ʣàkmìat	9	PACIFIC COAST	Hupa	-	
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	ʦáktʳ’ó	1		Kato	-	
	Southern Tutchone	zəjtr’û	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	-			Wailaki	-	
	Kaska (L)	ʦitɬ’an / ʣi:kitɬ’o:z	3/7		Kwa-Clat	-	
	Kaska (LL)	ʦitɬ’an	3	APACHEAN	Navajo	ʧéːht’iːʒ	2
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	ʦȋkitɬ’i:t			S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	-			Lipan A.	ʧʰajɛtoʃ	8

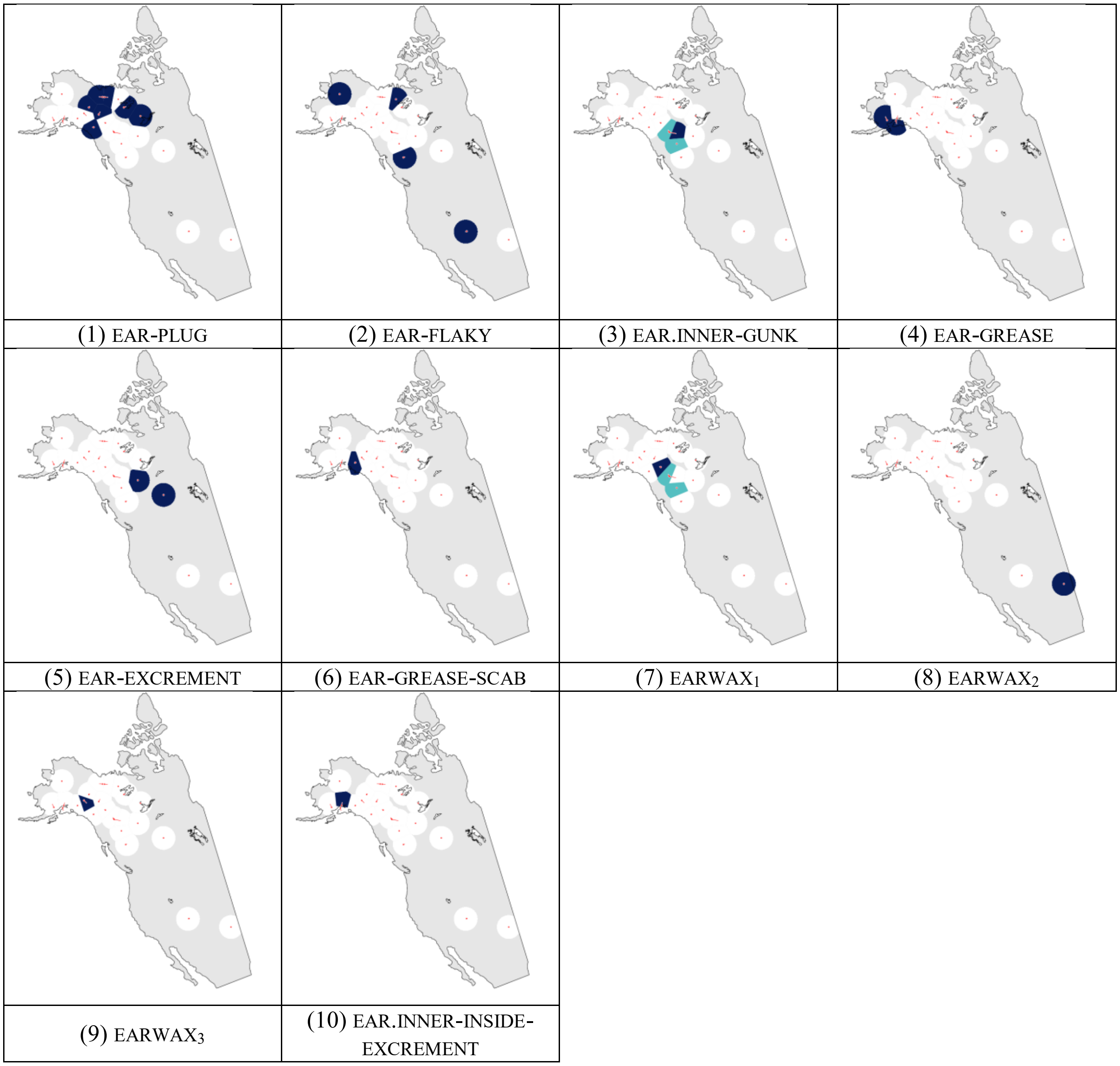


Figure 77. Distributions of terms for ‘earwax’

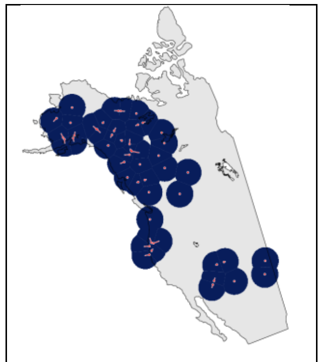
3.5.4 Excrement

All attested forms for the referent-concept ‘excrement’ are clearly related historically. The forms denoting ‘excrement’ constitute one of the most stable lexicalization patterns across all anatomical and effluvial terms found in the sample.

(1) EXCREMENT: The monomorphemic stem that lexicalizes the referent 'excrement' across the Athapaskan languages is characterized by a stem-initial alveolar affricate, alveolar fricative or retroflex plosive, and a stem-final nasal or nasalized vowel.

Table 64. Excrement

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tʳʰonʔ	1	INTERIOR CANADA	Hare	sṍʔ	1
	Koyukon	ʦɒnʔ	1		Mountain	-	
	Dena'ina (Iliamna)	ʧun	1		Bearlake	ʦṍ	1
	Dena'ina (Inland)	ʧʰun	1		Tłįchǫ	ʦõ̀	1
	Dena'ina (OCI)	ʧʰun	1		South Slavey	ʦʰõ	1
	Dena'ina (UCI)	ʧʰun	1		Dene Sųłiné	ʦʰã	1
	Ahtna	ʦʰɑ:nʔ	1		Dene Dháh	ʦʰon	1
	Holikachuk	ʦʰonʔ	1		Beaver	-	
	Gwich'in (Teetl'ıt)	-		BRITISH COLUMBIA	Carrier	ʦʰɑn	1
	Gwich'in (Gwıchya)	-			Witsuwit'en	ʦʰan	1
	Hän	trã̀ʔ	1		Sekani	ʦʰõ̀ʔ	1
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	tʳon	1		Chilcotin	ʦǽn	1
	Upper Tanana	ʦʰâ:nʔ	1	PACIFIC COAST	Hupa	ʧʷʌnʔ	1
	Tanacross	ʦʰãːʔ	1		Galice	ʃɑ:n	1
YUKON	Northern Tutchone	ʦʰénʔ	1		Kato	-	
	Southern Tutchone	sɑ̀n	1		Tolowa	-	
	Kaska (DL)	ʦʰṓ:n	1		Tututni	-	
	Kaska (FL)	ʦʰṓ:n	1		Mattole	txɑ:n	1
	Kaska (GHL)	ʦʰṓ:n	1		Wailaki	-	
	Kaska (L)	ʦʰṓ:n	1		Kwa-Clat	-	
	Kaska (LL)	ʦʰṓ:n	1	APACHEAN	Navajo	ʧʰɑ̃́:ʔ	1
	Kaska (P)	ʦʰṓ:n	1		Western A.	-	
	Kaska (RR)	ʦʰṓ:n	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	ʧʰã	1
	Tahltan	-			Kiowa A.	-	
					Mescalero A.	ʧʰã:n	1
	Tsuut'ina	ʦʰò	1		Lipan A.	-	



EXCREMENT

Figure 78. Distributions of terms for 'excrement'

3.5.5 Flatus

Four patterns are found in the lexicalization of the referent 'flatus'. One pattern, exemplified by Sekani /tɬ'ĩt/, is far more frequent than the other three, however, occurring in eighteen of twenty-seven languages for which data were available.

(1) FLATUS$_1$: This pattern is characterized by an ejective alveolar affricate in stem-initial position and an alveolar stop in the final position, as exemplified by Kaska (Dease Lake dialect) /tɬ'i:t/. Kaska (Ross River) is notable for exhibiting both the variants (**FLATUS$_1$** and **FLATUS$_2$**) indicating that these are indeed two historically distinct forms.

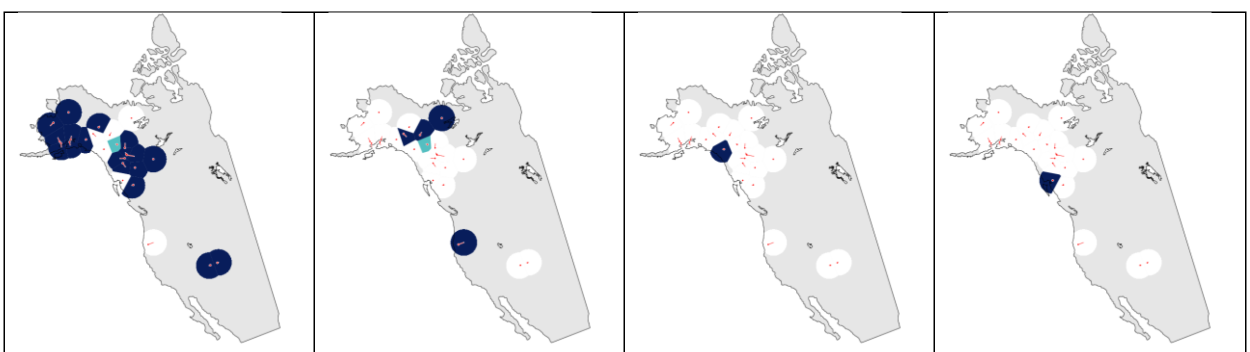
(2) FLATUS$_2$: The second most common pattern is found in Upper Tanana, Northern Tutchone, Hare and Hupa. This form is also characterized by an affricate in stem-initial position, as for example in Hare /ʧír/ but it is not ejectivized and the final position is occupied by either and alveolar stop, a glottal fricative or a trill.

(3) FLATUS$_3$: A possible cognate of the form identified as FLATUS$_2$ also occurs in the morphologically complex lexicalization pattern for the referent 'flatus' occurring in Southern Tutchone. However, there the morpheme /tɑ/ is added to form the expression /tɑ-ʒət̀/. This /ta/ is similar to the first syllable of the expression in the Ts'ets'aut expression. The exact meaning of this morpheme remains unclear.

(4) FLATUS$_4$: The expression lexicalization 'flatus' in Ts'ets'aut appears to be partially similar to the lexicalization pattern found in Southern Tutchone: /ta-p'ɛʔ/. The exact meaning of this morpheme remains unclear.

Table 65. Flatus

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tɬ’it	1	INTERIOR CANADA	Hare	ʧír	1
	Koyukon	tɬ’ət	1		Mountain	-	
	Dena’ina (Iliamna)	-			Bearlake	-	
	Dena’ina (Inland)	tɬ’ət’	1		Tłı̨chǫ	-	
	Dena’ina (OCI)	tɬ’ət’	1		South Slavey	-	
	Dena’ina (UCI)	tɬ’ət’	1		Dene Sųłiné	-	
	Ahtna	tɬ’ɛt’	1		Dene Dháh	tɬ’i	1
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	-		BRITISH COLUMBIA	Carrier	-	
	Gwich’in (Gwıchya)	-			Witsuwit’en	tɬ’ət	1
	Hän	tɬ’ìt	1		Sekani	tɬ’ĩt	1
	Lower Tanana	ʧê:t	2		Ts’ets’aut	tap’ɛ’	4
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	-		PACIFIC COAST	Hupa	ʦʰeh	2
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	ʧɑ:t	2		Kato	-	
	Southern Tutchone	tɑʒə̀t	3		Tolowa	-	
	Kaska (DL)	tɬ’i:t	1		Tututni	-	
	Kaska (FL)	tɬ’i:t	1		Mattole	-	
	Kaska (GHL)	tɬ’i:t	1		Wailaki	-	
	Kaska (L)	tɬ’i:t	1		Kwa-Clat	-	
	Kaska (LL)	tɬ’i:t	1	APACHEAN	Navajo	tɬ’it	1
	Kaska (P)	tɬ’i:t	1		Western A.	-	
	Kaska (RR)	tɬ’i:t / ʧe:t	1/2		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	tɬ’it	1
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	-			Lipan A.	-	



(1) FLATUS1 (2) FLATUS2 (3) FLATUS3 (4) FLATUS4

Figure 79. Distributions of terms for ‘flatus’

3.5.6 Gall[37]

There are six patterns among the lexicalization patterns, which encode the referent-concept ‘gall’ in the Athapaskan languages of the sample.

(1) GALL$_1$: The dominant pattern is given by a monomorphemic stem with an initial ejective alveolar affricate and a stem-initial affricate, as exemplified by the Deg Xinag form /tɬ’iʦ/.

(2) GALL$_2$: The lexicalization pattern /tɬ’ò:/, identified as GALL$_2$, is found in Tłı̨chǫ, Mountain Slavey, and Northern Tutchone.

(3) GALL$_3$: The lexicalization pattern /t’iʒ/, identified as GALL$_3$, is unique to Navajo.

(4) GALL$_4$: The lexicalization pattern /ʒĭ:t k’ȗ: nìni:dê:k/, identified as GALL$_2$, is unique to Upper Tanana.

(5) GALL$_5$: The lexicalization pattern /nʔʧʰi/, identified as GALL$_5$, is unique to Jicarilla Apache.

(6) WATER: In Ts’ets’aut the form for ‘gall’ also co-lexicalizes ‘water’. Since the form for ‘water’ /tˣuʔ/ is the reflex of a widely attested cognate across Athapaskan languages, it is clear that the lexicalization pattern found in Ts’ets’aut is the result of a polysemic extension [/tˣuʔ/ WATER ‘water’] > ℙ > [/tˣuʔ/ GALL ‘gall’].

(7) WATER-ILLNESS: In Tłı̨chǫ, the referent ‘gall’ can also be lexicalized through the form /tih-ɬĩ:/, a compound of the elements WATER and ILLNESS. This form also lexicalizes ‘diarrhea’.

[37] The term ‘gall’ is understood as a synomym for ‘bile’.

Table 66. Gall

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	tɬ’iʦ	1	INTERIOR CANADA	Hare	-	
	Koyukon	tɬ’əʦ	1		Mountain	tɬ’óʔ	2
	Dena’ina (Iliamna)	-			Bearlake	-	
	Dena’ina (Inland)	tɬ’əʧ’	1		Tłįchǫ	tihɬĩ: / tɬ’ò:	7/2
	Dena’ina (OCI)	tɬ’əʧ’	1		South Slavey	-	
	Dena’ina (UCI)	tɬ’əʧ’	1		Dene Sųłiné	tɬ’éz	1
	Ahtna	-			Dene Dháh	-	
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	-		BRITISH COLUMBIA	Carrier	tɬ’ʌz	1
	Gwich’in (Gwıchya)	-			Witsuwit’en	-	
	Hän	-			Sekani	-	
	Lower Tanana	-			Ts’ets’aut	tˣuʔ	6
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ʒĭ:t k’ŵ: nìni:dê:k	4	PACIFIC COAST	Hupa	tɬ’ɪsʧ’	1
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	tɬ’óʔ	2		Kato	-	
	Southern Tutchone	tɬ’ɨr	1		Tolowa	-	
	Kaska (DL)	tɬ’éʦ	1		Tututni	-	
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	tɬ’eʦ	1		Wailaki	-	
	Kaska (L)	tɬ’aʦ	1		Kwa-Clat	-	
	Kaska (LL)	tɬ’aʦ	1	APACHEAN	Navajo	t’iʒ	3
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	tɬ’éʦ	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	nʔʧʰi	5
	Tahltan	-			Kiowa A.	tɬ’ìʃ	1
					Mescalero A.		
	Tsuut’ina	tɬ’ìts	1		Lipan A.	-	

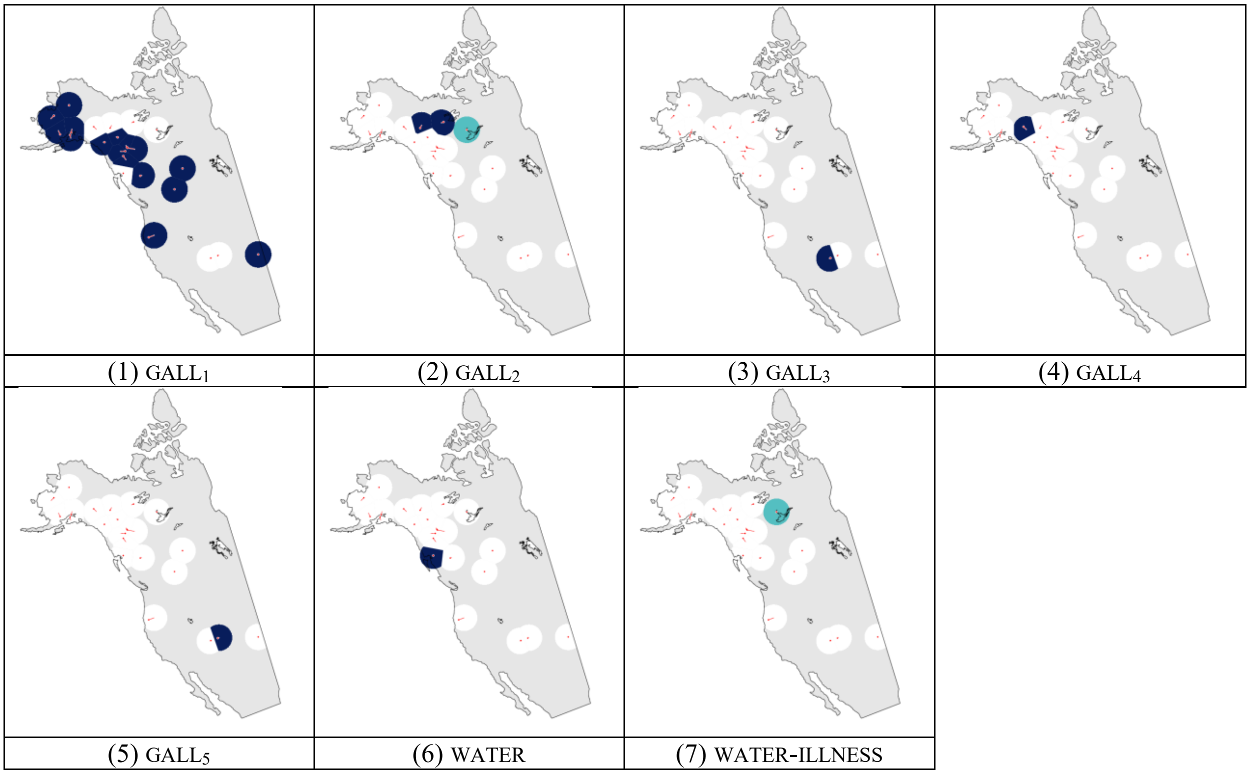


Figure 80. Distributions of terms for ‘gall’

3.5.7 Mother’s milk

The referent ‘mother’s milk’ (or ‘breast milk’) has the notable distinction of being the only case in the sample which exhibits some evidence of borrowing in the Dena’ina forms /muluku/ and /malaku/ glossed as ‘milk’. All lexicalization patterns contain either the element BREAST$_1$ or BREAST$_2$ (see Section 3.3.6). There are 8 distinct lexicalization patterns for this referent.

(1) BREAST$_1$: The most common lexicalization for ‘mother’s milk’ emerges as the result of a polysemic extension [/t’óʔ/ BREAST ‘breast’] > ℙ > [/t’óʔ/ BREAST ‘breast, mother’s milk’]. The term /t’óʔ/ with its denotation ‘breast’ may already be the result of a semantic shift [/t’óʔ/ SUCK ‘to suck’] > ℙ > [/t’óʔ/ BREAST ‘breast’], since this verb stem occurs in many Athapaskan languages. The directionality of this change remains unclear, however.

(2) BREAST$_2$: Parallel to the lexicalizations through the BREAST$_1$ cognates, the BREAST$_2$ cognates also extend to refer to ‘mother’s milk’: [/maʔ/ BREAST ‘breast’] > ℙ > [/maʔ/ MOTHER’S.MILK ‘breast, mother’s milk’] or [/mam/ BREAST$_2$ ‘breast’] > ℙ > [/mam/ BREAST$_2$ ‘breast, mother’s milk’].

(3) BREAST$_2$-SUCK: Dena’ina (Outer Cook Inlet) has a second lexicalization pattern for ‘mother’s milk’ /mamʔa-ɬts’iʔ/. Here the term BREAST$_2$ is combined with a deverbal form SUCK.

(4) BREAST$_2$-MILK: In Upper Cook Inlet and Inland Dena’ina the term encoding BREAST$_2$ is combined with the borrowed term for ‘milk’, resulting in the lexicalization pattern BREAST$_2$-MILK: /mamʔa muluku/.

(5) BREAST$_1$-JUICE: In Teetl’it Gwich’in the BREAST$_1$ reflex is combined with the term for ‘juice’ resulting in the lexicalization pattern BREAST$_1$-JUICE: /t’ok ʧʰùʔ/.

The lexicalization patterns in Northern and Southern Tutchone as well as Hän all involve the semantic element BREAST$_1$, but this element occurs in morphologically complex constructions that otherwise remain difficult to interpret.

(6) MOTHER’S.MILK$_1$: Hän as well as Northern and Southern Tutchone lexicalize ‘mother’s milk’ through closely related expressions, which involve the semantic element BREAST$_1$, as for example in Southern Tutchone /jèʧə̂̀l ʧ’û/. The other component, /jèʧə̂̀l/, remains opaque, and the lexicalization pattern is identified merely as MOTHER’S.MILK$_1$.

(7) MOTHER’S.MILK$_2$: Northern Tutchone has an additional lexicalization pattern for the referent ‘mother’s milk’, /ɑjéntjɑ́ʔ mɑ́ʔ/, closely related expressions to the pattern described as MOTHER’S.MILK$_1$. The pattern is distinct in that it features the semantic element BREAST$_2$, instead of the element BREAST$_1$.

(8) MOTHER’S.MILK$_3$: Deg Xinag lexicalizes ‘mother’s milk’ through the unique expression /maʔ-kes/. The first component of this morphologically complex form lexicalizes BREAST$_2$, but the second component remains unidentified.

Table 67. Mother’s milk

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	maʔ kes	8	INTERIOR CANADA	Hare	-	
	Koyukon	-			Mountain	tʼóʔ	1
	Dena’ina (Iliamna)	-			Bearlake	-	
	Dena’ina (Inland)	mam muluku	4		Tłı̨chǫ	-	
	Dena’ina (OCI)	mam / mam ɬtsʼiʔ	2/5		South Slavey	-	
	Dena’ina (UCI)	mamʔa malaku	4		Dene Sųłiné	-	
	Ahtna	-			Dene Dháh	-	
	Holikachuk	maʔ	2		Beaver	-	
	Gwich’in (Teetl’ıt)	tʼok / tʼok ʧʰùʔ	1/5	BRITISH COLUMBIA	Carrier	-	
	Gwich’in (Gwıchya)	-			Witsuwit’en	-	
	Hän	tʼʳèⁿjă: tʼŏ:ʔ	6		Sekani	-	
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	ʦʼuʔ	1		Chilcotin	tθʼóɣ	1
	Upper Tanana	tʼû:ʔ	1	PACIFIC COAST	Hupa	ʦʼo:ʔ	1
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	ɑjéntjáʔ tʼók / ɑjéntjáʔ máʔ	6/7		Kato	-	
	Southern Tutchone	jèʧə̂l ʧʼû	6		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	tʼu	1		Mattole	-	
	Kaska (GHL)	tʼóʧ	1		Wailaki	-	
	Kaska (L)	tʼu	1		Kwa-Clat	-	
	Kaska (LL)	tʼu	1	APACHEAN	Navajo	-	
	Kaska (P)	tʼu	1		Western A.	-	
	Kaska (RR)	tʼu	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	ʔíbèʔ	2
					Mescalero A.		
	Tsuut’ina	-			Lipan A.	-	

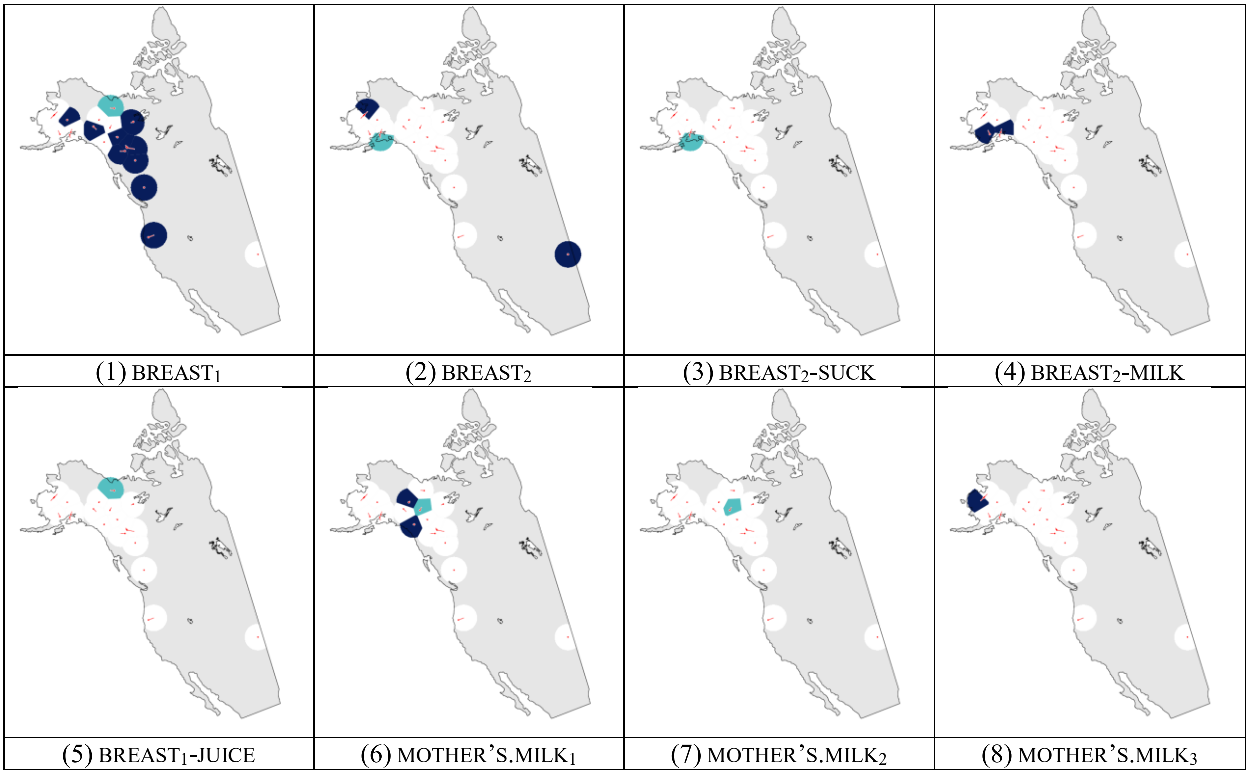


Figure 81. Distributions of terms for 'mother's milk'

3.5.8 Pus

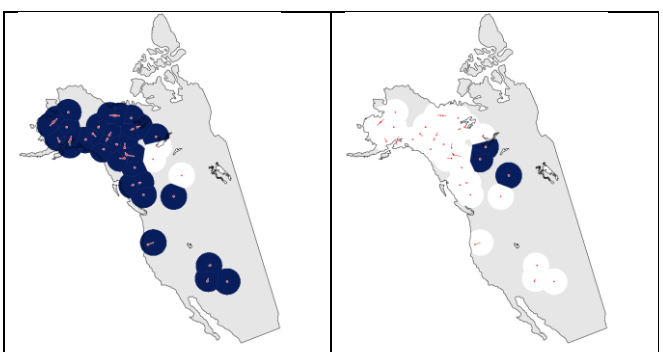
'Pus' is one of the most homogenously lexicalized referents in the sample. The terms for 'pus' fall into two lexicalization patterns, both constituted of monomorphemic stems.

(1) PUS$_1$: The first cognate set is characterized by an initial velar or uvular fricative and with occasional final fricatives, as for example in Witsuwit'en /χəz/. This pattern is decidedly more widespread than the pattern described as PUS$_2$.

(2) PUS$_2$: The second set is found only in the Mackenzie languages South Slavey, Dene Sųłiné and Dene Dháh and is characterized by an alveolar ejectivized affricate in syllable initial position, followed by a mid-front vowel and a fricative or zero in syllable final position, as in Dene Sųłiné /ʦʼés/.

Table 68. Pus

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	xiθ	1	INTERIOR CANADA	Hare	xewi	
	Koyukon	xəɬ	1		Mountain	xevi	
	Dena’ina (Iliamna)	həz	1		Bearlake	heweh	
	Dena’ina (Inland)	həz	1		Tłı̨chǫ	xe	1
	Dena’ina (OCI)	həj	1		South Slavey	ʦ’éh	2
	Dena’ina (UCI)	χəz	1		Dene Sų̨łiné	ʦ’és	2
	Ahtna	xiθ	1		Dene Dháh	ʦ’e	2
	Holikachuk	xaoh	1		Beaver	-	
	Gwich’in (Teetl’ıt)	xoh	1	BRITISH COLUMBIA	Carrier	xʌẕ	1
	Gwich’in (Gwıchya)	xiθ	1		Witsuwit’en	χəz	1
	Hän	xöh	1		Sekani	xũz	1
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	his	1		Chilcotin	xað̂	1
	Upper Tanana	ɣɯh	1	PACIFIC COAST	Hupa	xɪs	1
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	xo	1		Kato	-	
	Southern Tutchone	ɣɨ̂	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	hes	1		Mattole	-	
	Kaska (GHL)	hes	1		Wailaki	-	
	Kaska (L)	hēs	1		Kwa-Clat	-	
	Kaska (LL)	hes	1	APACHEAN	Navajo	his	1
	Kaska (P)	hes	1		Western A.	his	1
	Kaska (RR)	hes	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	jīz	1		Lipan A.	-	



(1) PUS1 (2) PUS2

Figure 82. Distributions of terms for ‘pus

3.5.9 Sweat

The referent ‘sweat’ is lexicalized through 10 distinct lexicalization patterns. Morphologically some of the forms in this sub-sample are verb forms, with no derived nominal form available in the lexicographic source materials.

(1) SWEAT$_1$: The main lexicalization pattern for the referent-concept ‘sweat’ takes the form of a monomorphemic root with a stem-initial dental or alveolar fricative or palatal approximant and a stem-final lateral approximant or labio-velar fricative, as in Witsuwit’en /zil/. The form was assigned the semantic value SWEAT$_1$. The root /zil/ is related to a verb stem with the meaning WARM as, for example, in Ahtna /zel/ (Kari 1990: 455).

(2) BE.WARM: The language Dene Sųłiné lexicalizes the referent-concept ‘sweat’ through a deverbal nominalization based on the stem WARM: /nĩ́-ðíɬ-i/. In the lexicographic source materials for Hupa and Wailaki no nominal form was given for ‘sweat’. However, verbs glossed as ‘I’m sweating’ contained the stem lexicalizing the semantic element WARM, as in Wailaki /ya:-di-ɣin-sil/. Therefore, these lexicalizations have been included as part of the TO.BE.WARM pattern.

(3) BE.SWEATING: In Lower Tanana and two dialects of Kaska (recorded at Frances Lake and Good Hope Lake), the referent ‘sweat’ is also lexicalized through a deverbal form, but the root morpheme is different from that in the BE.WARM case described above. All three languages share the cognate stem /t’a/, /t’eʔ/, or /t’e:s/, exemplified by the Lower Tanana form /se-ʔɬ to-ʧ’e-tað-t’aʔ/ which is glossed as ‘I am sweating’ (Kari 1994: 251).

(4) WATER.MOVES: In Koyukon, only a verbal form, /pəntʰotənhox/, is given in the source materials. This form is given the literal gloss ‘water is coming down on him’ (Jetté and Jones 2000: 703), which is here abbreviated as WATER-MOVES.

(5) HEAD-ON-WATER: Bearlake encodes the referent-concept ‘sweat’ through the tripartite form /kʷʰí-k’e:h-tʰu/ which encodes the lexicalization pattern HEAD-ON-WATER.

(6) FACE-WATER: In the first of the two lexicalizations found for the referent ‘sweat’ in Tłı̨chǫ, the form /nì-tʰì/, ‘sweat’ is encoded as the water occurring on the face or FACE-WATER.

(7) INSIDE-WATER: In the second of the two lexicalizations found for the referent ‘sweat’ in Tłı̨chǫ, the form /t’à:-tì/, ‘sweat’ is encoded as the water occurring on the inside or INSIDE-WATER.

(8) SWEAT$_2$: Inland Dena’ina has a unique lexicalization pattern for ‘sweat’ /əʃəma/, identified as SWEAT$_2$.

(9) SWEAT$_3$: Mountain Slavey has a unique lexicalization pattern for ‘sweat’ /tɬʰa-ni-fi/, identified as SWEAT$_2$.

(10) BE.SWEATING₂: The Teetl’it Gwich’in term /ʒi-nil-ʒaː/ is glossed as ‘I am sweating’ but the root /ʒaː/ is not cognate with the stems found in the forms described as BE.SWEATING (see pattern 3 in this section), hence it is assigned its own identifier BE.SWEATING₂.

Table 69. Sweat

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	-		INTERIOR CANADA	Hare	wél	1
	Koyukon	pəntʰotənhox	4		Mountain	tɬʰanifi	9
	Dena’ina (Iliamna)	-			Bearlake	kʷʰí k’eːh tʰu	5
	Dena’ina (Inland)	zil / əʃəma	1/8		Tłı̨chǫ	nìtʰì / t’àːtì	6/7
	Dena’ina (OCI)	zil	1		South Slavey	ðel	1
	Dena’ina (UCI)	jil	1		Dene Sų̨łiné	nĩ́ðíɬi	2
	Ahtna	səl	1		Dene Dháh	ðeːl	1
	Holikachuk	-			Beaver	-	
	Gwich’in (Teetl’ıt)	ʒinilʒaː	10	BRITISH COLUMBIA	Carrier	ʦ’ɑhɑɬt̪s̪íɬ	
	Gwich’in (Gwıchya)	-			Witsuwit’en	zil	1
	Hän	-			Sekani	zal	1
	Lower Tanana	totʃ’etaðt’aʔ	3		Ts’ets’aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	θîːlʔ	1	PACIFIC COAST	Hupa	xaːnɪʍseːl	2
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	ðʲáwʔ	1		Kato	-	
	Southern Tutchone	ðèl	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	kʰeːtenaːt’eʔ	3		Mattole	-	
	Kaska (GHL)	kʰeːtenaːt’eːs / zel	3/1		Wailaki	jaːdiɣinsil	2
	Kaska (L)	zel	1		Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	siːl	1
	Kaska (P)	-			Western A.	-	
	Kaska (RR)	-			S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	θɛɬ	1		Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	-			Lipan A.	-	

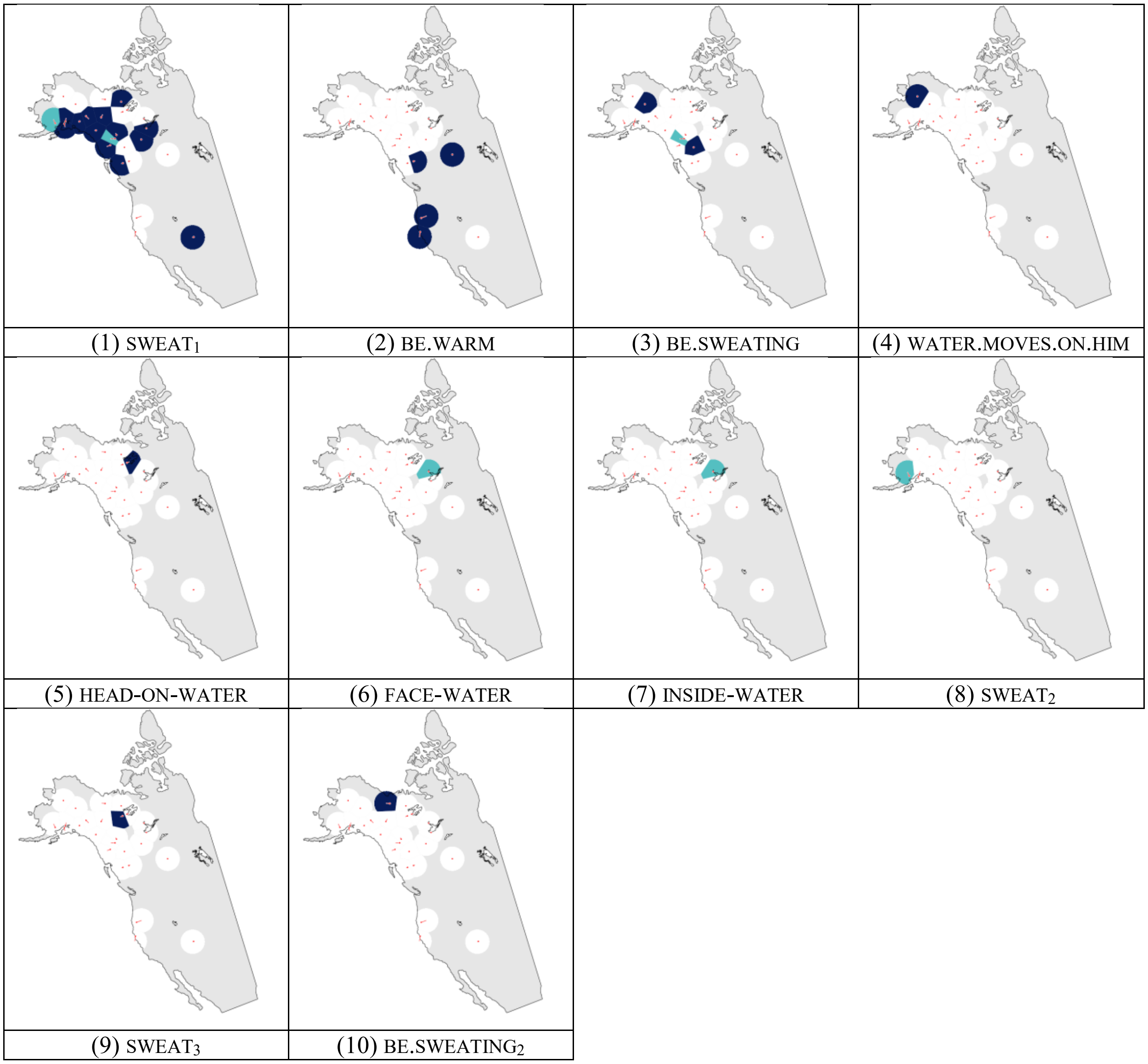


Figure 83. Distributions of terms for 'Sweat'

3.5.10 Tear

The referent 'tear' is lexicalized exclusively through morphologically complex forms, all of which contain the semantic element WATER. There are seven patterns overall.

(1) EYE$_2$-WATER: The most common lexicalization pattern is a compound formed from the semantic elements EYE$_2$ (see Section 3.2.5) and WATER, as for example in Mountain Slavey /ta-tʰúʔ/.

(2) EYE$_1$-WATER: The most common lexicalization pattern is a compound formed from the semantic elements EYE$_1$ (see Section 3.2.5) and WATER, as for example in Southern Tutchone /nɑ-ʧʰù/.

(3) CRYING-WATER: The second most widespread lexicalization pattern is crying-water, as exemplified by the Gwich'in (Gwıchya) expression /tʳeː-ʧùʔ/ (Firth 2005: 242).

(4) GRIEF-WATER: The Koyukon term /təni-tʰuʔ/ presents a variation on the theme described as CRYING-WATER, lexicalizing GRIEF rather than CRYING, rendering the pattern GRIEF-WATER.

(5) EYE$_1$-CRYING-WATER: Both the semantic element CRYING and EYE form part of the lexicalization pattern expressed by Hän /nə-trö-ʧʰùʔ/: EYE-CRYING-WATER.

(6) EYE$_1$-ON-WATER: Hupa /naː-q'i-toʔ/ encodes the location of the 'water' in the lexicalization pattern EYE-ON-WATER (Hoopa Valley Tribe 1996: 95), which is also found in Navajo /ná-k'eː-ʃ-tˣoʔ/.

(7) REGION-WATER: Kiowa Apache follows a similar principle to Hupa and Navajo, but with different morpho-semantic resources: /té-kʰòː/ REGION-WATER (Bross 1971:9).

Table 70. Tear

	Language	**BEET**	#		**Language**	**BEET**	#
ALASKAN	Deg Xinag	srixtʰeʔ	3	**INTERIOR CANADA**	Hare	ratúʔ	1
	Koyukon	təni tʰuʔ	4		Mountain	tatʰúʔ	1
	Dena'ina (Iliamna)	nuʧəʁtaʔa	3		Bearlake	natʰú	2
	Dena'ina (Inland)	-			Tłı̨chǫ	-	
	Dena'ina (OCI)	-			South Slavey	natʰú	2
	Dena'ina (UCI)	-			Dene Sųłiné	naɣétʰué	2
	Ahtna	ʦʰɑʁ tʰuː	3		Dene Dháh	daːtʰú	1
	Holikachuk	ʦʰixtʰoːʔ	3		Beaver	-	
	Gwich'in (Teetl'ıt)	tʳeːʧùʔ	3	**BRITISH COLUMBIA**	Carrier	nɑʦʰúltuʔ	5
	Gwich'in (Gwıchya)	tʳeːʧùʔ	3		Witsuwit'en	-	
	Hän	nətröʧʰùʔ	5		Sekani	tātʰùʔ	1
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	-			Chilcotin	næʦɛntú	5
	Upper Tanana	ʦʰɯh tûːʔ	3	**PACIFIC COAST**	Hupa	naːq'ito'	6
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	náːkʰ tʰúʔ / ʦʰáj tʰúʔ	1/3		Kato	-	
	Southern Tutchone	nɑʧʰù	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	taːtʰúʔ	1		Mattole	nάːtxóʔ	1
	Kaska (GHL)	teːtʰúʔ	1		Wailaki	-	
	Kaska (L)	taːtʰúʔ	1		Kwa-Clat	-	
	Kaska (LL)	-		**APACHEAN**	Navajo	nák'eːʃtxoʔ	6
	Kaska (P)	taːtʰúʔ	1		Western A.	náːtʰú / táːtʰú	1/2
	Kaska (RR)	taːtʰúʔ	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	tékʰòː	7
					Mescalero A.		
	Tsuut'ina	nátʰú	2		Lipan A.	-	

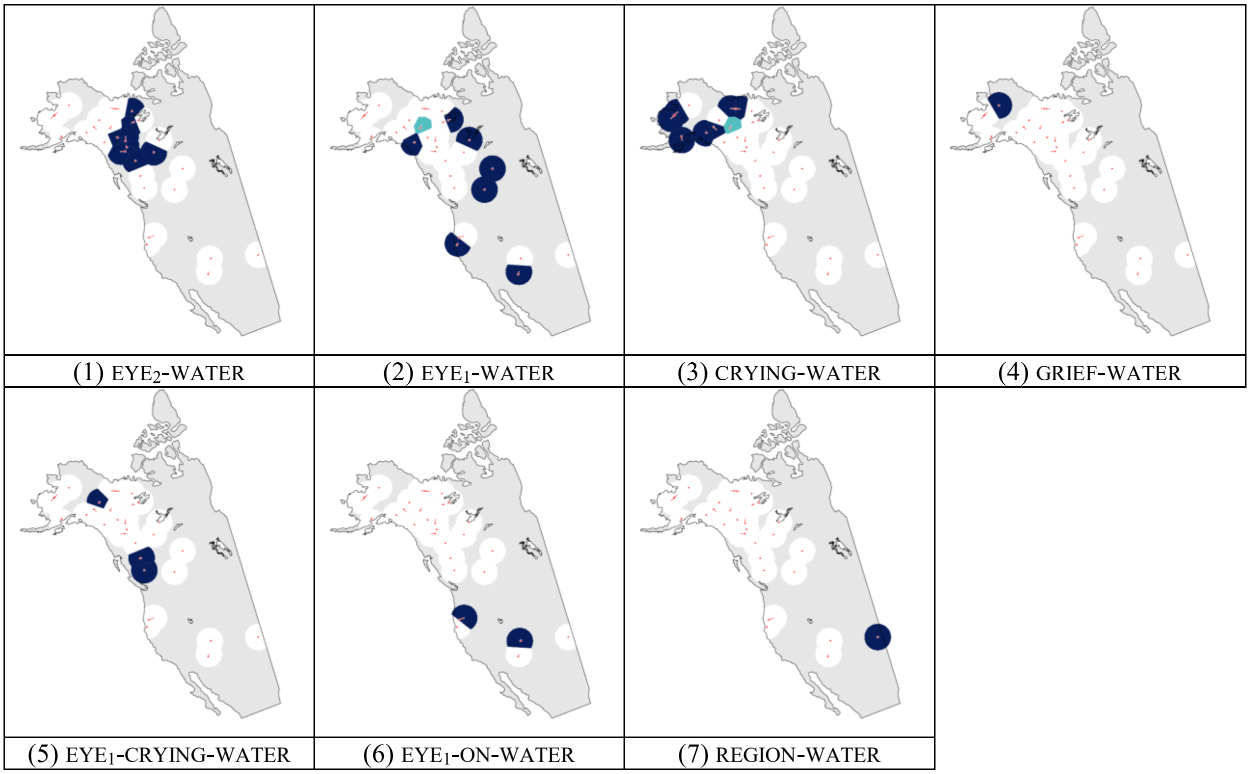


Figure 84. Distributions of terms for 'tear'

3.5.11 Urine

The forms lexicalizing the referent 'urine' are very cognate across the sample, almost exclusively falling under the same pattern, with only Dene Dháh and Ts'ets'aut showing diverging lexicalizations.

(1) URINE$_1$: The dominant pattern is characterized by a monomorphemic cognate stem with a voiceless lateral fricative, lateral approximant or glottal fricative in initial position and a stem-final consonant, typically a fricative or affricate, as exemplified by Dena'ina (Iliamna) /ɬəʧ/.

(2) URINE$_2$: Dene Dháh encodes 'urine' with the unique and divergent form /tɬʰáh-θói/, identified here as the lexicalization path URINE$_2$.

(3) URINE$_3$: Ts'ets'aut encodes 'urine' with the unique and divergent form /kul/, identified here as the lexicalization path URINE$_3$.

Table 71. Urine

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ɬitr	1	INTERIOR CANADA	Hare	léʔ	1
	Koyukon	-			Mountain	-	
	Dena’ina (Iliamna)	ɬəʧ	1		Bearlake	heːʃ	1
	Dena’ina (Inland)	-			Tłı̨chǫ	lo	1
	Dena’ina (OCI)	-			South Slavey	lez	1
	Dena’ina (UCI)	-			Dene Sųłiné	ləz	1
	Ahtna	ɬəʦ	1		Dene Dháh	tɬʰáhθói	2
	Holikachuk	ɬiʦ	1		Beaver	-	
	Gwich’in (Teetl’ıt)	ɬirh	1	BRITISH COLUMBIA	Carrier	lʌz	1
	Gwich’in (Gwıchya)	ɬirh	1		Witsuwit’en	łəz	1
	Hän	ɬor	1		Sekani	ɬaʦ	1
	Lower Tanana	ɬetr	1		Ts’ets’aut	kul	3
	Upper Kuskokwim	ɬitʳ’	1		Chilcotin	ɬɛd	1
	Upper Tanana	ɬɯh	1	PACIFIC COAST	Hupa	lɪʧ	1
	Tanacross	ɬɛʦ	1		Galice	-	
YUKON	Northern Tutchone	ɬro	1		Kato	-	
	Southern Tutchone	ɬɨr	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	leʦ	1		Mattole	lóʔ	1
	Kaska (GHL)	léʦ	1		Wailaki	-	
	Kaska (L)	láʦ	1		Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	ɬiʒ	1
	Kaska (P)	leʦ	1		Western A.	liʒ	1
	Kaska (RR)	leʦ	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	ɬiʃ, liːʧ	1
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	-			Lipan A.	-	

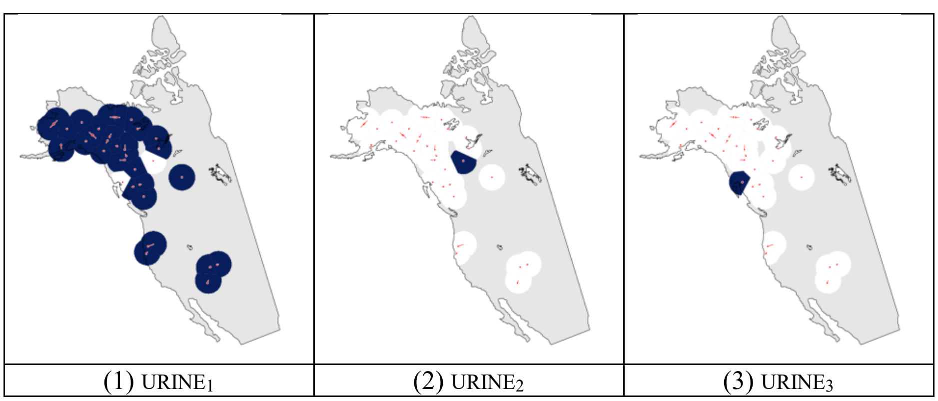


Figure 85. Distributions of terms for ‘urine’

3.5.12 Vomit

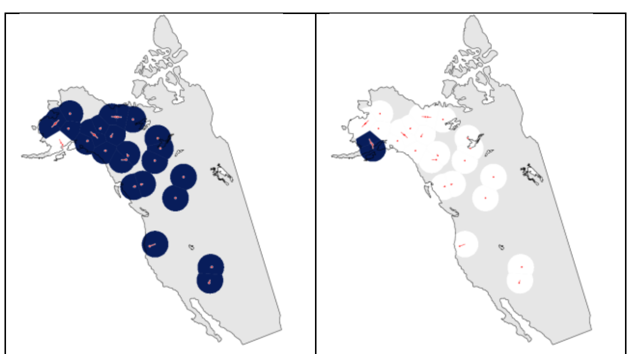
Almost all the terms lexicalizing the referent 'vomit' in the sample are all formed on the basis of the same root. However, the lexicographic source materials for some languages do not list a nominal form for 'vomit', only verbal forms. Since the stem corresponds to the general pattern, here identified as VOMIT$_1$, they have been classified as exhibiting the same lexicalization pattern. The languages for which the resources listed only verbal are: South Slavey, Upper Tanana, Tłı̨chǫ, Kaska (Good Hope Lake), Kaska (Liard), Western Apache, and Dena'ina (Iliamna). The last example forms a verb-stem on the basis of VOMIT$_2$.

(1) VOMIT$_1$: This monosyllabic cognate stem is characterized by an initial velar or uvular stop and a final fricative, palatal approximant, or glottal plosive, as exemplified by Navajo /kʷih/.

(2) VOMIT$_2$: The Inland and Iliamna dialects of Dena'ina lexicalize 'vomit' through the stem /vaq/.

Table 72. Vomit

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	qʰij̥	1	INTERIOR CANADA	Hare	kú	
	Koyukon	qʰuj̊	1		Mountain	-	
	Dena’ina (Iliamna)	nutʰvaq’i	2		Bearlake	-	
	Dena’ina (Inland)	vaq’	2		Tłįchǫ	naxaeko	1
	Dena’ina (OCI)	-			South Slavey	naʦ’ekʰu	1
	Dena’ina (UCI)	-			Dene Sųłiné	kʰúɬ	1
	Ahtna	kʰoj	1		Dene Dháh	kʰuʔẽ	1
	Holikachuk	qʰuj̊	1		Beaver	-	
	Gwich’in (Teetl’ıt)	kʷaìh	1	BRITISH COLUMBIA	Carrier	kʰu	1
	Gwich’in (Gwıchya)	kʷaìh	1		Witsuwit’en	qʰoj	1
	Hän	kʰoj	1		Sekani	-	
	Lower Tanana	-			Ts’ets’aut	-	
	Upper Kuskokwim	kwʃ	1		Chilcotin	-	
	Upper Tanana	naʔiʃkoj̊	1	PACIFIC COAST	Hupa	xoj	1
	Tanacross	kʰoj̊	1		Galice	-	
YUKON	Northern Tutchone	kʰu	1		Kato	-	
	Southern Tutchone	kʲu	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	-			Mattole	-	
	Kaska (GHL)	kʰuʔ	1		Wailaki	-	
	Kaska (L)	kʰuʔ	1		Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	kʷih	1
	Kaska (P)	-			Western A.	nákʰoi	1
	Kaska (RR)	-			S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut’ina	kʰùy	1		Lipan A.	-	



(1) VOMIT$_1$ | (2) VOMIT$_2$

Figure 86. Distributions of terms for ‘vomit’

3.5.13 Saliva

The terms for 'saliva' fall into two partially overlapping cognate sets, with the exception of Mattole, which has its own unique form.

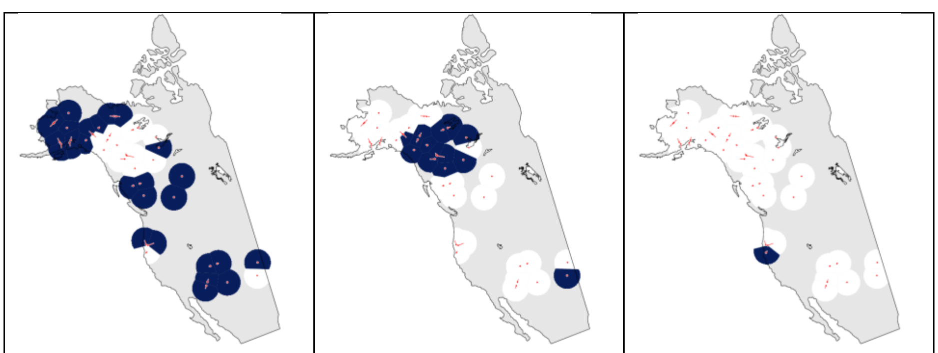
(1) SALIVA$_1$: All forms include cognate variants of a stem characterized by a stem-initial alveolar or post-alveolar fricative (retroflex in Deg Xinag, Gwich'in, Hän and Upper Kuskokwim) and, frequently, a plosive in stem-final position, as exemplified by Tanacross /sek/. Those languages that lexicalize 'saliva' through this monomorphemic stem have been identified as exhibiting the lexicalization pattern SALIVA$_1$.

(2) SALIVA$_2$: The forms of this lexicalization pattern are similar to those described under SALIVA$_1$, but they feature an additional morpheme /teː/ or /taː/. While it is tempting to see these terms morphemes as encoding the referent 'mouth', the correspondence is uneven and the resulting semantics improbable, especially for the Kaska examples. Therefore this form is analyzed simply as SALIVA$_2$, and the semantics of the term must remain opaque until further evidence can be brought to bear on these matters.

(3) SALIVA$_3$: The form /ʧxʰiʔɬ/ is unique to Mattole.

Table 73. Saliva

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	sraq	1	INTERIOR CANADA	Hare	-	
	Koyukon	saq	1		Mountain	tezéʔ	2
	Dena'ina (Iliamna)	ʃaq'	1		Bearlake	wá e:zé	2
	Dena'ina (Inland)	ʒaq'	1		Tłįchǫ	wazè:	2
	Dena'ina (OCI)	ʒaq'	1		South Slavey	zɛɛ	1
	Dena'ina (UCI)	jaq'	1		Dene Sųłiné	zex	1
	Ahtna	saʔ	1		Dene Dháh	ta:ze	2
	Holikachuk	saqʰ	1		Beaver	-	
	Gwich'in (Teetl'ıt)	srik	1	BRITISH COLUMBIA	Carrier	zo	1
	Gwich'in (Gwıchya)	srik	1		Witsuwit'en	soq	1
	Hän	srik	1		Sekani	tazẽ̀ʔ	2
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	srak'	1		Chilcotin	zi	1
	Upper Tanana	da:ʒê:k	2	PACIFIC COAST	Hupa	xeʔq'	1
	Tanacross	sek	1		Galice	sɛ:k'	1
YUKON	Northern Tutchone	tezjɑ:k	2		Kato	-	
	Southern Tutchone	tɑʒe	2		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	-			Mattole	ʧxʰiʔɬ	3
	Kaska (GHL)	te:zẽ́:k	2		Wailaki	-	
	Kaska (L)	te:zẽ́:k	2		Kwa-Clat	-	
	Kaska (LL)	ta:zéʔ	2	APACHEAN	Navajo	ʒé:ʔ	1
	Kaska (P)	te:zẽ́:k	2		Western A.	ʒít	1
	Kaska (RR)	ta:zek	2		S. Carlos A.	ʒít	1
	Tagish	-			Jicarilla A.	zẽk	1
	Tahltan	-			Kiowa A.	zek	1
					Mescalero A.		
	Tsuut'ina	zaj	1		Lipan A.	-	



(1) SALIVA$_1$ | (2) SALIVA$_2$ | (3) SALIVA$_3$

Figure 87. Distributions of terms for 'saliva'

3.5.14 Scab

The referent 'scab' is lexicalized through only three different patterns across the Athapaskan languages, with the pattern identified as **SCAB$_1$** dominating the distribution. Only two languages have diverging patterns: Mountain Slavey and Navajo. 'Scab' is among the most homogenous of referent-concepts in the sample.

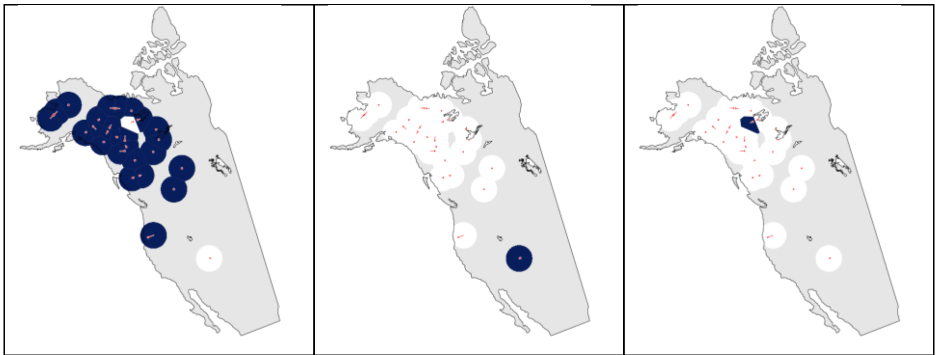
(1) SCAB$_1$: The dominant pattern is expressed through a monomorphemic stem characterized by an initial lateral fricative or approximant and an alveolar stop, glottal fricative or trill in stem-final position. This pattern is found in 26 of the 28 languages for which data were available.

(2) SCAB$_2$: The term /tiʃʧ'it/ which is listed with the glosses 'eczema, scabies, and skin itch' (Young and Morgan 1987: 334) and 'rash' (Young and Morgan 1987: 999) is unique to Navajo.

(3) SCAB$_3$: The term /xaʣi/, is unique to Mountain Slavey. It is simply designated SCAB$_3$.

Table 74. Scab

	Language	BEET	#		Language	BEET	#
ALASKAN	Deg Xinag	ɬet	1	INTERIOR CANADA	Hare	luh	1
	Koyukon	ɬut	1		Mountain	xadzi	3
	Dena'ina (Iliamna)	-			Bearlake	lur	1
	Dena'ina (Inland)	-			Tłįchǫ	lì:	1
	Dena'ina (OCI)	-			South Slavey	lút	1
	Dena'ina (UCI)	-			Dene Sųłiné	ɬur	1
	Ahtna	ɬu:t'	1		Dene Dháh	lut	1
	Holikachuk	ɬo:t	1		Beaver	-	
	Gwich'in (Teetl'ıt)	ɬit	1	BRITISH COLUMBIA	Carrier	ɬut	1
	Gwich'in (Gwıchya)	ɬet	1		Witsuwit'en	ɬot	1
	Hän	ɬut	1		Sekani	ɬut	1
	Lower Tanana	-			Ts'ets'aut	-	
	Upper Kuskokwim	-			Chilcotin	-	
	Upper Tanana	ɬu:t	1	PACIFIC COAST	Hupa	ɬoh	1
	Tanacross	-			Galice	-	
YUKON	Northern Tutchone	ɬjɑt	1		Kato	-	
	Southern Tutchone	ɬjet	1		Tolowa	-	
	Kaska (DL)	-			Tututni	-	
	Kaska (FL)	ɬu:t	1		Mattole	-	
	Kaska (GHL)	ɬu:t	1		Wailaki	-	
	Kaska (L)	ɬu:t	1		Kwa-Clat	-	
	Kaska (LL)	-		APACHEAN	Navajo	tiʃʧ'it	2
	Kaska (P)	ɬu:t	1		Western A.	-	
	Kaska (RR)	ɬu:t	1		S. Carlos A.	-	
	Tagish	-			Jicarilla A.	-	
	Tahltan	-			Kiowa A.	-	
					Mescalero A.		
	Tsuut'ina	lúd	1		Lipan A.	-	



(1) SCAB$_1$	(2) SCAB$_2$	(3) SCAB$_3$

Figure 88. Distributions of terms for 'saliva'

3.6 Summary

This concludes the description of the lexicalization patterns found for the referent-concepts on the onomasiological list. 452 different means of lexicalizing these referent-concepts have been identified, as well as 37 polysemy patterns and 13 semantic changes. The following chapter will discuss these semantic patterns from a more general perspective.

4. Data analysis

In Chapter 2, the onomasiological method was described as being anchored in a model of the linguistic sign with three main components: semantic structure, phonological structure, and the referent-concept. This chapter evaluates the data generated by this method in terms of each of these components. Two main concerns guide this chapter: first, the description of the characteristics of Athapaskan semantic structure as discerned from generalizations over individual lexicalization patterns and, secondly, the classification of Athapaskan languages as based on the semantic and phonological aspects of the items described in Chapter 3.

The discussion begins with an examination of the conceptual aspects of the linguistic sign. Zauner had envisioned onomasiology not just as a sister discipline to semasiology, but as a means of studying conceptual structure itself — in his own words — as a 'science of concepts'[38] (see Chapter 2). He quotes the Swiss linguist Ernst Tappolet as stating that onomasiology can provide insight into the nature and validity of concepts (Zauner 1902: 4). From a modern perspective, such remarks appear reminiscent of an older conception of etymology as a field of enquiry having the power to reveal a "deeper or more relevant ingrained message" (Malkiel 1993: 2) that has now, fortunately, been largely abandoned. Linguistics can still be understood as contributing to the study of concepts, however, in a less evaluative and more descriptive manner. Within the theoretical framework of Cognitive Linguistics, conceptual structure is investigated as a dynamic aspect of cognition. What Zauner understood as static concepts (*Begriffe*), cognitive linguistics sees as conventionalized construal (Croft and Cruse 2004, Langacker 2008). This means that in cognitive linguistics, the manner of representing an object semantically becomes a datum in itself. This contrasts with older views, such as Zauner's, in which the conceptual-phonological association is the main object of enquiry. The lexicalization patterns described in Chapter 3 are conventionalized construals of anatomical concepts and, as such, represent a new source of data emerging from onomasiological enquiry. On the basis of the morpho-semantic criteria of morphological complexity and degree of motivation, each of the patterns can be shown to form part of a more general type of lexicalization strategy. These semantic strategies are described in Sections 4.1.2-4.1.4.

The second aspect of the linguistic sign to be considered here are the referent-concepts themselves. The question of their possible classification into sub-domains and their relative diachronic stability are tackled in Sections 4.2.1-4.2.3. The discussion of the relative stability of referent-concepts and lexicalization patterns forms the basis for the remaining sections, which deal directly with the second

[38] *Wissenschaft der Begriffe* in the German original

concern of this chapter: the classification of Athapaskan languages. The classifications on the basis of first semantic and then phonological criteria follow brief descriptions of the quantitative methods employed in each case.

4.1 Semantic strategies in the lexicalization of anatomical referent-concepts

Chapter 3 described the lexicalization patterns that can be found to encode Athapaskan anatomical terms. These lexicalization patterns instantiate approaches to meaning construction that speakers of Athapaskan languages have employed in the denotation of anatomical referent-concepts. These approaches are strategies for meaning-making that can be shown to resolve to a number of general patterns. This section will elucidate these patterns and describe them relying particularly on the notions of morphological complexity and semantic motivation. Each lexicalization pattern has a morphological form that is constituted either of a single morphological root form or of a complex form made up of multiple morphological elements. Coded as simplex and complex, this simple distinction is an important factor, since, as will be shown below, the most stable patterns are morphologically simplex. Morphological complexity serves to characterize both the lexicalization patterns themselves and the semantic sub-domains that classify the referent-concepts.

Following Radden and Panther (2004), the analysis of linguistic expressions as *motivated* depends on two criteria: the identification of extra-linguistic factors and the identification of language-internal factors as the sources of motivation. For anatomical terms, the extra-linguistic factors are to be found in perceptual and conceptual cues provided by the four parameters of cognitive models of the body described in Chapter 2: the LOCATION, FUNCTION, FORM, and CONSTITUTION of the various body parts and bodily by-products. Language internal factors are found in the transfer of vocabulary from other semantic domains on the basis of processes of categorization, in the sense of Langacker (2008: 37), so that a term used to denote an aspect of form, such as ARCH can occur as part of an expression denoting ‘finger’, as in Northern Tutchone HAND-ARCH /lɑ-tθ’óʔ/. Here the form of the ‘finger’ (see Figure 89) has motivated the lexical deployment of this semantic element, which originates in the spatial domain: the form of this body part has motivated the categorization process enabling the element ARCH, specified by a locational reference point, to come to denote ‘finger’. The element HAND functions as a reference point for this compound, but it does not itself represent a transfer from any other semantic domain. The term HAND /lɑ/ is native to the anatomical domain and belongs to the class of monomorphemic unmotivated items, that component of the vocabulary which forms the arbitrary basis of the Athapaskan system of anatomical nomenclature. Therefore, this particular expression falls into the category of partially motivated complex expressions.

Figure 89. The curvature of the 'finger' is clearly depicted in this detail from Michelangelo's The Creation of Adam (Image: Wikimedia Commons)

The two terms /lɑ/ 'hand' and /lɑ-tθ'óʔ/ 'finger' differ in the important respect that the second term is semantically more transparent, it contains within itself an instruction for unravelling its meaning; for accessing the intended referent-concept. It is imaginable that the target meaning 'finger' could be understood by a speaker who was unfamiliar with the compounded expression, but knew the individual meanings of /lɑ/ and /tθ'óʔ/ by mentally locating the 'hand' and then inferring which part of it most closely resembles an arch. A similar inferential procedure is not possible with /lɑ/ 'hand', since this form contains no key to its own meaning; the target referent-concept is accessible only through knowledge of the linguistic convention by which /lɑ/ denotes 'hand'. Of course, it can also be assumed that a competent speaker of Northern Tutchone will associate the phonological form /lɑ-tθ'óʔ/ directly with the target referent-concept 'finger', without needing to go through the intermediate interpretive steps. This is so because the whole form /lɑ-tθ'óʔ/ has achieved a sufficient degree of conventionalization (or it would have likely not appeared in the lexicographic source for Northern Tutchone). Thus, both the simple form /lɑ/ and the complex form /lɑ-tθ'óʔ/ signify by convention, even though the latter form does not require knowledge of the convention in the same manner as the former does. Most of the Athapaskan anatomical terms, however, are opaque and denote by convention only, having no morphological elements that would guide interpretation. The conventional terms are the normal means of communicating about anatomy. The motivated terms can therefore be thought of as a peculiar surplus set of terms demanding of the interpreter, at least initially, to carry out additional conceptual work in order to decode the meaning of the term. This additional effort can only be warranted in a situation where the conventional expression is not available, i.e. in a novel context. In fact, conventionalization obviates the need for motivation. Conventionalized forms function perfectly well even in the total absence of semantic transparency. With the onset of conventionalization, a process of de-motivation can begin to set in (Keller 1995: 157), since the instruction for the interpretation of the given term is now supplied by the convention, rather than by an ad-hoc inference. This does not mean, however, that an expression loses all semantic motivation at the point in time where it becomes established firmly enough in the speaker community that it can be considered conventionalized. Rather, the semantic transparency now devoid of immediate purpose can become the object of slow processes of erosion as evident in semantic, morphological, and phonological fusion. It stands to reason, then, that forms that appear as unmotivated may in fact have been motivated in the past but have changed so much over time (or so little over a particularly long period of time) that their semantic analysis in terms of lexicalization pathways is no longer possible. Against this background, the identification of motivation itself can serve as an indication of age: motivated forms are new, unmotivated forms are old, partially motivated forms are somewhere in-between.

Care needs to be taken with the conclusion that unmotivated forms are old, however. It seems perfectly possible that new coinages take unmotivated forms, even though this may be improbable. Terms borrowed from other languages would also appear as unmotivated forms in the lexicons of the borrowing languages. Lexical borrowing, however, is rare in Athapaskan languages (Rice 2012: 21-22). Even though these factors leading to newer terms taking unmotivated forms are marginal phenomena in Athapaskan languages, additional criteria must nonetheless be drawn on to decide whether a particular lexical form belongs to a particularly old or new stratum of the vocabulary. This additional criterion can be constructed from the further premise that older forms would be more widespread among the languages as a whole. This does not require the radical step of considering only the forms that have been retained in all or most languages. Instead, attention can be focused on unique forms, since, by the same logic, these forms are bound to be local innovations. Thus, the estimation of the age of particular vocabulary items can be gauged from two criteria, both of which are ultimately semantic: (1) their relative motivation, and (2) their relative frequency (operationalized simply as unique or multiple occurrence). The analysis proceeds by establishing the relative level of motivation in various lexicalization patterns. The lexicalization patterns themselves have been classified into strategies for this purpose, as discussed next.

Four broad types of lexicalization strategies emerge from the combinations of motivation and morphological complexity: morphologically simplex and un-motivated, morphologically simplex and motivated, morphologically complex and motivated. Since motivation is considered “a matter of degree”

(Panther and Radden 2011: 12), a category of partially motivated forms must be taken into account. This category occurs only in morphologically complex expressions. Table 75 gives an overview of the categories of lexicalization strategy, and exemplifies each through an English term.

Table 75. Categories of lexicalization strategy exemplified through English terms

<table>
<tr><th colspan="5">Motivation</th></tr>
<tr><th rowspan="3">Complexity</th><th></th><th>Un-motivated</th><th>Partially Motivated</th><th>Fully Motivated</th></tr>
<tr><td>Simplex</td><td>hip</td><td>-</td><td>tongue (used to denote ‘language’)</td></tr>
<tr><td>Complex</td><td>-</td><td>hip joint</td><td>k' odenee too'[39]</td></tr>
</table>

The simplest cases, from the perspective of the analysis, are those in which the anatomical referent-concept is encoded through a morphologically simple form with no other obvious additional meaning. That is to say that the form in question could not be related to any other meanings among the sampled languages. These un-motivated forms are examples of arbitrary signs *par excellence*, and no internal semantic structure can be discerned in these forms, beyond the denotation of the referent itself. This group of terms forms the foundation of the system of anatomical nomenclature and constitutes the largest sub-group of items. These data do not directly shed light onto processes of construal and lexicalization in Athapaskan and are not considered further in the discussion of anatomical semantics, but they remain crucial for the analysis of historical relationships entering into the assessment of overall similarity among the languages based on semantic criteria (Section 4.4.1), and in the assessment of overall similarity among the languages based on phonological criteria (Section 4.4.2).

The lexicalization strategies in motivated and partially motivated forms can be further described through the general properties of the cognitive models of referent-concepts outlined in Chapter 2. The properties of cognitive models are divided into the major categories: FORM, CONSTITUTION, LOCATION, and FUNCTION. As realizations of these potential properties, lexicalization patterns can be classified with the aid of the same scheme. This reveals trends in the lexicalization of different parts of the anatomy. In particular, it shows the reliance on shape as a dominant means of the lexicalization of body-part terms among Athapaskan languages. The following sections discuss the three different categories of lexicalization strategy.

[39] This is a Koyukon word for ‘tear’ (see Section 3.5.10), which translates as GRIEF-WATER.

4.1.2 Monomorphemic motivated

Among the motivated monomorphemic forms, the most common types are those that relied on the spatial domain as the ground for lexicalization. For example, in Jicarilla Apache the form /zoːɨ/ PIPE.LIKE.OBJECT is used to encode 'throat'. The source glossing for /zoːɨ/ and its cognates already suggests a certain level of schematization: some semantic features of 'pipes' have been abstractly encoded in the form /zoːɨ/ and its cognates. The network of senses that extend from /zoːɨ/ develop along different semantic features of the source meaning. The central sense of all the extensions is that of a hollow container. This gives rise to a large set of meanings emphasizing the hollowness of denoted referents, as for example in *kk'eeyh lootl* 'cylinder of birch bark with tree rotted out of it', or *–dzaa-lool-e'* 'chest' (Jetté and Jones note that the literal translation is "hollow place in the chest"), *ten-looł* 'ice with air space underneath, hollow ice', and even *hʉdellooł* 'there is a hollow sound' (Jetté and Jones 2000: 422). These extensions emerge naturally from a primary referent of a hollow container, such as birch bark cylinders which are likely to have been commonplace to Athapaskan speaking hunter-gatherers in the subarctic. The semantic features of hollowness and containment, two sides of the same semantic coin, pertain to 'throats'. It seems likely that these features relate to the throat as a long object enclosing a hollow space along which matter can be moved: a schematic cylindrical container with open ends. These are the semantic specifications in which both 'pipes' and 'throats' match, and the use of a term referring to the former in the lexicalization of the latter is therefore motivated. Similar semantic features also present in the form STRAW (encoded by Dena'ina /ʧʼuʧʼ/ 'blood vessel'; see Section 3.1.5) but in this case the associated actions (i.e. the possibilities of sucking a liquid through this kind of container) are emphasized. The two forms which both occur in lexicalizations of 'blood vessel' (Section 3.1.5) highlight different aspects of their referent concepts: in the case of PIPE.LIKE.OBJECT the abstract shape is encoded, while in the case of STRAW the shape as related to a particular function is the target of the lexicalization. The meaning of the latter form is far more specific, and it occurs only once in the sample, in contrast to the PIPE.LIKE.OBJECT, which occurs in lexicalizations of different referent-concepts: 'throat', 'lungs', and 'chest'. Almost as common as the SHAPE-based types, are those based on the LOCATION of the referent-concept. An example of the use of location in the lexicalization of referent-concept 'chest' is Witsuwit'en /tʼoj/ 'front'. The motivation for this broad locative category is motivated by the forward orientation of this body part.

Among the types of lexicalization patterns that rely on the CONSTITUTION of the referent-concept, there are two that represent metaphorical extensions of terms stemming from other domains. The Northern Athapaskan languages, Hare and Bearlake, both lexicalize the referent-concept 'skin' with terms having the semantic structure BARK. Ts'ets'aut lexicalizes 'gall' through the term for 'water' /tˣuʔ/. Overall, reliance on the constitution of referent-concepts is less common than the two previously described categories of FORM and LOCATION. Finally, the rarest category of lexicalization types, those that rely on FUNCTION, is represented only by one case: SUCK. Here, the action associated with the body part in question, ‘breast’, has come to denote the body part as a whole in a lexicalization pattern similar to Wilkins’ tendency number five. Although overall the reliance on FUNCTION in the lexicalization of body parts is quite rare, this lexicalization strategy is a widespread means of lexicalizing ‘breast’ (see Section 3.3.6).

4.1.3 Partially motivated expressions

The first kind of partial motivation to be considered here is in the form of a structural motivation emerging from the parallelism of the upper and lower parts of the body. For example, in Chilcotin and Dena’ina (Inland and Outer Cook Inlet dialects), the referent-concept ‘toe’ is lexicalized through tri-partite polymorphic forms constituted of three arbitrary elements. The Chilcotin expression /ké-lǽ-ʦi/ FOOT-HAND-DIGIT contains no extrinsically motivated elements, even though the parallelism to terms for ‘hand’ (see Section 3.4.5) is partially motivated by the similarity of these two anatomical structures. The associative processes that underlie these kinds of lexicalizations must be the same as those that lead to the semantic change (iii): “Where the waist provides a midline, it is a natural tendency for terms referring to parts of the upper body to shift to refer to parts of the lower body and vice versa” (Wilkins 1996: 273-274).

A second kind of partially motivated expression is found in cases where conventional forms are combined with sub-morphemic forms, as for example in Dene Sųłiné /ʣí-tíθ/ HEART$_1$-LUNGS$_1$ denoting ‘lungs’. Here, the first element is a conventional monomorphemic form, but the second does not appear to have an independent existence in Dene Sųłiné, appearing only in this polymorphemic form. The second category contains those expressions whose syllable structure suggests morphological complexity, but whose internal morphological and semantic structure was closed to the analysis. These forms are not very common, but they do occur in various places (as described in Chapter 3).

All the other semantic structures in this group involve a schematic construction Langacker has referred to as ‘reference-point constructions’. These constructions are the lexical reflexes of the cognitive ability to “to invoke the conception of one entity for purposes of establishing mental contact with another, i.e., to single it out for individual conscious awareness” (Langacker 1993: 5). The invoked entity must have some property that singles it out for attention; it must be important enough on its own that the user of the reference point can be sure that the intended receiver of his communication will readily identify it. At the level of the lexicon, reference-points are special items that serve as the components of derived forms for inherently less salient body parts. Among the Athapaskan languages, this results in a substantial inventory of exocentric compounds. The reference points themselves can be seen as having special status as constitutive elements in the anatomical nomenclature. It follows, then, that the referent-concepts encoded by the referent points form a basic, arbitrary inventory of items, while those referent-concepts typically encoded by reference-points constructions (or, more precisely, by the targets of the reference-point constructions) are less basic. Furthermore, the derived forms in these particular cases must be newer than the monomorphemic items, which form part of their morphologically complex forms. The referent-point constructions types are now described following the classification of the head-elements as encoding the FORM, LOCATION, CONSTITUTION, or FUNCTION aspects of the referent-concepts they denote.

The semantic aspect of FORM enters into many lexicalization patterns. For example, in Northern Tutchone the 'finger' is encoded through the exocentric compound /lɑ-tθ'óʔ/ HAND-ARCH in which the 'hand' acts as a reference-point locating the body part on the body, but the target itself, the 'finger' is lexicalized through a property of its shape. A more complex reference-point construction involving aspects of form is the Kiowa Apache expression for 'throat' /zé:ɬ-ʦ'ő:-ʦ'è:/ MOUTH.INNER-STRING-TOWARD. Here, the arbitrary element MOUTH.INNER again acts as a reference point in an endocentric compound. The target referent-concept is encoded through a metaphorical extension of the element STRING on the basis of a similarity in FORM. This construction is unusual in that a third morphological element specifies the relationship between the form denoting the element ultimately denoting the referent-concept and the referent point. Another unusual pattern occurs among the reference-point constructions that build on form. This pattern appear to specify two reference points: /qa-la-ʦ'əq'/ FOOT-HAND-ARCH. This rare pattern (it occurs only among dialects of Dena'ina and in Upper Tanana) is the result of a parallelism between 'hand' and 'foot' terms in which the latter are clearly derived forms.

There are many expressions that combine reference-points with elements denoting LOCATIONS. For example, Deg Xinag /nax-toʔ/ combines the word for 'eye' with a locative element glossed as AROUND.IT. This construction targets the referent-concept 'eyelid'. An unusual variation of this otherwise common pattern is the occurrence of the reference-point in the second position in the Hupa expression /ʧe:ʔ-mɪ-ʧiŋʔ/: OPPOSITE-[3SG]-CHEST.

In some compounds, the reference points are combined with elements that denote the nature of the substance that makes up the referent-concept in question. These forms are analyzed as encoding the CONSTITUTION aspect of the cognitive models of anatomy. A prime example of this type are the lexicalizations of 'fingernail' that encode the pattern HAND-DRY, as in the case of Gwich'in (Gwichiya dialect) /le:-gã̃ĩ:ʔ/. The perceived dryness of the fingernail is the source for the encoding of the referent-concept in this exocentric compound. The compound /le:-gã̃ĩ:ʔ/ is therefore made up of an element, HAND, which functions as a reference point locating the semantic head, DRY on the human body. The element DRY metonymically stands for an aspect of the 'nail', its dryness understood as characteristics of its texture or substance. Therefore the compound /leː-gãĩːʔ/ instantiates a more general pattern that can be described as REFERENCE.POINT-CONSTITUTION. This pattern can even be expanded to include more details of the referent-concept. For example, in Kiowa Apache referent-concept 'liver' is lexicalized as: /ʧã́ː-tíɨ-kʰȍːséː/ ABDOMINAL-BLOOD-CLOT. Here the 'liver' is characterized through aspects of its color and form. The color is metaphorically evoked through the term for 'blood' /tíɨ/, while the term /kʰȍːséː/ encodes the FORM aspect. The pattern is interpreted as belonging to the CONSTITUTION type, since the color element is actually encoded through a metaphorical extension of the term denoting BLOOD.

Finally, some of the reference-point constructions involve the FUNCTION aspect of the cognitive models of human anatomy. The clearest cases of these are the lexicalizations of various joints. The joints are situated at the junctures of larger and often more salient body parts, and enable their movement. The functional aspect of joints surfaces as a constituent semantic element in terms for 'elbow', 'wrist', and 'ankle'. In the latter two, the more salient body part is the 'hand', which acts as a reference-point in the polymorphemic expressions HAND-REVOLVES.ON.ITSELF and FOOT-REVOLVES.ON.ITSELF respectively. In the case of 'elbow' the salient reference-point is 'arm'. Reference points and functions can also be combined with elements denoting the CONSTITUTION of the referent. For example, Hän /nə-tʳö-ʧʰùʔ/ encodes the lexicalization pattern EYE_1-CRYING-WATER. The final element of course more or less exactly denotes the referent-concept 'tear', while the modifying elements specify the associated FUNCTION, 'crying', as well as the associated LOCATION on the body, the 'eye'.

4.1.4 Fully motivated expressions

The final group of lexicalization types includes complex polymorphemic expressions whose elements are motivated by properties of the referent-concepts. For example, the Hupa term /ʦʼɪnʔ-tɪqʼaːn/ BONE-RIDGE lexicalizes its target 'shin' by denoting the bony matter of the shin and its form relative to the rest of the lower leg. The aspect of constitution also features in the lexicalization of 'tear' in a similar case to the complex example above. Koyukon /təni tʰuʔ/ lexicalizes 'tear' through the pattern GRIEF-WATER. The associated function acts as a modifier here specifying the 'water' in question. A more difficult case is presented by the Tłı̨chǫ form /tih-ɬĩː/, which lexicalizes the referent-concept 'gall' through the pattern WATER-ILLNESS. This bodily substance is perhaps only encountered in times of illness motivating the exocentric compound. The combination of two motivated elements occurs in the Mescalero Apache lexicalization of 'back': /ɣa-ʃı́ / HUMP-BASE. The form of the 'back' is doubly encoded through its outer shape and its location on the body. This lexicalization pattern is best understood in its use in the description of quadruped anatomy (see Section 3.3.1). An example of the instantiation of the pattern LOCATION-FORM is found in Tsuut'ina /ɣá-tɬ'ìk/ FRONT-BULGING.OUT. The target referent-concept here is 'chest'. This expression lexicalizes the location of the body part in the general orientation of the body as well as its characteristic shape. Constitutional aspects can also be combined with locative expressions, as in the lexicalization pattern INSIDE-WATER /t'àː-tì/ which encodes the referent-concept 'sweat' in Tłı̨chǫ. Finally, two locative elements can together form a lexicalization pattern as in the case of the Witsuwit'en term for 'chest': /t'a-jəq/ FRONT$_2$-DOWN.

This concludes the general description of lexicalization strategies found in the anatomical nomenclatures of Athapaskan languages vis-à-vis the notion of motivation. As indicated above, however, a further level of semantic structure may be discerned in the segmentation of the domain of human anatomy into sub-domains. This level is explored in the following sections. The characterization of Athapaskan lexical semantics in the domain of anatomy that emerges from these considerations is discussed in Section 4.3.

4.2 Distinctions among the referent-concepts

At the beginning of this study, a sub-division of the larger domain of the human body and its by-products was hypothesized and, consequently, the anatomical terms of the onomasiological list were categorized into three distinct domains: body parts, ephemera, and effluvia. This division was based on the reasonable notion that body fluids, easily and regularly dispensed in small amounts, would be treated differently in their conceptualization than more solid and permanent parts of the body. Most prominently opposed would be those frequently and necessarily dispensed fluids such as 'urine', and such permanent and indispensable parts of the body as the 'neck' and 'head'. Other terms would lie in-between, perhaps on a kind of continuous scale, with such terms as 'blood', for example, representing fluids that are dispensed in small amounts with little harm, and limbs, which are dispensed with great harm, but without the total collapse of the entire organism. As a special category of in-between terms were the ephemera, representing parts of the anatomy whose presence in the organism varied regularly in quantity, such as, for example, the 'fingernails', the 'hair', and the bodily 'fat'.

These three sub-categories, reasonable as they might seem, spring from the conjectures of the researcher and their adequacy in the description of semantic structure present in the Athapaskan languages is an empirical question. The question is addressed by considering whether select semantic and morphological variables are distributed over the three postulated semantic sub-domains in ways that would indicate distinct domain structures. The semantic variable investigated here is the alienability of terms and the morphological variable is related to complexity. Each variable and the implications of their distributions for sub-domain distinctions is described in the following two sections.

4.2.1 Alienability

While it is clear from the descriptions in Chapter 3 that morphological complexity varies greatly for the terms encoding referents across languages, it might seem less obvious that some variation is found even in the treatment of inalienable possession. Alienability refers to the potential of the terms in the study to differ as to whether they obligatorily occur with possessive prefixes, that is, whether they are inalienably possessed or whether they can occur as free morphological roots. For example, the terms for 'hand' are inalienably possessed in all Athapaskan language in the sample. This means that in some cases the forms listed in the tables in Chapter 3 are never encountered in actual speech, since they are morphologically bound roots. Such forms must carry prefixes, which signal information about the grammatical number and person of the possessor, as in the examples (a) and (b) in Table 76.

Table 76. Alienably and inalienably possessed forms

(a) Dene Sųłiné	(b) Navajo	(c) Witsuwit'en
/sĩ-la/	/ʃi-ná-ziz/	/χəz/
1.sg-HAND	1.sg-eye-skin	pus_1
'my hand'	'my eyelid'	'pus'

In contrast, the Witsuwit'en term for 'pus' given as (c) in Table 76, is not a bound root and does not obligatorily carry possessive marking. Since the depth of grammatical description varies greatly for Athapaskan languages and new fieldwork could not be carried out regarding the question of alienability in each language, alienability was inferred from the manner of presentation of the terms in question in the lexicographic source materials. It is common practice in Athapaskan lexicography to indicate inalienable forms either through the use of a hyphen preceding the stem in question (in the manner of technical morphological notation) or by writing the form together with the prefix; thus the absence of either of these markers was taken to indicate the forms alienability. For example, in the Gwich'in dictionary, the term for ‘blood’ is written as *dah* without affixation or other marking (Firth 2005: 30). Since other anatomical terms are given as entries with the possessive suffix, for example *shigwat* ‘my knee’ (Firth 2005: 138), the absence of any marking in the case of *dah* ‘blood’ is taken to indicate that this latter term is alienable. In contrast, the lexicographic sources for languages such as Kaska list the terms for ‘blood’ with the possessive suffix, e.g. *medelé’* (Ross River dialect, Kaska Tribal Council 1997: 259). The same source also lists terms without the possessive suffix, e.g. *hes* ‘pus’ (Ross River dialect, Kaska Tribal Council 1997: 280). This is interpreted to mean that in the Ross River dialect of Kaska ‘blood’ is inalienably possessed, while ‘pus’ requires no obligatory possessive marking. Inalienability of referents is therefore not an absolute characteristic which can be assumed to have invariant expression across Athapaskan languages and, therefore, it can instead be explored statistically.

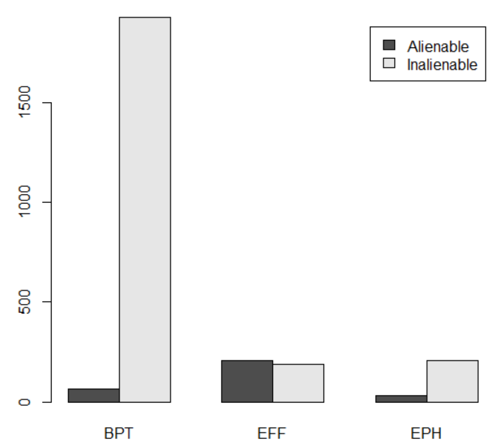


Figure 90. Obligatory possessive marking across sub-domains

Each individual term in the database was coded for whether it required obligatory possessive marking. Each term was also assigned to one of the three sub-domains — body part, effluvia, and ephemera — that were hypothesized to divide the semantic domain of the human body and associated by-products. These two sets of annotations can be compared through a contingency table and the results evaluated for statistical significance. Figure 90 shows the distributions of terms across these three hypothesized semantic sub-domains. The difference in distribution is statistically significant (χ^2=781.8369, $p < 2.2^{-16}$). These differences can be explored further by calculating the standardized residuals, that is, the relative divergence of the values of individual cells of the contingency table (the distributions) from an overall hypothetical homogeneous distribution. The calculated results are shown in Table 77.

Table 77. Divergence of values of individual cells from an overall hypothetical distribution

	Total	Alienable			Total	Inalienable	
Body Parts	64	-23.6607004	-		1929	23.6607004	+
Effluvia	208	27.5746525	+		190	-27.5746525	-
Ephemera	32	0.9042471	0		208	-0.9042471	0

The table shows three columns: the total number of terms identified as alienable or inalienable for each sub-domain, the calculated values, and the directionality of the association of the values in that cell with the category alienable or inalienable. Body-part terms show a strong association with inalienable possession, as opposed to alienable possession, as indicated by the plus and minus signs. The opposite is true for effluvia terms, while no effect either way is found for ephemera terms. This leads to the conclusion that from the perspective of alienability, effluvia terms are clearly distinguished from the body-part terms, and vice versa. The distinction of effluvia from body-part terms therefore has some value in this respect. The category of ephemera is arguably a valid category by some measures, but it is not associated with alienability in a significant way.

4.2.2 Morphological complexity[40]

Each of the sub-domains that anatomical terms belong to can also be characterized statistically in terms of the number of lexicalization patterns which are associated with complex or simplex representations. The distribution of forms over the three hypothetical semantic sub-domains is shown in Figure 91 below.

[40] Snoek (2013) had found statistically significant distances among sub-domains in a much smaller sample.

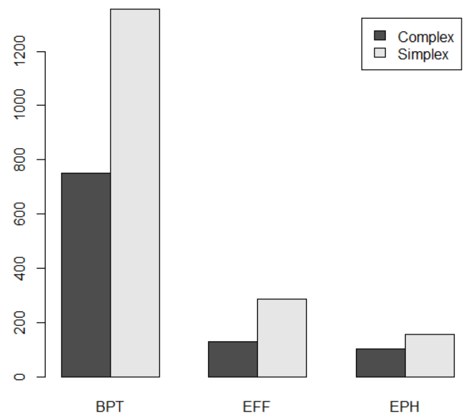


Figure 91. Morphological complexity across sub-domains

In the case of morphological complexity, the differences in the distributions were not found to be significant in the statistical sense (χ^2=4.5332, p =0.1037). Small tendencies or trends can nonetheless be observed from Table 78, whereby effluvia terms tend slightly toward simplex forms, while the other two categories tend slightly toward the complex. The zeroes in the column adjacent to the divergence values indicate that these individual values make no significant difference to the overall distribution however.

Table 78. Divergence of values of individual cells from an overall hypothetical distribution

	Total	**Simplex**			**Total**	**Complex**	
Body Parts	1367	-0.01587280	0		739	0.02964888	0
Effluvia	287	0.87346447	0		130	-1.63154869	0
Ephemera	156	-0.69131202	0		100	1.29130522	0

Together with the results obtained from the analysis of the alienability criterion a tentative conclusion can be reached regarding the nature of the sub-domain distinctions, namely that effluvia provide a weakly distinguished category, whereas ephemera do not. The creation of lists of referent-concepts for the discovery of better and more stable patterns of sound correspondence is therefore not achieved by reducing search terms to only those pertaining to a single sub-domain. The distinction into sub-domains is therefore a little too rough. However, the lexicalization patterns themselves can throw light on the stability of particular referent-concepts as outlined in the next section.

4.2.3 Diachronic stability

Chapter 3 provided descriptions of the lexicalization patterns that encoded each referent-concept on the onomasiological list in each of the Athapaskan languages in the sample. Some referents were encoded through a large number of lexicalization patterns whereas others were only encoded through a few. Furthermore, the lexicalization patterns themselves can be distributed so that some lexicalization patterns can account for the expressions encoding referent-concepts in most languages, while the rest are found only in a few languages. The referent-concept 'chest' (see Section 3.3.5), for example, is encoded by some 20 different lexicalization patterns, while 'excrement' is encoded by only one lexicalization pattern, a cognate monomorphemic element, in all the languages in the sample (see Section 3.5.4). Under the conservative assumption that Proto-Athapaskan is likely to have had only one or two variant terms for each referent-concept, the number of lexicalization patterns encoding a particular referent-concept across the Athapaskan languages can be taken as an indicator of diachronic stability. The basis for this assumption comes from the observation that the individual languages of the sample exhibit only this limited variation themselves. Limited variation at the level of individual languages coupled with the occasionally quite large range of variation cross-linguistically indicates that the source of the variation lies with the temporal and spatial separation of sister languages. Thus a large number of lexicalization patterns, as in the case of terms for 'chest' can be taken to indicate that this referent-concept was lexicalized differently and repeatedly as the individual Athapaskan languages evolved out of Proto-Athapaskan. From the cross-linguistic perspective, then, referent-concepts can be stable or unstable in the sense that they are prone to changes in lexicalization or not. From the same line of reasoning it follows that those referent-concepts which exhibit very little variation across the languages can be considered as diachronically stable.

The stability of a referent-concept can therefore be measured by looking at the coverage a particular lexicalization pattern has in terms of number of languages in which it occurs. Each lexicalization pattern is assigned a score based on the proportion of languages it occurs in vis-à-vis the other patterns lexicalizing the same referent-concept. In the case of the referent-concept 'arm', for example, only four different lexicalization patterns were found for the 49 items in the sample. These patterns along with their proportional coverage of occurrence in all expression available for the referent-concept 'arm' were: ARM (92%), BASE (4%), HAND (2%), and IT-EXTENDS-AWAY-FROM-ME (2%). The first pattern, arm, is clearly the dominant pattern in this case. It now becomes possible to rank all lexicalization patterns in terms of their proportional coverage of expression in their associated referent-concepts. Since only the particularly stable patterns and referent-concepts are of interest here, all patterns falling below an arbitrary cut-off point are ignored (although they may be considered in future work). This cut-off point is set at 90% so that the patterns are representative of truly stable concepts. Table 79 below lists the 16 patterns, which reach this level of coverage.

Table 79. Lexicalization patterns that account for over 90% of the expressions encoding their respective referent-concepts

Type	Referent	Proportion	Lexicalization Pattern
BPT	‘abdomen, inner’	1	ABDOMINAL.VISCERA
EFF	excrement’	1	EXCREMENT
BPT	‘face’	1	FACE
EPH	‘teeth’	1	TEETH
BPT	‘foot’	0.98	FOOT
BPT	‘sinew’	0.97	$SINEW_1$
EFF	‘urine’	0.94	URINE
EPH	‘scab’	0.93	$SCAB_1$
EFF	‘vomit’	0.92	$VOMIT_1$
BPT	‘arm’	0.92	ARM
EFF	‘pus’	0.92	PUS_1
BPT	‘tendon’	0.92	$TENDON_1$
BPT	‘buttocks’	0.91	BUTTOCKS
BPT	‘neck’	0.91	OUTER.NECK
BPT	‘bone’	0.9	$BONE_1$
EPH	‘hair’	0.9	$HAIR_1$

Since each referent-concept was classified as belonging to the Body Part (BPT), Effluvia (EFF), or Ephemera (EPH) semantic subdomain, these domains can now be assessed in terms of whether they give rise to highly stable concepts. Of the 16 patterns that surpass the 90% threshold 10 were body parts, 4 are effluvia, and 3 are ephemera. Proportionally ephemera and effluvia are well represented. Ephemera are especially well represented since 3 of the 29 lexicalization patterns associated with referent-concepts classified as ephemera are among the most stables of concepts, a proportion of 1% compared to 4% for effluvia and only 2% for body parts.

In conclusion, there appear to be slight tendencies in the semantic and morphological behavior among the referent-concepts that indicate some support for semantic sub-domain distinctions. These tendencies are not strong enough to be considered as alternative lists of source items for historical-comparative research on their own. However, the stability of some of the effluvia and ephemera terms speaks for the overall value of including them in larger word-lists used in classification studies. The Athapaskan data considered here should be seen as providing further evidence for the advantage of using culturally appropriate word-lists (Matisoff 1978) for historical-comparative work, even (or especially) if this results in lists of terms that are not wholly culturally appropriate for the researcher's cultural environment.

Besides being important for the development of better lists that can be used in the computer-aided and traditional assessments of language relationships, lexicalization patterns can also give insight into another aspect of language diachrony. While the lexicalization patterns occurring in the greatest number of languages indicated particularly stable form-meaning pairings, the lexicalization patterns at the bottom of the list indicate rare cases. The rarity of these items can be thought of as being a function of time: rare patterns are likely instances of innovations that have not had the time or opportunity to spread to other languages in the family. These patterns are of little use in the classification of languages, since, in the limiting case, they occur only in a single languages. Overall, however, their frequency can used to gauge which languages are most innovative, if innovation is taken as a function of the number of unique items. Most languages have more than a few unique lexicalization patterns, with the average number of patterns being just over 4. A small number of languages have particularly many, though, and these are listed in the Table 80.

Table 80. Most innovative languages

Language	**Number of Unique Patterns**
Ts'ets'aut	10
Tolowa	11
Tsuut'ina	11
Kiowa Apache	12
Koyukon	12
Hupa	14

Table 80 shows that Hupa is the most innovative of the Athapaskan languages by this measure. Hupa as well as Koyukon stand out as languages, because they are (or were) spoken in regions in which other Athapaskan languages were relatively close by. Speakers of Kiowa Apache and Tsuut'ina had migrated to regions in which they had closer contact with non-Athapaskan speaking peoples (Dempsey 2001; Levy 2001). Ts'ets'aut, Koyukon, and Hupa, however, were geographically in a position to spread innovations to other languages.

These results show that the referent-concepts exhibit considerable diversity in the number of lexicalization patterns which encoded them. Unstable referent-concepts have undergone frequent innovation and re-lexicalization processes and therefore have many different patterns encoding them cross-linguistically. Stable referent-concepts tend to remain constant through time being conventionally lexicalized by highly cognate terms across the language of the family. The immediate implication of these results is a modification of the sample for the evaluations of aggregate language similarity as based on semantic grounds. The highly stable patterns show little variation, except in the phonological sequences that represent them. Highly stable patterns are good phonological indicators of deep historic relationships, so they are included in the evaluations of language distance based on phonological data. However, the same property, invariance in lexicalization strategy, makes them poor indicators of sub-groupings, since they show little variation across languages. The semantic pattern encoding terms for ‘excrement’ (see Section 3.5.4) or ‘face’ (see Section 3.2.3) reveal no information about the proximity of languages to each other, since they are all, or almost all, the same with respect to the lexicalization patterns that encode them. Therefore, they have been eliminated from the quantitative evaluations of language similarity based on semantic data.

4.3 Semantic changes

The investigation of lexicalization patterns outlined in Chapter 3 revealed several cases of semantic change and polysemic extension. These two phenomena were kept apart in the descriptions of Chapter 3. Following Wilkins, however, they are better understood as being inter-related:

> Semantic change is not a change in meanings per se, but the addition of a meaning to the semantic system or the loss of a meaning from the semantic system…Synchronic polysemy becomes crucial in the investigation of semantic changes because it acts as a proof of the plausibility that two meanings are semantically related and that one meaning could give rise to the other…
>
> (Wilkins 1996: 269)

From this perspective, patterns of polysemic extension are the possible precursors of future semantic change, since they indicate cases of meaning addition. By the same token, semantic changes are the residues of polysemic patterns, in which some meanings have fallen away. Both processes can be described by theoretical constructs developed in Cognitive Linguistics. Adopting the cognitive linguistic terminology of source and target, semantic changes and polysemy patterns can be classified according to the type of relationship between older senses and the newer senses. For example, the relationship between two senses of the English word *cool*, as describing the property of being low in temperature or high in social desirability, can be described as *metaphoric*. This is because the semantic domains of temperature and social desirability are conceptually distinct and the usage of a term belonging to one domain, temperature, to describe properties of a second domain, social life, is a definitional criterion of metaphor (Lakoff 2007). According to Lakoff, metaphors are conceptual associations which are reflected in linguistic expressions. The description of the socio-cultural situation that led English speakers to associate temperature with social desirability is beyond the scope of the present study, suffice it to say that such a practice motivated the semantic extension of the word *cool* along a path described as metaphor here. A second important kind of relationship is metonymy, which has been defined as “a cognitive process in which one conceptual entity, the vehicle [source-CS], provides mental access to another conceptual entity, the target, within the same idealized cognitive model” (Radden and Kövecses 1999: 21). This definition needs to be clarified by interpreting it in terms of the cognitive model of human anatomy, which is the relevant idealized cognitive model in the case of anatomical nomenclature. The “mental access” Radden and Kövecses alluded to can then be more concretely formulated as one aspect of the cognitive model providing access to another part. From this perspective, metonymy shares an important quality with the reference-point constructions described above. Langacker has indeed interpreted metonymy as a special case of reference-point constructions (1993: 29).

An example of metonymy can be found in the semantic extension of the term /kan/ ‘arm’ in San Carlos Apache to also denote ‘hand’. The two parts of the body, ‘hand’ and ‘arm’, are immediately adjacent in the human body, so that the mention of one part easily evokes the second adjacent part. These associations motivate a semantic change which does not cross semantic domain boundaries and is, hence, clearly distinct from metaphor. These definitions of metaphor and metonymy are widely accepted, and it can be assumed that Wilkins used this distinction in his classification of semantic changes. These definitions are also applied to the semantic changes and polysemy patterns investigated here.

There are 77 cases of semantic change and polysemic extension in the database. Of these, 70 cases are metonymies of various types, and 7 are metaphoric. The metonymies can be further distinguished into types on the basis of the semantic elements that they interrelate. In terms of semantic changes and polysemic extensions, the most common case is when meanings denoting one body part shift to additionally, or exclusively, denote a second body part, which is directly adjacent in the model of the human body. For example, the term denoting the ‘viscera’ come to denote the ‘ribs’ which surround them in the semantic change ‘abdominal viscera’ > ‘ribs’ exemplified by Tłı̨chǫ [/ʧǒ̀ː/ ABDOMINAL.VISCERA ‘abdominal viscera’] > § > [/ʧǒ̀ː/ RIBS ‘ribs’]. Of the 70 semantic changes and polysemy patterns, 57 are of this type: a PART FOR PART metonymy. At a more abstract level, the loss of semantic specification can also be construed as a metonymic shift in contiguous body parts, as for example in Tłı̨chǫ [/wàh/ MOUTH.INNER

'inner mouth'] > §[41] > [/wàh/ MOUTH 'mouth'], but here the guiding process is a PART FOR WHOLE metonymy, which also results in an increase in generality.

A related kind of association is found in cases where an entity which can be conceptualized as a container comes to denote the associated contents. This process is exemplified by Bearlake [/tɬ'ò:/ GALL 'gall'] > ℙ > [/tɬ'ò:/ GALL 'gall, gallbladder'], a polysemic extension which instantiates the general metonymy CONTAINER FOR CONTENTS. Finally, another type of metonymy exploits the CONSTITUTION aspects of the cognitive model. In Tututni and Chilcotin, the term for 'knee' has been extended to also denote 'bone': [/gʷət/ KNEE 'knee'] > ℙ> [/gʷət/ KNEE, BONE 'bone'][42] . This is an example of a WHOLE FOR PART metonymy based on 'bone' being the material substance that is part of the cognitive sub-model of the 'knee'.

All these semantic shifts and extensions fall under Wilkins' general semantic tendency (ii), by which "[i]t is natural tendency for a person-part term to shift to refer to a spatially contiguous person part within the same whole" (Wilkins 1996: 273). The other tendencies which Wilkins had discovered are not attested in this sample, with the exception of tendency (v): "It is a natural tendency for a term for a verbal action involving the use of a particular person part to shift to refer to that person part" (ibid.: 1996: 274). This type of semantic change can be observed in the shifts from 'suck' > 'breast', attested in South Slavey /t'ô:/.

Some semantic changes are not easily classified as metonymies following the definition given by Radden and Kövecses even though they might very well be described as metonymies in more traditional approaches (see Peirsman and Geeraerts 2006 for an overview of metonymy as understood prior to the rise of Cognitive Linguistics). In Liard Kaska, for example, the term for 'mother's milk' co-lexicalizes 'breast' [/t'óʔ/ BREAST 'breast'] > ℙ > [/t'óʔ/ MOTHER'S MILK 'mother's milk']. The directionality of this extension is difficult to establish. Whatever it might be, this is a metonymy with metaphorical aspects, since it connects terms from the different domains: body parts and effluvia. At the same time, it is conceivable that the cognitive model of human anatomy contains functional information about the 'breast' so that this association is still metonymic.

A clearer example of metaphorical shift can be observed in Bearlake [/t'úw/ BARK 'bark'] > ℙ > [/t'úw/ SKIN 'skin']. Here, the functional similarities between 'bark' and 'skin' motivate the metaphorical extension of this item from a floral to a faunal domain. Another more complex case is found in Ts'ets'aut [/tˣuʔ/ WATER 'water'] > ℙ > [/tˣuʔ/ GALL 'gall']. The categorization of 'gall' as 'water' is a metaphorical

[41] This symbol indicates a semantic change. See the introduction to Chapter 3 for more details.
[42] This symbol indicates a polysemic extension. See the introduction to Chapter 3 for more details.

extension, even though 'water' is a component of 'gall', under the assumption that these two fluids are distinct enough to be considered as belonging to separate domains. It may be stipulated that the motivation for the cross-domain mapping in the case of 'water' > 'gall' is based in the similarity between the two substances. Similarity was already stipulated as the motivating force for the 'bark' > 'skin' metaphorical shift and it occurs also in the form of a parallelism between the upper and lower limbs, as in the case of Ts'ets'aut [/ɬá-qan/ HAND-DRY 'fingernail'] > ℙ > [/ɬá-qan/ HAND-DRY 'toenail']. Here, the term for 'fingernail' has been extended to denote 'toenail', in an example of Wilkins' tendency (iii): "where the waist provides a midline, it is a natural tendency for terms referring to parts of the upper body to shift to refer to parts of the lower body and vice versa" (Wilkins 1996: 273). From these data it is apparent that Wilkins' tendencies also describe processes in the semantics of Athapaskan languages and his guidelines for the identification of cognates can be usefully applied in future research on Athapaskan linguistic history. More immediately, however, it is worth considering whether the semantic changes that have been identified can be used as indicators of historical relatedness among languages.

Most of the semantic changes are unique to one language or a closely related set of dialects like the Kaska varieties. They therefore provide no information on the relationships between languages. Two sets of semantic changes stand out, however. These semantic changes occur among geographically disparate groups. These changes, as indicated in Chapter 2, are potential indicators of shared history. The first of these are the changes 'outer mouth' > 'outer mouth, lips' found in Central Carrier, Chilcotin, Navajo, and Mescalero Apache (see Section 3.2.10). This change violates Wilkins' tendency (i), the "Unidirectional law of synecdochic change" (1996: 275), which stipulates that changes following PART FOR WHOLE metonymies[43] are natural, while changes following WHOLE FOR PART metonymies are not. Since the change is rarely attested typologically it can be considered improbable. That this improbable change has occurred independently in multiple languages of the same family is even more improbable. Instead the change is more likely to have originated in one location at an earlier time. This would point to a synapomorphic connection (that is, based on a shared, inherited characteristic) between two languages spoken in modern-day British Columbia and the southwestern United States. This interpretation requires Western Apache and San Carlos Apache to have later abandoned this form for 'lips' in favor of the polymorphemic compounds /zé-báːn/ and /zá-báːn/ both encoding the lexicalization pattern MOUTH.INNER-EDGE, which is plausible since a cognate of this form also exists in Navajo, but nowhere else in the Athapaskan world, indicating that this form is a local innovation.

[43] Within mainstream Cognitive Linguistic synecdoche is considered a sub-type of metonymy.

A second semantic change violates the law of synecdochic change: ‘knee’ > ‘bone’. This change, too, involves Chilcotin, but connects this language with Tututni, a language spoken further south in present-day Oregon. Central Carrier also partially partakes in this change, as can be observed in the word for ‘skull’ which manifests the lexicalization pattern HEAD-KNEE (see Section 3.1.4). These two changes fail to neatly divide the Athapaskan languages like the branches of a phylogenetic tree, but they are potential indicators of ancient connections. Their import is discussed further in the conclusion. Having addressed the more qualitative evaluations, the next sections considers more quantitative perspectives on the data.

4.4 Quantitative measures of language proximity

The data gathered through the onomasiological method constitute an objective sample that can be submitted to quantitative evaluation. The quantitative methods used here allow for perspectives on the data that cannot be achieved through qualitative analysis alone. These methods can classify patterns in the data into groups (Jain et al. 1999), based on the evaluation of a large number of individual data points – numerous enough to be beyond the scope of unaided human analysis. Central to the employed methodology is the measurement of distance between the languages in the sample, since the ultimate goal is to arrive at a classification of Athapaskan languages indicative of historical relationships. The algorithms used for this are implemented in the software *Gabmap* (Nerbonne et al. 2011), freely available over the Internet.[44]

The objects to be classified are languages. The languages are grouped on the basis of their similarity to other languages, where similarity is operationalized as a numeric value calculated on one of two kinds of variables: lexicalization patterns and phonological strings. Each language is characterized by a vector of values consisting of one of the two types of data. In the case of lexicalization patterns, each language is characterized by one lexicalization pattern for each anatomical term available for that language. The phonological strings are the transcriptions of individual terms encoding the onomasiological referents in individual languages. The difference between strings is measured through the Levenshtein Distance (Levenshtein 1966). This use of Levenshtein Distances for the identification of historical language relationships has come under criticism for its inability to correctly identify language relationships in cases of greater phylogenetic distance (Greenhill 2011: 693). While Greenhill warns against the use of Levenshtein metrics in the construction of language phylogenies, he nevertheless recognizes the value of the method in its application to dialect data:

[44] https://www.gabmap.nl/

> …studies that have applied the Levenshtein distance to dialect-level data and have generally shown strong congruence between the subgroupings estimated by traditional dialectology methods and the Levenshtein distance. (Greenhill 2011: 693)

Therefore, the method is usefully applied to the Athapaskan languages, which, as discussed in Sections 1.3-1.5, appear to be more reflective of extended dialect complexes, rather than phylogenies.

The simple Levenshtein Distance (henceforth abbreviated as LD) distance between two words is informally defined as the minimum number of single-character edits required to change one string into another (Sankoff and Kruskal 1983: 18). The phoneme strings are aligned so that vowels will be compared with vowels and consonants with consonants. The distance between two strings is then established by comparing each character: if the characters are identical at an aligned location in each of the two strings, the distance will be measured as 0. If the two aligned characters are different the distance will be measured as 1. Should only a secondary feature of articulation such as aspiration, vowel length, etc. (e.g. /t/ vs. /tʰ/) distinguish the two characters, the distance will be measured as 0.5. The distance between two strings is the sum of the character distances. In Table 81 below, two phoneme strings representing the concept 'thumb' are compared and found to have an Levenshtein distance of 3.5.

Table 81. Measuring the simple Levenshtein distance between two cognate strings in two Athapaskan languages

Ahtna — Kaska (Frances Lake)

l	a		kʰ	o	ʦ'	
l	aː	s	ʧʰ	o	ʔ	
0	0.5	1	1	0	1	3.5

Diacritical marks, such as vowel length or aspiration, are measured as distances of 0.5. So as not to exaggerate the distance between longer words compared to shorter words, the "distance of each word pair is normalized by dividing it by the mean length of the word pair" (Nerbonne et al 1999: x). For the example above, the distance between the two strings is calculated as:

(5)

$$\frac{Distance\ between\ strings}{Average\ lenght\ of\ string} = \frac{3.5}{(6+5)/2} = 0.636363$$

The result is a distance matrix in which each cell lies at the intersection of two languages and contains the numeric distance value between them, as can be observed in the matrix excerpt in Table 82. This matrix serves as the input for two classification methods: clustering and multi-dimensional scaling. Before these methods are described further, distance measures on lexicalization patterns are discussed in more detail.

Table 82. Excerpt of distance matrix

	Deg Xinag	**Koyukon**	**Dena'ina (Iliamna)**
Deg Xinag	0	0.387154	0.431306
Koyukon	0.387154	0	0.372488
Dena'ina (Iliamna)	0.431306	0.372488	0

The comparison of lexicalization patterns which are categorical variables is slightly different. As in the case of the string comparisons described above, each term in each language is again matched with the term corresponding to the same referent-concept in every other language. As categorical variables, the lexicalization patterns are judged by the algorithm as being either identical, for which a distance value of 0 is counted, or different, for which a difference value of 1 is counted. To return to the example above, the lexicalization pattern HAND-BASE encoding 'wrist' in Dene Dháh is compared to the lexicalization pattern HAND-REVOLVES.ON.ITSELF found for the same referent-concept in Dene Sųłiné. In this case, the difference between the two languages, for this comparison, is counted as 1. However, the distance between Dene Dháh and Kaska (Liard dialect), which also has the lexicalization pattern HAND-BASE is counted as 0. In order to attain a comparable judgment of distance for languages with different levels of data availability, the distance between two languages is then calculated as:

(6)

$$1 - \frac{number\ of\ matches}{number\ of\ comparisons}$$

The results of these comparisons are two data matrices, each of which can be submitted to further techniques designed to discover patterns in the data.

The two techniques used here for uncovering group structure in the distance matrices are hierarchical agglomerative clustering and multi-dimensional scaling. Clustering is "the process of classifying objects into subsets that have meaning in the context of a particular problem" (Jain and Dubes 1988: 55). The technique used here begins by forming individual clusters of each of the objects to be classified — the languages. The algorithm then proceeds by gradually "merging these atomic clusters into larger clusters until all objects are in a single cluster" (Jain and Dubes 1986: 57). The clustering is hierarchical because the languages are ultimately ordered into a "nested sequence of partitions" (ibid.).

With regard to establishing relationships of closeness among languages that can be interpreted historically, the groups to be identified are determined by the phonological and semantic similarities between individual languages, as described in the preceding sections. Multi-dimensional scaling (MDS) is a method that constructs a geometrical model of the differences between the objects, in this case languages that are being compared. As such it is "…an attempt to represent the observed similarities or dissimilarities in the form of a geometrical model by embedding the stimuli of interest in some coordinate space…" (Everitt et al. 2011: 37). The distances between the languages are calculated as Euclidian distances, which are then plotted in a low dimensional space. The algorithm implemented in Gabmap projects these data on three dimensions, which has been found to account for over 90% of the variation in the data (Prokić and Nerbonne 2008). Multi-dimensional scaling represents a robust assessment of relative distance among objects (Nerbonne et al. 2011:15), which is less sensitive to small variations in input data, but the visualizations it produces are less easily interpretable and less detailed than those produced through clustering. Clustering, however, is prone to producing results that are difficult to replicate, making the resulting cluster arrangements unreliable (Nerbonne et al. 2008, Kleiweg et al. 2004). This is particularly important, as Nerbonne and colleagues warn, because the danger of interpreting too readily the highly appealing dendrograms derived through hierarchical agglomerative clustering is quite high. The solution to this problem is to cluster multiple times in order to ascertain which clusters re-emerge after many repetitions. To test cluster stability further, the clustering algorithm is applied to slightly varied datasets. The variation is created through the artificial addition of randomly created data, so-called *noise,* within the specified limits:

> To cluster with noise we assume a single distance matrix, from which it turns out to be convenient to calculate variance (among all the distances). We then specify a small noise ceiling c, e.g. $c = \sigma/2$, i.e. one-half standard deviation of distances in the matrix. We then repeat 100 times or more: add random amounts of noise r to the matrix (i.e. different amounts to each cell), allowing r to vary uniformly, $0 \leq r \leq c$. (Nerbonne et al. 2008: 5)

The results can be plotted on a dendrogram in which the clusters are labeled with percentage values. The percentages indicate the frequency at which particular clusters re-emerge in repeated clusterings with the simulated noise in the data. Cluster re-emerging at high frequencies, for example at 70% or more of the repeated clusterings, can be considered stable and therefore reflecting accurate representations of groups in the data. In what follows, these methods are applied to the semantic data and the phonological data in turn.

4.4.1 Grouping of languages based on overall semantic similarity

As discussed above, referent-concepts encoded through highly stable lexicalization patterns are excluded from the quantitative evaluation of language proximity presented below. The referent-concepts thus excluded are: ‘abdomen, inner’, ‘excrement’, ‘face’, ‘teeth’, ‘foot’, ‘sinew’, ‘urine’, ‘scab’, ‘vomit’, ‘arm’, ‘pus’, ‘tendon’, ‘buttocks’, ‘neck’, ‘bone’, and ‘hair’. The remaining referent-concepts thus enter into an overall estimation of language proximity based on semantic grounds. These evaluations begin with the Multi-Dimensional Scaling model of the semantic data, represented in Figure 92.

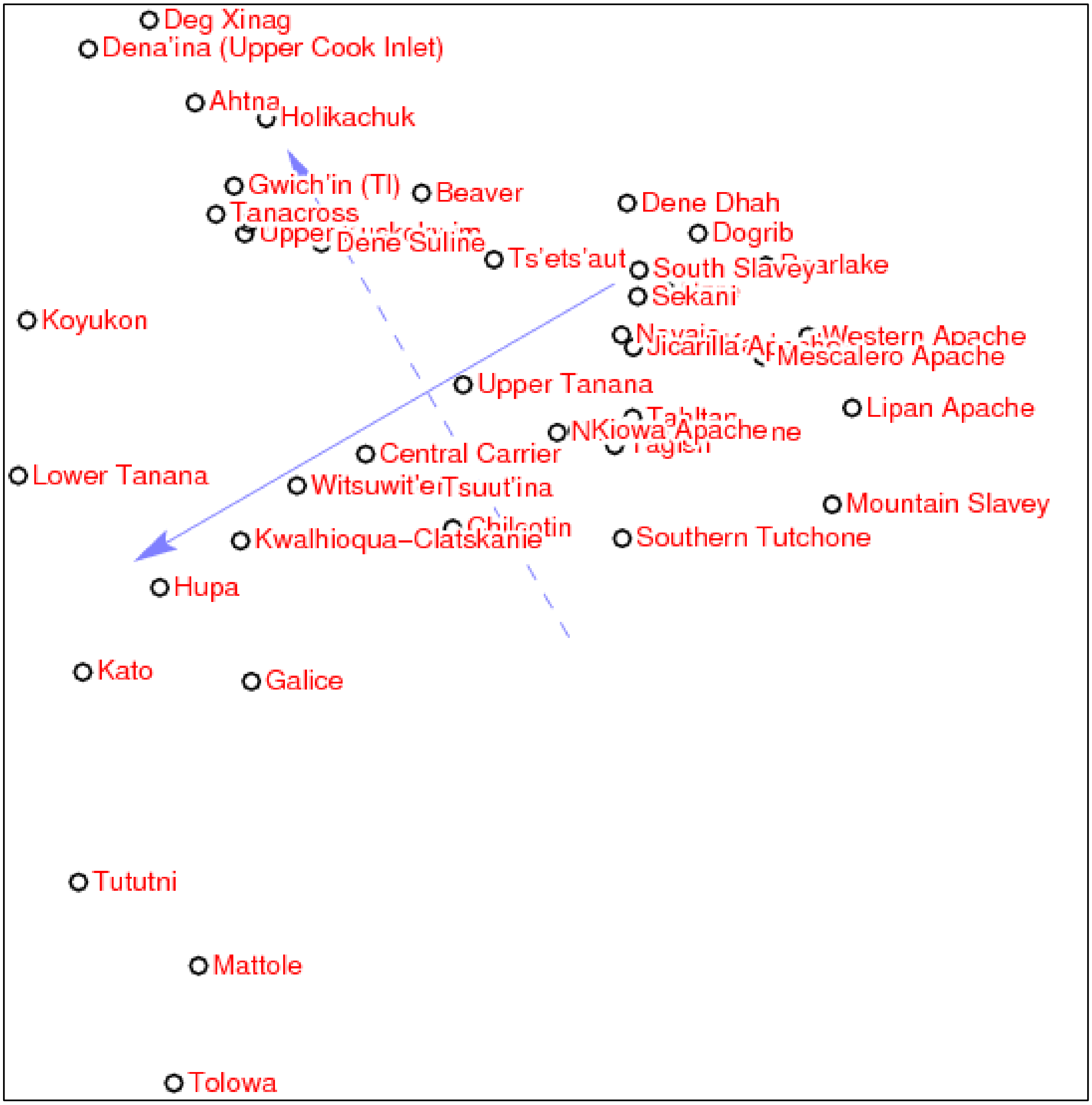


Figure 92. MDS graph of Athapaskan languages on the basis of similarities in lexicalization patterns

The graph in Figure 92 has labeled data points with the name of the corresponding language. Overlapping names indicate particularly tightly knit clusters. The identification of individual languages is less important than the overall distribution (individual positions are more apparent in the visualizations presented in Figure 93 below). The arrows in the diagram can be read as approximate cardinal directions and serve as aids to orientation. The algorithm is able to reproduce the geographic constellation of the languages in the case of the western (Tolowa, Tututni, Mattole), the southern (Navajo, various Apache languages), and the northern

(Deg Xinag, Upper Cook Inlet Dena'ina) extremes. Those languages spoken in the more southerly Canadian Interior, Alaska, and the southwestern United States, however, form a dense but drawn-out cluster on the eastern half of the graph. The languages spoken in modern-day British Columbia and sections of the Pacific Coast form their own sparse cluster in the south-western portion of the graph. Multi-Dimensional Scaling of the Athapaskan languages on semantic criteria therefore seems to suggest four language clusters: one in the north with a tail extending toward the center (from Deg Xinag to Ts'ets'aut moving from north to south), one west of center (from Central Carrier to Kwalhioqua-Clatskanie moving east to west), and a long, drawn-out chain, in the far west of the graph (from Dene Dháh to Lipan Apache in the west, and toward the center, reaching Upper Tanana). The true separation appears to be in the far west (of the graph), which is a sparsely populated section of the graph with languages spoken in Alaska, Oregon, and California, and the remaining languages which form an extended dialect cluster that can be visualized as a wedge whose sides stretch north and west (see Figure 102 below). The MDS graph gives a general overview of language clusters, but the details of smaller clusters are not visualized well. More fine detail in language relationship can be discerned from the cluster dendrogram reproduced in Figure 93.

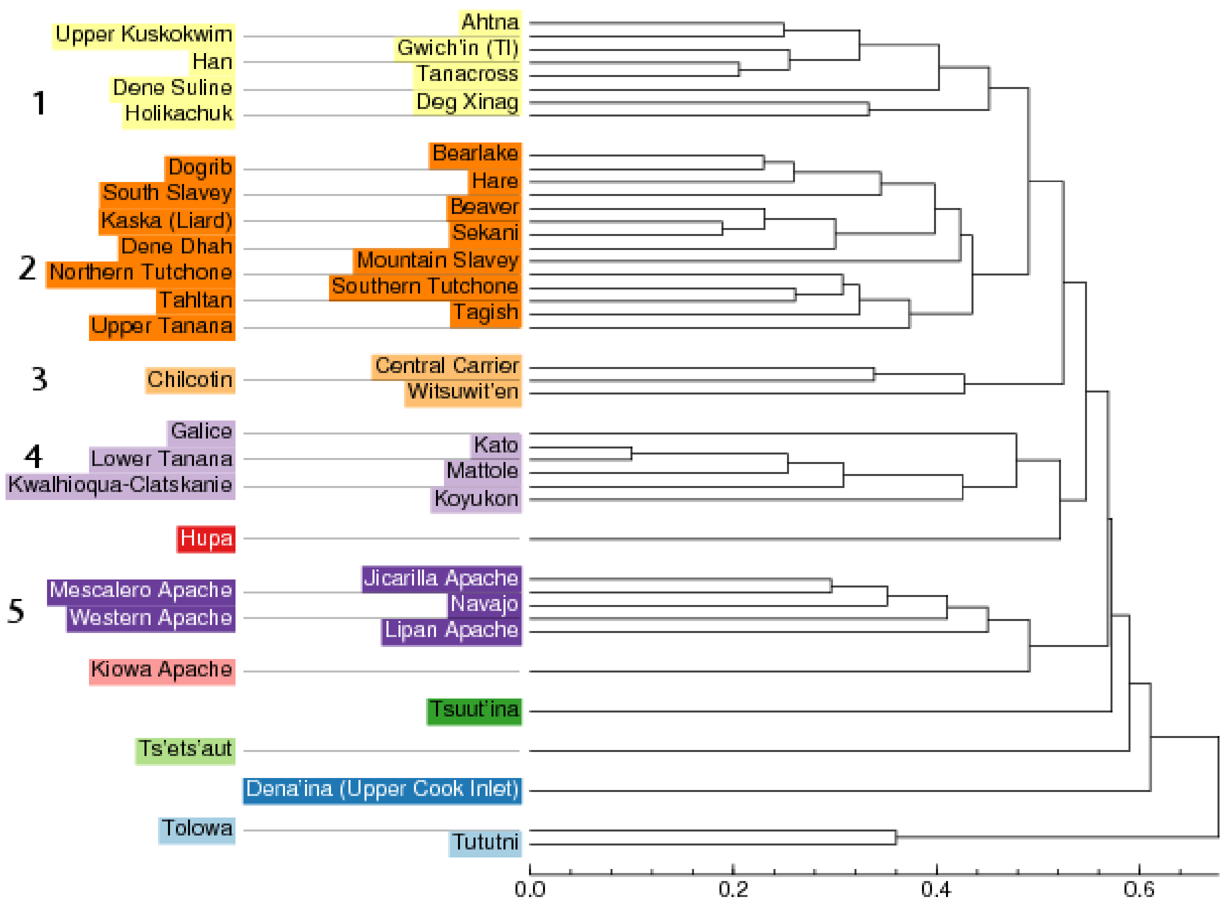


Figure 93. Cluster Dendrogram on the basis of similarities in lexicalization patterns (Group Average Method; colors are randomly assigned and intended only as a visual aid)

The dendrogram in Figure 93 represents the relationships among the Athapaskan languages in the sample on the basis of similarities in lexicalization patterns. The method of visual representation relies on the grouping together of the languages according to aggregate measures of the distance between languages, and between groups of languages (clusters). This means that languages with low measures of distance between them form clusters. Separate clusters form if the between distances of a group of languages are particularly low compared to the distances to other languages and other clusters. While this is the desired representation showing which languages are closer to which other languages, and which groups are closer to which other groups, an unintended effect occurs with language groups with particularly low intra-group distances. Since language proximity is represented in the visualization on the basis of relative language distance (and not on the basis of some absolute measure of distance),[45] very tight clusters tend to skew the relationship of these

[45] No such absolute measure for assessing language distance exists, even though such a measure is conceivable and desirable

languages to other languages by overestimating the distance between tight and loose clusters. This problem is dealt with by operationalizing a distinction between *language* and *dialect*. This distinction is made on phonological grounds based on the reasoning that if the pronunciation differences between two languages fall beneath a given threshold, they are highly likely to be mutually intelligible. Those languages whose mutual distance falls below this threshold are therefore considered dialects of one language and only one (typically the language that is best represented in the sample) is chosen as a representative for the dialect group. Section 4.4.2 describes this procedure in more detail. This means that the Kaska dialect complex is represented by Liard Kaska, Gwich'in is represented by Teetl'it Gwich'in, and the Dena'ina dialects are represented by Upper Cook Inlet Dena'ina.

Figure 93 is a dendrogram produced by a hierarchical agglomerative clustering algorithm based on semantic data. This means that the representational structure, the dendrograms, is built from the bottom up, beginning with languages that have the shortest distances between them. Short distances are the basis for grouping, or clustering languages. Clusters, in turn, are compared to languages outside the cluster, and other clusters. As indicated in the description of Figure 93, clusters are assigned new distance values, for the purposes of out-group comparison, based on the average distance within the cluster. If the dendrograms is thought of as a tree (*dendro* is Greek for 'tree'), then the lines can be thought of as branches. The length of branches is be assigned a value, the *cophenetic* value,[46] that is derived from the distance matrix (Sokal and Rohlf 1962: 36). In practical terms, this means that shorter branches indicate groupings in which the languages are more similar. In Figure 93, for example, Kato and Lower Tanana are situated at the ends of two very short branches, indicating that these two languages are semantically very similar. In contrast, Central Carrier and Chilcotin, which are also situated on the ends of two immediately adjoining branches, are much less alike, as indicated by the much longer branch. The coloring of groups is arbitrarily assigned to the groups of languages in this dendrograms and has no bearing anywhere else. It is intended as an aid visual identification of groups.

The dendrogram in Figure 93 is constituted by five large clusters that are approximately representative of geographic regions. The clusters have been numbered arbitrarily. Cluster 1 is made up of languages spoken in Alaska and Northern Canada. There is one exception in this group, Dene Sųłiné, which is spoken further east in Canada. This deviation between geography and placement in the group is notable and deserving of further comment. *Gabmap*, the software in which the clustering algorithms are implemented, allows for the examination of individual clusters in order to ascertain those features that contributed most to the formation of the cluster in question. This is achieved by comparing the "average

[46] The term is derived from *phenetic* indicating a classification based on similarity and not inherited characteristics as in the case of *phylogenetic* relationships (Sneath and Sokal 1973: 3).

distances between groups to average distance to objects outside groups with respect to individual features" (Prokić et al. 2012: 75). This allows clusters to be mined for distinctive features. The features carrying the most weight in this cluster are the lexicalization patterns: ELBOW$_1$, NOSE$_2$, SALIVA$_1$, and HIP$_1$. In these patterns, Dene Sųłiné behaves like an Alaskan Athapaskan language.

The languages of Cluster 2 are spoken in the geographic areas identified as Yukon and Interior Canada in Chapter 3. These languages form a stable region of linguistic interaction, as can be more clearly discerned from the beam map in Figure 94. This visualization has been produced by drawing beams of color between (geographically) neighboring languages. The depth of hue of these beams indicates greater similarity. The dark blue beams are indicative of area of linguistic (semantic) interaction.

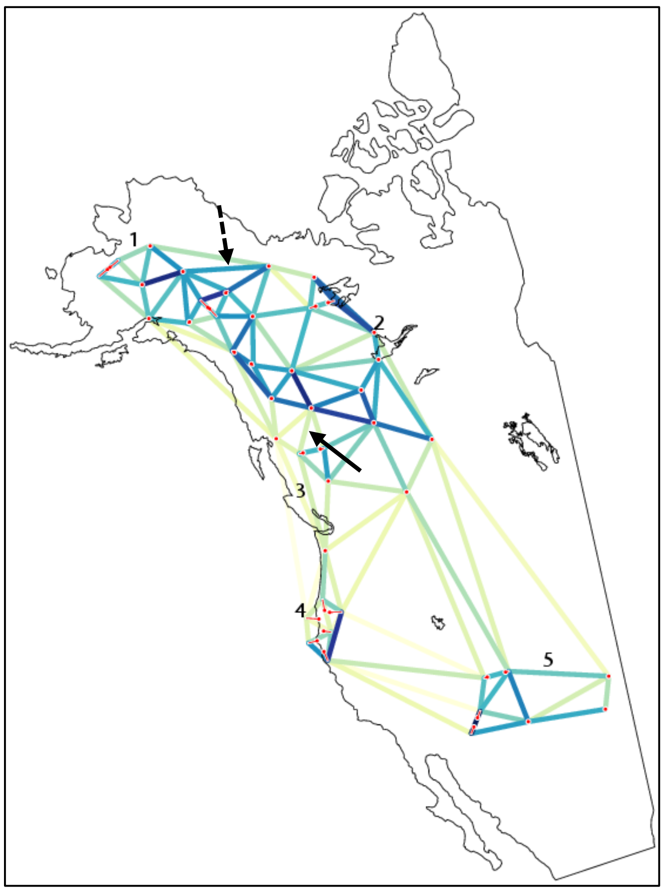


Figure 94. Beam map showing the strength associations between neighboring languages by depth of hue (numbers correspond to the cluster of Figure 93)

Cluster 2 forms a U-shaped chain of languages (labeled with the number 2). It can be noted here that this group of languages is spoken on both sides of the Rocky Mountains and in the northern Northwest Territories. However, it is important to note where the links lie. For example, Beaver (indicated by the solid arrow) links cluster 2 and 3, as well as integrating the languages on the western and eastern sides of the Rocky Mountains. At the northern end of the chain, the connection between languages is quite weak (dashed arrow), rendering the U-shape. The dialect chain ultimately extends to the languages of Clusters 1. Semantically, then, the northern Athapaskan languages all share some similarities, albeit in different degrees. Cluster 3 is very weakly integrated into this northern complex and instead forms a relatively neatly delimited cluster made up of languages spoken in present day British Columbia.

Cluster 4 forms a geographically heterogeneous grouping, and one that is unexpected from the perspective of traditional Athapaskanist classifications. Most of the languages are spoken on the Pacific Coast, but Koyukon and Lower Tanana are spoken in Alaska, and typically associated with the other languages of that region. The reasons for their inclusion in this group can be found following the method outlined for Cluster 1. In this case, the shared lexicalization patterns ABDOMINAL.VISCERA-ON, BACK$_1$, and CHEST$_1$, NOSE$_2$ carry the most weight in determining cluster membership.

Cluster 5 reproduces the Apachean sub-group, already established in the literature (Hoijer 1963), and clearly geographically delineated. An interesting aspect to this group is the distance that Kiowa Apache bears to the remaining members. Although it is still associated with this larger grouping, proving the accuracy of its nominal inclusion among the Apachean languages, Kiowa Apache is semantically a distant relative, equally far from any other Apachean language. In fact, the length of the branch separating Kiowa Apache from the other Apachean languages is superseded only by Hupa and the three isolates Tsuut'ina, Ts'ets'aut, and Dena'ina (UCI), attesting to the weak association of Kiowa in the Apachean group.

Finally, the dendrogram in Figure 93 reveals that Dena'ina and Hupa, as well as Tolowa and Tututni, both form isolated couplets. The two couplets are of distinct character, however. Tolowa and Tututni are geographically close and separated by a much smaller cophenetic distance (the value of which is indicated on the horizontal axis below the dendrogram). Dena'ina and Hupa are geographically far apart and the cluster they share is separated by quite a large cophenetic distances, indicating that this is a rather loose and unstable cluster. Two other languages, Tsuut'ina and Ts'ets'aut, are semantically quite remote and do not form any closer associations other languages in the Athapaskan family.

4.4.2 Groupings based on measures of phonological distance

The following sections consider the phonological representations of the lexicalization patterns as an alternate perspective on grouping among the Athapaskan languages. For this purpose, each term expressing a lexicalization pattern is transcribed as a string of phonemes. Each language in the sample is therefore represented to the algorithm as a set of phonemic strings. These sets are compared by averaging the distances between word pairs, for each pair of languages, as described above. However, not all languages and varieties represented in the sample where taken into consideration in the measurements of phonological (and semantic) distances. The languages which were consistently identified by the algorithms as constituting very close groups are the Kaska dialects, the two Gwich'in dialects, and the dialects of Dena'ina. These dialect groups are identified on the basis of the expertise of each researcher who produced the lexicographic source materials. The measurement of LD offers a replicable and more precise means of testing the assessments language and dialect distinctions made by experts. This is done by measuring the mean distance among the sample languages, which is 0.442 ($s^2 = 0.055$). This value can be compared to the mean distance among the languages that had been identified as potential dialect subgroups. Since the distances among the languages are approximately normally distributed, see Figure 95, differences in means can be compared through a simple t-test. For the Kaska dialects, the mean distance was 0.087 ($s^2 = 0.034$); for the Dena'ina dialects, 0.149 ($s^2 = 0.02$); for the Gwich'in dialects, it was 0.064. All these means are statistically significant from the overall sample mean (p-values < 1.366^{-07}, 2.2^{-16}, and 2.2^{-16} respectively). The differences among languages that had been identified as dialects are indeed significantly smaller than the mean distance among clearly distinct languages in the sample. Consequently, the languages identified as dialects of Kaska as well as those of Dena'ina and Gwich'in enter the qualitative analyses in reduced form. Each of these languages groups is represented by only one member language. This was done because the MDS and clustering algorithms used to assess group structure among Athapaskan languages can be distorted by the inclusion of groups of highly similar languages. This distortion arises due to the manner in which the data are distributed in data visualization techniques such as MDS and dendrograms: the data are plotted on the available visualization space in relative positions to one another. Since the algorithms consider each data point (each language) as being an independent entity, its assessment of the total space available will factor in the particular proximity that these points exhibit. In omitting these languages, the resulting visualizations render a clearer picture.

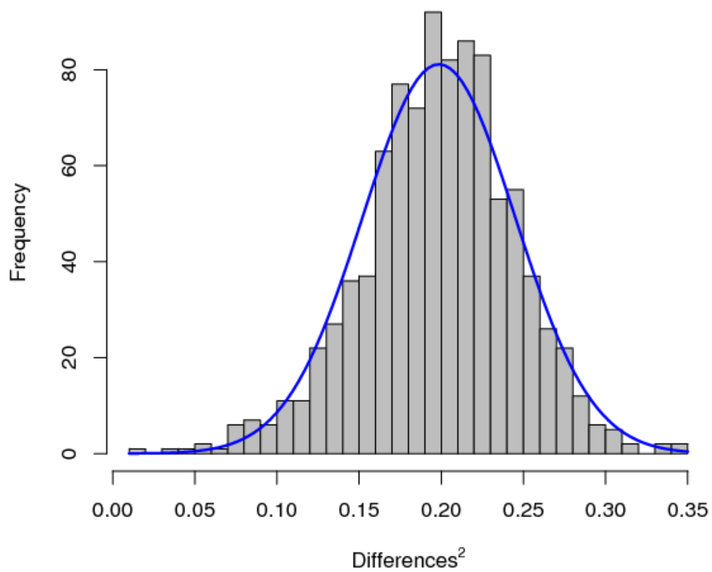


Figure 95. Frequency distribution of squared distances from the distance matrix

The reduction of the sample through the substitution of particularly close dialect clusters through representative members is justified. It must be emphasized that this final sample of languages is arrived at through considerations both of the quantitative results of edit distance comparison and the more qualitative assessments based on expert opinion. In some cases, this conclusion is better supported than in others. The distances between the languages can be ranked in order of increasing size. Doing so reveals that the 23 smallest distance values, from a distance of 0.0202897 between the Pelly and Frances Lake dialects of Kaska, to a distance of 0.133792 between the Iliamna and Outer Cook Inlet dialects of Dena'ina, all the values are between languages of the three dialect groups described above. The result is a more representative distribution of the languages over the plotting space, and clearer dendrograms.

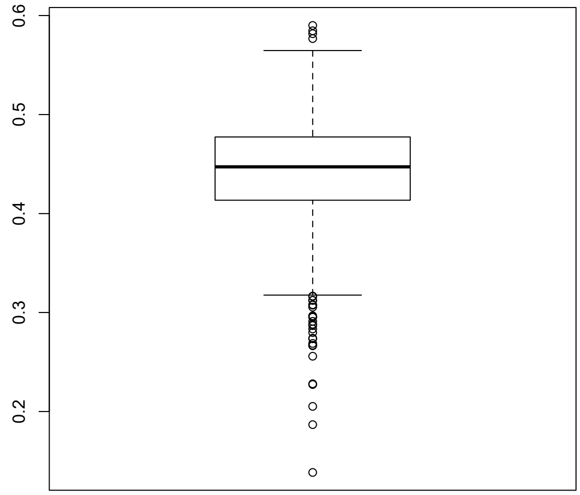


Figure 96. Boxplot of the frequency distribution of distances (y-axis)

Figure 96 gives additional perspective on the distribution of distances among Athapaskan languages. As can be seen from the boxplot, there is quite a large group of distances which fall into the lower threshold - they are represented as individual circles below the lower 'whisker'. This group of values all represent distances smaller than 0.2. This is the left tail from Figure 96 above, in which the distances can be observed to fall under the bell-shaped curve of a normal distribution, without major jumps in the inter-lingual distances. There is reason to suspect that there is something worth noting at this point, a division bearing some importance. There are 30 distances in this group, 28 of which occur among languages identified as dialects (the aforementioned variants of Kaska, Gwich'in, and Dena'ina). Since these particularly low distance values dovetail with the expert assessment of dialect/language distinction, it is reasonable to conclude that this value range presents a good operationalization of this division. Relating to pronunciation similarity, it captures the valuable aspects of the traditional "mutual intelligibility" criterion, but without the latter's subjectivity and individual variability. This approach is also far superior to the arbitrary 70%-cognates cut-off that serves as the operationalization of the language/dialect divide in the work of Dyen and Aberle (1974: 11).

Having established the worthiness of considering this lower threshold of language similarity as constituting a distinction of some importance in the matter of languages grouping or classification, the remaining two language distances in this group, not part of the established dialect sets, can now be considered. The first pairing is between San Carlos Apache and Western Apache, which have a distance of

0.138784 (this difference is significantly lower than the mean distance p = 0.008924). Again the classification of these two languages as dialects is supported by expert opinion (de Reuse 2006: 2). The final pairing in this group is between the languages Sekani and Lower Liard Kaska, which following the logic of this argument, should also be classified as dialects of each other, rather than closely related languages. This final distance value, 0.18032, lies at the upper threshold of this group, already quite large compared to the distances between the other Kaska dialects and the two Gwich'in dialects. However, the distances among the Dena'ina dialects also fall into this higher range. The low value of the measured distances between the Kaska dialects and Sekani suggests that these, too, might fall into a grouping best considered dialectal, in the sense of the term used here. Again, group coherence can be measured by comparing the mean distance among the languages of this sub-grouping with the mean overall distance.

Using the method described above, it is possible to show that this method of assessing dialect structure will not work for just any subset of distance by measuring the means of random sub-groups in the set of distances and assessing whether those means are significantly different from the general sample mean. This procedure can be repeated for each supposed, or even, possible combination of languages to test whether they fall into groups of dialect complexes, and carried further to higher-level language groupings. Instead of pursuing this lengthy and painstaking procedure step-by-step, clustering algorithms can be used to carry out this work and their results can be visually represented in dendrograms.

As discussed above, the sample to be evaluated by the algorithm measuring phonological string distances is amended by the representation of dialect complexes through individual languages. Furthermore, the language Wailaki has been removed because of the general under-representation of this language in the dataset. Since the computational methods used to construct cluster dendrograms and beam maps work from relative values, under-represented languages like Wailaki give rise to artefactual representations and skewing. Aside from these exclusions, the entirety of the sample is entered into the evaluations. As with the semantic data described above, a coarse-grained grouping of the languages on the basis of phonological data can be attained from inspection of the Multi-Dimensional Scaling graph, reproduced in Figure 97.

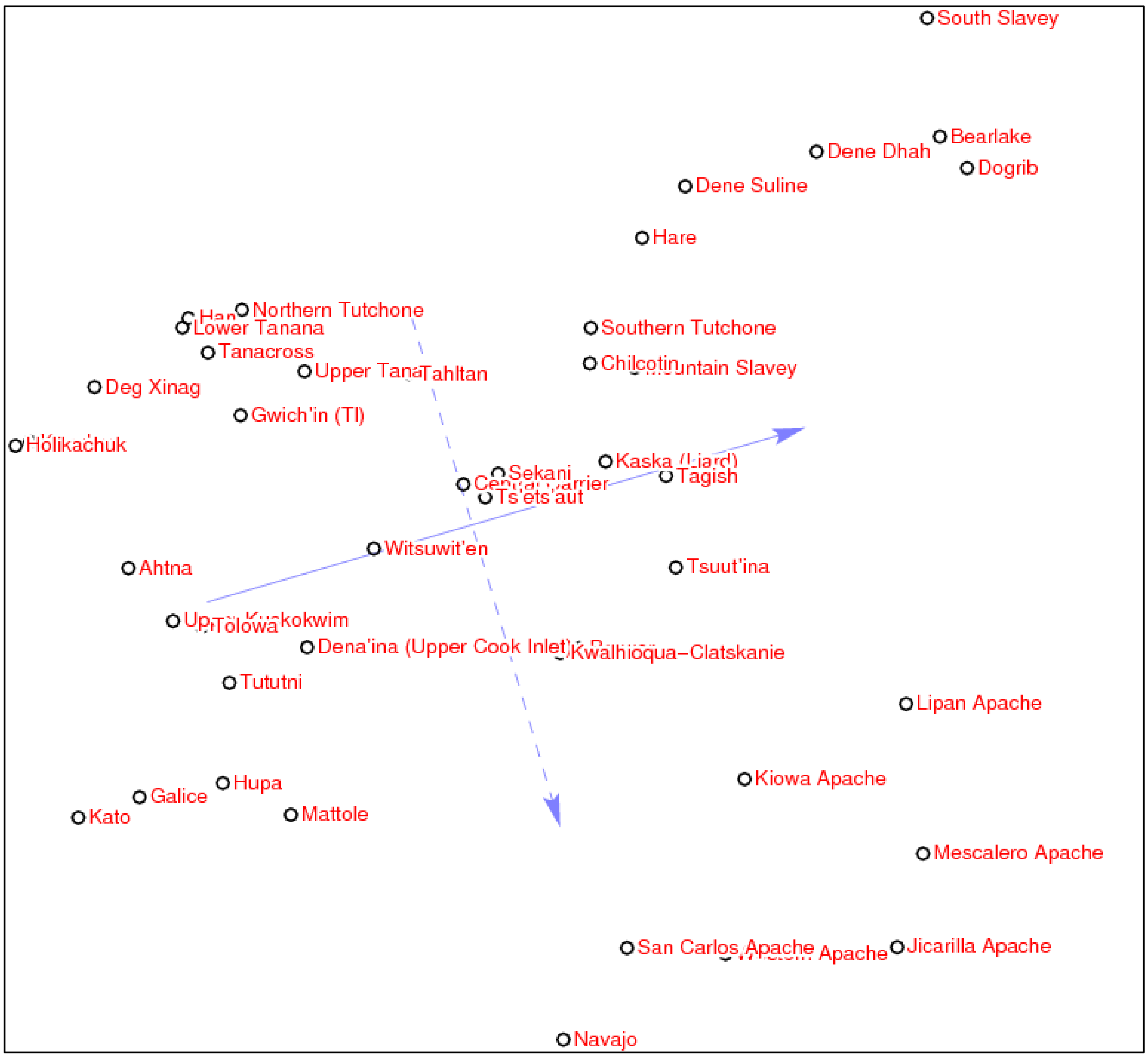


Figure 97. MDS graph of Athapaskan languages based on phonological data

The MDS graph of the Athapaskan languages based on phonological data differs from the graph based on semantic data in important ways. The North-South axis (represented by the dashed arrow) dissects the Athapaskan languages into two large clusters with predominant geographic associations: the western half is dominated by languages spoken in Alaska and northern Canada, a group which includes most of the languages of Cluster 1 in Figure 93. The eastern half, which is sparser, contains the languages of interior Canada and the American Southwest, largely overlapping with Clusters 2 and 5 from Figure 93. Languages spoken in present-day British Columbia are situated to the east on the east-west axis, but overall closer to the Interior Canadian languages. Overall, the languages are more evenly distributed and fall more or less into the traditional geographic regions. However, three major clusters appear to be connected through intermediary languages. The north-eastern quadrant contains three clusters. A tight cluster made up of Sekani, Central Carrier, and Ts'ets'aut, and Tagish and Liard Kaska with Witsuwit'en as an outlier is situated in the lower section of the quadrant, toward the center of the graph. Close to this central cluster and midway to the cluster in the far north-east of the graph, is a cluster made up of Chilcotin, Southern Tutchone, and Mountain Slavey. These languages present a phonological mid-way point between the cluster at the center and the north-eastern cluster, which is made up of interior Canadian languages (Kaska, Mountain Slavey, Southern Tutchone, Hare, Dene Sųłiné, Dene Dháh, Bearlake, Dogrib, South Slavey). To the south (both in terms of North American geography and in terms of the graph) lies a very sparse area populated only by Tsuut'ina and a little farther to its southwest, the couplet Beaver and Kwalhioqua-Clatskanie. From a certain perspective, these can be viewed as residing in the intermediary phonological and geographic space between the northern Athapaskan languages of the north-eastern quadrant and the Apachean languages of the far southwest. On the other side of the graph, Witsuwit'en is closest to the cluster of languages around the core couplet of Upper Kuskokwim and Tolowa. These in turn reach down to the group of languages spoken in California and Oregon (Hupa, Galice, Kato, Mattole). Even though the spaces between these groups and languages are quite large, they present more gradual transitions from one group to the next, than between these groups and the Alaskan languages clustered in the northwestern quadrant of the graph. The structure of individual clusters is more easily discernible from the dendrogram reproduced in Figure 98.

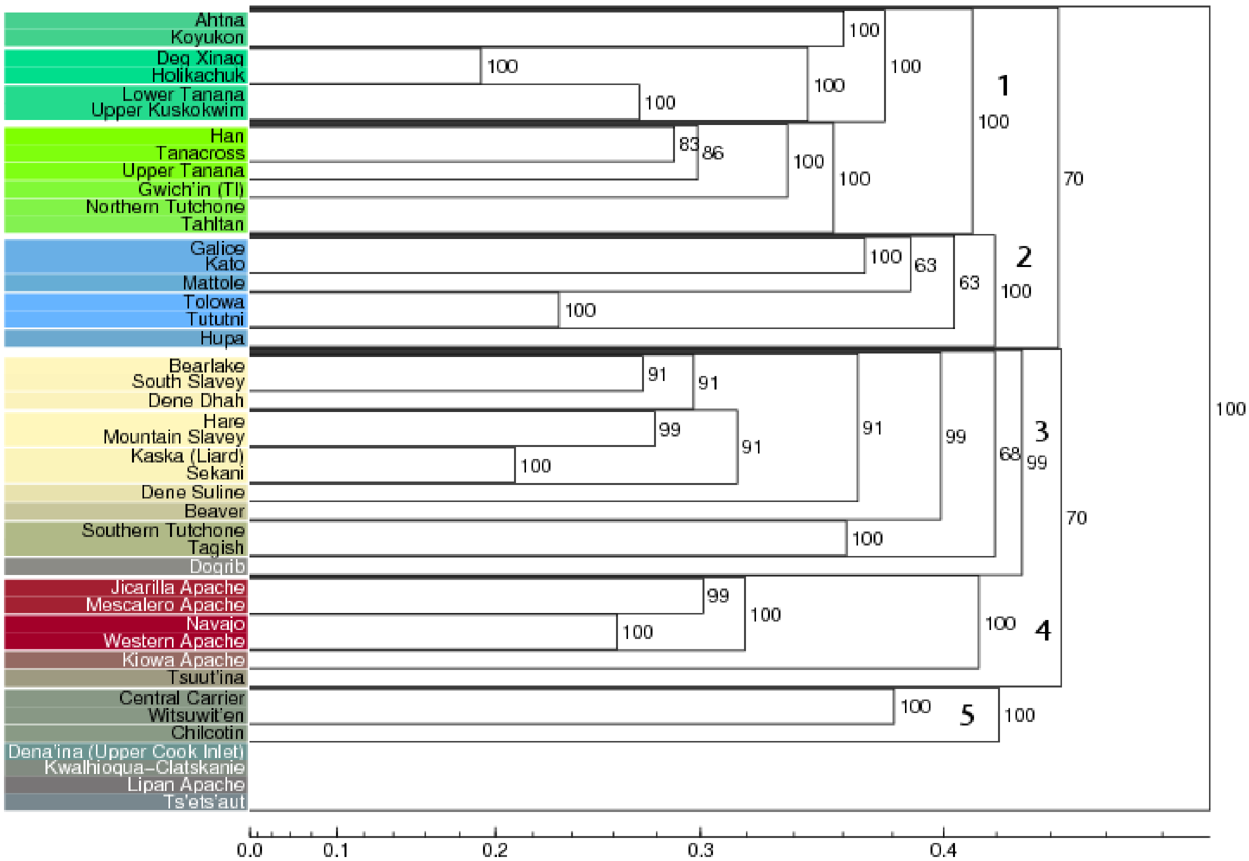


Figure 98. Fuzzy cluster dendrogram of Athapaskan languages based on phonological data indicating likelihood of cluster re-emergence after repeated clustering with noise (figures indicate percentages of cluster re-emergence, see introduction to this section)

From Figure 98, it can be observed that four languages are isolates: Dena'ina (UCI), Ts'ets'aut, Kwalhioqua-Clatskanie, and Lipan Apache. The joining of the branches carrying these last two languages is considered spurious, for reasons that lie with the nature of the data on these two languages. Kwalhioqua-Clatskanie and Lipan Apache are perhaps the least well-described languages in the dataset. Only hand-written notes, in the case of Lipan dating back to the 19th century, exist in the documentary record of these languages. That they both cluster together may therefore be based on the fact that they are phonologically the most different from the other languages. This phonological difference is perhaps best attributed to differences in habits of transcription, at least until the likely event of the emergence of clearer data. The dendrogram shows five major clusters that have been numbered for convenience. The dendrogram then indicates a division splitting clusters 1-4 as well as Tsuut'ina from cluster 5. The next splits divide the remaining languages into two further sets of two clusters each: clusters 1 and 2 and clusters 3 and 4. These cluster fall into clear geographical areas, but these areas are not commensurate with modern Canadian and

American geographic subdivisions. The standard practice of Athapaskanist naming must therefore be abandoned where it is inaccurate, but can be retained in cases where it is appropriate. Consequently, Cluster 1 is named Northwestern Athapaskan, Cluster 2 remains Pacific Coast Athapaskan, Cluster 3 becomes Northeastern Athapaskan, Cluster 4 becomes the Southeastern Athapaskan group, and Cluster 5 becomes North-Central Athapaskan, because this group lies at the approximate center of the Athapaskan maps used in Chapter 3. This nomenclature has the advantage of preserving Northern Athapaskan as a hypernym for the languages in clusters 1, 2, and 5, which remains an important association in regard to the semantic data, as will become clearer below. The dendrogram provides information on higher levels of structure among the languages, which are no longer clearly associated with geography, however. The Northwestern and Pacific Coast languages (clusters 1 and 2) together form a cluster, which can be called *Western Athapaskan*, while the Northeastern and Southeastern languages in turn form a cluster which can be referred to as *Eastern Athapaskan*. These names correspond to the theoretical notions of migratory history introduced in Chapter 1, as will be discussed in more detail in Chapter 5.

Thus, at the deepest level, the Athapaskan languages fall into three major subdivisions, as well four isolates. This three-cluster division is a stable reproducible result, as indicated by the measures of the cluster stability indicated in the maps below. The east-west division discernible from the MDS graphs is represented in the dendrogram as a division between the Western (Clusters 1-2) and Eastern (clusters 3-4) branches of (Northern) Athapaskan. The MDS graph and the dendrogram should be read together (or against each other). This dual representation adds depth to the phonological analysis. The clusters found in each visualization are similar, but the MDS-graph adds further depth to individual clusters. Thus, Eastern Athapaskan made up of geographically widely dispersed languages, with a crucial cluster at the center. This cluster is a point of overlap between the North-Central languages group and the Eastern Athapaskan group, and an apparent point of contradiction. In fact this higher-level branching, between the Eastern Athapaskan, Western Athapaskan, and the North-Central Athapaskan is less strongly supported, than the lower level branchings. Nevertheless, all three divisions and their relationship are stable above a predetermined threshold. This stability can be expressed in numbers by means of the fuzzy clustering technique discussed in the introduction to Section 4.4.

The technique for establishing the stability of clusters involves repeatedly applying the clustering algorithm to the same data set, while adding small levels of artificial distortions (noise). The clusters produced from the phonological data were tested by means of the fuzzy clustering procedure, with a noise level of 0.2. This means that the clustering was repeated multiple times, adding random values in each case. Only those clusters were considered stable that re-emerged from the repeated clusterings at 60% of the time or greater. The results of these clusterings are represented in Figure 98. The division into Eastern and

Western Athapaskan is supported by cluster stability at a level of 70%. The branches of Northwestern Athapaskan (100%), Pacific Coast Athapaskan (100%), Northeastern Athapaskan (99%), North-Central Athapaskan (100%), and Southeastern Athapaskan (100%) each obtain very high stability levels. The association of the isolate Tsuut'ina with the Southeastern Athapaskan is also supported at the level of 88%. Figure 98 contains all the details of the clusterings and sub-clusterings, with groups being associated by spatial proximity and color coding. The color-coded groups can be plotted on maps. Figures 99-101 show these grouping and their geographical locations.

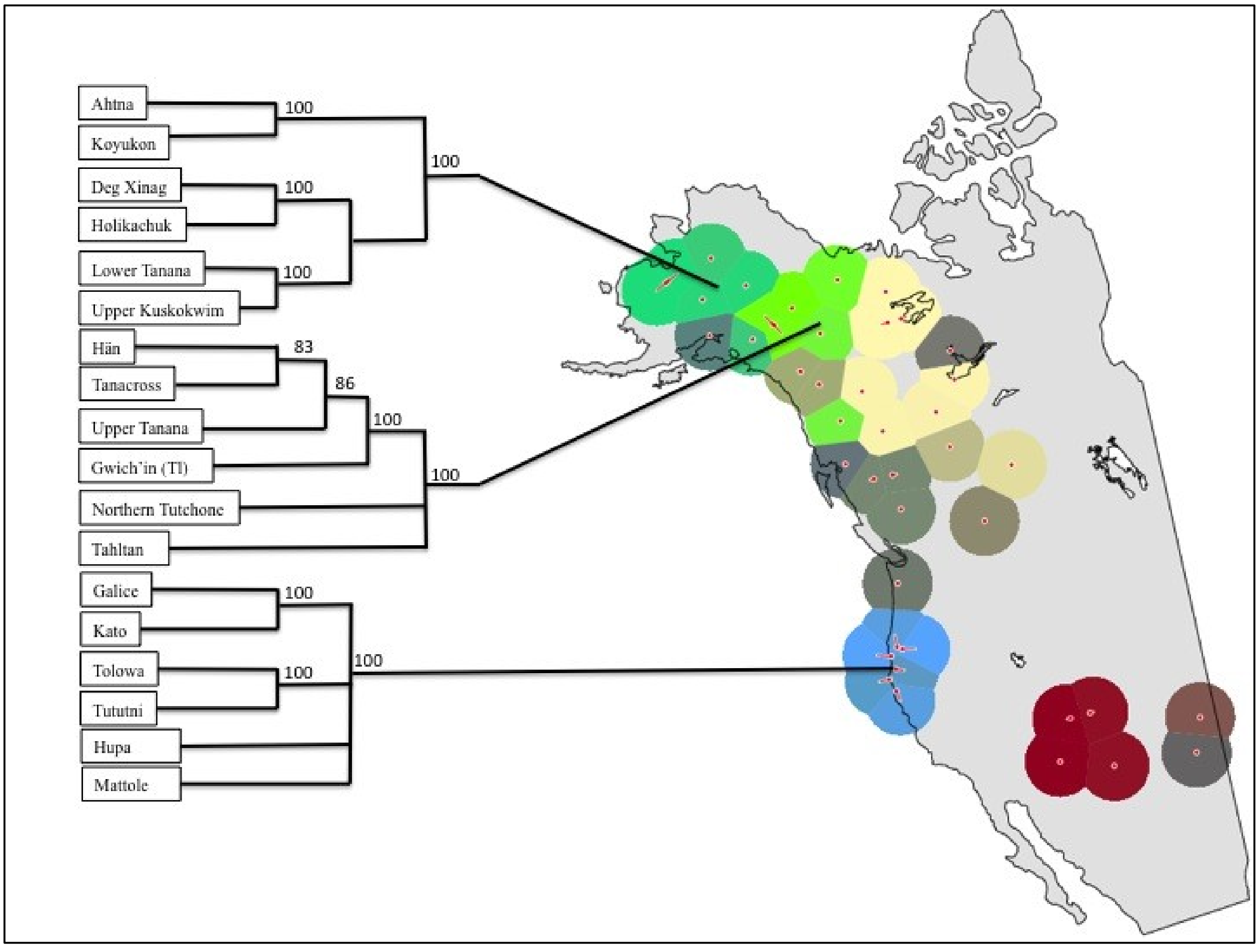


Figure 99. Structure of Western Athapaskan encompassing Northwestern Athapaskan (green) and Pacific Coast Athapaskan (blue)

Figure 99 shows the languages belonging to the Western Athapaskan branch of the Athapaskan language family. The internal structure of this branch is indicated by further branching (in contrast to the dendrogram of Figure 99 branch length is arbitrary here and carries no information), with the cluster stability values written to the right of each cluster root. As indicated above, this branch is made up of three larger clusters. The Northwestern branch can be further sub-divided into Outer and Inner groupings. The Outer

Northwestern languages are indicated in blue on the map and include those languages from Ahtna to Upper Kuskokwim (moving downward from the top of Figure 99). The Outer branch is further sub-divided into three language pairings. All these cluster re-emerge 100% indicating that they are stable groupings in the data. The association between Outer and Inner Northwestern Athapaskan is indicated on the map by the similarity in color, and is specifically indicated in Figure 100 below, which gives an overview of the whole language family. The Inner Northwestern Athapaskan branch is constituted of two individual (Northern Tutchone, Tahltan) languages and one larger cluster (from Hän to Gwich'in). While the internal structure of the cluster exhibits a mild decrease in stability, the cluster is highly stable overall. The Pacific Coast branch of Western Athapaskan also shows some internal structure with the couplets Galice-Kato and Tolowa-Tututni. It is worth noting that Northern Tutchone does not cluster with its nominal sister language Southern Tutchone. Instead, the latter forms part of Eastern Athapaskan.

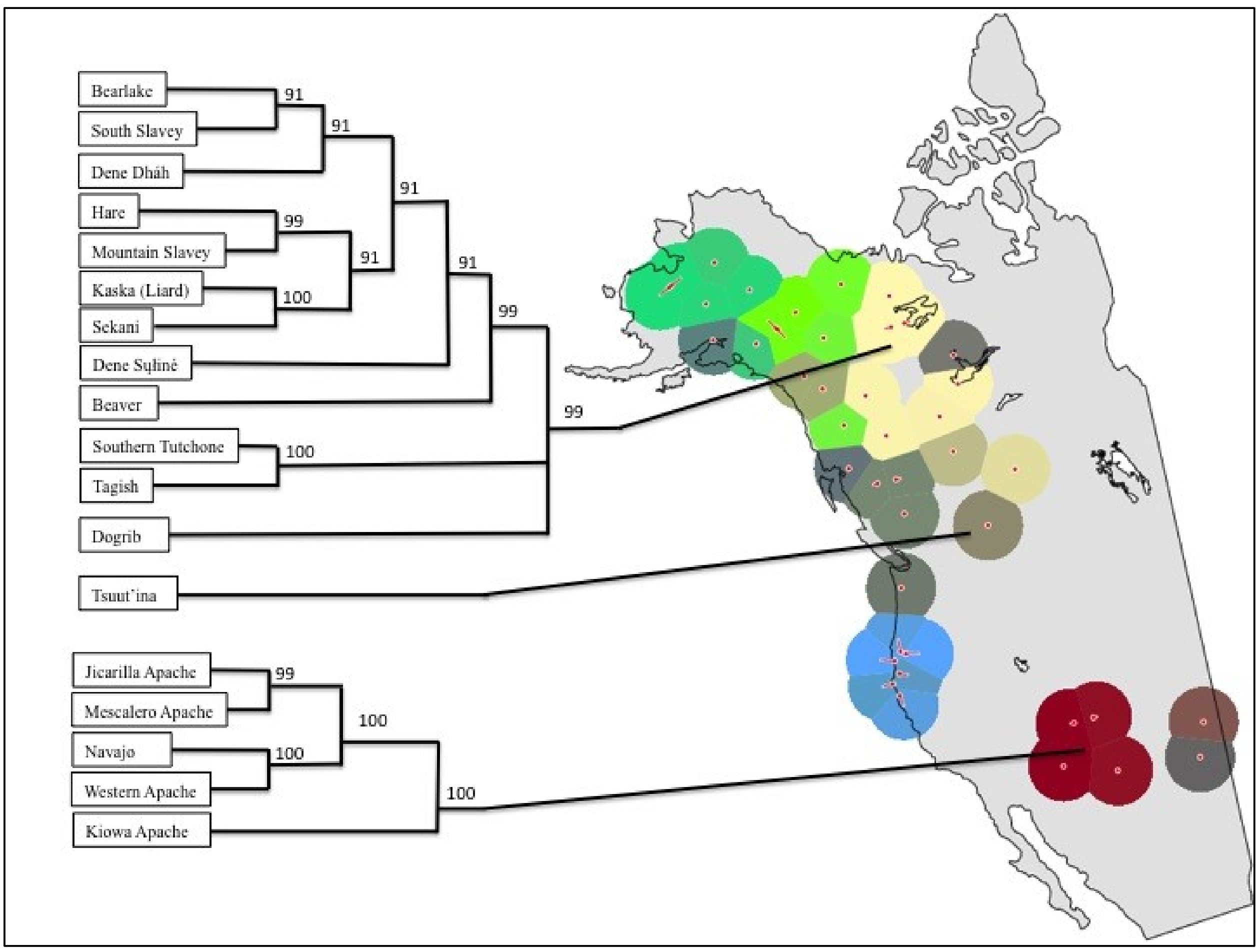


Figure 100. Structure of Eastern Athapaskan encompassing Northeastern Athapaskan (yellow) and Southeastern (red) as well as Tsuut'ina (grey)

Eastern Athapaskan is also composed of two geographically disparate groups as indicated on the map. The two clusters can be terminologically distinguished as Northeastern Athapaskan, Tsuut'ina, and Southeastern Athapaskan. Tsuut'ina is the least stable member of this otherwise solid group, remerging as part of Eastern Athapaskan only 70% of the time.

In the Southeastern branch, the distinction into east and west sub-groupings originally suggested by Hoijer (1938) is replicated here in the clusters Jicarilla-Mescalero Apache in the east and San Carlos-Western Apache and Navajo in the west. Kiowa Apache is an outlier of the Southeastern Athapaskan group. The last traditional member of this group, Lipan Apache, does not form stable clusters with these languages. Tsuut'ina is an isolate within Eastern Athapaskan.

The Northeastern branch has a more complex structure. A first split occurs between Dogrib (Tłı̨chǫ), the couplet Southern Tutchone and Tagish, and the remaining languages of the group that form one large cluster at this level. These splits are strongly attested, re-occurring in repeated clusterings. All the subsequent branchings in Northeastern Athapaskan achieve stability levels of over 90%. Beaver and Dene Sų̨łiné are isolated within this larger cluster, however. The remaining languages are organized in two further clusters with Bearlake, South Slavey, and Dene Dháh forming one branch, and Hare, Mountain Slavey, Kaska (Liard), and Sekani forming the other.

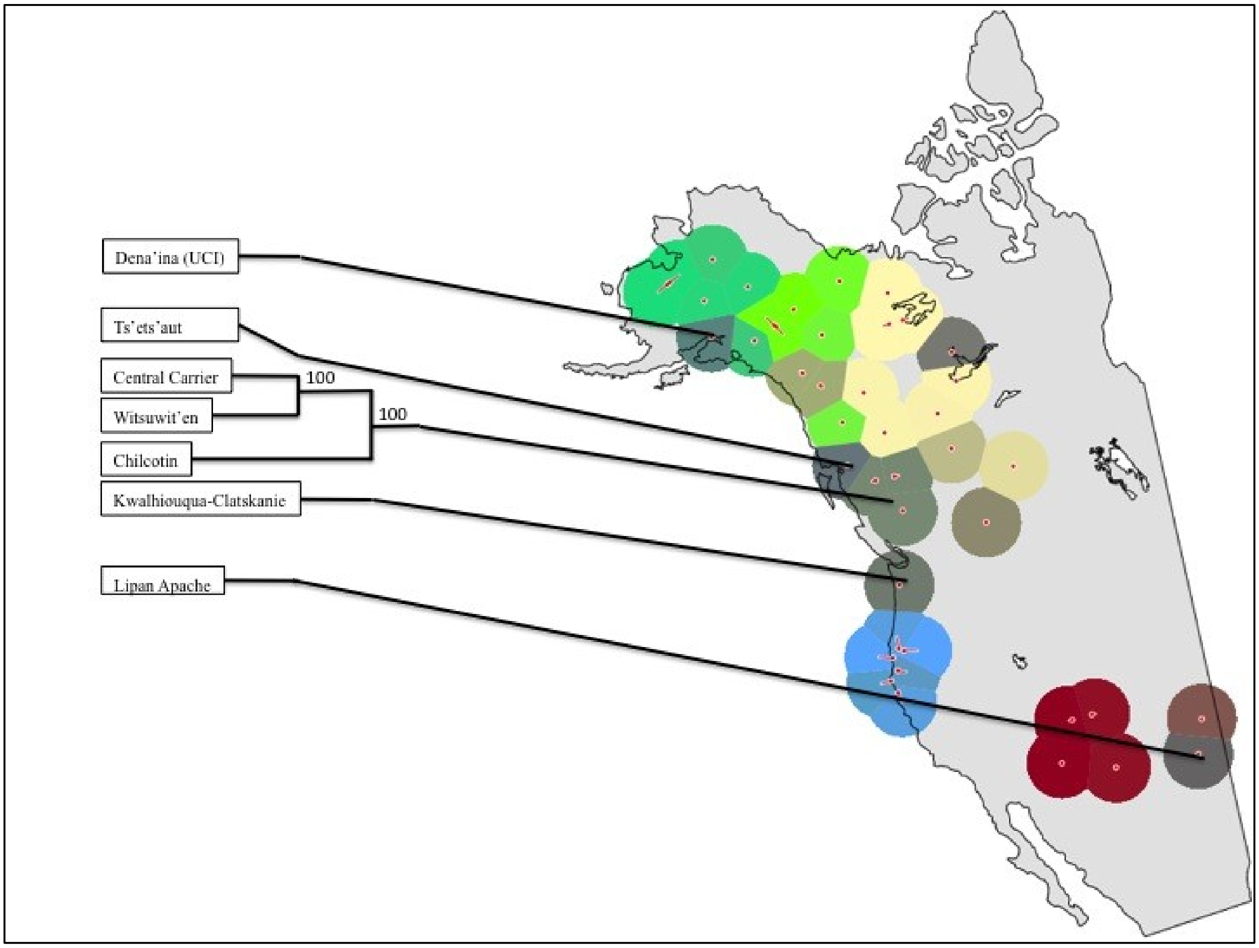


Figure 101. Structure of North-Central Athapaskan and Isolates

Figure 101 shows the remaining languages in the sample. As noted above, three languages are isolates bearing the same distance to all other languages within the Athapaskan family: Dena'ina, Kwalhioqua-Clatskanie, and Lipan Apache. Dena'ina is represented here through the Upper Cook Inlet dialect. Repeated clusterings have shown that the Dena'ina dialects always occur as a single stable cluster, equidistant from other Athapaskan languages. The only cluster shown on this map is the bi-partite group of languages identified as BC in Chapter 3. This cluster has two branches: Chilcotin and Witsuwit'en-Central Carrier.

4.4.3 The classification of Athapaskan languages based on anatomical terms

The clusterings based on semantic and phonological data result in classifications that are similar to each other overall, but different in certain important respects. Taking into account both semantic and phonological criteria brings a level of depth to the classification that has not been achieved before. The emerging picture of historical languages relationship resolves some, but by no means all, of the complexities noted by Hoijer, Krauss and other Athapaskanist scholars (Hoijer 1963, Krauss 1976, Krauss and Golla 1981). Compared to previous efforts at classification, however, the results presented here offer a cleaner picture, richer in details, and firmer in its empirical foundations. What sets this analysis apart, first and foremost, is that the classifications has been constructed on the basis of a rigorously assembled and publicly available dataset, and with the help of methods that are clearly replicable and easily accessible. The results can therefore be asserted with some confidence. The excellence of previous scholars is demonstrated by the fact that many of the intuitions and impressionistic groupings that have been suggested turn out to be correct from the perspective of the data and analysis presented here. Nevertheless, these data also give a strong indication that the pessimism voiced by Krauss (1976) regarding the impossibility of finding classificatory structure among the Northern Athapaskan languages can be rejected. Stable clusters show that there are deeper affinities among some languages than among others. The analysis showed, as represented in Figure 98, that these affinities could be reliably identified.

The picture of Athapaskan language relationships that emerges from this study can best be represented in three figures: the two MDS graphs, and the dendrogram annotated with cluster stability values (Figure 98-101, and Figure 106 below). Each of these diagrams informs the other, and while the third figure offers the clearest generalization of the data, all three diagrams together should be understood as depicting the same state of affairs. The MDS graphs offer different perspectives on the same data. They are reproduced here with annotations that clarify the general argument and conclusions.

Figure 102. MDS graph of semantic data showing extended clustering of Athapaskan languages from the north, with the exception of Koyukon and Lower Tanana. The Athapaskan languages of the Pacific Coast form a clearly distinct and widely dispersed sub-group.

In the semantic graph, most Northern Athapaskan languages located in present-day Alaska and western Canada (with the exception of Koyukon and Lower Tanana), as well as the Southeastern and North-Central Athapaskan languages are arranged in two dense clusters along the sides of a wedge shape, as indicated by the dark lines in Figure 103. Three Apachean languages (Mescalero, Jicarilla, Western) and Navajo form a dense cluster within this larger formation. These languages are close to the languages of modern-day interior Canada and the Yukon Territory. These languages are situated at the apex of the wedge with the two branches of this cluster trailing away to the northwest and the Pacific coast. The languages spoken in California and Oregon form a sparse group in one corner of the graph. In between are Central Carrier and as well as Tsuut'ina and Kwalhioqua-Clatskanie. This is quite different from the phonological graph in which the languages more or less occupy the corners of the graph corresponding to the geographical regions in which they are spoken (with the exceptions and peculiarities already noted above).

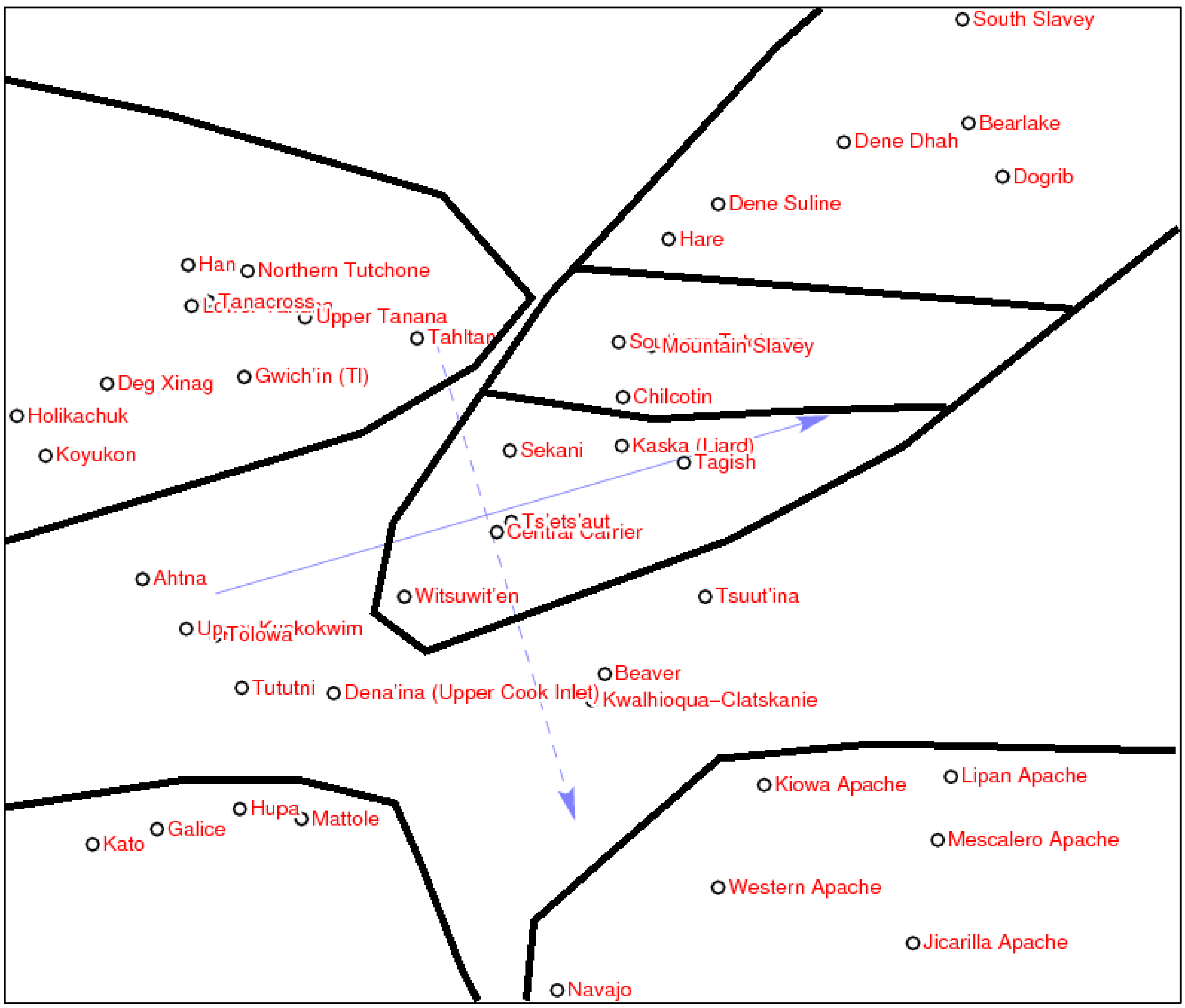


Figure 103. MDS graph of phonological data showing major groups

The divergence in the two graphs lies chiefly with the closer association of Northern Athapaskan languages (as constituted by the Northwestern, North-Central and Northeastern Athapaskan groups defined above) in the semantic graph. The phonological graphs offer a perspective on the evolution of the language family constituted by a gradual increase in distinctiveness of the phonological character of the member languages. In general, the languages sharing geographic spaces (sometimes vast areas) resemble each other phonologically more than languages from distant geographical regions. Figure 104 shows that the smallest linguistic distances (those between mean measured values of 0.1-0.3) all fall within the range of a few hundred kilometers of geographic distance. After this interval there is a sharp increase in language distance, which begins to taper off after about 1000 km of geographic distance. Linguistic distance increases very gradually with geographic distance thereafter. Taking geographic distance as a proxy for temporal distance, the distribution of linguistic distances as a function of geographic distances plotted in Figure 104 should be taken to indicate that phonological differentiation has proceeded at a more or less constant rate, with distance in space correlating in a sub-linear manner with distance in space (that is, it diverges from a linear curve in a roughly downward concave shape). This phenomenon is an expected result in dialectometry that has been called “Seguy’s curve” (Nerbonne 2010: 3823). The curve measuring linguistic difference over geographic distance on the basis of phonological data is given in Figure 104.

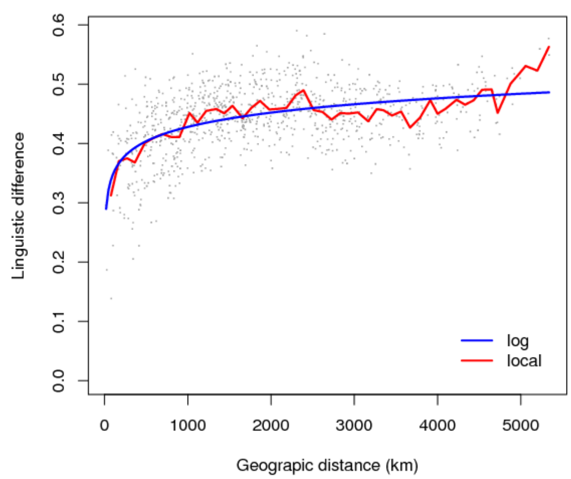


Figure 104. Graphing geographic distance as a function of linguistic distance for the Athapaskan languages in the sample

However, geographic distance is not always a good indicator of temporal distance. In fact, rapid migratory movements over large distances, rather than slow gradual migrations, can be expected to produce diversions from the correlation of geographic over linguistic distance. A case in point is the Southeastern Athapaskan group which is not, on average, closer to its closest geographic neighbors, but to the languages of the Northern Athapaskan group. The graph in Figure 105 exemplifies this point. Here, Navajo has been taken as a representative reference point for Southeastern Athapaskan.

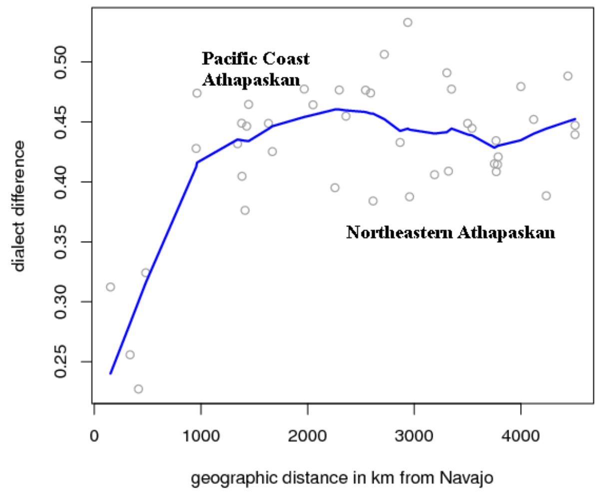


Figure 105. Graphing geographic distance as a function of linguistic distance for Navajo (represented at the origin)

The graph measures linguistic difference as a function of geographic difference, just as in Figure 105 above. The vertical line of circles beneath the label 'Pacific Coast Athapaskan' represents the languages so named, while the series or horizontal circles directly above the label 'Northeastern Athapaskan' represents those languages. It can easily be established through visual inspections that the Pacific Coast languages are geographically more proximate, but linguistically more distant than the Northeastern Athapaskan languages. It appears plausible to interpret this pattern, not as a reflection of the geographic barrier presented by the Rocky Mountains that divide these groups, but rather of the migratory history of Athapaskan-speaking peoples. This point is elaborated further in Chapter 5. These notable exceptions aside, the data show that the phonological differentiation is, on the whole, gradual and predictable.

This is not the case with the semantic data. Rather the semantic structures of Northern Athapaskan groups exhibit an aggregate pattern that runs contrary to the aggregate pattern of their phonological forms. These languages are moving away from each other phonologically, but are moving closer or staying close to each other semantically. The tentative explanation for this constellation is proposed on the basis of the observation that "intergroup communication has ordinarily been constant, and no Northern Athapaskan language or dialect was ever completely isolated from the others for long" (Krauss and Golla 1981: 68). Why would languages in constant contact diverge phonologically but not semantically? One likely explanation is that the speakers of groups along the sides of the "wedge" are participating in a steady exchange of semantic representations. Northern Athapaskan is the site of an epidemic of representations perpetuated by the ease of calquing from one closely related language to another as people encounter each during the times of the salmon runs, caribou migrations, annual gatherings, temporary shared campsites, or as members move between groups for marriage.

If the above analyses are correct, the MDS graphs of phonological and semantic data are therefore giving dynamic insight into the historical processes taking shape in Athapaskan. Their current status (from the perspective of the data, not of the writing) is concomitant with gradual phonological divergence and semantic rapprochement and in the North, most clearly articulated in the cluster dendrograms presented above and in their transpositions to geographical space (Figures 99-101). An overview of the picture emerging form the phonological data is depicted in Figure 99 is given in simplified form in Figure 106 below which represents the branching structures uniting all the Athapaskan languages in the sample as well giving an indicator of the stability each branching. These dendrograms represent the complex situation of the Athapaskan languages as systems existing in differing degrees of mutual exchange and isolated development, and shaped by multiple and sometimes contradictory forces. The dialectometric methods employed here constitute an attempt to deal with the complexity of the history of these linguistic systems and their speakers. While the search for sets of synapomorphies that will define phylogenetic branching and provide a traditional Stammbaum for Athapaskan should not be given up entirely, these data should strengthen the idea that such a phylogenetic model of linguistic history can only provide one perspective, and is but one an additional tool in the exploration of Athapaskan history.

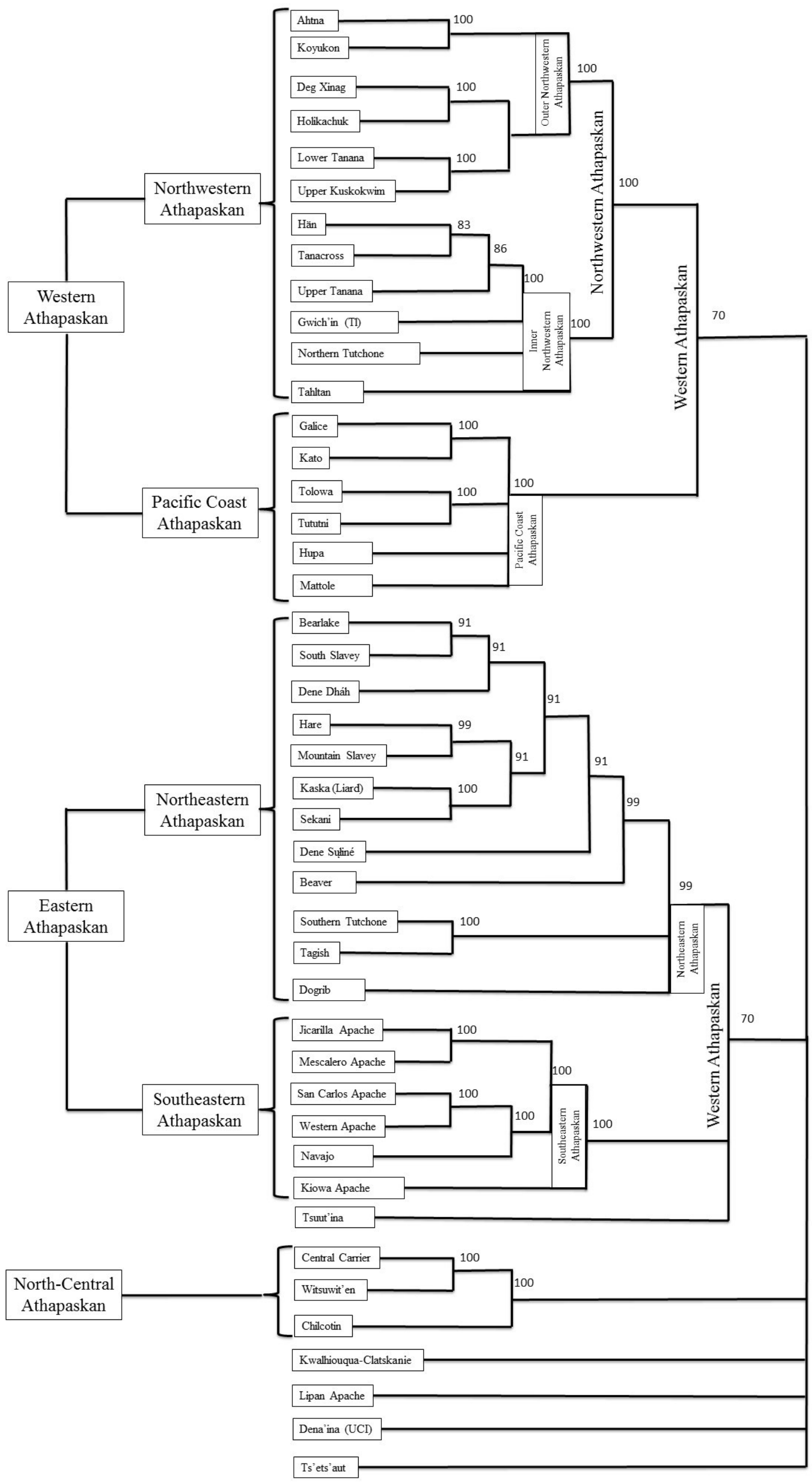


Figure 106. Classification of Athapaskan languages arrived at in this stud

4.5 Summary

This chapter described the results of the analysis of the data in the sample. The lexicalization patterns described in Chapter 3 were found to fall into higher-level patterns of semantic structure. This indicated that Athapaskan anatomical terminology is made up of an old, arbitrary, and morphologically simplex stratum, as well as morphologically complex expressions that represent later innovations with respect to the first group. The most common type of innovative term was found to be instantiations of reference-point constructions. In general, the semantic structures employed in the lexicalization of anatomical terms do not represent exceptions to the typological findings of Andersen and represent regularities that are "based in good part on the perceptual salience of certain shapes and certain spatial dimensions" (1978: 364). At the level of the referent-concepts, the impressionistic division of the anatomical domain into the three semantic sub-domains of body parts, ephemera, and effluvia was not found to be supported by semantic and morphological evidence. Instead, there was some support for a two-way division of the domain into body parts and effluvia. The patterns of semantic change and polysemic extension, with the two exceptions described above, support the generalizations of the natural semantic tendencies described by Wilkins (1996).

The second part of the chapter described the results of quantitative investigations. Instead of aiming at the higher levels of generality aspired to in the qualitative investigations of the first part of the chapter, these sections took into account the low-level detail of actual lexicalization patterns and their phonological representations in order to discern groupings among the languages themselves. This process resulted in an overall classification of the Athapaskan languages into Eastern Athapaskan, Western Athapaskan, and North-Central Athapaskan, as well as three isolates. The wider implications of the findings for the study of lexical semantics and the study of Athapaskan prehistory are discussed in the final Chapter.

5. Discussion and Conclusions

> The data of historical research are not things past, since these are gone, but those aspects of the past that are still present in the here and now, may these be memories of what was and what happened, or the traces of past things and events.[47]
>
> (Droysen 1882: 8)

> A name is therefore not simply an external sign attached to a complete pre-existing objective representation, rather, it contains within itself a particular path, a way and direction of becoming acquainted with the represented object.[48]
>
> (Cassirer 2010/1942: 139)

The first part of the present Chapter draws implications from this study for research in lexical semantics from a CL perspective and argues for the relevance of that research undertaking, properly construed, for the epidemiological study of representations. The kind of onomasiology practiced here relies crucially on the notion of a referent-concept theorized as a cognitive model of an entity in existing in the socio-cultural world of speaker populations. This notion is in need of greater clarification and more developed theorizing in cognitive linguistics. The second part of this chapter is concerned with the implications of the linguistic classification for the migratory history of speakers of Athapaskan languages.

5.1 Toward a more detailed treatment of referent-concepts in cognitive linguistics

At the center of the research methodology implemented in this study is the model of the linguistic sign described in Chapter 2. This model, inspired by Blank (1997), condenses several strains of thought already present in cognitive linguistic theorizing of the processes of conceptualization. Mainstream cognitive linguistics understands meaning as conceptualization. However, the semiotic model of the linguistic sign developed here emphasizes a further refinement of the theoretical understanding of conceptualization by drawing a clear distinction between *referent-concepts*, as models of extra-linguistic reality, and *semantic structures*, as intra-linguistic and language-particular representations of that reality. This distinction, while not in contradiction with the guiding principles of cognitive linguistics, is not everywhere observed. This becomes apparent in the discussion of the role of imagery in conceptual semantics by Langacker, arguably

---

[47] "Das Gegebene fuer die historische Forschung sind nicht die Vergangenheiten, denn diese sind vergangen, sondern das von ihnen in dem Jetzt und Hier noch Unvergangene, mögen es Erinnerungen von dem, was war und geschah, oder Überrest des Gewesenen und Geschehenen sein." [Translation mine]
[48] "Der Name wird somit nicht einfach an die fertige und vorhandene gegestaendliche Anschauung, als ein ausseres Kennzeichen, angefuegt, sondern in ihm drueckt sich ein bestimmter Weg, eine Weise und Richtung des Kennen-Lernens aus." [Translation mine]

the most important theoretician in cognitive linguistics. For example, Langacker discusses the information that is relevant to the description of the semantics of anatomical terms in terms of the larger bodies of conceptual structure which they evoke:

> Essential to the characterization of terms like *head, arm,* and *leg* is the position of the profiled entity relative to the body as a whole, whose conception thus functions as their domain and immediate scope of predication. Each of these designated entities functions in turn as immediate scope of predication for other body-part terms defined on a smaller scale, e.g. *hand, elbow, and forearm* in the case of *arm.* (Langacker 1991: 8)

Langacker is saying that the relationship of each body part to the body is important, as is the inter-relationship between body parts, so that each bigger part provides the semantic background (scope) for a smaller part conceptualized on a lower hierarchical level: the immediate scope or the conceptual background for *hand, elbow,* and *forearm* is *arm*. Langacker goes on to argue that this aspect of conceptual structure is responsible for the oddity or impossibility of anatomical compounds that fail to encode the immediate scope of the body part in question in the modifier position of the compound:

> We find numerous terms like *fingertip, fingernail, toenail, eyelash,* and *eyelid,* where the first element of the compound constitutes the immediate scope of predication for the second. Compare this to the nonexistence and oddity of expressions like **bodytip, *armnail, *footnail, *facelash, and *headlid* to designate the same entities. (Langacker 1991: 8)

However, the oddity noted by Langacker is an effect of the semantic structure of English anatomical terms, not of the conceptualization of the human body. The impossibility, even the oddity, of this relation disappears in the face of cross-linguistic data. The Athapaskan terms that lexicalize 'toenail' (see Section 4.4.15) predominantly favor the 'foot' as the immediate scope of the predication and not the 'toe'. Thus, *footnail* (as a literal translation) is quite normal in Athapaskan. This is true even for German *Fußnagel*, which is linguistically and culturally close to English. To draw the full inference here, that speakers of Athapaskan languages, of German, and of English have different conceptual models of 'toenails' seems implausible. The differences exhibited by the varying scope relations among these terms are not in the conceptualization itself, but in the construals of these concepts frozen in the different lexicalization paths. They are evidence of a speaker-community's *ways of becoming acquainted* with a concept in Cassirer's sense as reflected in the semantic structures of the languages they use.

Keeping referent-concepts and semantic structure apart as distinct aspects of the linguistic sign allows for the reintroduction of the onomasiological method as a means of revealing semantic structure. In the case of referent-concepts that are universally represented, such as the human body, this opens semantics to a principled cross-linguistic comparison on the basis of a *tertium comparationis* that can be known independently of individual languages. The means of representing this *tertium comparationis* through the morpho-semantic means provided by individual languages can be described as the level of semantic structure. Thus, semantic structure emerges as a properly linguistic entity, separate from extra-linguistic types of cognitive structure.

The re-introduction of semantic structure as separate from conceptual structure raises the specter of structuralist semantics, whose proponents had clearly conceptualized the difference between extra-linguistic conceptual structure, the "thought-mass", and the structuring order imposed by linguistic forms:

> Each language lays down its own boundaries within the amorphous "thought-mass" and stresses different factors in it in different arrangements, puts the centers of gravity in different places and gives them different emphasis. It is like one and the same handful of sand that is formed in quite different patterns, or like the cloud in the heavens that changes shape in Hamlet's view from minute to minute. Just as the same clouds take on ever new shapes, so also the same purport is formed or structured differently in different languages. (Hjelmslev 1963: 52)

However, structuralist semantics placed too much of an emphasis on the linguistic structure reaching a point where extra-linguistic conceptual knowledge was not considered important to linguistic meaning. This implied that linguistic meaning and extra-linguistic knowledge were entirely separate entities: the former being located in the mental dictionary, while the latter formed part of the mental encyclopedia, metaphorically speaking. This theoretical stance was heavily criticized by cognitive linguists such as Haiman (1980) and Taylor (1995) who saw the distinction as leading to highly implausible assumptions:

> Bickerton (1981: 230f.) claimed that the meaning of *toothbrush* is delimited by the meanings of other items in the linguistic system such as *nailbrush* and *hairbrush*. But is it really plausible that a person who does not have the words *nailbrush* and *hairbrush* in his vocabulary would understand *toothbrush* differently from those who know what nailbrushes and hairbrushes are? Surely, *toothbrush* derives its meaning from the role of toothbrushes in dental hygiene, and not from paradigmatic contrasts with other terms in the language system. (Taylor 1995: 87)

Taylor thus rejects the structuralist viewpoint by which meanings emerge, language internally, through systems of differences. Instead, Taylor views meanings as embedded in the context of other cognitive structures, which are "external to the language system as such" (ibid.: 1995: 83). This raises the important question of the relationship between extra-linguistic and linguistic knowledge, which Taylor noted as the "demarcation problem" (ibid.: 1995: 83). The demarcation between the knowledge that is strictly linguistic and that which belongs to the wider conceptual system is only one side of this relationship. The other side is the reproduction, at the level of semantic structure, of aspects of the extra-linguistic understanding of some object, event, process, etc. This side of the relationship has been treated as motivation in the analysis of the previous chapters. Seen through the prism of motivation, the aspects of conceptual structure that are linguistically encoded are readily apparent. For example, Langacker proposes to view the meaning of a linguistic form as a profiled or highlighted area in a relevant domain (Langacker 2008: 66; Taylor 1995: 84). In the anatomical domain, for example, the word *lungs* can be described as profiling a particular part of the cognitive model (*frame* in Taylor's usage, 1995: 85) of the body using the means of a part-for-whole schema to impose a specific order on the anatomical domain. The word *lungs* expresses a compositional path in Langacker's terms (Langacker 2008: 61) made up of two elements: the English plural marking morpheme *-s* and the root *lung.* In Deg Xinag, a very different structure is encoded in the term /dʳo-teloj/ which also profiles the same body part as the English term *lungs*. However, the compositional path of the Deg Xinag term, HEART$_1$-THINGS.NEXT.TO.IT, which explicitly indicates the heart and lexicalizes the 'lungs' with reference to it, is quite different. While both expressions lexicalize the plurality of the lungs, the Deg Xinag expression contains further semantic structure by encoding the 'heart' as a reference point. Both the Deg Xinag term for 'heart' /dʳo/ and the English /lʌŋ/ are fully arbitrary (*degenerate* in Langacker's terminology) expressions and contain no semantic structure of their own beyond the profiling relationship of indicating a region in the domain or cognitive model of the body. This example, as well as the descriptions and analyses of Chapters 3 and 4 very clearly show the difference between semantic structure, which is language internal and represented through compositional paths, and extra-linguistic structure, which may be very similar even for very different languages. The adoption of the terminological distinction *semantic structure* and *referent-concept* (adapted from Blank 1997) makes it easier to distinguish between those aspects of conceptual structure that are directly characteristic of individual languages, such as lexicalization patterns, and the potentially much more general extra-linguistic knowledge that is represented mentally in the form of cognitive models.

From this perspective, the full equation of semantic structure with extra-linguistic knowledge should be rejected. Equally, the relationship between semantic structure and extra-linguistic structure should be considered vital to cognitively informed linguistic description, in contrast to structuralist theory. The nature of this relationship should be treated as an empirical question, whose answer renders specific information in specific cases. This has two important implications. Firstly, the degenerate or arbitrary signs directly profile aspects of cognitive models (or regions in semantic domains). These cognitive models are idealizations of lived experience that may be culturally mediated. Their description must have some basis outside of linguistic description itself. That is to say, information regarding cognitive models must emerge either from universal constants (Munsell color charts, human bodies, etc.) or be the result of ethnographic description, or ideally both. Secondly, there are expressions which have complex compositional paths as well as profiling particular entities in specific cognitive models. These latter types constitute a level of language-particular semantic structure and as such should be properly viewed as cultural. Haiman's claim that "[d]ictionaries are encyclopedias" (Haiman 1980: 331) can ultimately be taken as correct, although likely not in the manner that he intended. Instead of a blend of two types of information structure that cannot be distinguished, the resulting perspective on lexical semantics would view extra- and intra-linguistic knowledge as two distinct but interrelated forms of conceptual knowledge whose relationship should be treated as a distinct property of linguistic expressions. The aim of revealing this property of linguistic forms is precisely the aim of onomasiological studies. Through the onomasiological method, semantic structures (along with the other aspects of the linguistic sign) become a source of data for cross-linguistic comparison.

5.2 Lexicalization patterns in space and time

The semantic aspects of linguistic signs become sources of historical knowledge when viewed from the twin perspectives of Droysen's idea that each point in the present encapsulates the traces of its own history and Cassirer's understanding of the linguistic sign as constituting the speaker's cognitive apperception of the object.[49] These two ideas are drawn together in an onomasiological study of historical processes. Reading Droysen from Cassirer's perspective on language reveals that the careful study of the nature of lexicalization can be an approach to the history of individual terms, a semantic etymology that is useable in those cases where traditional etymological techniques fail. The analysis of lexicalization patterns can be used to uncover the linguistic past when more traditional approaches to etymology, i.e. the tracing of the history of a particular term in a corpus of historical texts or the reconstruction of ancient forms through the comparison of cognate phonological forms, cannot be applied because the data lack historical depth or have been subjected to a level of dialect admixture that distorts the historical signal. As discussed in previous chapters, both of these conditions hold true for the Athapaskan languages. Etymologies, therefore, need to be revealed through semantic structure, which in many cases does indeed indicate "a way and direction of becoming acquainted with the represented object" (Cassirer's *Kennen-Lernen*). Semantic structure itself is discerned from the study of glossing patterns in lexicographic resources, especially as regards the polysemy patterns that the forms under scrutiny may enter into.

Finally, lexicalization patterns — especially when they are expressed through complex compositional paths — are important units in an epidemiological study of representations. The analysis of lexicalization patterns through the conceptual tools provided by cognitive linguistics can reveal the structure of different lexicalizations and thereby provide insights into the cognitive mechanism which structure their mental representation. Through the use of dialectometric and mapping methods, the distribution of lexicalization patterns can be tracked geographically and historically. This study made use of lexicalization patterns only in order to classify the Athapaskan languages, but it is hoped that future scholarship will be able to reveal their origins and trace the spread of individual patterns. Therefore, this study can be seen as

[49] The linguistically appropriate reading of Cassirer's use of the word *Name*.

laying the groundwork for a more detailed and thorough epidemiology of representations that will lay bare even more of the complex relationships that exist among Athapaskan languages.

The application of the onomasiological method to Athapaskan anatomical nomenclature has established that the lexicalization of the body itself (not the patterns of metaphorical and metonymic extension that may reach into other semantic domains) appears everywhere to follow broadly similar patterns (Andersen 1978, Wilkins 1992). Even though they differ in many specifics, Athapaskan anatomical terms are, over time, shaped by similar forces as anatomical terms in Bantu, Dravidian, Indo-European and Tibeto-Burman. Wilkins' observes that these regularities are due to cognitive factors:

> The cognitive dimension comes in when one is trying to explain why two or more notions tend to be naturally associated with one another through parallel semantic changes in a number of genetically and areally distinct language families. An underlying assumption throughout this chapter has been that crosslinguistically natural tendencies of semantic change arise out of universally shared perceptual and cognitive mechanisms which regularly trigger the same kind of association independent of language or culture. (Wilkins 1996: 298)

The accuracy of this observation is supported by the patterns of semantic change and polysemic extension described in Chapter 4. However, it was also noted there, as well as in Chapter 3, that a substantial portion of the vocabulary was diachronically stable. This stability is, perhaps, to be expected since the referents of anatomical terms are not themselves subject to (perceptible) change. The human body changes at an evolutionary scale far beyond the time scale of a lexical system. The fact there appears, prima facie, no need to adapt the vocabulary of anatomical terms to changing situations, as might be the case for semantic domains such related to technology or social organization, raises the question of why anatomical terms change at all. This is a question, which can be suitably posed, if not wholly answered, within the framework of an epidemiology of representations.

Sperber has proposed to account for the evolution of cultural forms in terms of the concept of *cultural attractors* (Sperber 1996; 2012). Sperber uses the term *attractor* (which is already close to the language of Complex Adaptive Systems) to denote a point at which cultural phenomena, such as stories or lexical items, converge in the process of transmission. His example is that of a story, such as *Little Red Riding Hood,* which is likely to retain its happy ending even through long chains of transmission. The happy ending is simply remembered better or is more pleasing to the audience (Sperber 1996: 107ff.). The happy ending provides a conceptual structure on which many re-tellings of the story converge, lending it its stability. With slight modifications, this idea is applicable to lexicalization patterns too, since, just like other cultural forms, linguistic forms are passed from one generation to another by learning and observation. Forms, which are faithfully replicated in the next generation of speakers, remain stable through the power of a sustained convention. Nonetheless, languages change in spite of the theoretical impracticality that a break, however slow, with convention should constitute. Several models explaining long term linguistic change in evolutionary terms have been proposed (Croft 2008). In these models, synchronic variation results in the differential replication of variants. Synchronic variation itself is considered the result of social factors leading to differential usage of sociolinguistic variants (Croft 2008: 222). Additionally, individuals might form part of different social networks in which they are exposed to the particular variants that they then replicate (ibid). While such models help to explain the distribution of variant motivated expressions for some cases, the terms for 'ankle' present an interesting case here, the more general trends among lexicalization patterns, polysemic extensions, and semantic changes expose a deeper regularity. In this context, Wilkins' natural semantic tendencies can be thought of as describing cultural attractors that are rooted in "universal human psychology" (Sperber 1996: 108). Some of these are attractors that move toward end-points such as the larger wholes that some terms form part of, as in the case of tendency (i). In other cases, the attractors are inherently unstable endpoints causing constant creeping shift, as in the association of contiguous parts described in tendency (ii). Further instability can be caused by the fact that a change in one form causes other forms to change in its wake (see for example the terms for 'leg' in Section 3.4.9). On this view, the frequent occurrence of reference-point constructions in the lexicalization patterns can be interpreted as indicating that this particular semantic structure also embodies an 'attractor state', more attractive, perhaps, than an arbitrary monomorphemic form, at least in context where conventional linguistic usage is affected in some way, as for example in the case of conversation between speakers of distantly related dialects.

The introduction of the terminology of attractors into the study of lexicalization patterns and changes among lexicalization patterns has to remain speculative at this stage, but it points the way to future research that can actively implement an understanding of language as a Complex Adaptive System (CAS). This interdisciplinary notion has been used to describe the behavior of the kinds of systems, which exhibit large variations in behavior and defy traditional linear modeling. Thinking of language as a CAS has recently been advocated for linguistics in general (Beckner et al. 2009) and for cognitive historical linguistics in particular (Frank and Gontier 2010). The research paradigm surrounding CAS in many fields is dynamic and promising (Miller and Page 2007, Mitchell 2009), but, within linguistics, there is little clarity as to how it might actually be implemented. Frank (2015) formulates an approach to semantic change in this paradigm and offers attractive botanical metaphors as a means of visualizing semantic change in terms of a "rhizome-like structure" (Frank 2015: 89), which helps in the task of "identifying the cognitive pathways that once existed, by analyzing the semantic debris left behind and attempting to reconstruct the bridging mechanisms (ibid.: 74). Useful as it is, Frank's approach is to use CAS as a mental workshop in which semantic change can be visualized and theorized from within a qualitative approach very much in line with traditional cognitive linguistics approaches to semantic analysis (for example, Lakoff 1987). In combination with the notion of cultural attractors and epidemics of representations, these ideas can be brought into a format that can look more profitably towards computational models, such as those that Frank and Gontier (2010) called for. This could be especially useful if data on lexicalization patterns and semantic changes from many languages could be pooled and probabilities of semantic changes and the attractors that guide them could be calculated. It is then, somewhat regrettable, that the majority of recent calls for CAS models in linguistics have failed to notice the useful and advanced work carried out by Sperber and others beginning almost thirty years ago (Sperber 1995; Enfield 2003, 2014). On the positive side, the field of historical cognitive linguistics is now poised to engage fruitfully with CAS modeling approaches and to break new ground in the study of language change and lexicalization.

5.3 Implications of the study for Athapaskan prehistory

As indicated in Chapter 1, one of the main problems of Athapaskan prehistory that can be addressed through a linguistic classification of the Athapaskan languages is the *who* of the great migrations. The classification presented in Chapter 4 strongly supports the notion that Proto-Eastern-Athapaskan (PEA) speaking groups were the ancestors of modern-day South-Eastern Athapaskans (traditionally referred to as Apacheans). This is not a radical proposal and has been noted in many places (Ives 1990), but here the data and the means by which these conclusions were reached are accessible and transparent. While further historical linguistic research holds the promise of uncovering more detailed knowledge on the character of PEA, a hasty identification of individual North-Eastern Athapaskan groups as ancestors of South-Eastern Athapaskan groups is inaccurate and most likely mistaken (*pace* Gordon 2012). The reduction of complex linguistic facts to a few simple data that appear to 'show' a particular conclusion is little more than an exercise in cherry-picking — selecting suitable data in support of a particular, favored hypothesis. Such research strategies can, at best, stimulate subsequent research and, at worst, pose the risk of closing avenues of discovery. Instead, research toward prehistoric relations among Athapaskan-speaking peoples should pay tribute to the complexity of the historical situation which is more likely to have involved active, if extended, networks of interactions, migrations and back migrations, and linguistic admixtures at multiple levels. Against this background, aggregating clustering methods should be viewed as giving one perspective on the problem of historical relationships, albeit a particularly useful one. Aggregating semantic and phonological distances between word-pairs drawn from a principled sample in order to characterize differences between languages is a method capable of integrating the varied and complex data of the Athapaskan languages and producing a clear result. This result is now placed in perspective with the archaeological data presented in Chapter 1.

The most important archaeological work on the origins of Athapaskan migrations has pointed out the possible connection between the first diasporic movements and the volcanic eruptions associated with the White River Ash deposits (Ives 1990, Derry 1975). These deposits found across a wide area of present-day Alaska and the Yukon Territory would have had catastrophic short-term effects for the flora and fauna in the affected area and consequently, for any hunting and gathering peoples living there. Such environmental conditions could easily have led to a scattering of an ancestral Athapaskan population. To facilitate the discussion, the diagram produced by Leberkmo (2008) is reproduced here in Figure 107. The north lobe of these deposits was found to date to 100 C.E. (1900 B.P.) and the east lobe to 850 C.E. (1250 B.P.)

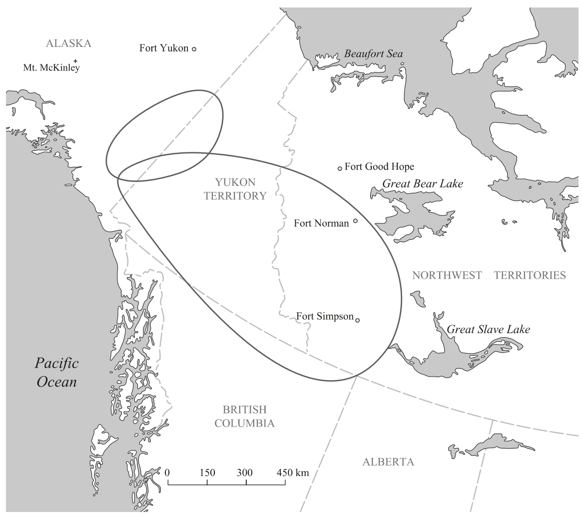


Figure 107. Location map of bi-lobate White River Ash deposits (Lerbekmo 2008: 693)

The deposits of the much smaller north lobe cover the very center of the geographic area considered to be the ancestral Athapaskan homeland (Krauss and Golla 1981, Ives 1990: 16). Groups retreating from this area could have moved most readily to the west, east, and south creating the three large clusters observed in the analysis of the phonological data and resulting in the Western, North Central, and Eastern Athapaskan branches posited in Chapter 4. This analysis has two consequences: firstly, it allows the dating of this fundamental split in the language family as having occurred approximately 1900 years ago. Secondly, it creates the question of what motivated the second branchings. Ives and others have proposed that the splitting in Eastern Athapaskan is the result of the southward movement of what was to become South-Eastern Athapaskan (Apachean in Ives' terms) as a result of the effects of the second eruption (the larger east lobe in Figure 107). This eruption and the ecological devastation it caused constitute a *push* factor driving the inhabitants out if this region. At the same time, the Bison-hunting lifestyles practiced by groups living on the Great Plains provided an attractive alternative to hunting and gathering in the Boreal forest:

> …the East Lobe White River eruption (which deposited massive quantities of volcanic ash over much of the Yukon and Northwest Territories) had a ripple effect among northern Dene populations at roughly ad 800 (Ives 1990, 2003; Matson and Magne 2007; Workman 1979). This ecological catastrophe over a vast region of the western Subarctic, when coupled with the highly attractive nature of the Plains bison-hunting lifestyle, very likely encouraged Navajo and Apache ancestors to move from the Peace River country of northeastern British Columbia and northwestern Alberta southward along Alberta's Eastern Slopes and northern Plains regions.
>
> (Ives 2013: 150)

Ives' usage of the term 'ripple effect' provides a particularly good model for thinking about the likely complex effects of this second, far more extensive, set of deposits. There is good genetic evidence to support the notion the ancestors of the present-day Apachean and Navajo populations departed the Subarctic quite recently, as a relatively small group, expanding in the south through intrinsic growth as well as by incorporating other peoples (Malhi et. al. 2008: 420; Achilli et al. 2013). Furthermore, material culture artifacts material excavated from caves on Promontory Point, Utah can now be quite confidently associated with Athapaskan cultures (Ives et al. 2014, Billinger and Ives 2014). Promontory Point itself is on a suitable mid-way point of a potential migratory route from Subarctic Canada to present-day New Mexico and Arizona. The Promontory Culture occupations of these caves lasted "one or two human generations in the latter half of the 13th century" (Billinger and Ives 2014: 86). This timeframe is a good approximate date for the branching off of Southeastern Athapaskan and a good indicator of the age of the languages spoken by modern Navajo and Apache peoples.

While the setting in motion of events leading to the departure of groups that were eventually to settle the lands inhabited by Southeastern Athapaskan speaking peoples now is perhaps the most obvious consequence, attention should also be drawn to the movements occurring among groups, which stayed in the north. Movements both away from the affected area and subsequent return to this area should be taken into consideration as probable causes for considerable social upheaval and linguistic variation. As groups moved toward other parts of the vast territory inhabited by the Athapaskans in the north they would have had to adapt to different social context as they interacted with those groups living there. Whatever these adaptations may have been it does not seem unreasonable to speculate that such movements and encounters could have led to the kinds of social networks that lead to similarity in semantic forms. While speculative, it is worth noting that calquing of expressions from one closely related Athapaskan language to another could have emerged from the exchange of individuals from one group to another. Thus, the semantic similarity among the northern groups observed in Chapter 4 could also be related to the cataclysmic geological events and their profound social consequences. The effects of this second eruption would have been most acutely felt by the groups residing in the north and it thus explains the greater semantic similarity of those groups that separated as a consequence of this second event, as opposed to those that separated much earlier. If there is some accuracy to this hypothesis, it would support the proposals made above, that the semantic similarity of northern groups is the result of a dynamic process moving toward convergence. The further implication is that this process began after the separation of Proto-South-Eastern-Athapaskan speaking groups.

These considerations leave the division in Western Athapaskan unexplained. For the Pacific Coast languages, Golla proposes an arrival date of around 700 C.E. (1300 B.P., Golla 2011: 257). This would mean that the southward migration of the future Pacific Coast Athapaskans would have begun about 150 years prior to the second volcanic eruption. Golla envisions this southward migration as a slow process, taking about 600 years and occurring in distinct waves, with the languages spoken in present-day Oregon stemming from later migratory movements. Thus, the consequences of the later eruption might have led to the final severing of ties between the Northwestern and Pacific Coast groups as the disaster-related population movements disrupted the kind of networks likely to have facilitated ongoing population movements. The hypothesis of gradual migration toward the Pacific Coast from the north at least fits reasonably well with the branching of the Athapaskan language family suggested by the findings of this study. The positing of an ancestral homeland for the Pacific Coast groups in present-day British Columbia requires some reconciliation with the possibility of the creation of a Proto-Western-Athapaskan speech community as a consequence of the first volcanic eruption. It seems possible that Proto-Western-Athapaskan speaking peoples first moved south, towards the coast, before gradually splitting off and populating the Alaska and British Columbia regions.

Golla's discussion is marred by the lack of evidence for the dates he gives beyond the archaeological finding of arrow tips in northern California at around 500-600 C.E. Nonetheless, these arrow tip finds provide a limit on the earliest entry dates for Athapaskan speakers to the region. In contrast, Golla's proposal of the solidification of the Athapaskan presence in Oregon at around 1000 C.E. goes unsupported. In a similar discussion (Krauss and Golla 1981), further dates are provided but, again, without specifically stating how these were obtained. A possible source for these time estimates is Krauss (1976), who calculates dates for the age of the Athapaskan language family with glottochronological methods. Given that these methods have been criticized from every possible angle (see discussions in MacMahon and MacMahon 2005, Campbell 2004), dates arrived at through glottochronological calculation should not be cited, not even as approximate indicators of time depth.

This discussion of the origin of claims related to dating made in the Athapaskanist literature highlights a problem present in Athapaskan studies quite generally: the lack of transparency. It is surprising that scholars such as Golla and Krauss, otherwise excellent in their research and extensive in their knowledge, should cling to dates derived through glottochronological methods, even though these have long been discredited. It should stand to reason that if the method produces incorrect results, then these results should be rejected: faulty methods produces incorrect results, not imprecise results. The move toward the more detailed consideration of archaeological dating already apparent in Krauss and Golla (1981), in contrast, is laudable and should point the way to the dating of migratory movements, and consequently, linguistic divisions in the future. For the splits in Eastern Athapaskan, the recent discoveries by Ives and associates in Utah (Ives *forthcoming*), hold the greatest promise. The nature and distribution of the languages of the Athapaskan family represent the culmination of complex social, linguistic and historical processes. It is reasonable, therefore, to suppose that their study requires a combined inter-disciplinary research effort with linguistic and archaeological data at its center.

5.4 Outlook

The practical result of this study is the classifications of Athapaskan languages that can serve in the further unraveling of Athapaskan prehistory, especially in conjunction with archaeological findings. This leads to the more general implication that future research in historical semantics can profit from inter-disciplinary approaches capable of addressing questions relating to the study of semantics within historical cognitive linguistics and archaeology. The move toward broader frameworks such as Complex Adaptive Systems theory provides an environment in which the research problems addressed here can be studied further. However, the risk posed by the adoption of such broad frameworks lies in the obscuring effect that new terminology can have. It emerged from the discussion above that the older paradigm of an epidemiology of representations realizes many of the demands made of Historical Cognitive linguistic research undertaken from a Complex Adaptive Systems perspective. In fact, proposals made by Sperber and Enfield are much more detailed and practical than those put forward by Beckner et al. (2009) and Frank and Gontier (2010). Perhaps the lack of reception for the Sperberian epidemiology of representations approach results from the somewhat esoteric, if well motivated, terminology. If that is the case, the advantage of adopting the terminology and mode of thought which is commensurate with other work on Complex Adaptive Systems lies in finding a common language with which to cross inter-disciplinary boundaries. Indeed, the conceptualization of languages as systems emerging from the interactions of individual agents is reminiscent of anthropological concepts such as *agency* (Kockelman 2006). Thus, for Cognitive linguistics to adopt a Complex Adaptive Systems outlook is broaching the terrain of the discipline of linguistic anthropology with its core view that "language, culture, and social structures emerge from social practice on the part of individuals but cannot be understood with reference only to those individuals" (Ahearn 2012: 25). One of the most important tools of linguistic anthropology is the theoretical model of the sign. Expanding the cognitive linguistics model of the sign can contribute to a shared theoretical platform in which we integrate ideas from cognitive linguistics, philosophy, semiotics, historical linguistics, genetics and anthropology. That research framework promises to be capable of addressing the most difficult questions in the study of the historical development of the complex, socio-cultural communicative behavioral system called language.

Lexicographic sources

Table 83 lists the lexicographic sources from which the sample used in this study was constructed. The abbreviations serve to identify the terms listed in the database (as well as those listed in Appendix II: Sample of the Database).

Table 83. Lexicographic source materials

AL1978	Alexander et al. 1978. Holikachuk noun dictionary. MS. ANLC.
AN1974	Antoine, Francesca et al. 1974. *Central Carrier Bilignual Dictionary.* Fort Saint James (BC): Carrier Linguistic Committee.
BLMS	Bloomquist, Chuck. *Slavey Topical Dictionary (Ft. Franklin Dialect)*. Unpublished manuscript.
BO1924	Boas, Franz. 1924. Ts'ets'aut an Athapascan language from the Portland Canal, British Columbia. International Journal of American Linguistics 1 (3): 1-35.
BM2006	Boommelyn, Me'laashne Loren. 2006. *Taa-laa-wa Dee-ni' Wee-ya' Tolowa People's Language.* Smith River (CA): The Howonquet Indian Council of the Smith River Rancheria.
BM1995	Boommelyn, Me'laashne Loren. 1995. *Now you're speaking Tolowa.* Center for Indian Community Development. Arcata (CA): Humboldt State University.
BR1998	Bray, Dorothy. 1998. *Western Apache-English Dictionary.* Tempe (Az): Bilingual Press
BE1984a	Breuninger, Evelyn, Elbys Hugar and Ellen Ann Lathan. 1982. Mescalero Apache Dictionary. Mescalero (NM): Mescalero Apache Tribe.
BE1984b	Breuninger, Evelyn, Hugar, Elbys, and Scott Rushforth. *Mescalero Apache Medical Phrasebook.* Unpublished manuscript.
BS1971	Bross, Michael Grantham. 1971. The Kiowa Apache Body Concept in Relation to Health. Oklahoma Papers in Anthropology 12. Norman (OK): University of Oklahoma.
CA1994	Carter, Colin and Patrick Carlick. 1994. *Tahltan Children's Illustrated Dictionary*. Tatl'ah (BC): Tahltan Tribal Council.
CO1979	Collins, Raymond and Betty Petruska. 1979. *Dinak'i (Our Words): Upper Kuskokwim Athabaskan Junior Dictionary.* Anchorage (AK): National Bilingual Materials Development Center.
DR1996	Dogrib Divisional Board of Education. 1996. *Tłı̨chǫ Yatıì Enı̨htł'è A Dogrib Dictionary.* Rae-Edzo (NT): Dogrib Divisional Board of Education.
EE1998	Elford, Leon W. and Marjorie Elford. 1998. *Dene (Chipewyan) Dictionary*. Prince Albert (SK): Northern Canada Mission Distributors.
FI1991	Firth, William G. (ed). 1991. *Gwich'in Language Dictionary*. First Edition. Fort McPherson (NT): Gwich'in Language Centre and Gwich'in Social and Cultural Institute.
FI2005	Firth, William G. (ed). 2005. *Gwich'in Language Dictionary.* Fifth Edition. Fort McPherson (NT): Gwich'in Language Centre and Gwich'in Social and Cultural Institute.
GA1884	Gatschet, Albert S. 1884. *Lipan Vocabulary*. Bureau of American Ethnology.
GO1917	Goddard, Pliny E. 1917. *Beaver texts and Beaver dialect.* New York: The American Museum of Natural History.

GO1923	Goddard, Pliny E. 1923. Wailaki texts. *International Journal of American Linguistics* 3-4 (2): 77-135.
GO1912	Goddard, Pliny Earl. 1912. *Elements of the Kato language*. Berkeley: University of California Press.
GL2008	Golla, Victor. 2008. Tututni (Euchre Creek) Wordlist. Unpublished manuscript provided by Justin Spence.
GL1996	Hoopa Valley Tribal Council. 1996. *Hupa Language Dictionary.* Hoopa (CA): Hoopa Valley Tribal Council.
GLMS	Golla, Victor. *Tagish notes*. Unpublished manuscript.
HA2001	Hargus, Sharon. 2001. *Fort Ware (Kwadeche) Sekani Dictionary: Sekani-English English-Sekani.* Unpublished manuscript.
HA2007	Hargus, Sharon. 2007. *Witsuwit'en Grammar.* Vancouver (BC): UBC Press.
HR2012	Harnum, Betty (ed) (2012) *Chipewyan dictionary. Fort Smith (NWT):* South Slavey Divisional Education Council.
HH1966	Hoijer, Harry. 1966. Galice Athapaskan: A grammatical sketch. *International Journal of American Linguistics* 32 (4): 320-327.
JJ2000	Jetté, Jules and Eliza Jones (authors) and James Kari (ed.). 2000. *Koyukon Athabaskan Dictionary*. Fairbanks (AK): Alaska Native Language Center.
JO1997	John, Bessie. 1997. *Upper Tanana glossary*. Beaver Creek (YT): Upper Tanana Cultural Society.
KA1990	Kari, James. 1990. *Ahtna Athabaskan dictionary*. Fairbanks (AK): Alaskan Native Languages Center.
KA1991	Kari, James. 1991. *Lower Tanana Athabaskan Listening and Writing Exercises.* Fairbanks: Alaska Native Languages Center.
KA1994	Kari, James. 1994. *Lower Tanana Athabaskan Dictionary*. Unpublished manuscript.
KA2007	Kari, James. 2007. *Dena'ina Topical Dictionary.* Alaskan Native Languages Center
KA1978	Kari, James. 1978. *Deg Xinag (Ingalik) noun dictionary*. Unpublished manuscript.
KS1997	Kaska Tribal Council. 1997. *Guzāgi K'ū́gé': Our language Book: Nouns Kaska, Mountain Slavey and Sekani.* Lower Post (BC): Kaska Tribal Council.
KI1979	King, Quindel. 1979. "Chilcotin Phonology and Vocabulary". In: *Contributions to Canadian Linguistics*, Hamp, Eric P., Robert Howren, Quindel King, Brenda M. Lowery and Richard Walker (eds.). Canadian Ethnology Service Paper No. 50. Ottawa (ON): National Museum of Man Mercury Series.
KRMS	Krauss, Michael E. *Unpublished fieldnotes*.
LA1977	Landar, Herbert. 1977. Three Rogue River Athapaskan Vocabularies. *International Journal of American Linguistics* 43 (4): 289-301.
LI1930	Li, Fanggui. 1930. *Mattole: an Athabaskan language.* Publications in Anthropology, Linguistics Series. Chicago (IL): The University of Chicago Press.
MAMS	Marsh, Gordon H. *Tagish fieldnotes - Patsy Henderson*. Unpublished fieldnotes.
MCMS	MacKeinzo, Edith. *Slavey (Bearlake) Dictionary.* Unpublished manuscript.
MR1973	McRoy (1973) *Beginning Tanacross Dictionary*. Unpublished manuscript.
MOMS	Moore, Pat, George Ahnassay, Lorny Metchooyeah, Georgena Kolay, Josephine Natannah, Rick Seniantha, Thomas Talley, Stanley Salopree and Johnny Providence. *Dene Dháh Dictionary and Grammar*. Unpublished manuscript.
PH2007	Phone, Wilhelmina, Maureen Olson, M. Martinez and M. Axelrod. 2007. Dictionary of Jicarilla Apache. University of New Mexico Press.

RE2006	de Reuse, Willem J. 2006. *A Practical Grammar of the San Carlos Apache Language.* Muenchen: Lincom Europa.
KR1978	Rice, Keren. 1978. *Hare Dictionary.* Northern Social Research Division, Department of Indian and Northern Affairs.
SRFNa	Rice, Sally and John Janvier. *Semantic Systems - Body Parts*. Unpublished fieldnotes.
SRFNb	Rice, Sally. 2011. Unpublished fieldnotes.
RI1977	Ritter, John, McGinty, Tommy and Johnson Edwards. 1977. *The Selkirk Indian language Noun Dictionary (Northern Tutchone Athapaskan).*Whitehorse (YT): Yukon Native Languages Centre.
RI1978	Ritter, John. 1978. *Han Gwich'in Athapaskan noun dictionary.* Unpublished manuscript.
SE1977	Seaburg, William R. 1977. A Wailaki (Athapaskan) Text with Comparative Notes. *International Journal of American Linguistics* 43(4): 327-332.
SS2009	South Slave Divisional Education Council. 2009. South Slavey Topical Dictionary Kátå'odehche Dialect. Fort Smith, NT: South Slave Divisional Education Council.
SS2012	South Slave Divisional Education Council. 2012. South Slavey Topical Dictionary Kátå'odehche Dialect. Fort Smith, NT: South Slave Divisional Education Council.
ST2008	Starlight, Bruce and Gary Donovan. 2008. *Tsuut'ina Pedagogical Dictionary*. Calgary (AB): Tsuut'ina Nation.
TL1993	Tlen, Daniel L. 1993. *Kluane Southern Tutchone Glossary*. Whitehorse (YT): The Northern Research Institute.
YO1987	Young, Robert W. and William Morgan. 1987. *The Navajo Language: A Grammar and Colloquial Dictionary*. Albuquerque: University of New Mexico Press.
YO1984	Young, Robert W. and William Morgan (1980) *The Navajo Language: a Grammar and Colloquial Dictionary.* Albuquerque: University of New Mexico Press.
SS1990	Dehcho Divisional Education Council. 1990. *A dictionary of the verbs of South Slavey.* Fort Simpson (NT): Dehcho Divisional Education Council

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Appendix I: Language names

Language Name	Alternative Name	ISO 639-3
Ahtna		aht
Bearlake	North Slavey	scs
Beaver	Danezaa	bea
Central Carrier	Dakelh	crx
Chilcotin	Tŝilhqot'in, Tzilkotin	clc
Deg Xinag	Deg Xit'an, Deg Hitan, Degexit'an, Kaiyuhkhotana, Ingalik	ing
Dena'ina (Iliamna)	Tanaian, Kinayskiy	tfn
Dena'ina (Inland)	Tanaian, Kinayskiy	tfn
Dena'ina (Outer Cook Inlet)	Tanaian, Kinayskiy	tfn
Dena'ina (Upper Cook Inlet)	Tanaian, Kinayskiy	tfn
Dene Dhah	Denetha, South Slavey	xsl
Dene Sųłiné	Chipewyan	chp
Tłįchǫ	Dogrib	dgr
Galice		gce
Gwich'in (Gwichiya)	Kutchin, Loucheux, Tukudh	gwi
Gwich'in (Teetl'it)	Kutchin, Loucheux, Tukudh	gwi
Hän	Han, Dawson, Han-Kutchin, Moosehide	haa
Hare	North Slavey	scs
Holikachuk	Innoko	hoi
Hupa		hup
Jicarilla Apache	Abáachi Bizaad	apj
Kaska (Dease Lake)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kaska (Frances Lake)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kaska (Good Hope Lake)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kaska (Liard)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kaska (Lower Liard)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kaska (Pelly)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kaska (Ross River)	Caska, Danezagé', Eastern Nahane, Nahane, Nahani	kkz
Kato	Cato	ktw
Kiowa Apache	Plains Apache	apk
Koyukon	*Denaakk'e*, Ten'a, Coyukon, Coyoukon, Koyukukhotana, Ketlitk-Kutchin, Koyukuns, Куюканцы / Kuyukantsy	koy
Kwalhioqua-Clatskanie	Tlatskanie, Clatskanie, Willapa, Willoopah, Suwal, Lower Columbia Athabaskan	kwa
Lipan Apache		apl
Lower Tanana	Tanana	taa
Mattole	Mattole River	mvb
Mescalero Apache		apm

Mountain Slavey		scs
Navajo	Diné bizaad, Naabeeho, Navaho	nav
Northern Tutchone	Selkirk, Pelly, Gens de Foux ("Crow People"), Tutchone-kutchin, Koltchanes, Galzanes, Titlogat	ttm
San Carlos Apache	White Mountain Apache, Western Apache	apw
Sekani	Tsek'ehne, Sikani, Sicanee, Secunnie, Sékanais	sek
South Slavey	Denedha zhahtié, Slavey, Southern Slavey, South Slavey, Dene, Dené, Mackenzian, Déné-Dindjíe	xls
Southern Tutchone	Kluane, Champagne, Burwash	tce
Tagish	Tākizi, Chilkaht-tena, Nehaunees of the Chilkaht	tgz
Tahltan	Tāłtān, Nahanni, Nehaunee	tht
Tanacross	Nee'anděg', Transitional Tanana	tcb
Tolowa	Smith River Athabaskan	tol
Ts'ets'aut	Wetał, Ts'ets'a'ut	txc
Tsuut'ina	Tsúùt'ínà, Sarsi, Sarcee, Tsu T'ina	srs
Tututni	Euchre Creek	tuu
Upper Kuskokwim	Kolchan, Goltsan, McGrath Ingalik	kuu
Upper Tanana	Nee'aandeegn'	tau
Wailaki	Eel River Athabaskan	wlk
Western Apache	Nn̲ēē biyátii'	apw
Witsuwit'en	Northern Carrier, Western Carrier, Bulkley Valley–Lakes District Language, Babine Carrier	bcr

Appendix II: Sample of the Database

Abbreviations for sources correspond to the lexicographic source materials listed in Table 83.

Referent-Concept	Language	Community	Orthography	IPA	Lexicalization Path	Morphological complexity	TYPE	Inalienable	Source
arm	Ahtna	Copper River, AK	c'eggaane'	qɑːn	ARM	simplex	BPT	yes	KA1990
arm	Bearlake	Déline, NT	begǫ́né	kǫ̃́n	ARM	simplex	BPT	yes	BLMS
arm	Central Carrier	Stuart Lake, BC	'ugan	kɑn	ARM	simplex	BPT	yes	AN1974
arm	Chilcotin	Tsi Dele Del (Alexis Creek)	sɛgǽn	gǽn	ARM	simplex	BPT	yes	KI1979
arm	Deg Xinag	Shagekuk, AK	siggon	qon	ARM	simplex	BPT	yes	KA1978
arm	Dena'ina (Iliamr	Pedro Bay, AK	vegguna	qun	ARM	simplex	BPT	yes	KA2007
arm	Dene Dháh	Chateh (Assumption), AB	mbegóné	kón	ARM	simplex	BPT	yes	MOMS
arm	Dene Sųłiné	Cold Lake, AB	sįchę̨ne	ʧʰę̃n	BASE	simplex	BPT	yes	SRFNa / EE1998
arm	Galice	Galice Creek, OR	šgaaneʔ	kɑːn	ARM	simplex	BPT	yes	HH1966
arm	Gwich'in (Gwıch	Tsiigehtchic, NT	shigyı̀n	kı̀n	ARM	simplex	BPT	yes	FI2005
arm	Gwich'in (Teetl'	Fort MacPherson, NT	shigyı̀n	kı̀n	ARM	simplex	BPT	yes	FI2005