LUNDS
UNIVERSITET

Motivations for Sound Symbolism in Spatial Deixis

A study of 101 languages

Niklas Johansson

BA Thesis in General Linguistics
Centre for Languages and Literature, Spring Semester 2011

Supervisors: Jordan Zlatev and Arthur Holmer

Abstract

This thesis is concerned with the possible existence of a motivated relation between sound and meaning ("sound symbolism") in demonstrative pronouns. The goal was to search for evidence of such non-arbitrariness, and to gain a better understanding of the motivating factors behind it. Six motivations are considered. Two motivations were based on the senses of Touch and Vision. Two others - on the sense of Hearing, concerning vowels and consonants. Lastly, two concerned "proto-pointing", based on the senses of touch and vision, respectively.

Demonstrative pronouns belonging to two-way or three-way deictic systems were used through a genetically and areally spread sample consisting of 101 languages. The findings were divided into *motivated* (supporting the motivations), *non-motivated* (not supporting the motivations, arbitrary) and *anti-motivated* (the reverse of motivated, perhaps functionally).

The results showed support for the Touch, Visual and Hearing–Vowel motivations, most strongly for the latter. This implied that the vowel frequency of the demonstrative pronouns is a potent factor in expressing a sound-symbolic relation, perhaps reinforced by the two other motivations. Functional causes such as faster learning of non-arbitrary words are suggested as the driving force behind the phenomenon.

Keywords: deictic words, demonstrative pronoun, non-arbitrariness, sound symbolism, spatial deixis

Acknowledgements

I would like to thank my supervisors Jordan Zlatev and Arthur Holmer for all the valuable input, guidance and rewarding discussions during the course of writing this thesis. I would also want to give a special thanks to Gerd Carling for providing information about the fascinating subject of anti-iconicity, to Joost van de Weijer for providing aid in the statistical analysis, as well as to my examinator Junichi Toyota for help in formatting and giving general input. It has all been very much appreciated.

Contents

Tables

Figures

1 Introduction

Being a matter of debate for over two thousand years, the controversy of whether the linguistic sign's expression and content are connected through total arbitrariness or a "natural" connection, continues to divide linguists. Still, most scholars now agree that certain types of words whose meanings denote very basic and in most cases universal concepts, e.g. size (Sapir 1929), shape (Köhler 1929) and so on, seem to be cross-linguistically represented by the similar phonemes. This phenomenon, called *sound symbolism* by Hinton, Nichols and Ohala (1994), is referred to as *non-arbitrariness* in this thesis.

Similar investigations of this association have been made concerning spatial deixis, more specifically deictic demonstratives. These have mostly focused on the frequency/pitch of vowels (Ultan 1978; Woodworth 1991; Traumüller 2000). This has left languages such as English (*here* and *there*) aside, not taking other types of sounds e.g. consonants into account. Furthermore, the samples used have been rather small containing roughly 40 languages, with the exception of study of Ultan (1978).

Hence the aims of this thesis are the following three: (I) to answer whether there is significant support for non-arbitrariness in spatial deictic words; (II) to try to pinpoint which underlying motivation or motivations govern the association between sound and meaning through examining different spectra of speech sounds; (III) to consider how the results can aid in explaining why non-arbitrariness exists. These are schematically shown in Figure 1.

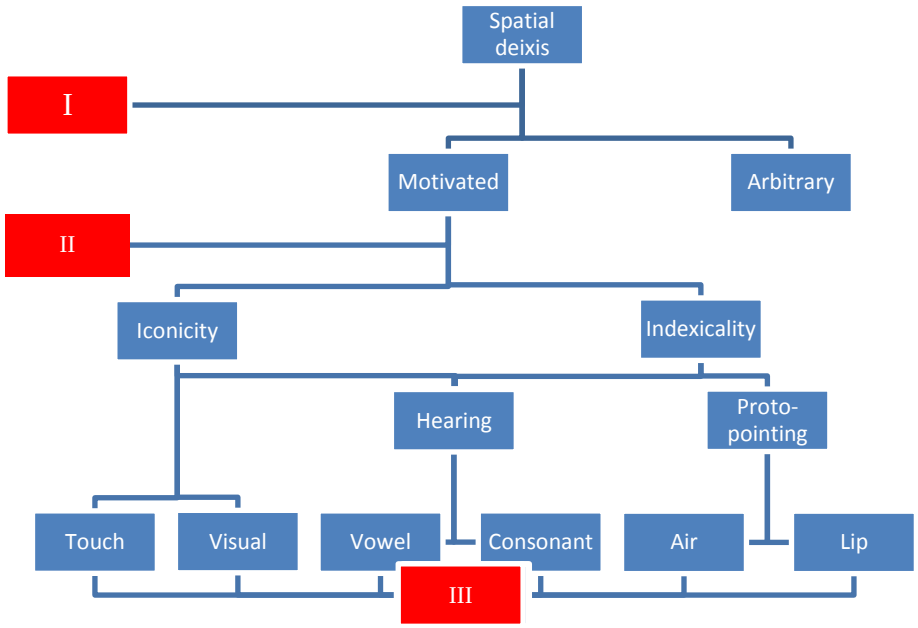


Figure 1: Walkthrough of the aims of this thesis

The organization of this thesis is as follows: Chapter 2 presents important background information. Firstly a historical overview of the debate is provided in section 2.1, also offering results of investigations of non-arbitrariness in different types of words yielded by various authors. This is followed by a discussion of how the actual association between sound and meaning can be understood in section 2.2. Section 2.3 provides a discussion of the phenomenon known as *anti-iconicity*. Section 2.4 gives an overview of different deictic systems found in the world languages and examples of investigations concerning non-arbitrariness in deictic words.

Chapter 3 covers dozens of possible motivations for non-arbitrariness in spatial deixis. However, this thesis is six (see Figure 1): the first two concerning the senses of sight and based on iconicity; the second pair concerning the sense of hearing and based on iconicity and/or indexicality, and the third pair being indexical motivations concerning *proto-pointing:* the usage of explosions of stop and lip protrusion. Chapter 4 describes the methods of the study: the course of action in creating a balanced language sample to test motivations against, and a procedure for evaluation. The chapter ends with three specific predictions, to be applied to each of the six motivations.

Chapter 5 presents the results and discusses some general correlations between motivations and geographical distribution. Chapter 6 offers a more general discussion of the results, relates these to aim III ("why non-arbitrariness?), as well as methodological issues. Finally, Chapter 7 provides conclusions and suggestions for further research.

2 Historical and theoretical background

This chapter offers a historical overview of the debate regarding the relationship between the form and meaning of words, followed by an attempt to explain how non-arbitrariness can be understood, from a cognitive-semiotic perspective, recently presented by Ahlner and Zlatev (2011). The discussion continues concerning the notion of "anti-iconicity", followed by an overview of (possible) non-arbitrariness in spatial deixis.

2.1 History of non-arbitrariness

During the last 2300 years, a great number of texts concerning the connection between the form and the meaning of the word have been written and discussed. The first documented text is *Cratylus*, a 360 B.C. dialogue written by Plato concerning whether the names of individuals, places and words are "natural" or "conventional". In the text, the protagonist Cratylus argues for naturalness, e.g. that the sound [l] would be better suited for words representing liquid meanings. For example, the [s] in the name of the sea god Poseidon would originally have been an [l] due to the god's connection with water. On the other hand, Hermogenes argues that words are "man-made", and gives examples of non-naturalness. Approximately one hundred years later the same topic was approached by Confucianists in ancient China. Notably Xun Zi in 221 B.C. argued that the name of the object and the meaning of the object had a completely arbitrary relationship, due to conventions and popular usage (Hong 1982, quoted in Lapolla, 1994).

During the eighteenth century the subject was brought up once again, now as a popular theory of the origins of language proposed by Herder (1772), referred to disparagingly as "the bow-wow theory" by Müller (1861). The basic idea was that language originated as imitations of sounds of natural phenomena occurring around us.

One of the more "recent" voices advocating total arbitrariness comes from Saussure (1916), who considered language to be "a system of signs that express ideas". This meant that the sign consisting of two integrated, inseparable parts, the *signifier,* the sound image, and the *signified*, the concept in question. According to Saussure the sign is completely arbitrary due to several reasons. First, there is no reason for the signifier to be connected to any specific concept since concepts do not precede language: the connection is internal between the signifier and the signified, not between a sign and its referent. Furthermore, signifiers are purely conventional, and any cross-linguistic similarities in onomatopoeic words and interjections are considered either coincidental or "marginal".

Contemporary with Saussure, Jespersen (1922a, quoted in Abelin 1999) disagreed with Saussure, and "the dogma of arbitrariness". He pointed out that onomatopoeic words are constantly recreated after being subjected to sound change, which makes them retain the same form, independent of the passing of time. He exemplified this by the word *cut* in which the vowel has changed from [u] to [ʌ]. However in the word *cuckoo* (imitating the sound made by the referent) the [u] which should have gone through the same change has not. Kaufman (1994) shows similar evidence of resistance in present-day Huastec, in which onomatopoetic roots contain phonemes that are almost non-occurring in the general vocabulary. A similar case is provided by Traumüller (1994: 216) concerning the sound change in sound symbolic words: "English *tiny* 'impressively small' is an illustrative example. Due to the general vowel shift, most of the original symbolism of this word has been lost, but it has been restored in the informal variant *teeny-weeny*".

During the twentieth century a plethora of investigations indicating the existence of some sort of "natural" connection between sounds and meaning have been conducted. One of the first of these was Sapir (1929), who conducted different experiments concerning if it is possible to predict the size of an object if the words representing it contained certain vowels. By using the two fictive words, *mil* and *mal* and asking which meant a small and a big table, respectively, it was shown that over 80% of 500 English-speaking subjects considered *mal* more suitable for the large table and *mil* more suitable for the small one.

Köhler (1929) directed his attention to the associations between shapes and sounds. The participants in his experiment were offered one asymmetrical roundish shape and one pointy figure, which were to be associated with two fictive words; *takete* and *maluma.* 95% of the subjects connected *takete* with the pointy shape and *maluma* with the roundish shape. This has later been confirmed by several authors, notably Ramachandran and Hubbard (2001), who used the words *kiki* (characterized by voiceless obstruents and front, unrounded vowels) and *bouba* (characterized by voiced sonorants and back, rounded or open vowels) for the same experiment, which have given rise to the so called *kiki/bouba-effect*.

Sereno (1994) investigated the possible connection between vowel quality and lexical categories, in this case nouns and verbs. Through a reaction time experiment it was found that nouns were faster categorized with back vowels than with front vowels, and vice versa: verbs containing front vowels categorized faster than verbs containing back vowels. From this, Sereno concluded that the mental lexicon could be organized around this interaction between lexical classes and the categorization of vowels. General universal tendencies of patterns of certain segments used for certain meanings have been argued on this

basis. Hinton, Nichols and Ohala (1994) listed *stops* to be associated with abrupt sounds and acts, *continuants* with continuing sounds and acts, *fricatives* with quick audible motions through air and *nasals* with ringing and reverberating sounds. Likewise, *phonesthemes*, referred to as *conventional sound symbolism* by Hinton et al., e.g. the initial "gl-" in certain English words such as ***gl****immer* and ***gl****itter*, show analogical associations of phonemes or phoneme-clusters and certain meanings, as shown in Table 1. However the usage of sounds in this phenomenon does not have to be cross-linguistic.

Table 1: Conventional sound symbolism in Guaraní. Different semantic values of phonemes can be combined for different meanings (Langdon 1994)

	[p] "sharp, snappy"	[ʃ] "friction"
[o] "burst"	[poɾoɾo] "popcorn; sparks"	[ʃoɾoɾo] "torrential rain"
[ã] "tinny"	[pãɾãɾã] "rocks in tin can"	[ʃãɾãɾã] "tinny, no tone; shooting at tin can"

The same type of direct relationship between sounds and meaning can be found on a more lexical level in *ideophones* (called *mimetics* for Japanese and Korean and *expressives* for Austro-Asiatic languages). Often characterized as descriptive words concerning different traits perceptible by our senses e.g. color, sound or movements etc., they are associated with certain sounds. Diffloth (1994: 108) writes that ideophones "represent an attempt to fully exploiting the semiotics of iconicity, in order to convey various sensations in as direct a manner as speech makes possible". The Japanese ideophones in (1) and (2), are given by Hamano (1994).

(1) /noro-noro/ 'slow movement'

(2) /kata-kata/ 'something solid and square hits a hard surface and makes a homogeneous sound'

2.2 Understanding "non-arbitrariness"

In a recent article, Ahlner and Zlatev (2011) attempt to clarify the notion of "sound symbolism" from a cognitive semiotic perspective. They point out that onomatopoeic words such as *meow* indeed show a clear resemblance between the sound pattern and the sounds produced by a cat, since the expression and the referent involve the same sensory modality,

audition. However, what is the "similarity" or "imitation" in the many cases, such as the ideophones in (1) and (2), where several modalities are involved?

Ahlner and Zlatev emphasize that linguistic signs are indeed semiotic conventions, mutually known in a speech community. However conventionality does not imply arbitrariness. Rather, conventions can be more or less *motivated*. Ahlner and Zlatev attempt to explicate how convention and motivation can co-exist, following the seminal ideas of Peirce. A sign involves at least three interacting entities in the process of *semiosis*. An *object* gives rise to a *representamen* which creates an *interpretant* in the mind of an interpreter. A forth notion, *ground* is the connection between the representamen and object. This need to be known, or perceived, by the interpreter, in order to make the connection between the three entities, so that the representamen can "mean" the object for him/her (see Figure 2.)

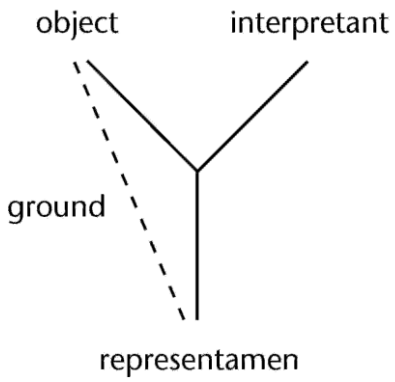


Figure 2: Peirce's model of semiosis, as used by Ahlner and Zlatev (2011)

Depending on the nature of ground, there are three "ideal types" of signs. The *iconic sign* is when a representamen and object share certain similar qualities independently of each other, e.g. a picture which depicts an object on the basis of visual similarity. The ground here is iconicity. The *indexical sign*'s ground is based on contiguity in time and space, *indexicality*. Iconicity and idexicality often coexist in a particular sign: a footprint in the sand provides us with information about the one who walked there on the basis of both. Finally, according to Peirce's use of the term, a *symbolic sign* is purely conventional, lacking any of the other types of ground. It is difficult to come up with a specific example, but $ for 'dollar', comes close. The reason that it is difficult is that most linguistic signs are not only symbols, but also

indices (linked to time and space of utterance) and may contain various types and degrees iconicity. More than one type of ground usually coexist as pointed out.

Ahlner and Zlatev (2011) applied this analysis to the so-called *synesthetic sound symbolism*. As mentioned earlier, in such studies two representamina, e.g. *takete* and *maluma*, and two contrastive objects e.g. pointyness and roundedness, are asked to be matched. The fact that the majority of subjects can perform such matching uniformly shows that they can indeed discern a similarity, or iconic ground, between the representamina and objects, even if they are given in different sensory modalities, i.e. cross-modal iconicity. How this could take place, is suggested by Ikegami and Zlatev (2007: 332).

> If we start with the shapes, the cross-modal mapping between vision and touch would allow them to be perceived as "soft" and "sharp" [respectively], motivating the use of these quasi-synaesthetic metaphors as a natural way to describe these figures. From the side of the expressions the production of the velar stop /k/, even more so combined with the front, unrounded vowel /i/involves obstructions and narrowings in the vocal tract, which can similarly be perceived as "sharp" and "edgy". On the other hand, the shape of the vocal tract and the lips in the production of /u/ in bouba are quite literally "roundish" and the passage of air is "soft".

Furthermore, Ahlner and Zlatev (2011) performed such a study, manipulating systematically vowels and consonants, and showed that types of sounds (and possibly their combination) had a positive contribution to making the mapping to the visual figures in a uniform way.

The iconic and/or indexical ground serving as the basis for connecting representamina and objects are in other words the non-arbitrary, motivating factors in the linguistic sign. But motivation is overlayed by convention, and two languages can use the same sounds for the representamen and the same sensations for the objects, while conventionalizing different mappings, possibly relying on different non-arbitrary motivations. For example, voiceless obstruents have been shown to be associated with *small*, but also *pointy* (though one could perhaps suggest that this is the case since the tips of pointy figures, which are their defining characteristic, are small). Other pairs of antonyms that could be motivated in such ways are e.g. *big-small, dark-bright, soft-hard, warm-cold* and – for the purpose of this thesis – the contrasts of spatial deixis, as discussed in Section 2.4. But prior to that, the notion of "reversing" the motivation needs to be considered.

2.3 Anti-iconicity

Carling (2011) explained that the shaping of cultural specialization e.g. trade, particular occupations or marginalization of certain speech communities can be manifested in the form of the language. This can be shown through *hypocoristic formations* i.e. actively clipping or camouflaging morphemes, as well as lexical manipulation e.g. prosodic change or sporadic phonetic change. Though many different explanations for manipulation of language are possible. Sprachbund effects can produce "incorrect" words, as well as reversed (expected) relationships between terms e.g. antonyms. The original distinction between terms could also have been blurred through language change and then reestablished. However, after being restored the original distinction between them could have ended up in the opposite position, though still retaining the distinction between the terms.

Without further historical backgrounds for specific languages, it is rather difficult, if not impossible, to trace the actual reason for the manipulation. Hence, regardless of origin, completely reversed relationships of expected terms and sounds were in this thesis referred to as *anti-iconicity*, *anti-indexicality* or *anti-motivation*, depending on context.

In Mayrinax Atayal gender specific morphemes have developed. Male language contains a hunting code in the form of additional morphemes, while the female form reflects the proto-Austronesian forms. The male form has then been transferred to other Atayalic languages e.g. Seediq (Carling and Holmer 2011; Li 1982, 1983), see Table 2.

Table 2: Atayal gender-specific vocabulary. Male-specific morphemes are shown in red (Carling and Holmer 2011).

proto-Austronesian	**Seediq**	**English**
*batu	*btu**nux***	'stone'
*kahuy	*qhu**ni***	'tree'
*hapuy	*pu**niq***	'fire'
*qabuH	*qbu**lic***	'ash'
*Cau	*see**diq***	'human'

Frequently used words, such as determiners, adpositions and particles should according to Zipf's law contain a small number of phonemes, e.g. English personal pronouns *me* [mi], *you* [ju], *we* [wi] and demonstrative pronouns *this* [ðɪs] and *that* [ðæt]. However in several Romani dialects, including Scando-romani, many closed class words e.g. pronouns, conjunctions and the copula, as well as frequently used adverbs contain "too many" phonemes (Carling 2011), as shown in Table 3. Another example is Welsh Romani demonstrative pronouns (featured in the sample of this thesis) *kadava* 'this' and *kodova* 'that'. This can be regarded as a case of *motivated* (*quantitative) anti-iconicity*: the forms are not arbitrarily non-

motivated; they are motivated to be, so to speak, "unnatural", for purposes of social cohesion, and keeping a distance to other communities.

Table 3: Quantitative anti-iconicity in Scando-romani (Carling 2011)

Romani (Kelderash)		**Swedish**		**Scando-romani**		**English**
Personal pronoun	Copula	Personal pronoun	Copula	Personal pronoun	Copula	
me	sim	jag	är	mander	honkar/ashar	'I am'
tu	san	du	är	diro	honkar/ashar	'you (sg.) are'
vov	si	han	är	lo/lester	honkar/ashar	'he is'
voj	si	hon	är	li/listkri(s)	honkar/ashar	'she is'
		den	är	kava/dova	honkar/ashar	'it is'
ame	sam	vi	är	vorsnos	honkar/ashar	'we are'
tume	san	ni	är	ersnus	honkar/ashar	'you (pl.) are'
von	si	de	är	dolle	honkar/ashar	'they are'

The relationship between certain sounds and certain meaning was shown by Sapir et. al. (1929) to have the complete *opposite* relationship to what would be expected on the basis of iconicity. It may be common, in languages which often differ to a greater extent from the surrounding larger languages, to associate the "incorrect" sound with terms such as *largeness* to *smallness* or vice versa. For example, [i], often a part of words with the meaning of small, is used in Georgian for the word 'large' დიდი /didi/. The word meaning 'small' პატარა /patara/ contains three [a], usually associated with the meaning large. Hence the [i]-[a] relationship may still be thought to be motivated, though it is reversed compared to the iconic pattern, i.e. a case of motivated *qualitative anti-iconicity* (Carling 2011).

This phenomenon has by most authors simply been judged as a reflex of arbitrariness. However since this "anti-motivation" may not be simply a matter of chance, but as suggested here *motivated*, it needs to be considered separately from the clearly non-motivated case, e.g. where there is no relevant contrast at all. This will be the approach taken in this thesis.

2.4 Non-arbitrariness in spatial deixis

If it is indeed a fundamental part of language, it should not be surprising to find non-arbitrariness in deictic expressions. The following two sub-sections provide a typological summary of spatial deixis, as describe some earlier investigations into its (possible) non-arbitrariness.

2.4.1 Spatial deixis

To interpret the meaning of an utterance, the participants of a conversation are more than often reliant on context giving information about the time, place and the participants in the interaction. All languages have systems of spatial, temporal, and person deixis, which conventionalize certain categories of such information. For person deixis, shown in personal pronouns, such conventionalized information includes gender (*he, she, it, him* and *her*) number (singular, plural and dual) and inclusivity. Time deixis is expressed in tenses, adverbials, which can be more or less vague *(now, then, later).*

One of the most used types of deixis is spatial, analyzed from a typological perspective by Diessel (2008). Demonstrative pronouns such as the English words *this* and *that* are relative in distance to a so called *deictic center* or *origo* which can change in place and in time depending on context (Saeed 2003). The origo is usually the location of the speaker at the time of the utterance Diessel (2008), hence *this* is within the relative proximity of the origo, while *that* is further away.

Distance contrasts as in English demonstratives are not the only possible distinction. Languages can contrast in whether the referent is visible or out of sight, at higher or lower elevation in relation to the origo or uphill or downhill and so forth. Other languages do not distinguish between distance contrasts at all and are called "distance-neutral". Standard Swedish is one example of a distance-neutral language; the demonstratives *denna* and *detta* only differ in gender, *common* (*utrum*) and *neuter* (*neutrum*). Since the demonstratives do not contrast deictically, adverbials are used together with them to express distance contrast; *här* (proximal) and *där* (distal) are placed after the demonstrative, as shown in (3) and (4).[1]

(3) den här hunden
DEM here dog
'this dog'

(4) den där hunden
DEM there dog
'that dog'

According to Diessel (2008) all languages have a minimum of two adverbial demonstratives or deictic particles and are able to distinguish between the concepts of *here* and *there* in some

[1] Considering the close relationship between the demonstrative and the adverbial, as well as the fact that the words' pronunciation have started to merge, these could be regarded as one word, and (at least some dialects of) Swedish as having distance-based spatial deixis.

manner. Some of these languages use one of the terms as a default, neutral demonstrative. Modern Hebrew *ze* indicates both a proximal referent, as well as a non-contrastive distance neutral referent, while other languages use a special neutral term aside of the contrastive terms. These languages are, however, still classed as two-way systems since the neutral demonstrative do not add another distance contrast to the system.

Three-way systems can either be distance-oriented or person-oriented. Terms of distance-oriented systems indicate the relative distance between the referent and the origo. Independent of being proximal (*this*), medial (*that*) or distal (*that yonder*), the origo remains the same for all demonstratives. Terms of person-oriented systems indicate that one of the demonstratives is relative to the proximity of the addressee; one is relative to the proximity of the speaker and the last being away from both. Hence there are two different origos: firstly the domain of the speaker contrasts with the domain of the hearer for the first and second term. And secondly the common domain of the speaker and hearer is contrasting with the distal term or terms. The English term *that* can be translated both into the near-listener term and the away-from-both term depending on the context. Languages with systems containing more than three terms are usually person-oriented, as shown in Table 4.

Table 4: The deictic system of Hausa (Wolff 1993) in (Diessel 2008)

Near speaker	nân
Near addressee	nan
Away from speaker and addressee	cân
Further away from speaker and addressee	can

However, even more advanced distance-oriented systems are possible, such as Malagasy which has contrasts between six different degrees of distance, as shown in Table 5. Certain languages use a vertical dimension along with the horizontal, as shown in Table 6. Deictic systems can also include information about motion towards and from the referent, similar to the English terms *come* and *go*; Somali *soo* 'towards the speaker' and *sii* 'away from the speaker' (Saeed 2003: 185). Finally a very complex system is used in Yup'ik, which includes information significantly more advanced than that of the English two-way distance-oriented system, as shown in Table 7. According to Diessel (2008) in *The World Atlas of Language Structures (WALS)* (http://wals.info/) as of February 24 2011, out of the 234 languages listed 54.3% use a two-way system and 37.6% use a three-way system. The distance-neutral systems and systems containing more than three terms are fairly uncommon, adding up to 8.1 % of the world's languages. Person-oriented systems are less common, used by one third of

the world languages. Two-way and three-way systems are quite evenly spread across the world, while the less common systems are situated in certain areas. Distance-neutral systems are mostly found in Africa, Europe and Mesoamerica and systems containing more than three terms are found in North America, Africa and the Pacific region.

Table 5: The deictic system of Malagasy (Anderson and Keenan 1985) in (Saeed 2003)

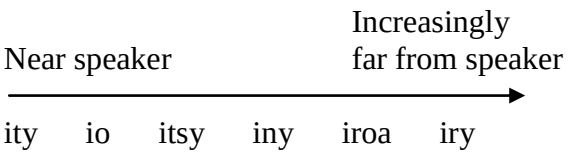


Table 6: The deictic system of Daga (Anderson and Keenan 1985) in (Saeed 2003)

oea	overhead	ea	underneath	ata	same level
ao	up, high	ae	down, low	ase	same level (far)
uta	higher (near)	ita	lower (near)	ma	near speaker, this
utu	higher (far)	isi	lower (far)	ame	near addressee, that
use	higher (remote)	ise	lower (remote)	-	-

Table 7: The deictic system of Yup'ik (Anderson and Keenan 1985) in (Saeed 2003)

Extended	Restricted	Obscured	Meaning
man'a	una	-	this (near speaker)
tamana	tauna	-	that (near addressee)
-	-	imna	the aforementioned one
ukna	-	-	the one approaching the speaker
augna	ingna	amna	the one going away from the speaker
agna	ikna	akmena	the one across there
qaugna	kiugna	qamna	the one inland, inside upriver
qagna	keggna	qakemna	the one outside
un'a	kan'a	camna	the one below, towards river
unegna	ugna	cakemna	the one downriver, by the exit
paugna	pingna	pamna	the one up there, away from river
Pagna	pikna	pakemna	the one up above

2.4.2 Investigations of non-arbitrariness in spatial deixis

A number of investigations concerning possible non-arbitrariness in spatial deixis have been conducted. The first, to the best of my knowledge, is that of Ultan (1978, summarized by Sereno, 1994), who found that of 136 languages. 33.1% of the languages exhibited sound symbolism connected to distance in their demonstrative systems. The most consistent

association found was that the proximal term was expressed by a closed, front, unrounded vowel. It was also found that 27.3% of the languages in the sample had diminutive markings, which were in almost 90% of these languages also expressed by a closed, front, unrounded vowel.

Woodworth (1991), reviewed by Traumüller (1994), also showed evidence for a relationship between vowel quality and demonstrative pronouns, as well as in locative adverbials. It was found that for 13 languages of a sample of 26, vowels with high frequency F2 were used in the proximal form while vowels with lower F2 were used in the distal form. Two languages showed the opposite association and the remaining languages gave no clear results.

Traumüller (1994) expanded Woodworth's investigation of iconicity in demonstrative pronouns and hypothesized that the association between pitch and size is based on the following correlation: when pointing at something far away is usually a large object, such as a tree; when pointing at something close by it is usually something small. Languages with word pairs that only differed in the vowel quality were used in the study, and it was expected that the F2 in the vowels would be higher in the proximal form: [i] - *smallest* (distance) and [u] - *largest* (distance). Support for this hypothesis was found in 32 out of the 37 languages in the sample. Furthermore, Traumüller investigated possible non-arbitrariness existing in personal pronouns. It had previously been observed that first-person personal pronouns often contain a nasal, while second-person personal pronouns contain a stop consonant. Thus, the first hypothesis was that first person would be expressed by oral closure and sustained voicing (atypically voiced nasal) and second person would by an oral pressure build-up and explosion (atypically voiceless stop). A second hypothesis was based on the fact that in conversation it is possible to point with the tip of the tongue or by protruding the lips and refer accordingly, i.e. dental consonants and lip protruding sounds. Since it is difficult to point to oneself with the tongue, non-pointing would be the counterpart to the pointing sounds, which is done by closing the lips and hence without protrusion. For first person, the oral pointing gestures would be expressed by absence of dental articulation and/or lip protrusion (atypically [m]), while second person by the presence of dental articulation and/or lip protrusion (atypically [t] and [w] etc.). Initially some support was found for both hypotheses, though after disregarding some language families due to possible genetic relationships, hypothesis 1 received 11 supporting cases and 3 counterexamples, while hypothesis 2 received 9 supporting cases and 7 counter. Traumüller (1994: 229) suggests that

"the association between second person and dental articulation or lip protrusion might be just somewhat weaker and hierarchically subordinated to those described by hypothesis 1".

In sum, the studies summarized in this section offer some evidence for non-arbitrariness in spatial deixis, as well as for person deixis. However, with the exception of Traumüller, most attention has been given to vowel contrasts, thereby neglecting the possible role of consonants, considered important also for cross-modal iconicity by Ahlner and Zlatev (2011), see Section 2.2. Although vowel frequency is obviously an important way of establishing the iconic/indexical ground between expression and content, several other non-arbitrary motivations are likely to exist, as indicated by Traumüller's findings. Furthermore, with the exception of Ultan (1978), fairly small languages samples have been used. The following chapter presents six possible motivations/grounds and Chapter 4 deals with creating a larger sample.

3 Possible motivations

The majority of investigations concerning non-arbitrariness have merely judged their findings in terms of "iconicity" or "sound symbolism", in a rather vague manner. Which are the motivations/grounds for associating expression and content in the case of spatial deixis? In this chapter, and thesis as a whole, I single out six possible ones: the first two concerning the senses of sight and vision-based iconicity; the second pair concerning the sense of hearing and hearing-based iconicity and/or indexicality, and the third pair being indexical motivations concerning *proto-pointing:* the usage of explosions of stop and lip protrusion

3.1 Touch

From the speaker's point of view, producing sounds by having the tongue close to the upper jaw i.e. closed vowels, could "feel" narrower since the feeling of the air flowing out of the mouth when speaking is more profound if the vocal tract is narrower, as shown in Figure 3. This sensation perceived while producing a sound could easily be associated with the auditory perception occurring simultaneously (yielding cross-modal iconicity between touch and sight). Therefore sounds produced by having a relative narrow vocal tract should be associated with *proximal* and sounds produced by having a greater distance between the tongue and the upper jaw i.e. open vowels, should feel less narrow and thereby be associated with *distal*.

As mentioned in Section 2.2, Ikegami and Zlatev (2007) suggested that the cross-modal mapping between vision and touch of Ramachandran and Hubbard's (2001) word pair, *bouba* and *kiki* corresponding to *soft* and *sharp*, could be motivated by that the /k/ and the /i/ involve obstructions while produced which could be felt as sharp or edgy. The /u/ in *bouba* on the other hand is produced by a rounding of the lips and of the vocal tract, at the same time as the passage of air is perceived as soft and smooth.

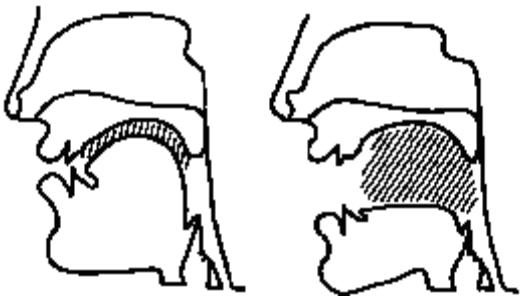


Figure 3: Openness in producing vowels. Showing the amount of open space while producing closed (left) and open (right) vowels (http://www.unil.ch/ling/page24437.html)

More closed vowels should hence be associated with *narrow* and more open vowels should be associated with *far away* regardless if the vowel is rounded or not. Since all consonants are produced by having an obstacle in the vocal tract it is difficult to divide them into closed and open. Although approximants, especially semi-vowels, are considerably "more open" than nasals which are produced by completely closing off the oral cavity, the differences are not great enough to be associated with narrowness in the same manner as vowels in the author's opinion. Hence if consonants were to be used in this way, they would all be more "narrow" than any of the vowels and secondary articulations such as pharyngealization has to be taken into account. Thus, this motivation is predominantly concerned with vowels.

3.2 Visual

When a listener sees the speaker talk, some of the sounds are produced by having the mouth more open than others sounds. By displaying a more open mouth, a larger area is shown for the listener which is perceived visually at the same time as it is perceived through hearing when the sounds are produced. In the same manner by having the mouth more closed, a smaller area is shown and another sound produced and perceived as shown in Figure 4. This type of iconic gestures could be associated with both size and distance, by displaying a relative covering of the mouth and connected sounds. Closed vowels, regardless of backness, are obviously less open than open vowels, meaning that [i], [ɨ] and [ɯ] are the extreme on the one end of the scale, while [a] and [ɑ] are the extreme on the other, with several levels found in between.

The same logic applies for the rounded counterparts of these vowels, making [y], [ʉ]and [u] to be associated with *more proximal* while [œ] and [ɒ] are associated with the *more distal* as shown in Figure 5. Being rounded, these vowels are visually perceived as being less open, which means that even the *most distal* rounded vowel is viewed as *less proximal* than the *most proximal* of the unrounded vowels. The neutral vowel [ə] is positioned in between the rounded and unrounded vowels. One could argue that rounded vowels are more open than some unrounded vowels since the vertical dimension is relatively more open compared to the horizontal dimension, as shown in Figure 6, however this is not taken into account.

All consonants are produced by having some type of obstruction in the vocal tract hence the variation of openness in consonants is negligible. This excludes the possibility of having "open consonants" and therefore they cannot be applied to the Visual motivation.

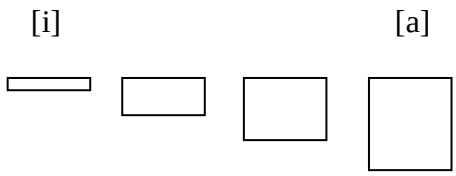


Figure 4: (simplified) relative openness of unrounded vowels

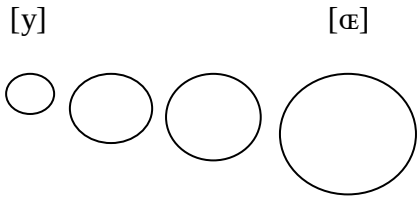


Figure 5: (simplified) relative openness of rounded vowels

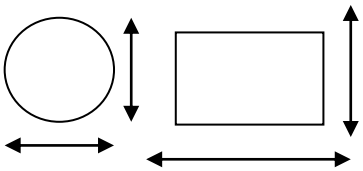


Figure 6: (simplified) difference between open vowels. Showing the difference between equally open rounded (left) and unrounded (right) vowels

3.3 Hearing

A dog's growl is low and threatening while its whine is low and submissive - why are these types of sounds produced and perceived in this way? Ohala (1994) answer this question by the so-called "frequency code". It is in animals interests to appear large, since being big would give the upper hand in combat, meaning that an individual smaller than its opponent, though appearing larger, can go victorious out of a confrontation without commencing battle. Such deceptive behavior can be achieved by erecting hair or feathers to visually seem larger, which have become permanent markers on some animals e.g. the male lion's mane.

Another way appear large is simply to imitate large creatures' low frequency voice. Due to the larger resonance chamber of big animals, the frequency created by the vibrating membranes, the vocal cords of animals and the syrinx of birds, is dependent on the body size of the individual and therefore indicates how powerful that individual is. Through manipulating the voice quality and/or intonation, an individual can indicate a certain size as well as attitudes etc. This is further supported by Ertel (1969), quoted by Traumüller (1994),

who argues that vocalizations of large and therefore strong individuals have a lower pitched voice than that of small individuals. Furthermore massive vibrating membranes can create secondary vibrations resulting in harsh voice quality, which could resemble the growl of larger animals. Hence certain sounds (with low frequency) are *indexically* (contiguity in space-time) associated with certain animals (large ones) or great natural phenomena, such as thunder.[2]

However, this motivation also involves iconicity. As Traumüller (1994) suggested, large objects referred to are usually far, while small objects are near. In walking toward something at a distance, the longer the walk is the larger the object becomes. Furthermore low frequencies attenuate with distance less rapidly than high frequencies, meaning that low frequency sounds can be heard from much larger distances (Larom et al.1997). An example of this is elephants, whose low frequency vocalizations can be used to keep in contact with conspecifics despite being great distances apart; under optimum conditions up to 10 km (Garstang et al. 1995). This means that to refer to something or to communicate with someone at a distance, low frequency sounds are favorable. All these factors combine to establish a *proportion* between vowel frequency, object size and distance: LOW-BIG-FAR vs. HIGH-SMALL-NEAR, which is an example of an iconic ground.

In sum, a high and/or rising F0 could be used as an combined iconic and indexical ground for indicating smallness but also related concepts such as deference, politeness, submission, lack of confidence (Bolinger 1964; 1978), questions, familiar, dependence and *narrow*; *near*, while a low and or falling F0 could be associated with largeness but also assertiveness, authority, aggression, confidence, threat (Bolinger 1964; 1978), dominance, statements and *large distance*, i.e. *far away*.

3.3.1 Vowels

In vowel quality F2 is the most varying formant, governing a great deal of the characteristics of vowels and therefore the associations as well; a high F2 can be associated with *proximal* and low F2 can be associated with *distal.*[3]

Traumüller (1994) used a scale of the five most used vowels in the world's languages, [i,e,a,o,u], in which the *more distal* sound would have to be to the right of the *more proximal* sound to agree with his hypothesis. For this thesis all 21 primary and secondary cardinal

[2] Note that if large animals and phenomena would produce high frequency sounds, this would still be an indexical ground. Hence, this is not a case of iconicity.

[3] Other traits are also possible: Yoruba verbs for 'being small' *bírí* (high tone) and 'being large' *bìrì* (low tone), contrast in tone. Tonal languages could associate high or rising tones in vowels with *proximal* and low or falling tones with *distal* due to the difference created towards the frequency of the modal voice.

vowels are taken into account to include less common, but still important vowels such as closed, front, rounded vowels such as [y], closed, back, unrounded vowels such as [ɯ] and open, rounded vowels such as [ɶ]. These are placed on a relative *proximal-distal* scale following the F1-F2 diagram (Iivonen 1994) featured in (Lindblad 1998)[4, 5].

3.3.2 Consonants

The association connected to F0 frequency can, according to Ohala (1994), also be plotted onto consonants. Voiceless obstruents, which are produced by having a high velocity of airflow, have more energy on higher frequencies, while voiced obstruents have more energy on lower frequencies Silverstein (1994). Hence voiceless obstruents ought to be associated with *proximal* and voiced sonorants with *distal*. The two levels in between; voiceless sonorants and voiced obstruents, are considered too ambiguous to be incorporated with the two already mentioned kinds of consonants. However, in contexts with two identical consonants, except for the voicing, the voicing should play a role in possible associations, since one is distinctly higher in frequency than the other. For example a [n̥] contrasting with its voiced counterpart [n], representing *proximal* and *distal*.

3.4 Proto-pointing

Apart from producing sounds that can represent traits and qualities of objects and living beings, manual gestures are used for iconically representing and indexically referring to objects, actions and events. They emerge early in children, even before language is acquired. There are many cross-cultural similarities, but also culture-specific conventions (Zlatev & Andrén 2009). Though sometimes performed without speech, gestures are most frequently used within the contexts of spoken utterances, as part of a multi-modal utterance (Kendon 1996).

As reviewed in Section 2.4, Traumüller (1994) proposed two hypotheses concerning the association between indexical terms (personal pronouns and demonstratives) and different sounds. The idea behind these can be generalized to what is here called *proto-pointing*. Oral gestures that can be clearly *seen* by the listener in a conversation can serve as a

[4] An alternative way for scaling vowels, instead of making the frequency of F1 constituting one axis and the frequency of F2 on the other, would be to use the frequency of F1 on one axis and the difference between F1 and F2 on the other. This would give [i] greatest difference between F1 and F2 and [ɑ] the smallest difference between F1 and F2, however this will not be used in this particular thesis.

[5] Although nasal vowels have their formants lowered compared to their oral counterparts, the difference is not taking in consideration for this thesis, since the differences are judged to small by the author.

pointing gesture towards something, and oral gestures that cannot be seen by the listener would not.

Following Traumüller speech sounds can be divided into different sections of the vocal apparatus in order to associate them with certain meanings, depending on the motivation. In this thesis it is accomplished through different steps, summarized in the end of this chapter.

3.4.1 "Proto-pointing" sounds

Firstly, the oral cavity can be divided into one part where the sound produced can actually be seen by the listener, and one part where they sounds cannot. The sounds that can *point* are sounds created from the middle of the alveolar ridge to the lips, leaving the post-alveolar sounds to the glottal sounds to be *non-pointing* as shown in Table 8. Traumüller (1994) suggests that labials could be considered *non-pointing*, since pointing to oneself is impossible and closing the lip would at least prevent lip-protrusion. However, labials are produced by an action performed by the mouth that can be seen, and are hence considered "pointing" for present purposes.

Table 8: Consonant chart 1. Showing a consonant chart divided into non-pointing, or back sounds (red) and pointing, or front sounds (blue)

	Place												
	Labial		Coronal				Dorsal			Radical		Glottal	
Manner	**Bilabial**	**Labiodental**	**Dental**	**Alveolar**	**Post alv.**	**Retroflex**	**Palatal**	**Velar**	**Uvular**	**Pharyngeal**	**Epiglottal**	**Glottal**	
Nasal	m	ɱ	n̪	n		ɳ	ɲ	ŋ	ɴ				
Plosive	p b	p̪ b̪	t̪ d̪	t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ	ʔ	
Fricative	ɸ β		θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ	ʁ	ħ	ʕ	ʜ	ʢ	H	ɦ
Approximant		ʋ	ɹ			ɻ	j	ɰ								
Trill	B		r			• *			ʀ							
Flap/tap	ⱱ	ⱱ	ɾ			ɽ			ɢ̆			ʡ				
Lateral fricative			ɬ ɮ			ɭ̊˔	ʎ̝	ʟ̝								
Lateral approximant			l			ɭ	ʎ	ʟ								
Lateral flap			ɺ			ɭ̆*	ʎ̆									

3.4.2 Air

There are at least two possible ways to use the vocal apparatus to point in a more obvious way. The first one is to shoot out air using the mouth towards the referent which would make the performer of this action (the speaker) feel a forceful flow of air dislodging. This would

indexically associate vision with touch in a similar manner as for the Touch motivation, though on an indexical basis/ground. Furthermore this feeling can be understood by the listener, due to the familiarity of producing sounds preformed in this manner.

What Williams (1995) called "prelinguistic utterances", i.e. vocalizations resembling /da/, /d/, /t/ and similar variants, seem to have a deictic function across the majority of the world's languages. They are primarily used when pointing to or touching an object, and thereby referring (Clark 1978). The origin of this usage of sounds is apparently not due to (parental) input, since languages differ in their choice of phonemes. Williams investigated what she called the "D-system" in a bilingual French/German child. The French deictic words contain an initial [l] or [s] (*le, la, les, ce, cette, ces* etc.), while the German contain an initial [d] (*dieser, diese, dieses* etc.). The results showed that before 1 year 10 months of age, the D-system was used frequently in both French and German contexts. After this age, the level of occurrence in the German context remained high, while declining in the French: the D-system merged with the German language in the German context while fading and giving room for the deictic words containing [l], and to some extent [s], in the French context. It was also shown that the usage of the D-system was connected to grabbing and touching objects. According to Williams there is a structural parallel between the act of touch and exploring something with the tip of the finger and bringing the tip of the tongue in contact with the alveolar ridge or the teeth. This is further strengthened by the fact that the infants lack sufficient fine motor skills in hands and fingers while adequate fine motor control in the tongue has already emerged through months of sucking and oral exploration. Hence there seems to be a possible universal connection between these sounds and acts involving other objects at an early age.

The D-system being connected with touching would seem to make it connected with proximity. However, since infants' attention is often focused on objects in the immediate vicinity, referring is seldom directed to objects at a distance. Later in life attention is more widely spread due to objects referred to often concern new information in discourse. Furthermore new information is rarely found to be nearby from the start; hence the same sounds should presumably follow the direction of attention and therefore being connected also with distal (cf. Traumüller's, 1994, results containing second person pronouns).

When plosives and affricates are produced, an "oral pressure is built up and subsequently released in an explosion, a speaker has the impression of suddenly projecting something outward and away from himself, and this is also what he does physically with a quantity of air" (Traumüller 1994: 223). This phenomenon should reasonably "feel" more

forceful and therefore more *pointing* than any positioning of the tongue in the mouth, even the *front-sounds*. This means that [k] would be more *pointing* in relation to [n], even though the production of [k] is not *seen* and [n] is *seen*, as shown in Table 9.

Deictic word pairs which both contain plosives or affricates are divided into the *front-sounds* and the *back-sounds* groups e.g. the theoretical deictic word pair of proximal [ka] and distal [ta], would agree with this motivation. Although both are plosives, [ta] belongs to the *front* group and [ka] belongs to the *back* group, bordered at the same point as the other consonants, as shown in Table 10.[6] Vowels are not taken into account for this motivation since no vowel forces out air from the mouth in comparable manner.

Table 9: Consonant chart 2. Showing a consonant chart divided into back sounds (red), front sounds (blue) and occlusives (yellow)

	Place												
	Labial		Coronal				Dorsal			Radical		Glottal	
Manner	Bilabial	Labiodental	Dental	Alveolar	Post alv.	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Epiglottal	Glottal	
Nasal	m	ɱ	n̪	n		ɳ	ɲ	ŋ	ɴ				
Plosive	p b	p̪ b̪	t̪ d̪	t d		ʈ ɖ	c ɟ	k g	q ɢ			ʔ	ʔ
Fricative	ɸ β		θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ	ʁ	ħ	ʕ	h	ɦ
Approximant		ʋ	ɹ			ɻ	j	ɰ			ʜ	ʢ		
Trill	B		r			• *			ʀ			ʡ *	
Flap/tap	ⱱ	ⱱ	ɾ			ɽ			ɢ̆			ʡ̮	
Lateral fricative			ɬ ɮ			ɭ̊˔	ʎ̝	ʟ̝					
Lateral approximant			l			ɭ	ʎ	ʟ					
Lateral flap			ɺ			ɺ*	ʎ̮						

Table 10: Consonant chart 3. Showing a consonant chart divided into back sounds, *BS* (red), front sounds, *FS* (blue), back-occlusives, *BO* (orange) and front-occlusives, *FO* (green)

	Place												
	Labial		Coronal				Dorsal			Radical		Glottal	
Manner	Bilabial	Labiodental	Dental	Alveolar	Post alv.	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Epiglottal	Glottal	
Nasal	m	ɱ	n̪	n		ɳ	ɲ	ŋ	ɴ				
Plosive	p b	p̪ b̪	t̪ d̪	t d		ʈ ɖ	c ɟ	k g	q ɢ			ʔ	ʔ
Fricative	ɸ β		θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ	ʁ	ħ	ʕ	h	ɦ
Approximant		ʋ	ɹ			ɻ	j	ɰ			ʜ	ʢ		
Trill	B		r			• *			ʀ			ʡ *	
Flap/tap	ⱱ	ⱱ	ɾ			ɽ			ɢ̆			ʡ̮	
Lateral fricative			ɬ ɮ			ɭ̊˔	ʎ̝	ʟ̝					
Lateral approximant			l			ɭ	ʎ	ʟ					
Lateral flap			ɺ			ɺ*	ʎ̮						

[6] Cf. glottal and velar sounds are dominating the produced sounds by young infants, though declining at about six months of age, being replaced by dental sounds (Locke 1983) in (Williams 1995).

3.4.3 Lip

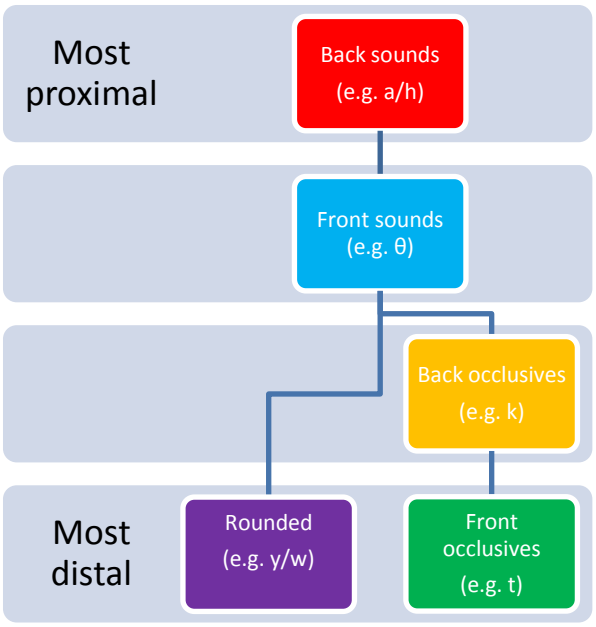
The second way of using oral gestures to point in a more apparent way is to use lip protrusion in order to point towards the referent. This can be visually perceived by the listener of a conversation and thereby directing the attention of the listener, yielding an indexical ground. Hence this motivation is the indexical counterpart of the Visual motivation.

Andrew (1963) suggested that lip-protrusion is a generalized form of protection; to "shoot" something noxious out from the mouth, which would give this gesture an even closer connection to pervious explained possible motivation.

In *actual object pointing*; objects referred to through pointing can be actual objects in the world that surrounds the participants (Kendon 1996). Pointing using the index finger while speaking to refer to something, which is common in Europe and North America, is not as universal as often assumed. In some parts of the world this gesture is considered impolite and often avoided. Instead the whole hand is used, partially or completely taking the role of the index finger. Likewise in certain parts of Southeast Asia, including countries such as Malaysia and Indonesia, the thumb is used for pointing, Pointing using the lips is widespread in at least Southeast Asia, the Americas, Africa, Oceania, and Australia. This type of pointing is almost always accompanied with a quick raising of the head and chin, as well as the gaze oriented towards the referent, with occasionally an eyebrow-raise Kendon (1996).

Thus, co-articulated labial consonants, labialized consonants, as well as rounded vowels are considered to be "pointing sounds", contrary to the suggestion made by Traumüller (1994). The sounds referred to as *rounded* (R), in Table 11, being visually perceptible, obviously contrast with non-visually perceptible sounds e.g. unrounded back consonants such as [h] and unrounded vowels such as [a]. Even though e.g. [i] is more fronted than [u] it is still within the area of the *back-sounds* in the mouth and is not visually perceived while produced. In between these two groups *front-sounds* e.g. [θ] have been put, being visually perceivable, though not to the same extent as the *rounded* sounds. Hence there are two possible ways of using oral pointing gestures, and thereby two different sets of types of sounds, to refer to an object as shown in Table 11.

Table 11: The proto-pointing motivations in relation to proximity



3.5 Summary of motivations

Touch: The proximal form should be represented by a vowel belonging to a group to the left of the distal form, more narrow, as shown in Table 12.

Visual: The proximal form should be represented by a vowel belonging to a group to the left of the distal form, more closed, as shown in Table 13.

Hearing–Vowel: For vowels the proximal form ought to be represented by a high or rising tone and the distal form should be represented by a low or falling tone, or the proximal form should be represented by a vowel to the left of the vowel representing the distal form in the following scale, higher F2, as shown in Table 14.

Hearing–Consonant: For consonants the proximal form should be represented by a voiceless obstruent and the distal form by a voiced sonorant, voiceless sonorants and voiced obstruents are not taken into consideration, as shown in Table 15. If the proximal and distal form is represented by two identical consonants except for the voicing, the unvoiced form should be the proximal form and the distal form should be voiced, as shown in Table 16.

Proto-Pointing–Air: There are four levels of "air"-pointing sounds, three visually perceptible and one not visually perceptible. The most pointing sounds should be the sounds produced by shooting out air produced in the front of the mouth; *front-occlusive* e.g. [t]. Followed by sounds produced by shooting out air at the back of the mouth; *back-occlusive* e.g. [k]. The least pointing sound that still can be seen are *front-sounds* e.g. [θ], produced by having the

tongue visually perceptible, while sounds that do not point what so ever are grouped as *back-sounds* e.g. [h]. The proximal form ought to belong to a group to the left of the group the distal form belongs to, as shown in Table 17.

Proto-Pointing–Lip: There are three levels of lip-pointing sounds. The most pointing sounds should be those sound produced by protruding the lips; *rounded* sounds e.g. the consonants [w] or [kʷ] or the vowel [y]. These are followed by pointing sound that can still be seen; *front-sounds* e.g. [θ], produced by having the tongue visually perceptible. Sounds that do not point what so ever are grouped as *back-sounds* e.g. [h] and unrounded vowels e.g. [e]. The proximal form ought to belong to a group to the left of the group the distal form belongs to, as shown in Table 18.

The six iconic and indexical motivations cover both vowels and consonants, three senses, speaker, listener, as well as speaker and listener combined, as seen in Table 19 which also contains example sounds for each motivation and deictic term.

Table 12: Chart for the Touch motivation. Showing the most narrow and therefore most proximal vowels to the left and the most open and therefore most distal vowels to the right

i y ɨ ʉ ɯ u	e ø ɤ o	ə	ɛ œ ʌ ɔ	æ ɐ	a ɶ ɑ ɒ

more proximal — more distal

Table 13: Chart for the Visual motivation. Showing the most closed, rounded and therefore most proximal vowels to the left and the most open, unrounded and therefore most distal vowels to the right

y ʉ u	ø o	œ ɔ	ɶ ɒ	ə	i ɨ ɯ	e ɤ	ɛ ʌ	æ ɐ	a ɑ

more proximal — more distal

Table 14: Chart for the Hearing–Vowel motivation. Showing the vowels with the highest second formant and therefore most proximal to the left and the vowels with the lowest second formant and therefore most distal to the right

i	y	e	ɛ	ø	æ	ɨ	a	œ	ə	ɶ	ɐ	ʉ	ʌ	ɤ	ɑ	ɒ	ɯ	ɔ	o	u

more proximal — more distal

Table 15: Chart for the Hearing–Consonant motivation 1. Showing consonant type and voicing in relation to proximity

voiceless obstruents	proximal
voiced obstruents	-
voiceless sonorants	-
voiced sonorants	distal

Table 16: Chart for the Hearing–Consonant motivation 2. Showing specific consonant types and voicing in relation to proximity

voiceless sonorant /obstruent (specific)	proximal
voiced sonorant /obstruent (specific)	distal

Table 17: Chart for the Proto-Pointing–Air motivation. Showing consonant groups in relation to proximity

BS - FS - BO - FO

more proximal more distal

Table 18: Chart for the Proto-Pointing–Lip motivation. Showing consonant groups in relation to proximity

BS - FS - R

more proximal more distal

Table 19: Summary of motivations

Type of ground	**Motivation**		**Sound type**	**Senses involved**	**Person**	**Example**	
						Proximal	**Medial/Distal**
Iconic	**Touch**		Vowels	Touch	Speaker	i	a
	Visual		Vowels	Sight	Listener	u	a
Indexical + Iconic	**Hearing**	**Vowel**	Vowels	Hearing	Speaker and Listener	i	a
		Consonant	Consonants	Hearing	Speaker and Listener	t	n
Indexical	**Proto-pointing**	**Air**	Consonants	Touch	Speaker	h	t
		Lip	Vowels and Consonants	Sight	Listener	a/h	y/w

4 Method

4.1 Sampling

Using Ethnologue online (http://www.ethnologue.com), a free and frequently updated language database, which contains information of approximately 6800 living languages as well as additional dead languages, my sampling was initiated by looking at the language families which contain living languages. The information taken from Ethnologue is of 20th of November 2010.

Two groups in the listing from Ethnologue were excluded, the first one being *Constructed languages* since they are not natural languages and the second being *Deaf sign languages* since they are not spoken. The aim was to have a sample that consists of approximately 100 living languages. Since dead languages that are well-documented are often situated in certain areas of the world, Mediterranean and the Middle East, the use of such languages could result in areal bias and they were not used. The size of sample was chosen for pragmatic purposes: it was considered manageable for the timeframe of this thesis. It corresponds to the size of the "small sample" used by Veselinova (2005) in a typological study of verbal suppletion, which also inspired the present method of sampling.

Given that some language families contain a very small number of languages and therefore cannot be represented in a sample of this size, it was necessary to determine just how big a language family has to be to be represented. The world's total number of living languages was simply divided by 100, yielding ~68, making up the threshold of languages that a language family is required to contain in order to be represented by 1 language.

Language families that contain more than 68 languages and are represented by more than 1 language were divided into subgroups. The primary subgroups yielded by Ethnologue were to be as well-represented as possible. This was done by first covering as many branches of a language family as possible. Second, the number of languages for each branch is assigned roughly accordingly to the percentile relation to the total number of languages in the language family. Some language families were normalized by adding or subtracting up to 5 languages from the original designated number of representative languages. The *Unclassified* group in each language family was generally chosen lastly, and represented only if all the other primary subgroups are represented.

All language families containing less than 68 languages were divided into four bigger groups. More or less following Bybee, Perkins and Pagiuca (1994), described by Veselinova (2005), these languages were divided according to the number of languages in the

language families. Through some slight tweaking the following groups were used: Creoles, Pidgins and Mixed languages; language families containing less than 7 languages, isolates and unclassified languages; language families containing 7-20 languages; language families containing 21-44 languages and language families containing 45-67 languages. Languages picked from these four groups, were geographically spread into different portions of the Earth following Nichols (1992), with some modifications.

This procedure was carried out as thoroughly as possible. However, complications in finding suitable languages belonging to the correct branches altered the actual outcome. In other words, the final selection was governed by available data. Even though further areal spreading was attempted, when data is not found, the spreading for particular languages may have suffered due to the limited timeframe of this thesis.

The Niger-Congo family was reduced by five languages, both due to lack of data and having quite homogeneous languages. The Trans-New Guinea group was reduced by two; mainly because of that much of the data available concerned the language family Sepik, which is categorized as 45-67 languages per family group. The Indo-European and Sino-Tibetan families were both increased by three languages each due to the abundance of data. Remaining families and groups have only gone through minor alterations.

Sources for the languages used primarily come from *Compendium of the world's Languages, vol. I* and *vol. II* (Campbell 1991). Other sources include various reference grammars. Due to the threshold of 68 languages in a family to be represented by 1 language in the sample, the percentile for each language family was rounded down, yielding 88 languages. Ultimately the number of languages in the sample became 101. The list is presented in Table 20 and for the geographical positioning of the sampled languages see appendix A.

Table 20: Sampled languages. Showing the number of sampled languages in different stages of the sampling

Language family	Rounded off percentile of the of the number of the world's languages	Initial count of languages per family or group	Actual number of languages in sample
Afro-Asiatic	5,11	5	6 (+1)
Australian	2,21	2	3 (+1)
Austro-Asiatic	2,45	2	4 (+2)
Austronesian	17,82	17	18 (+1)
Dravidian	1,22	1	3 (+2)
Indo-European	6,17	6	9 (+3)
Mayan	1	1	2 (+1)
Niger-Congo	21,86	21	16 (-5)
Nilo-Saharan	2,87	2	4 (+2)
Oto-Manguean	2,53	2	2
Sino-Tibetan	6,44	6	9 (+3)
Tai-Kadai	1,30	1	2 (+1)
Trans-New Guinea	6,88	6	4 (-2)
Creoles, Pidgins and Mixed languages	1,49	1	2 (+1)
Language families containing less than 7 languages, isolates and unclassified languages	2,22	2	4 (+2)
Language families containing 7-20 languages	2,86	2	2
Language families containing 21-44 languages	6,96	6	5 (-1)
Language families containing 45-67 languages	5,64	5	6 (+1)
Total	~100	88	101

4.2 Words used

The words chosen were demonstrative pronouns in their least marked form, regardless of whether the demonstrative is derived from e.g. a locative adverbial or if the demonstrative pronouns constitute the "base". The words were converted into International Phonetic Alphabet (IPA) as much as possible; uncertainties were left as they were found in the source material.

Considering that over 90% (according to **WALS)**, of the world's languages distinguish between proximal and distal, this is clearly a semantic dimension in spatial deixis. In comparison, vertical distinctions are less important. Hence on the contrary to previous authors both languages with *two-way and three-way deictic systems* were used, which meant

that both proximal-medial and proximal-distal contrasts are taken into consideration (the medial-distal was not used since it does not provide any relevant information for the purpose of the thesis).

Distance-neutral languages cannot give any information due to the lack of phonetic and semantic contrasts and were therefore not used. This also applied to languages that utilize locative markers together with the distance-neutral demonstrative. Systems using more than three terms were considered too difficult to handle in relation to the goals of this thesis. However some of these systems could be used as two- or three-way systems if there was a clear distinction between the horizontal distinction words and the other types of distinctions in the source material. Out of the 101 chosen languages, 40 languages used a 3-way system and 61 languages used a 2-way system, balanced in regard to the distribution on *WALS*: 59.1 % for 2-way systems and the 40.9 % for 3-way systems, if other systems are disregarded.

4.3 Coding

For all languages, the demonstratives were coded for each of the six possible motivations, using the following categories; (a) *motivated*, (b) *non-motivated*, and (c) *anti-motivated*. If a particular contrast followed the scales shown in Chapter 3 (Tables 12-18), it received the value 1 for (a) and 0 for (b) and (c). If a contrast was the reverse to the scales, it received the value 1 for (c) and 0 for the other two. And finally, if it neither followed nor was reverse, it received value 1 for (b) and 0 for the other two. In the case of three-way systems, the comparison was first made between the proximal and the medial form, and then between the proximal and distal form and then averaged (giving the possible values 0, 0.5 and 1 for the three categories).

4.4 Predictions

The following predictions, for one or more the motivation were made:

(I) A greater ratio for (a) *motivated* than (b) *non-motivated*.

(II) A greater ratio for (a) *motivated* than (c) *anti-motivated*.

(III) A greater ratio of (c) *anti-motivated* than (b) *non-motivated*.

Motivations following all three predictions were considered as having *very strong* support. Motivations following prediction I and II are considered having *strong* support. Those

following only I – as having *weak* support. And finally, motivations following none of the three predictions as having no support, as shown in Table 21.

Table 21: Support criteria. Showing the criteria for different levels of support

	I	II	III
very strong support	+	+	+
strong support	+	+	-
weak support	+	-	-
no support	-	-	-

Questions concerning whether the iconic, combined or indexical motivations would be (most strongly) supported were left explorative, as well as for the sub-motivations. Considering that previous investigations have found positive results for the hypothesis that the frequency of vowels' second formant (F2) is relevant, the first two motivations were expected to be at least moderately supported. It was further expected that the hearing motivation concerning consonants to be less supported, considering the already proven association in the frequency of vowels. Another factor suggesting this is the often limited number of phonemes occurring in words which are frequently used i.e. Zipf's law, combined with the syllable nucleus being made up of vowels in the overwhelming majority of the world's languages.

5 Results

5.1 General results

The results shown in Table 22 were found.

Table 22: Motivation results. Showing the results yielded for the motivations of this thesis with significant values in grey

Motivation		Value			Support
		motivated	non-motivated	anti-motivated	
Iconic	**Touch**	47,5	33,5	20	Weak
	Visual	44,5	27	29,5	Strong
Iconic and Indexical	**Hearing–Vowel**	56	22,5	22,5	Strong
	Hearing–Consonant	13	74,5	13,5	No
Indexical	**Proto-Pointing–Air**	35	45	21	No
	Proto-Pointing–Lip	42,5	36,5	22	No

Support was found for the first three motivations, the clearest of which was for the Hearing–Vowel motivation (as could be expected from previous research, see Section 2.4). Predictions I and II were confirmed for this, and for the Visual motivation, since the motivated ratios were significantly higher (according to a binominal test) than both the non-motivated and the anti-motivated ratios. For the Touch motivation, results for predication I were found to be on the edge of significance. However, due to prediction II being fulfilled, this motivation is all together judged as weakly supported. Prediction III, stating that the anti-motivated contrasts would be higher than the non-motivated, which would be expected if these were not "arbitrary", was not confirmed for any of the motivations. Hence the support was not "very strong" even in the two clearest cases (Visual and Hearing–Vowel).

The results for the fourth motivation clearly showed that it should be disqualified: a strong majority of the languages had non-motivated forms. For the last two motivations, related to "proto-pointing", the ratio of motivated was higher than anti-motivated (Prediction II), but in both cases, not (statistically significantly) higher than non-motivated (Prediction I), and hence, they were deemed to be unsupported.

5.2 Patterns and correlations

In order to help to interpret these findings I searched for patterns and possible correlations between motivations, language families and languages groups, as well as areal distribution.

5.2.1 Language families and language groups

By looking at motivated, non-motivated and anti-motivated values exceeding 50% of the total value of each language family or group, it was found that languages families and language groups with positive results for the Hearing–Vowel motivation were often found to also have positive results for the other two supported motivations: Visual and Touch. Likewise, non-motivated results for the same motivations follow each other for at smallest two language families, see Table 23.

The Hearing–Consonant motivation had the most obvious single values for each language family or group, all with non-motivated results, except for the Tai-Kadai family which was found to be anti-motivated. However, values for languages families or groups with few languages are harder to determine due to the low total values.

No apparent evidence was found for small languages families or isolates to use anti-motivated systems. Also, no indication of any converse relation between iconicity motivations (the first two) the indexicality motivations (the last two) were found.

Table 23: Results for language families and language groups

Language family/group after number of languages	Iconicity		Indexicallity +Iconicity		Indexicallity	
	Touch	Visual	Hearing		Proto-pointing	
			Vowel	Cons.	Air	Lip
Niger-Congo	-	-	-	non	-	moti.
Austronesian	moti.	moti.	moti.	non	-	-
Trans-New Guinea	non	-	-	-	-	-
Sino-Tibetan	moti.	-	moti.	non	-	moti.
Indo-european	-	-	-	non	-	-
Afro-Asiatic	non	non	non	non	moti.	-
Nilo-Saharan	-	-	-	-	non	-
Oto-Manguean	non	non	non	-	anti	-
Austro-Asiatic	non	-	moti.	non	non	-
Australian	moti.	moti.	moti.	non	moti.	moti.
Tai-Kadai	moti.	moti.	moti.	anti	moti.	non
Dravidian	moti.	moti.	moti.	non	non	non
Mayan	-	-	moti.	non	moti.	moti.
45-68 languages /fam., group	-	-	-	non	moti.	moti.
21-44 languages /fam., group	-	-	-	non	-	-
7-20 languages /fam., group	-	-	-	non	-	non
<7 languages /fam., group	-	non	-	non	non	non
Creoles, Pidgins and Mixed	moti.	-	-	-	non	-

5.2.2 Areal distribution

Most results were found to be distributed evenly across the world. However, some distinct patterns were discovered, as can be seen in the maps given in Appendix C.

Results for the Hearing–Vowel and for the Touch motivation were found to be very common in Southeast and East Asia as well as in East Central Africa. Anti-motivated results for the Touch motivation were found to be almost nonexistent. Motivated results for the Proto-Pointing–Air motivation were found to be uncommon in North America, while anti-motivated results were very uncommon in Africa. For the four first motivations, motivated results, as well as for anti-motivated results for the Visual motivation, were found to be absent in South America (however, just four languages represent this area of the world). No correlation between the use of lips for pointing instead of the hand or index finger and the distribution of indexical results for the Proto-Pointing–Lip motivation were found.

Out of the languages with motivated results for the Proto-Pointing–Air motivation, no correlation was found with person-oriented three-way deictic systems, which would support Traumüller's second investigation, in which the second person pronoun often is represented by a (voiceless) stop.

5.2.3 Hearing–Vowel and word order

A noteworthy correlation between the areal distribution of motivated results for the Hearing–Vowel motivation and word order was discovered. Out of the 60 motivated values, 21 languages had SVO-word order, 35 %, virtually equal to the 35.5% of the larger sample of languages found on WALS (436 out of 1228 languages). What is more interesting, 39 languages (65 %) had VO-word order, compared to the 640 of 1370 languages (46.7 %) listed on WALS. These correlating languages' families are both spread across the world, as well genetically diverse; 1 Afro-Asiatic, 1 Australian, 3 Austro-Asiatic, 14 Austronesian, 4 Indo-European, 2 Mayan, 7 Niger-Congo, 3 Sino-Tibetan, 2 Tai-Kadai, Welsh Romani and Nahuatl. One area clearly diverged: the Indian subcontinent, whose languages all had supporting results for the Hearing–Vowel motivation with three exceptions[7], though typically utilizing SOV-word order. Furthermore out of the 15 languages with full or some supporting results for the Hearing–Consonant motivation, only the proximal-distal distinction of Armenian did not have VO-word order.

[7] Limbu, the proximal-distal term for Brahui and the proximal-medial term for Mundari.

6 Discussion

6.1 Supported motivations

The three motivations with significant support (Hearing–Vowel, Visual and Touch) are all concerned with rather similar sets of vowels. This could be interpreted as suggesting that the Hearing–Vowel motivation alone being supported, while the support for the Visual and Touch motivations was solely due to similarities with the Hearing–Vowel motivation. [i] was considered the, or one of the most proximal sound for Hearing–Vowel and Touch and relatively small for Visual (cf. Traumüller's (1994) suggestion of [i] being ideal for the meaning of narrowness and smallness), while [a] was considered rather distal for all of the three motivations. However, [u] was not as clear-cut: it was considered the most distal sound for the Hearing–Vowel, but one of the most proximal sounds for Visual and Touch. Still, back vowels are produced by retracting the tongue inwards, which creates a greater distance between the tongue and the palate for closed vowels. This would then make [i] the sound closest to the palate and thereby most proximal for the Touch motivation and thereby more or less merging the Hearing–Vowel and the Touch motivations together regarding the usage of sounds for meanings.

The greater anti-motivated support for the Visual motivation could perhaps be explained as an incorrect categorization of rounded vowels as smaller than their unrounded counterparts. They could be perceived as more open due to the vertical dimension being relatively more open compared to the horizontal dimension. Another explanation could be that the Hearing–Vowel motivation is overriding the Visual motivation.

On the other hand, the degree of support for the Touch motivation combined with other kinds of confirmed investigations, e.g. Ramachandran and Hubbard's (2001) *kiki-bouba* experiment and Ahlner and Zlatev's (2011) vowel+consonant effects, could indicate that the Touch and possibly the Visual motivations exist in their own right, though enforcing the more vital Hearing–Vowel motivation.

As described in Section 2.4 Woodworth (1991) found iconic support for the proximal form being higher in frequency than the distal form in 50% of the languages in the sample of 26 languages and Traumüller (1994) found 86.5 % iconic support of a sample of 37, both rather small samples which could be judged as unreliable. Ultan (1978) on the other hand, using a larger sample of 136 languages, found lower iconic support for the same investigation, 33.1 %, though supported by the fact that 27.3 % of the languages in the same sample had diminutive markings, mostly represented by similar sounds as the proximal term.

Hence in comparison with Ultan (1978), the Hearing–Vowel motivation received stronger support in the present study, since the supporting results was considered one out of three, instead of one out of two, perhaps due to a better dividing of phonemes. This ought to be an indication for confirmation. Furthermore it has been shown that even people that have been deaf or blind from birth generally show the same associations between low pitch and threat, dominance and high pitch with submissiveness etc. (Fónagy 1963 in Traumüller 1994).

6.2 Motivations without support

The Hearing–Consonant motivation's remarkably high non-motivated results could be explained by the generally much more diverse consonant systems of the world's languages, compared to the relatively more consistent vowel systems. Vowels could simply be considered more fundamental and therefore more suitable for usage for sound symbolism. There is also a tendency of using a reduced inventory of phonemes in sound symbolic words (Oswalt 1971).

Animals usually can only utter a few vowel-like types of calls. If imitation is the key factor for sound symbolism involving size, distance etc, then consonants ought not to be the first choice in the selections of sounds representing various animals. However, imitation of inanimate objects should involve a wider arrange of sounds, including consonants, to better represent the objects perceived, which are often more connected to actions or manners of actions.

Judging from the results, the Proto-Pointing–Air motivation did not correspond to person-oriented three-way deictic systems. It might be that this type of motivation is more tied to personal pronouns, which are more specific in referring than demonstrative pronouns. The only vowels classed as pointing (indexical) are rounded, which are lower in frequency. This could mean that at least the motivated results for the Proto-Pointing–Lip motivation which consist of vowels, are actually governed by the Hearing–Vowel motivation, which would yield the same value. Moreover the lack of a greater correlation between languages utilizing the Proto-Pointing–Lip motivation in their deictic systems could enforce the notion of this particular motivation as not supported; the gesture itself might be a separate phenomenon, not connected to speech in such a direct way.

If the motivated values are weighed against the non-motivated and anti-motivated values in the same manner as previous authors (e.g. Ultan 1978 et al.), the support for the Proto-Pointing–Air and the Proto-Pointing–Lip motivations could be taken into account, yielding somewhat higher support than for Ultan's more thorough investigation. It is

possible that actual occurrence of the motivations lay around 30-40%. However, such a percentile can never be shown to be significant using a binominal test.

On the other hand, while not independently supported, the usage of multiple motivations is plausible. In the Ainu (a language isolate spoken in the northern part of Japan) the demonstratives proximal [ta] and distal [to] both consists of sounds with rather low F2 frequency, possibly too little difference to be distinguished. This could mean that Proto-pointing has stepped in as a secondary motivation, to be able to still have more "natural" association between word and meaning. This also supports the notion that other motivations could exist.

Diffloth (1994) showed evidence for the reversed relationship of grouping sounds for the Touch motivation in ideophones of language of Bahar (a Mon-Khmer language spoken in Vietnam). Instead of perceiving having the tongue raised as the air is being compressed and therefore more small or narrow, the sensation could be that the tongue is taking up a lot of space in the mouth, hence being perceived as large size or far away. Front unrounded and back rounded closed and close-mid vowels i.e. /i/ and /ee/ represent *largeness* and front unrounded and back rounded open-mid vowels i.e. /ɛ/ and /ɔɔ/ represent *smallness*. Also some examples of a three-way distinction was provided, adding the sense of *enormous* represented by front unrounded and back rounded closed vowels i.e. /i/ and /uu/. This could, however, also be considered a case of anti-iconicity.

No support for Prediction III (that the anti-motivated values would be greater than non-motivated values) was found. This could be due to the fact that language minority groups that are likely to use anti-iconicity (or anti-indexicality) are often few in number of speakers and even fewer in relation with surrounding majority languages. Although the sample used included 17 languages which contain less than 68 languages in each language family, including isolates, as well as 2 languages for the Creoles, Pidgins and Mixed languages group, this does not reflect the numerous languages spoken only by a small number of people. Hence the languages using anti-iconicity or anti-indexicality *non-arbitrarily* are likely not to have been represented by more than a handful of languages. Hence anti-motivation, as an independent category of analysis, should not be discarded.

6.3 Relevance for the existence of non-arbitrariness

The grouping of vowels associated with *soft* and *large* was explained by Lapolla (1994) as the mother's heartbeat heard by the fetus consists of a low, no-tone-like sound and that many animal and bird mother's calls to their young are made up by a low tone and a soft sound.

According to Collias (1960) the voice quality is changed to soft and or a drop in pitch of voice by females after birth. This in relation to the large size (in comparison with an infant) and softness of the mother could certainly cause such an association between sound and meaning. This would cause the opposite end of the frequency scale to be associated with meanings such as *hard* and *small*, the association of size could then have been mapped over to distance (Traumüller 1994; Williams 1995).

The sound [i] associated with the meaning HARD could further be strengthened by the fact that [i] is produced by the tongue being fixed in a tensed and thereby hard mode close to the palate. This very phenomenon is explained by Ramachandran and Hubbard (2001: 29) as *synaesthesia*; "(a) cross-activation […] between visual appearance and vocalizations […] sound contour and motor lip and tongue movements […] and between motor maps concerned with gesticulation and vocalizations." Thus this neurologically based "cross-wiring" between different senses could in turn yield non-arbitrary associations.

These considerations, however, seem to regard sound-symbolism as a "bi-product", and not playing any *functional role in language leaning and communication*. Many investigations have shown that iconicity and indexicality are not epiphenomenal. Kita, Kantartzis and Imai (2010) looked into whether three-year old Japanese children (Imai, Kita, Nagumo and Okada 2008) and three-year old English children (Kantartzis, Kita and Imai 2009) were introduced to novel actions (in this case manner of walking). The children were asked "which one is doing the 'nosunosu'?" (the sound symbolic word for walking heavily and slowly). The same results were found for both the Japanese and English children: they performed better when the sound symbolic condition was introduced. This is not surprising for the Japanese speaking children since Japanese speakers use ideophones extensively. However the corresponding results for the English speaking children are more interesting, considering the sparse sound symbolic lexicon of English. The conclusion was that regardless of which language is used by a child, it will learn words faster if they are sound symbolically matched.

Kita, Kantartzis and Imai (2010) speculate that our evolutionary history makes all children biologically endowed to use sound symbolism in learning; a remnant from a common proto-language largely consisting of sound symbolic words (Kita 2001; Ramachandran and Hubbard 2008). Some language families may have retained this more than others (cf. Ahlner and Zlatev 2011). The uneven distribution of ideophones in the world e.g. in the languages of Central Africa and East Asia, is also analogue with occurrence of languages with VO-word order. There may also be correlations with cultural values. Kita,

Kantartzis and Imai (2010) mention that speakers of Zulu, who use ideophones extensively, tend to use these less due to their associations with rural way of life which they want diverge from (Childs 1996). Ancient values of Indo-Europeans ancestors could have decreased the usage of that type of words in their languages, in the same manner. Speakers of Indo-Europeans languages are still able to detect cross-linguistic sound symbolic words (Davis 1961 et. al. in Kita, Kantartzis and Imai 2010), in appropriate context, i.e. perceive an iconic/indexical ground (Sapir 1929; Köhler 1929; Sereno 1994; Ahlner and Zlatev 2011).

The Touch motivation as well as the Proto-Pointing–Air motivation both solely relay on the speaker's own sensory feedback when producing speech sounds, while the Visual and the Proto-Pointing–Lip motivations rely on the listener. The Hearing motivations were the only ones that gave sensory information to both the speaker and the listener. Judging from the results of this thesis, this may be important. Furthermore not being forced to keep track of the speaker's mouth (as with the Visual, Proto-Pointing–Air and Proto-Pointing–Lip motivations) could be beneficial for communication during night-time, as well as in hunting situation when visibility is poor.

6.4 Hearing–Vowel and OV-word order

The positive results ("motivated") for the Hearing–Vowel motivation were found to occur more frequently in areas of the world where the unmarked word order is verb preceding the object. Even though Austronesian languages represent a good part of the total number, the correlation is worth exploring. Explaining this as a sprachbund-related phenomenon or a recent genetic relation seems implausible.

Conradie (2001) argues that SVO word order is a manifestation of *structural iconicity*; since it reflects the events according to what order and time they are experienced or reported upon, the *event model*:

> Structural iconicity occurs when the structure of linguistic elements, as manifested in their ordering in particular, may be shown to reflect a process or state of affairs in extralinguistic reality or our perception of reality, and is violated when the ordering of linguistic elements may be shown to run counter to extralinguistic reality Conradie (2001: 230).

Passive constructions, on the other hand represent the complete opposite, hence are considered anti-iconic and are in the need of verb marking or case marking to be understood

completely. Arguments enforcing this notion include the gradual drift of many languages to employ SVO-word order as default and that creoles usually continue to use SVO after evolving from the pidgin-stage. Conradie further argues that universal tendencies ought to have iconic motivations and quotes Danchev (1991: 115-116) who explains the fact that English has become an SVO-language through influence from the languages of Europe starting to lean towards a less marked and more iconic word order. This would mean that the English s-genitive is modeled upon iconicity of the SVO-word order, reflected by the animacy hierarchy. The more animate/human entity precedes the less animate/human entity, e.g. *Mary's cat* and *the cat's basket*. The event model which is action-based runs parallel with the animacy hierarchy, which is substance-based. However the action hierarchy implies the animacy hierarchy since the more human properties an entity is, the more likely it is to be agentative.

It is worth noting that the iconicity of the (S)VO word order could be challenged through evidence that "homesigns", sign systems spontaneously created by deaf children that are not exposed to a conventional sign language (Fant 1972; Moores 1974; Tervoort 1961), show a different chain of events in relation to time. According to Goldin-Meadow (2009) these sign systems develop categories of meanings which were essentially iconic with only hints of arbitrariness. Goldin-Meadow further investigated whether speakers of four languages with different predominant word orders (English, Turkish, Spanish, Chinese) would differ in word order when asked to describe events using gesture without speech. Exemplified by Goldin-Meadow (2009: 355-356) "to describe a captain swinging a pail, the adults produced a gesture for the captain (Actor), then produced a gesture for the pail (Patient), and finally a gesture for the swinging action (Act), that is, an Actor-Patient-Act (ArPA) order". No influence of mother tongues or conventional sign languages were found; speakers of all four languages used the same gesture order. Instead, just like all homesign systems, they tended to place gestures for Patients before gestures for Acts. The same word order was found to emerge in sign languages created spontaneously e.g. the Al-Sayyid Bedouin Sign Language which for the last 70 years rose up in an isolated community (Sandler et al. 2005). This is further supported by the fact that infants combine pointing gestures with words to produce meanings months before they can use word for the same purpose, e.g. to utter the verb "eat" followed by pointing at a cookie. And similarly, it is not hard to grasp the fact that in order to understand an action such as kissing, it is natural to first show the two people involved in the act, followed by mimicking the actual action.

6.5 Methological issues

6.5.1 The categorization of deictic variables

The semantic analysis of spatial deixis is still the subject of much debate. According to Diesel (2005) a person-oriented system with three distance terms could be viewed as a distance-oriented system with two distance terms. The common domain of speaker and hearer makes up one referent and something outside of that domain makes up the second one. In the same manner a person-oriented system with four demonstratives could be viewed as a distance-oriented system with three distance terms. If this is the case, to distinguish between proximal (combined with medial) and distal is the only distinction of importance.

It is easy to suppose that the pivot of deixis ought to be the first person since it is the person one first thinks of. Even so, according to Gärdenfors (1996) quoted by Johansson (2005) you-awareness is discovered before me-awareness, thus the pivot might be lying on the second person. This would mean that for three-way deictic systems, the interesting contrasts would be to compare medial terms with proximal terms and medial terms with distal terms. This ought to yield results that would differ from those found in this thesis.

Some three-way deictic systems might have distal terms which are formed by adding a second word to the medial term, similar to English, in which *yonder* is following the deictic term *that* to create the same meaning. This second word could then have been attached and merged with the first word, not giving anything of non-arbitrary value to said term, unless only those phonemes retrained are the non-arbitrary ones. This could call for excluding the distal terms of certain languages. However, in the present study, most three-way systems did not seem to use this addition of words for the third term, though some clear cases were found, e.g. the Puyuma terms; proximal *iḍi*, medial *iḍu* and distal *iḍi**iu***.

6.5.2 Coding difficulties

Though using a small sample, Traumüller (1994) found greater support for associating second person singular pronouns with oral pressure followed by an explosion than with pointing with the tip of tongue or by protruding the lips. However, combined with arguments and findings made by Williams (1995), it might be that alveolar stops have a unique position as the most pointing consonant, while other sounds are non-pointing. This would in that case explain the lack of significant support for the Proto-Pointing–Air motivation.

By representing high frequency sounds (proximal) by voiceless obstruents and low frequency sounds (distal) by voiced sonorants, thus excluding devoiced sonorants and voiced obstruents, information might have been lost. This could possibly have contributed to

the significantly low motivated ration and high non-motivated ratio of the Hearing–Consonant motivation. For example, the distinction between [s] and [d] ought to be perceived as rather clear. [s] represents a much higher frequency than [d] despite being considered non-motivated due to both being obstruents with different manner and place of articulation in the results of this thesis.

Completely excluding consonants from certain motivations could be one factor which has lowered the support for these compared to the Hearing–Vowel hypothesis. This could particularly concern the Touch motivation due to the fact that sibilants, plosives and affricates could very well be perceived as *narrow* in relation to other consonants e.g. lateral and approximants. This could also make comparisons between vowels and consonants possible. If consonants would to be judged as narrower than vowels this could thereby yield different results for languages which were (possibly incorrectly) coded as non-motivated (arbitrary).

It should finally be pointed out that categorizing Welsh Romani is not classed as a Mixed language. Furthermore, even if it was classed as belonging to the Mixed language-group both Welsh and the Romani language belong to the Indo-European language family. A Mixed language made up by two different language families should have been used instead or at least a Romani language with a Non-Indo-European language family e.g. a Turkish Romani dialect.

7 Conclusion and further research

This thesis investigated the occurrence of non-arbitrariness in spatial deictic words by looking into 101 areally and genetically spread languages. Six possible motivations were formulated, giving rise to different scales of phonemes on the proximal-distal dimension: Two iconic motivations utilizing the senses of touch and vision, two motivations with iconic and indexical grounds, as well as two indexical motivations. The iconic/indexical motivations concerned the sense of hearing, one focusing on vowels, the other on consonants. The last two were motivated by oral pointing gestures, one through the sense of touch, involving the feeling of air being projected towards a referent and the other through the sense of vision, involving lip protrusion for the same purpose.

The questions asked were: Can significant support for non-arbitrariness in spatial deictic words be found? What motivation or motivations receive strongest support, given a typological perspective? What can the results aid in explaining why non-arbitrariness exists?

Some support as found for all but the Hearing–Consonant motivation. However, only three of the five supported motivations yielded significant results for two of the three predictions: Touch, Visual and Hearing–Vowel. These motivations were made of similar sets of vowels which could explain the shared support. Judging by the results of previous investigations (Traumüller 1994 et. al.), the Hearing–Vowel motivation seems to be most strongly supported. The Touch and Visual motivations could be supported simply due to the similarity of phonemes, or perhaps enforcing the already established Hearing–Vowel motivation by yielding coinciding stimuli through touch and visual oral gestures, combining indexical and iconic grounds.

This means that the Hearing–Consonant motivation does not seem to be important for sound symbolism in spatial deictic words. The two indexical proto-pointing motivations gave no significant results, while the Hearing–Vowel motivation clearly is supported, perhaps with the help of the iconic Touch and Visual motivations. Hence vowels seem to be more suited for non-arbitrariness in spatial deictic expressions and closed, front unrounded vowels seems to be the most suited for the proximal term. Due to alternative ways of looking at relations within deictic systems and different iconic or indexical parameters (cf. Diffloth 1994), other motivations are possible and probably exists.

The present findings, combined with previous research, seem to lead us towards functional reasons of why non-arbitrariness, at least in spatial deixis, exists. Children perform

memory, matching and learning tests better if in sound symbolic conditions, regardless of whether the L1 of the parents utilize sound symbolism e.g. ideophones, to a greater extent or not (Kita, Kantartzis and Imai 2010). Sound symbolic words were also understood faster in reaction time tests by adults (Sereno 1994). It was significant that the most clearly supported motivation was that of Hearing–Vowel, which is (a) both indexically and iconically motivated and (b) relies on both the speaker and hearer.

Furthermore, an interesting correlation between the majority of languages supporting the Hearing–Vowel motivation and VO-word order was found. This could strengthen the claim that the Hearing–Vowel motivation being the predominate motivation. However, arguments both supporting and opposing the notion of VO languages being more "iconic" than others were discussed.

As in most cases, answering one complex question poses a handful new ones which ought to be addressed. Further research could include using different approaches for grouping proximal, medial and distal (perhaps combining proximal and medial). For a similar investigation could dramatically change the results. Investigating whether similar findings as those of spatial deixis could be found in other dimensions e.g. the horizontal and thereby including more complex systems could be carried out. Also other types of deixis could be considered e.g. time; *now* and *then*.

A larger sample of languages could be used to confirm the correlation between the frequencies of F2 of vowels associated with distance and VO-word order, and furthermore if confirmed, investigate whether it can be explained by genetic, including early human migration, or areal are the causes. A larger sample of languages with very few speakers and isolates could also be used to find a more apparent correlation with anti-iconicity and anti-indexicality as well. Furthermore the positioning of certain phonemes in words could possibly also yield some yet to be found information about non-arbitrariness in spatial deixis, cf. the vowel positioning of Hixkaryana *oni* (this) and *iro* (that).

Perhaps the most interesting point to look at is what other motivations for non-arbitrariness exists. What type of speech sounds that are important and whether they have iconic or indexical grounds? Investigating this is paramount to even attempt to understand what connects sound to meaning, and thereby better understand how language might have once originated.

References

Abelin, Å., 1999. *Studies in Sound Symbolism: Doctoral Dissertation*. Göteborg University.

Ahlner, F. and Zlatev, J., 2011. Cross-modal iconicity: A cognitive semiotic approach to sound symbolism. *Sign System Studies, vol. 38*.

Anderson, Stephen R. and Keenan, Edward L. 1985. Deixis. In: Timothy Shopen (ed.). *Language Typology and Syntactic Description, vol. III: Grammatical Categories and the Lexicon*. Cambridge: Cambridge University Press, 259-308.

Andrew, R.J. 1963. The origin and evolution of the calls and facial expressions of the primates. *Behavior* 20. 1-109.

Bolinger, D. L. 1964. Intonation as a universal. In H. G. Lunt (ed.) *Proceedings of the Ninth International Congress of Linguistics, 1962*. The Hague: Mouton, 833-844.

Bolinger, D. L. 1978. Intonation across languages. In J.H. Greenburg, C. A. Ferguson, and E. A. Moravcsik (eds.) *Universals of Human Language*, vol 2: *Phonology*. Stanford: University Press, 471-524.

Bybee, Joan, Perkins, Revere and Pagiuca, William. 1994. *The Evolution of Grammar*. Chicago IL: The University of Chicago Press.

Carling, Gerd 2011. The emergence and decay of iconicity in language. *presented at GESUS Prague, May 26, 2011*.

Carling, Gerd & Holmer Arthur. 2011. The methodological tools for interrelating language, culture and nature in (pre)history: a case in Amazonia. *presented at "Centre for Cognitive Semiotics"-seminar, Lund University, May 19, 2011*.

Childs, G.T. 1994. African ideophones. In: L. Hinton, J. Nichols, J.J. Ohala (eds.). *Sound symbolism*. Cambridge: Cambridge University Press, 178-204.

Clark, E.V. 1978. From gesture to word: on the natural history of deixis in language acquisition. In: J.S. Bruner (ed), *Human growth and development*. Oxford: Charendon Press.

Collias, N. E. 1960, An exological and functional classification of animal sounds. In: W. E. Lanyon and W. N. Tavolga (eds.) *Animal Sounds and Communication*. Washington DC: American Institute of the Biological Sciences. Publication no. 7, 368-391.

Conradie C. J. 2001. Structural iconicity: The English -S- and OF-genitives. In: Fischer, Olga and Max Nänny (eds.), *The Motivated Sign*. xiv. Amsterdam: John Benjamins B.V. 229–247.

Danchev, A. 1991. Language change typology and some aspects of the SVO development in English. In: Kastovsky, Dieter, *Historical English syntax*. Berlin: Mouton De Gruyter, 103-124.

Diessel, Holger. 2005. Distance contrasts in demonstratives. In: Martin Haspelmath, Matthew Dryer, David Gil, and Bernard Comrie (eds.), *World Atlas of Language Structures*. Oxford: Oxford University Press. 170-173.

Diffloth, G., 1994. i: big, a: small. In: L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*. Cambridge: Cambridge University Press, 107-114.

Ertel, Suitbert. 1969. *Psychophonetik, Untersuchungen über lautsymbolik und Motivation*. Göttingen: Verlag für Psychologie.

Fant, L.J. 1972. *Ameslan: An introduction to American Sign Language.* Silver Springs, Md.: National Association of the Deaf.

Fónagy, I. 1963. *Die metaphern in der phonetik*. The Hague.

Gärdenfors, P. 1996. Language and the evolution of cognition. In Rialle, V. and Fisette, D., (eds), *Penser l'esprit: Des sciences de la cognition à une philosophie cognitive*. Grenlobe: Presses Universitaires de Grenlobe.

Garstang, M., Larom, D.L., Raspet, R. and Lindeque, M. 1995. Atmospheric controls on elephant communication. *J. exp. Biol*.198, 939–951.

Goldin-Meadow, S 2009. Titel. In: J. Zlatev, M. Andren, M. Johanson, Falck, C. Lundmark (eds.) Studies in Language and Cognition, 363-379. Newcastle: Cambridge Scholars.

Hamano, S. 1994. Palatalization in Japanese sound symbolism. In: L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*. Cambridge: Cambridge University Press, 148-157.

Herder, J. G. 1772/1969 Essay on the origin of speech. In: P.H. Salus (ed.) *On language: Plato to von Humboldt, Holt, Rinehart and Winston*. New York, 147-166.

Hinton, Leane, Nichols, Johanna, and Ohala, John 1994. *Sound Symbolism*. Cambridge: Cambridge University Press.

Hong, C. 1982. *Reading in Chinese Linguistics from Different Historical Periods*. Nanjing: Jiansu People's Press. (in Chinese).

Iivonen, Antti. 1994. A psychoacoustical explanation for the number of IPA vowels. In:
Journal of the International Phonetic Association 24:2, 73-90.

Ikegami, Takashi; Zlatev, Jordan 2007. From non-representational cognition to language. In: Ziemke, Tom; Zlatev, Jordan; Frank, Roslyn M. (eds.), *Body, Language and Mind. Vol 1: Embodiment*. Berlin: Mouton, 241–283.

Jacobsen Jr., W. H. 1994.Nootkan vocative vocalism and its implications. In: L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*. Cambridge: Cambridge University Press, 23-39.

Jespersen, O. 1922a. *Language - its nature, development and origin*. London: Allen and Unwin.

Johansson, S. 2005. *Origins of language: Constraints on hypotheses*. Amsterdam: John Benjamins Publishing Company.

Kaufman, T. 1994. Symbolism and change in the sound system of Huastec. In L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*, Cambridge: Cambridge University Press, 63-75.

Kendon, A., 1996. An Agenda for Gesture Studies. *Semiotic Review of Books vol. 7 (3).*

Kita, Sotaro 2008. World-view of protolanguage speakers as inferred from semantics of sound symbolic words: A case of Japanese mimetics. In: Masataka, Nobuo (ed.) *The Origins of Language, Unraveling Evolutionary forces*. Tokyo: Springer.

Kita, Kantartzis and Imai 2010. Children learn sound symbolic words better: Evolutionary vestige of sound symbolic protolanguage. In: Andrew D. M. Smith,Bart De Boer,Marieke Schouwstra, *Evolution Of Language, The - Proceedings Of The 8Th International Conference (Evolang8).* Singapore: World Scientific Publishing Company Co. Pte. Ltd., 206-213.

Köhler, W. 1929 *Gestalt Psychology*. New York: Liveright.

Langdon, M. 1994. Noise words in Guaraní. In: L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*. Cambridge: Cambridge University Press, 94-103.

Lapolla, R.J, 1994 An experimental investigation into phonetic symbolism as it relates to Mandarin Chinese. In: L. Hinton, J. Nichols, J.J. Ohala (eds.) *Sound symbolism*. Cambridge: Cambridge University Press, 130-147.

Larom, D., Garstang, M., Payne, K., Raspet, R., Lindeque, M. 1997. The influence of surface atmospheric conditions on the range and area reached by animal vocalizations. *Journal of experimental biology* 200 (3): 421–431.

Li, Paul Jen-kuei. 1982. *Male and female forms of speech in the Atayalic group*. Bulletin of the Institute of History and Philology Academia Sinica 53-2: 265-304.

Li, Paul Jen-kuei. 1983. *Types of lexical derivation of men's speech in Mayrinax*. Bulletin of the Institute of History and Philology Academia Sinica 54-3: 1-18.

Lindblad, P. 1998. *Talets akustik och perception*. Göteborgs Universitet.

Ohala, J. J., 1994. The frequency code underlies the sound-symbolic use of voice pitch. In: L. Hinton, J. Nichols, J.J. Ohala (eds.) *Sound symbolism*. Cambridge: Cambridge University Press, 325-347.

Locke, J. 1983. *Phonological acquisition and change*. New York: Academic Press.

Moores, D.F. 1974. Nonvocal systems of verbal behavior. In: R.L. Schiefelbusch and L.L. Lloyd (Eds.), *Language perspectives: Acquisition, retardation, and intervention.* Baltimore: University Park Press.

Müller, Max 1861. *Lectures on the Science of Language*. London: Longmans, Greens and Co.

Nichols, Johanna 1992. *Linguistic Diversity in Space and Time.* Chicago: University of Chicago Press.

Oswalt, R. L. 1971. Inanimate imitatives in Pomo. In Jesse Saweyer (ed.) *Studies in American Indian Languages*. University of California Publications in Linguistics 65, 175-190.

Plato c. 428-348 B.C. *Cratylos dialogue,* 1962. Loeb Classical Library. Harvard University Press. Cambridge.

Ramachandran, Vilayanur. S.; Hubbard, E. M. 2001. Synaesthesia – a window into perception, thought and language. *Journal of Consciousness Studies* 8: 3–34.

Rhodes, R. 1994. Aural images. In: L. Hinton, J. Nichols, J.J. Ohala (eds.): *Sound symbolism*. Cambridge: Cambridge University Press, 276-292.

Saeed, J. 2003. *Semantics, Second Edition*. Malaysia: KHL Printing Co Sdn Bhd.

Sandler, W., Meir, I., Padden, C. and Aronoff, M. 2005. *The emergence of grammar: Systematic structure in a new language*. *PNAS* 102: 2661-2665.

Sapir, E. 1929. A study in phonetic symbolism. In D. Mandelbaum (ed.) *Selected writings*. Berkeley. California.

Saussure, F. 1916/1983. *Course in general linguistics*, Duckworth. London.

Sereno, J. A. 1994. Phonosyntactics. In: L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*. Cambridge: Cambridge University Press, 263-275.

Short, Thomas L. 2007. *Peirce's Theory of Signs*. New York: Cambridge University Press.

Silverstein, M. 1994. Relative motivation in detonational and indexical sound symbolism of Wasco-Wishram Chinookan. In: L. Hinton, J. Nichols, J.J. Ohala (eds). *Sound symbolism*. Cambridge:Cambridge University Press, 40-60.

Tervoort, B.T. 1961. Esoteric symbolism in the communication behavior of young deaf children. *American Annals of the Deaf* 106: 436-480.

Traunmüller, Hartmut 1994. Sound symbolism in deictic words. In: Hans Auli and Peter af Trampe (eds.) *Tongues and Texts Unlimited. Studies in Honour of Tore Jansson on the Occasion of his Sixtieth Anniversary*. Dept. of Classical Languages, Stockholm University, 213-234.

Ultan, R. 1978. Size-sound symbolism. In: J. Greenberg (ed.), *Universals of human language 2*.

Veselinova, Ljuba, N. 2005.*Suppletion in Verb Paradigms*. Amsterdam: John Benjamins Publishing Company.

Williams, Sarah 1995. *Da and its variants in a bilingual context*. Center for Research on Bilingualism, Stockholm University.

Wolff, H. Ekkehard 1993. *Referenzgrammatik des Hausa: Zur Begleitung des Fremdsprachenunterrichts und zur Einführung in das Selbststudium.*Hamburg: LIT Verlag.

Woodworth, N. L. 1991. Sound symbolism in proximal and distal forms. *Linguistics 29*: 273-299.

Zlatev, J. and Andrén, M. 2009 "Stages and transitions in children's semiotic development". In: J. Zlatev, M. Andrén, M. Johansson Falck and C. Lundmark (eds.) *Studies in Language and Cognition, 380-401*. Newcastle: Cambridge Scholars

Online resources

http://*www.wals.info*

http://www.ethnologue.com/web.asp

Maps:
http://www.124diary.com/

Figure 3:
http://www.unil.ch/ling/page24437.html

Language data sources

Number	Language	Source
1.	Abkhaz	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 4.
2.	Ainu	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 25.
3.	Akan/Twi	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 29.
4.	Alamblak	Foley, William A. 1986. *The Papuan languages of New Guinea*. Cambridge: Cambridge University Press, 76.
5.	Albanian	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 39.
6.	Amis	Wu, Jinglan. 2000. *阿美语参考语法 [Reference grammar of Amis]*. Taipei: Yuanliou Publishing, 71.
7.	Apurinã	Narayana, Darbhe and Bhat, Shankara. 2004. *Pronouns*. Oxford: Oxford University Press, 137.
8.	Armenian	Tragut, Jasmine. 2009. *Armenian: modern Eastern Armenian*. Amsterdam: John Benjamins Publishing Co., 129.
9.	Awyu	Lehmann, Christian and Mugdan, Joachim. 2004. *Morphologie*. Berlin: Walter de Gruyter, 1501.
10.	Basque	Trask, Robert Lawrence. 1997. *The history of Basque*. London: Routledge, 220.
11.	Batak	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 185.
12.	Beja	Kaye, Alan, S. 2007. *Morphology of Asia and Africa*. Indiana: Eisenbrauns, 460.
13.	Belorussian	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 191.
14.	Brahui	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 217.
15.	Bunun	Zeitoun, Elizabeth. 2000. *布農语参考语法 [Reference grammar of Bunun]*. Taipei: Yuanliou Publishing, 76.
16.	Buginese	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 232.
17.	Burmese	Campbell, George 1991. *Compendium of the world's*

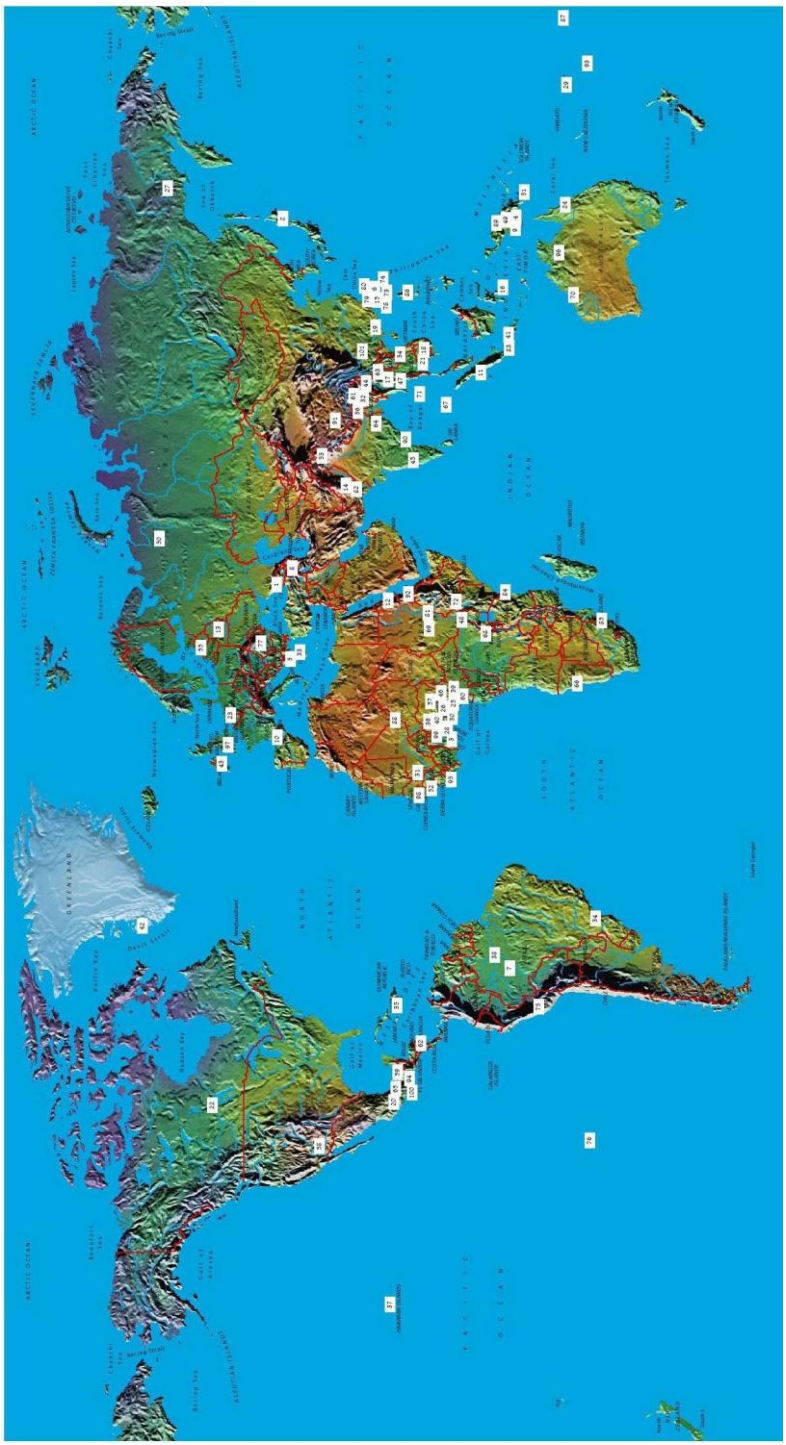
		Languages, vol. I. London: Routledge, 243.
18.	Cambodian (Khmer)	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 257.
19.	Cantonese	Matthews, Stephen and Yip, Virginia. 1994. *Cantonese: a comprehensive grammar*. London: Taylor and Francis Ltd, 89.
20.	Chalcatongo Mixtec	Macaulay, Monica Ann. 1996. *A grammar of Chalcatongo Mixtec*. Berkeley: University of California, 112.
21.	Cham	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 279.
22.	Chipewyan	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 321.
23.	Dutch	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 391.
24.	Dyirbal	Dixon, Robert M. W. 2002. *Australian languages: their nature and development*. Cambridge: Cambridge University Press, 466.
25.	Efik/Ibibio	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 397.
26.	Etsako	Elimelech, Baruch. 1978. A Tonal Grammar of Etsako. Berkeley: University of California, 65.
27.	Even	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 439.
28.	Ewe	Levinson, Stephen C., Wilkins, David P. 2006. *Grammars of space: explorations in cognitive diversity*. Cambridge: Cambridge University Press, 367.
29.	Fijian	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 458.
30.	Fon/Fongbe	Lefebvre, Claire and Brousseau, Anne-Marie. 2002. *A grammar of Fongbe*. Berlin: Mouton de Gruyter, 41.
31.	Fulani/Fula	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 478.
32.	Garo	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 486.
33.	Greek	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 533.
34.	Guaraní	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 539.
35.	Haitian Creol	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 1117.
36.	Hausa	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 557.
37.	Hawaiian	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 563.
38.	Hixkaryana	Derbyshire, Desmond C. 1979. *Hixkaryana*. Amsterdam: North Holland Publishing Company, 57.
39.	Hdi	Frajzyngier, Zygmunt and Shay, Erin. 2001. *A grammar of Hdi*. Berlin: Mouton de Gruyter, 84.
40.	Igbo	Campbell, George 1991. *Compendium of the world's*

		Languages, vol. I. London: Routledge, 601.
41.	Indonesian	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 616.
42.	Inuit West Greenlandic	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 622.
43.	Irish	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 635.
44.	Kachin/Jingpho	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 690.
45.	Kannada/Kanarese	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 699.
46.	Kanuri	Croft, William. 2003. *Typology and universals*. Cambridge: Cambridge University Press, 273.
47.	Karen	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 712.
48.	Keliko	Tucker, A. N. 1940. *The Eastern Sudanic Lanuanges*. London: Oxford University Press, 145.
49.	Kewa	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 1092.
50.	Komi	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 748.
51.	Korafe	Foley, William A. 1986. *The Papuan languages of New Guinea*. Cambridge: Cambridge University Press, 75.
52.	Kpelle	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 760.
53.	Ladakhi	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 776.
54.	Lao	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 791.
55.	Latvian	Campbell, George 1991. *Compendium of the world's Languages, vol. I*. London: Routledge, 809.
56.	Limbu	van Driem, George. 1987. *A grammar of Limbu*. Berlin: Mouton the Gruyer, 26.
57.	Margi	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 899.
58.	Maricopa	Narayana, Darbhe and Bhat, Shankara. 2004. *Pronouns*. Oxford: Oxford University Press, 167.
59.	Maya	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 908.
60.	Mbili	Ayuninjam, Funwi F. 1998. *A reference grammar of Mbili*. Lanham: University Press of America Inc, 231.
61.	Meithei	Chelliah, Shobhana Lakshmi. 1997. *A grammar of Meithei*. Berlin: Mouton the Gruyer, 81.
62.	Miskito	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 933.
63.	Mon	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 943.
64.	Mundari	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 963.

65.	Nahuatl	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 974.
66.	Nama	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 981.
67.	Nicobarese	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1010.
68.	Nkore-Kiga	Taylor, Charles. 1985. *Descriptive Grammars: Nkore-Kiga*. Beckenham: Croom Helm, 53.
69.	Nubian	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1045.
70.	Nyamal	Dixon, Robert M. W. 2002. *Australian languages: their nature and development*. Cambridge: Cambridge University Press, 335.
71.	Onge	Blevins, Juliette. 2007. A Long Lost Sister of Proto-Austronesian? Proto-Ongan, Mother of Jarawa and Onge of the Andaman Islands. *Oceanic Linguistics, Volume 46, Number 1*: 154-198.
72.	Oromo/Galla	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1067.
73.	Paiwan	Zhang, Xiujuan. 2000. *排灣语参考语法[Reference grammar of Paiwan]*. Taipei: Yuanliou Publishing, 92.
74.	Puyuma	Ten, Stacy Fang-Ching. 2008. *A reference grammar of Puyuma, an Austronesian language of Taiwan*. Camberra: Pacific Linguistics, 66.
75.	Quechua	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1145.
76.	Rapanui	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1156.
77.	Romanian	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1161.
78.	Rukai	Zeitoun, Elizabeth. 2007. *A Grammar of Mantauran (Rukai)*. Taipei: Institute of Linguistics, Academica Sinica, 302.
79.	Saisyat	Ye, Meili. 2000. *賽夏语参考语法 [Reference grammar of Saisyat]*. Taipei: Yuanliou Publishing, 84.
80.	Seediq	Holmer, Arthur J. 1996. *A parametric grammar of Seediq*. Lund: Lund University Press.
81.	Shilluk	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1228.
82.	Sindhi	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1236.
83.	Sundanese	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1279.
84.	Swahili	Ashton, E. O. 1947. *Swahili Grammar (including intonation).* London: Longmans, Green and Co Ltd, 58.
85.	Swazi	Zienvogel, D. 1952. *A Grammar of Swazi*. Johannesburg: Witwaterstrand University Press, 45.
86.	Tagalog	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1303.
87.	Tahitian	Campbell, George 1991. *Compendium of the world's*

		Languages, vol. II. London: Routledge, 1308.
88.	Tamashek Tuareg	Heath, Jeffrey. 2005. *A grammar of Tamashek Tuareg (Tuareg of Mali)*. Berlin: Mouton de Gruyter, 240.
89.	Tauya	MacDonald, Lorna. 1990. *A Grammar of Tauya*. Berlin: Mouton the Gruyter, 99.
90.	Telugu	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1337.
91.	Tibetian	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1349.
92.	Tigrinya/Tigrigna	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1359.
93.	Tongan	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1373.
94.	Tzeltal	Levinson, Stephen C. and Wilkins, David P. 2006. *Grammars of space: explorations in cognitive diversity*. Cambridge: Cambridge University Press, 239.
95.	Vai	Welmers, William Everett. 1974. *A grammar of Vai*. Berkeley: University of California Press, 55.
96.	Wardaman	Merlan, Francesca. 1993. *A grammar of Wardaman: a language of the Northern Territory of Australia*. Berlin: Walter de Gruyter and Co, 138.
97.	Welsh Romany	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1167.
98.	Wolof	Lehmann, Christian and Mugdan, Joachim. 2004. *Morphologie.* Berlin: Mouton de Gruyter. 987.
99.	Yoruba	De Gaye, J. A. and Beecroft, W. S. 1964. *Yoruba Grammar*. Routledge and Kegan Paul Ltd, 31.
100.	Zapotec	Campbell, George 1991. *Compendium of the world's Languages, vol. II*. London: Routledge, 1487.
101.	Zhuang	Diller, Anthony V. N., Edmondson, Jerold A., Luo, Yongxian.2008. *The Tai-Kadai languages*. New York: Routledge, 327.

Appendix A: Sampling map



Appendix B: Values of motivations

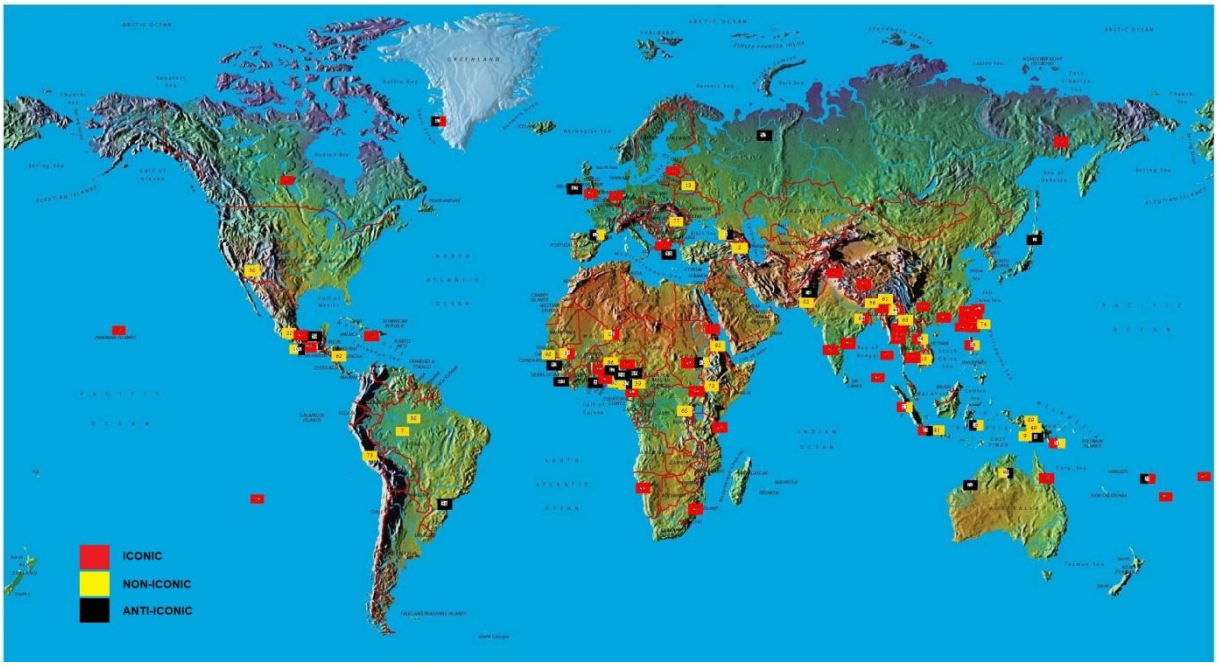
Number	Language	Deictic system	Demonstrative pronoun: proximal	medial	distal	Touch – airflow: motivated	non	anti	Visual – size of mouth: motivated	non	anti	Hearing – vowel: motivated	non	anti	Hearing – consonant: motivated	non	anti	Proto-pointing – air: motivated	non	anti	Proto-pointing – lip: motivated	non	anti
1	Abkhaz	3	a(b)rəj	a(b)nəj		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0
			a(b)rəj		we(b)rəj	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0,5	0	0	0,5	0	0
2	Ainu	2	ta		to	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
3	Akan/Twi	2	(e)há		(e)hó	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
4	Alamblak	2	ɨndarr		ɨndurt	0	0	1	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0
5	Albanian	2	ky		ai	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1
6	Amis	3	ni	ra		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0	0,5	0	0	0,5
			ni		ja	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0	0,5	0	0	0,5
7	Apurinã	2	-je		-kira	0	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0	1	0
8	Armenian	3	sa	da		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0	0,5	0
			sa		na	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0	0,5	0	0	0,5	0
9	Awyu	2	nombo		ep	0	1	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	1
10	Basque	3	au	ori		0	0	0,5	0	0,5	0	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
			au		ura	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0
11	Batak	3	on	an		0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0	0	0,5	0	0	0	0,5
			on		aduwi	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0	0,5	0	0	0	0,5	0
12	Beja	2	-ɯ́-		-eé-	1	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	1
13	Belorussian	2	getɨ		tou	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
14	Brahui	3	da:	o:		0	0	0,5	0	0	0,5	0,5	0	0	0	0,5	0	0	0	0,5	0,5	0	0
			da:		e:	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0	0,5	0	0	0,5
15	Bunun	3	-in	-an		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
			-in		-a	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0	0,5	0	0	0,5
16	Buginese	3	-e/-we	-tu		0	0	0,5	0	0	0,5	0,5	0	0	0	0	0,5	0,5	0	0	0	0,5	0
			-e/-we		-ro	0	0,5	0	0	0	0,5	0,5	0	0	0	0,5	0	0	0	0,5	0	0	0,5
17	Burmese	2	di		ho	1	0	0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	0
18	Cambodian (Khmer)	2	nih		nuh	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
19	Cantonese	2	ni1		go2	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	1	0	0
20	Chalcatongo Mixtec	2	ʐaʔá		wãã́	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	1	0	0
21	Cham	2	ni(i)		nan	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
22	Chipewyan	2	diri		ʔɛji	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1
23	Dutch	2	dit		dat	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
24	Dyirbal	2	gi-		ba-	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
25	Efik/Ibibio	3	ɛ́mì	órò		0	0,5	0	0	0	0,5	0,5	0	0	0	0,5	0	0	0	0,5	0,5	0	0
			ɛ́mì		ókò	0	0	0,5	0	0	0,5	0,5	0	0	0	0	0,5	0,5	0	0	0,5	0	0
26	Etsako	2	ɔ̀nà		ɔ́ní	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0	0	1	0
27	Even	2	ərək		tara:k	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
28	Ewe	2	sia		kemá	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	1
29	Fijian	3	oŋgo:	oŋgori		0	0	0,5	0,5	0	0	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
			oŋgo:		(k)oja	0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0	0,5	0	0	0	0,5	0
30	Fon/Fongbe	2	(é)lɔ́		(é)nɛ́	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0	0
31	Fulani/Fula	3	o	on		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0	0,5	0
			o		oja	0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
32	Garo	2	ia		aoa	1	0	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
33	Greek	2	aut-		ekein-	0	0	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1
34	Guaraní	2	ko/koʔã		aipo(v)a	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	1	0	0
35	Haitian Creol	2	sa-a		sila-a	1	0	0	1	0	0	0	0	1	1	0	0	0	1	0	0	1	0
36	Hausa	2	nan		can	0	1	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1
37	Hawaiian	3	(kee)ia	(kee)naa		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
			(kee)ia		(kee)laa	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0

38	Hixkaryana	2	oni		iro	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	1
39	Hdi	3	ná	já		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5
			ná		á	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5
40	Igbo	2	à		ahù	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
41	Indonesian	2	itu		ini	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1
42	Inuit West Greenlandic	3	manna	una		0	0	0,5	0	0	0,5	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
			manna		inŋa	0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
43	Irish	3	ʃo:	ʃin		0	0	0,5	0,5	0	0	0	0	0,5	0,5	0	0	0,5	0	0	0	0	0,5
			ʃo:		ʃu:gʸ	0	0	0,5	0	0	0,5	0,5	0	0	0	0,5	0	0,5	0	0	0	0,5	0
44	Kachin/Jingpho	3	ndai	dai		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0
			ndai		waw	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
45	Kannada/Kanarese	2	i:/intha		a:/antha	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
46	Kanuri	2	ádə		túdù	0	0	1	0	0	1	1	0	0	0	0	1	0	1	0	1	0	0
47	Karen	2	i		ne	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
48	Keliko	2	nɔ		na	1	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	1
49	Kewa	2	go		mo	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	1	0	0
50	Komi	2	tajə		sijo	0	0	1	0	0	1	0	0	1	0	1	0	0	0	1	1	0	0
51	Korafe	3	e	a		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
			e		o	0	0,5	0	0	0	0,5	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
52	Kpelle	2	ŋei		ti	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0
53	Ladakhi	3	i	ote		0,5	0	0	0	0,5	0	0,5	0	0	0	0,5	0	0,5	0	0	0,5	0	0
			i		te	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0	0	0,5	0	0
54	Lao	3	nii	nan		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
			nii		pʰun	0	0,5	0	0	0	0,5	0,5	0	0	0	0	0,5	0,5	0	0	0,5	0	0
55	Latvian	2	ʃi-		ta-	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
56	Limbu	2	koŋ		kʰeŋ	0	1	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	1
57	Margi	3	ku	ta		0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0	0,5	0	0	0	0	0,5
			ku		na	0,5	0	0	0,5	0	0	0	0	0,5	0,5	0	0	0	0	0,5	0	0	0,5
58	Maricopa	3	da	va		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0
			da		aas	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0
59	Maya	3	a	o		0	0	0,5	0	0	0,5	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
			a		e	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
60	Mbili	2	-i/-i:		-a/-ɛ	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
61	Meithei	2	si		tu	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	1	0	0
62	Miskito	2	naha		baha	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0
63	Mon	2	ano?		akoh	0	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1
64	Mundari	3	ne	en		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0
			ne		han	0,5	0	0	0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0	0	0,5	0
65	Nahuatl	2	inin		inon	1	0	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
66	Nama	2	nee		llnăă'	1	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	1	0
67	Nicobarese	2	nẽe		ane	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
68	Nkore-Kiga	2	ogu		ogwu	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0	0
69	Nubian	3	in(i)	tar		0,5	0	0	0,5	0	0	0,5	0	0	0	0	0,5	0,5	0	0	0	0,5	0
			in(i)		man	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
70	Nyamal	2	ɲa		nuŋa	0	0	1	0	0	1	1	0	0	0	1	0	1	0	0	1	0	0
71	Onge	3	li	lə		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
			li		lua	0,5	0	0	0	0,5	0	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
72	Oromo/Galla	2	xuni		suni	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0	0
73	Paiwan	2	itso		ðua	1	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	1	0
74	Puyuma	3	iɖi	iɖu		0	0,5	0	0	0	0,5	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
			iɖi		iɖiju	0	0,5	0	0	0	0,5	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
75	Quechua	3	kaj	ʧaj		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0
			kaj		wak	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0

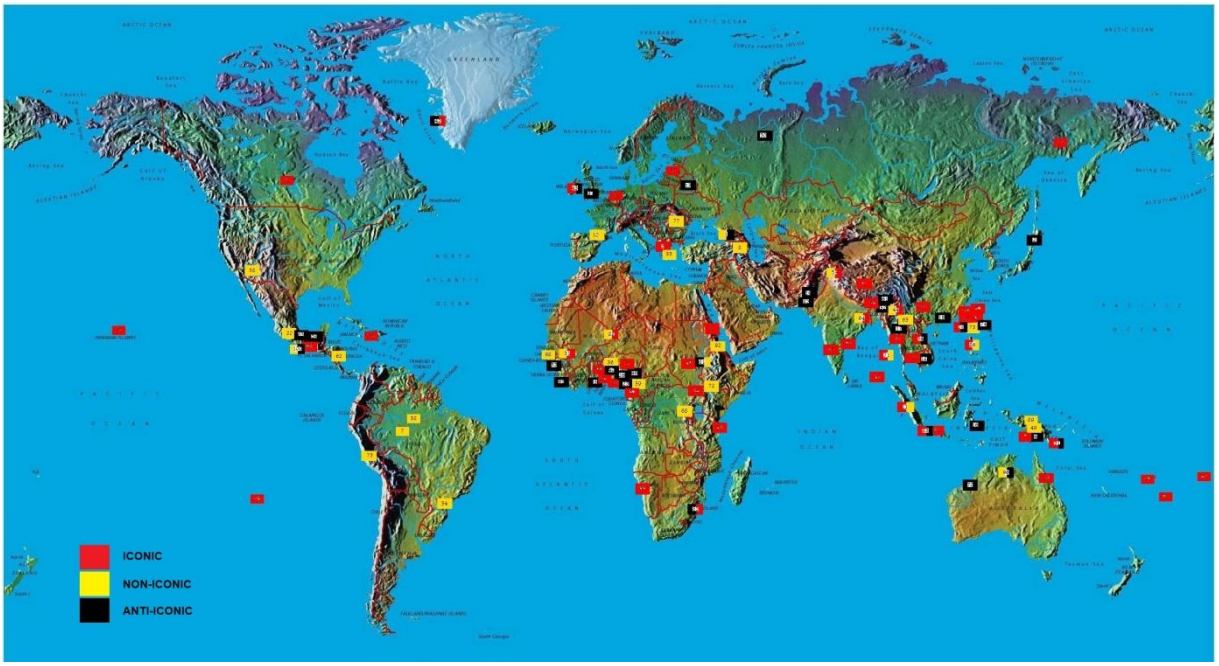
76	Rapanui	3	nei	ena		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
			nei		ra	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0	0,5	0	0	0,5
77	Romanian	2	atʃest(a)		atʃel(a)	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	0
78	Rukai	3	ʔina	ana		0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0	0,5	0	0,5	0
			ʔina		ona	0,5	0	0	0	0	0,5	0,5	0	0	0,5	0	0	0	0	0,5	0,5	0	0
79	Saisyat	2	hiniʔ		hiðaʔ	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
80	Seediq	3	ni:	kia		0,5	0	0	0,5	0	0	0,5	0	0	0	0	0,5	0,5	0	0	0	0	0,5
			ni:		gaga	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0	0	0	0	0,5
81	Shilluk	3	àn	ɛ´ni		0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
			àn		àtʃà	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0,5	0	0	0	0,5	0
82	Sindhi	2	hi:		hu:	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
83	Sundanese	3	ieu	eta		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0	0	0	0	0,5
			ieu		itu	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0,5	0	0	0	0,5	0
84	Swahili	2	h-		-le	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0
85	Swazi	3	-i	-o		0,5	0	0	0	0	0,5	0,5	0	0	0	0,5	0	0	0,5	0	0,5	0	0
			-i		-a	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
86	Tagalog	3	ito	ijan		0,5	0	0	0,5	0	0	0	0	0,5	0,5	0	0	0	0	0,5	0	0	0,5
			ito		ijon	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0	0	0,5	0	0,5	0
87	Tahitian	3	teie	te:na		0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0
			teie		te:ra	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0
88	Tamashek Tuareg	3	-hi	-dí		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0
			-hi		-én	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0
89	Tauya	2	me		ʔe	0	1	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1
90	Telugu	2	idi		adi	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
91	Tibetan	2	di		de	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
92	Tigrinya/Tigrigna	2	-z-		-t-	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0
93	Tongan	3	ni	na		0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5	0	0	0,5	0
			ni		ia	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0	0,5	0	0	0,5
94	Tzeltal	2	ini		mene	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0
95	Vai	2	mɛ´ɛ`		mɛ`núú	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
96	Wardaman	3	dana	nana		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0	0,5	0
			dana		darni	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
97	Welsh Romany	2	kadava		kodova	1	0	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	0
98	Wolof	3	-rda	-ja		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0	0,5
			-rda		-wa	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0
99	Yoruba	2	-ji		-na	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0
100	Zapotec	3	nga	na		0	0,5	0	0	0,5	0	0	0,5	0	0	0,5	0	0	0	0,5	0	0,5	0
			nga		niʔ	0	0	0,5	0	0	0,5	0	0	0,5	0	0,5	0	0	0,5	0	0	0,5	0
101	Zhuang	2	ni6		te1	1	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	0
Number	**Language**	**Deictic**	**proximal**	**medial**	**distal**	**Touch – airflow**			**Visual – size of mouth**			**Hearing – vowel**			**Hearing – consonant**			**Proto-pointing – air**			**Proto-pointing – lip**		
		system				**motivated**	**non**	**anti**	**motivated**	**non**	**anti**	**motivated**	**non**	**anti**	**motivated**	**non**	**anti**	**motivated**	**non**	**anti**	**motivated**	**non**	**anti**
						47,5	33,5	20	44,5	27	29,5	56	22,5	22,5	13	74,5	13,5	35	45	21	42,5	36,5	22
		motivated vs non-motivated				0,00763			1			0,09489			0,49068			0,99286			0,72752		
		motivated vs anti-motivated				0,00007			0,57749			0,04025			0,00065			0,04071			0,00843		
		motivated vs non-motivated				0,00007			1			0,02841			0,05964			0,89074			0,24995		
		motivated vs anti-motivated				0,00007			0,57749			0,04025			0,00065			0,04071			0,00843		
		anti-motivated vs non-motivated				0,5			1			0,44693			0,97328			0,99907			0,97603		

Appendix C: Result maps

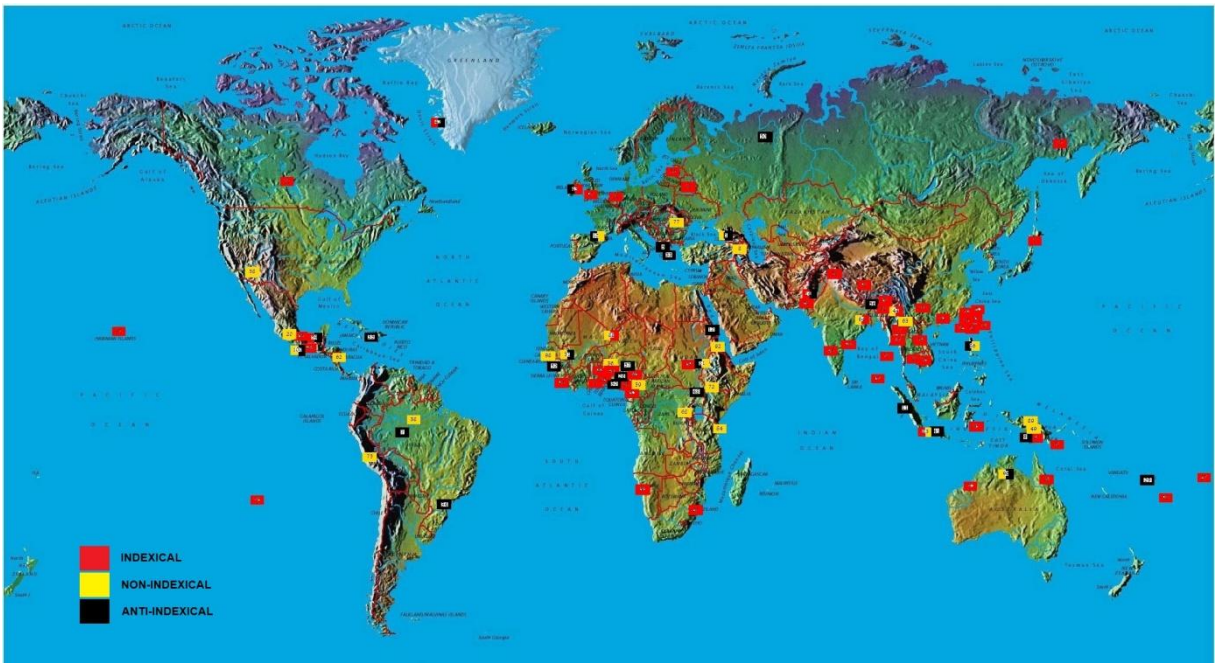
Touch



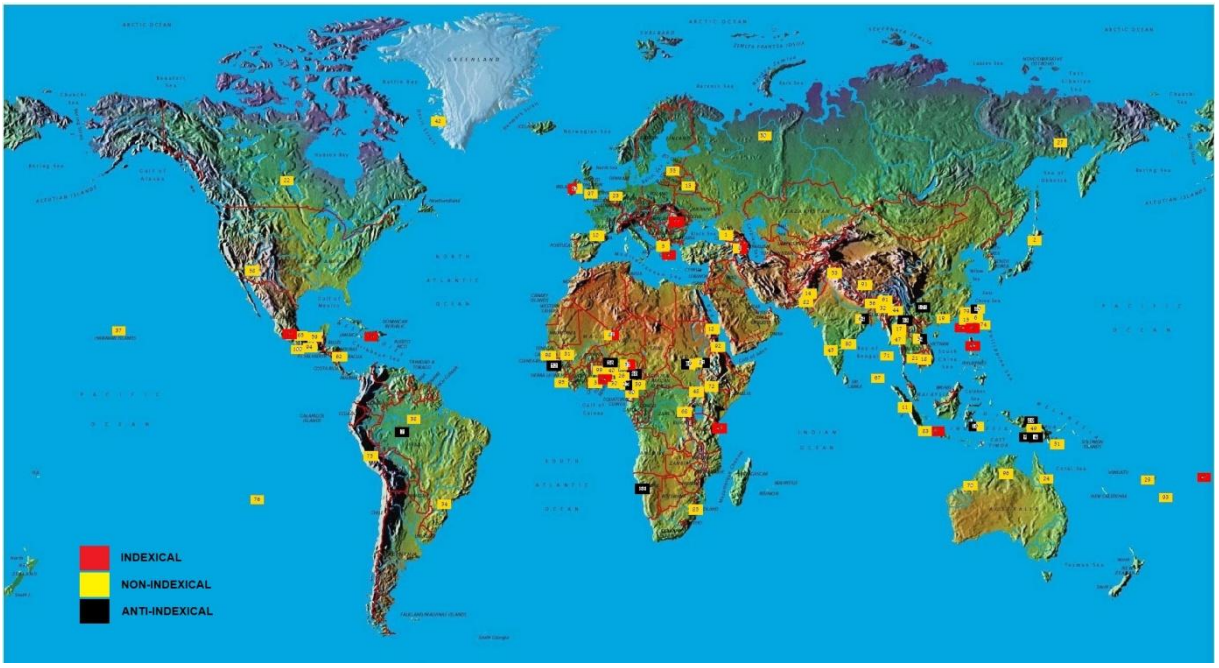
Visual



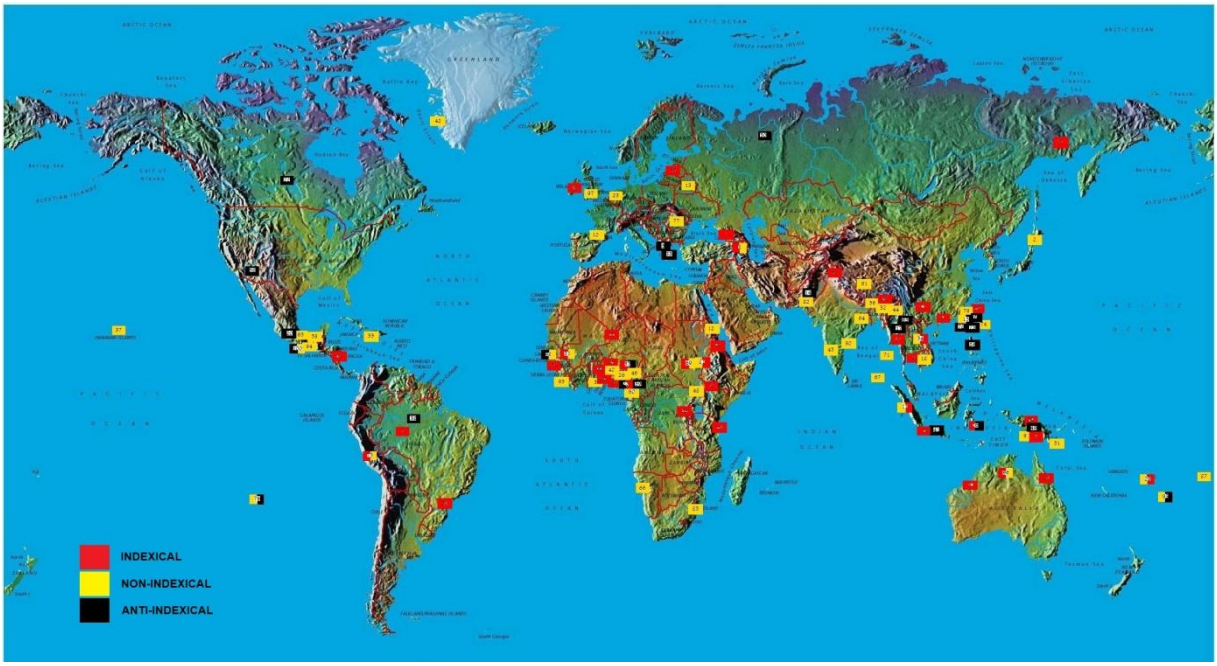
Hearing–Vowel



Hearing–Consonant



Proto-Pointing–Air



Proto-Pointing–Lip