

# Lexical Comparisons of Signed Languages and the Effects of Iconicity<sup>1</sup>

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*Lexical comparisons of signed languages present new methodological challenges not found in comparisons of spoken languages. Two standards for comparing wordlists are examined using a sample of four European sign languages that are not known to be related to each other and a second sample of different dialects of the signed languages of Spain. The use of different standards is shown to affect the numerical results; comparing signs on the basis of probable historical relatedness typically yields percentages that are 5-10% greater than comparisons on the basis of similarity. The amount of iconicity inherent in signed languages affects the wordlist scores even more. Comparing lexical items that were chosen for their low potential for iconicity resulted in significantly lower scores among unrelated languages than did word lists of basic vocabulary or highly iconic signs. Conversely, the non-iconic word list comparison showed greater similarity between closely related language varieties. Therefore, wordlists that are low in iconicity give more insightful results than wordlists that include significant numbers of iconic items.*

## 1. Similarity and cognate studies

There are two different approaches to lexical comparisons that have been used in the study of sign language variation, each with distinct objectives. Studies of LEXICAL SIMILARITY investigate to what extent the words of two languages are similar, often with the hopes of making a further correlation to the intelligibility between languages. For example, *family* and the Spanish equivalent *familia* are very similar to each other. If an English speaker heard the word *familia*, he might be able to guess the correct meaning. In most cases, the greater the lexical similarity between two variations, the more likely it is that they will be able to understand each other. Lexical similarity is only one of many factors that determine intelligibility; nevertheless it is a relatively easy place to start.

The second main approach looks for HISTORICAL RELATEDNESS. Two words that are historically related are called COGNATES. While lexical similarity is most concerned with how languages appear at the present time, cognate studies are most concerned that the two varieties had the same historical root. It is possible that at one time two words may have been historically very similar, but with the natural changes that occur over time, the two words have evolved into forms that are so distinct as not to be easily recognizable. For example, the words *eight* and the Spanish equivalent *ocho* do not look or sound at all similar, yet they can both be traced to the Latin word *octo* (Campbell 1998). In making judgements about similarity, the assumption is that a monolingual Spanish speaker would not understand the English word. For the person studying similarity, this lack of potential intelligibility is significant. For the historical linguist, it is of little concern.

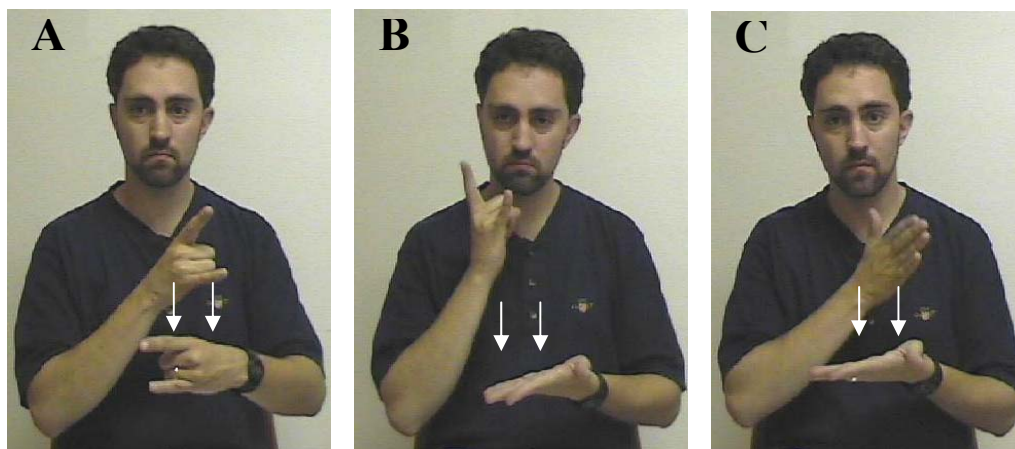
For sign languages, consider three signs that mean MEAT, in figure 1, used in different cities in Spain<sup>2</sup>. At first glance it is easy to see that A and B are probably related, and that B and C are related, but

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if one were to look only at A and C, the historical relationship might not be immediately obvious. More importantly, the signer of variety A would likely have a harder time understanding variety C than understanding variety B. (It is likely, however, that C would understand A because A is very iconic—an issue we will address momentarily.)

As we have seen, two words can be cognates without much similarity in how they appear in the language. While similarity is relatively easy to judge, cognates are more difficult because sometimes words appear to be cognates but really they are not. For example, the words *madre* in Spanish and *mae* in Thai (both meaning female parent) look a lot alike; a natural sound change called intervocalic deletion could very easily have deleted the intermediate consonants. The meaning of the two words is the same but the similarity is coincidental<sup>3</sup>—they are called false cognates or chance cognates. When searching for historical relatedness between two languages, it is important to reduce the number of potential false cognates.



**Figure 1: MEAT in three dialects of Spanish Sign Language**

In four unrelated sign languages<sup>4</sup>, the sign for BOOK is exactly the same, as illustrated in figure 2.

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<sup>2</sup>Variety A is common in the central and northern parts of Spain. Variety B is used in Valencia and parts of Andalucía. C is used in Barcelona, Valencia and parts of Andalucía.

<sup>3</sup>The references to “coincidence” and “chance” in this paper refer to the lack of historical relatedness or borrowing. It does not deny that the words for *mother* and *father* around the world tend to use those sounds that are first articulated by infants, nor does it deny that the reason for chance similarity in sign languages is primarily based on iconicity.

<sup>4</sup>Sign languages used in this comparison come from Spain, Northern Ireland, Finland and Bulgaria. There is no known relation between any of these sign languages other than that they are all from Europe.



**Figure 2: BOOK in four unrelated sign languages**

We can hypothesize three ways in which these languages came to use the identical sign for BOOK:

1. All the sign languages were originally one sign language and the sign BOOK was passed down to each language without change. This is unlikely since there is no other evidence that any of these languages had any direct historical relation.
2. Each language borrowed the sign from a common source. Since all four languages are from Europe, this is a possibility.
3. The sign was invented without foreign influence. When the sign BOOK was invented in each language, each inventor took some prototypical aspect about a book (that it opens and closes) and created the sign.

If option 3 is correct, the fact that the signs are identical is due to chance, but it is chance based on iconicity. ICONIC SIGNS look or act like the thing they represent. Iconicity skews the results of cognate studies.

Sign languages make great use of iconicity. The vast majority of signs in a sign language have some iconic reference. While some, like BOOK, are obvious, others are subtler. The sign WINE (figure 3A), used throughout much of Spain, comes from the idea of sniffing the wine before pouring it. An apparently older version of the sign is still used in Cordoba, in which the handshape more closely resembles a bottle (figure 3B). It is possible that the original sign used the bottle handshape and moved it back and forth under the nose.

Signs that are articulated close to a part of the body tend to migrate in one of two directions: closer to the part of the body so that the hand makes contact; or away from the body into the neutral space in front of the signer. These natural tendencies are called FORMATIONAL CONSTRAINTS. By understanding these constraints it becomes easier to determine which signs might be historically related. A full discussion of formational constraints is beyond the scope of this paper (Battison 1974, Mandel 1981, Klima and Bellugi 1979, Frishberg 1975, Siple 1978, Swicher, Christie and Miller, 1989, Woodward 1982, 1985, 1987).



**Figure 3: WINE in two dialects of Spanish Sign Language**

In addition to chance cognates, which skew comparison results, there are also loan words. The word *karaoke* in Spanish and English was borrowed directly from Japanese. Because this word appears in all three languages does not mean that they are genetically related<sup>5</sup>. The same thing can happen to sign languages. The similarity between the different signs for EUROPE in the four unrelated sign languages is not likely from the same chance process that occurred with BOOK. More likely, the sign was invented in one location and then others saw the sign and copied it, introducing the sign into the language. Again, to use this sign as an example of how these four languages are historically related would be inaccurate.

Historical relatedness is considered a better judge of intelligibility than mere similarity. If two languages are related there will be relatedness across all the linguistic disciplines--phonology, morphology, syntax, idioms, etc. It is possible that a language may have borrowed lexical items from a dominant language while the rest of the language remains radically different from that language. For example, many indigenous languages in Mexico borrow heavily from Spanish and this might give the impression that the languages must be somewhat mutually intelligible. However, the vast difference in syntax and morphology (among other factors) makes the languages completely unintelligible to each other.

In this paper we are chiefly interested in two factors: 1. How does the decision to look for similarity rather than possible cognates affect the results of a lexical study? 2. How does the choice of vocabulary, particularly the choice of iconic or non-iconic signs, affect the results?

## 2. Background

Between 1995 and 1996 we conducted a survey of the varieties of sign language used in Spain, testing for lexical similarity using word lists (and for intelligibility, using recorded text tests) (Parkhurst and Parkhurst, 2001). The lexical information was gathered from 18 locations around Spain using a list of 200 basic vocabulary words. The selection of vocabulary was an attempt to represent a cross section of the language without regard to the role of iconicity.

Other studies whose lexical items were chosen to show a general cross section of the language include these:

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<sup>5</sup>We make a distinction between genetic relatedness, in which two languages can be traced to the same parent language, versus relatedness due to borrowing, in which two languages may have borrowed from each other but their origins can be traced to two distinct original languages. We use the terms historically related and genetically related as synonymous.

- Bickford 1991: Mexico
- Bickford, in preparation: Eastern Europe
- Woodward 1991: Costa Rica
- Woodward 1993: India, Pakistan and Nepal
- Woodward 1996: Thailand

### 3. Methodology

In this present paper we compared lists of signs from four different countries: Spain, Northern Ireland, Finland, and Bulgaria<sup>6</sup>. There is no known historical connection between any of these countries other than that they are all in Europe and therefore there is some interaction between communities at European events. We also compared sign language varieties from five Spanish cities: Madrid, La Coruña, Granada, Valencia and Barcelona (Figure 4). The word lists consisted of approximately 200 basic vocabulary words (Appendix A). From that master list we made a second list of 50 signs that were not likely to be highly iconic, as well as another list of 50 nouns such as animals, foods and easily identifiable objects (Appendix B).



Figure 4: Map of Spain, showing the locations mentioned in the Spanish portion of this study

The 200-word lists were compared and scored using two different criteria. First we tested for similarity. Would the varieties in comparison be considered similar enough to be understood by each other? In this case we used a three-level scale: the same or very similar, somewhat similar, quite different. Secondly we judged according to possible cognates<sup>7</sup>. Could these varieties have possibly evolved from the same root? In this case we only used a binary scale of yes or no.

The nouns and non-iconic word lists were evaluated using only the cognate criteria.

### 4. Similarity or cognates

Figure 5 and Graph 1 show the results of the comparisons of similarity and cognates for the unrelated languages based on the list of 200 basic vocabulary items. (In figure 5, the upper left-hand corner of the cell shows the percentage; the lower right-hand corner gives the actual number of signs tested.)

<sup>6</sup>Data from Spain and Northern Ireland were gathered by Stephen Parkhurst; from Finland, by Niina Rissanen; and from Bulgaria, by Beverly Staley.

<sup>7</sup>Throughout this paper our reference to cognates is based on *potential cognates*. Unless one can show systematic correspondences of how the language has changed over time, they cannot be called real cognates. We know that there is historical relatedness between language varieties in Spain and therefore many of the potential cognates may in fact be real cognates, whereas the comparisons of the four unrelated languages, by definition, precludes any possibility of their being real cognates. However, whether the cognates are real or potential, the process of judging cognates (such as looking for natural changes based on formational constraints) is the same.

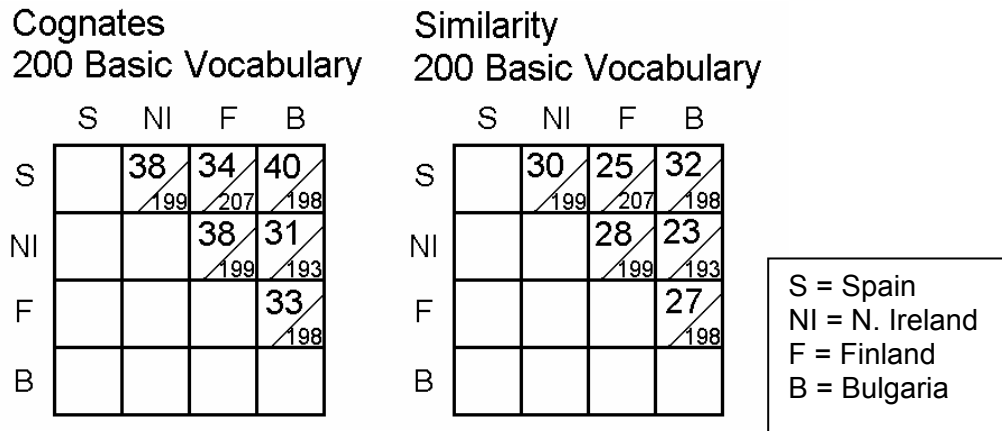
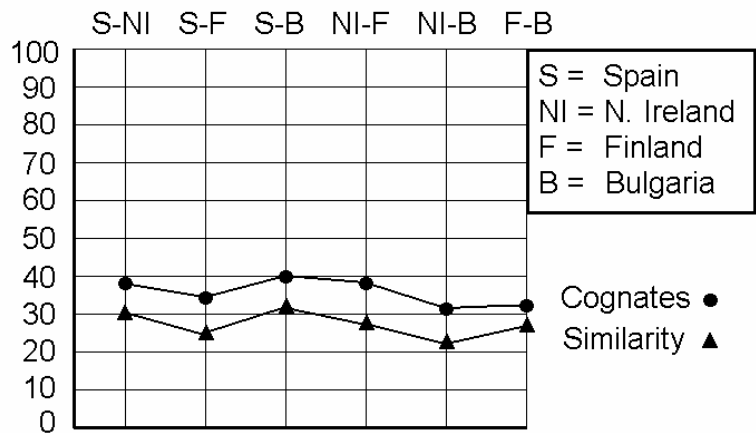


Figure 5: Similarity and cognate scores based on the same list of basic vocabulary for unrelated languages.



Graph 1: Similarity and cognate scores based on the same list of basic vocabulary for unrelated languages

The criteria for determining potential cognates were more lenient than the similarity criterion. In other words, some signs were considered potential cognates even though they were not highly similar. For example, the two signs for milk in figure 6 might be considered cognates since it is possible for both to have evolved from the same root sign. Variety B (used in Northern Ireland) could have evolved from A when someone changed the location from neutral space to the mouth as in other signs for drinkable liquids. Signs touching the face tend to be one-handed, and if the thumb touches the mouth then the handshape could feasibly change from a fist to a claw. The reverse process is also possible. The sign could have originated near the mouth but then moved to a more neutral location in front of the signer. Either way, it is possible that there could be a historical relationship between the two signs. Nevertheless, the difference in location, handshape, number of hands, and movement all imply that they are not currently very similar to each other. The result of this difference in scoring is a lower overall score for similarity.

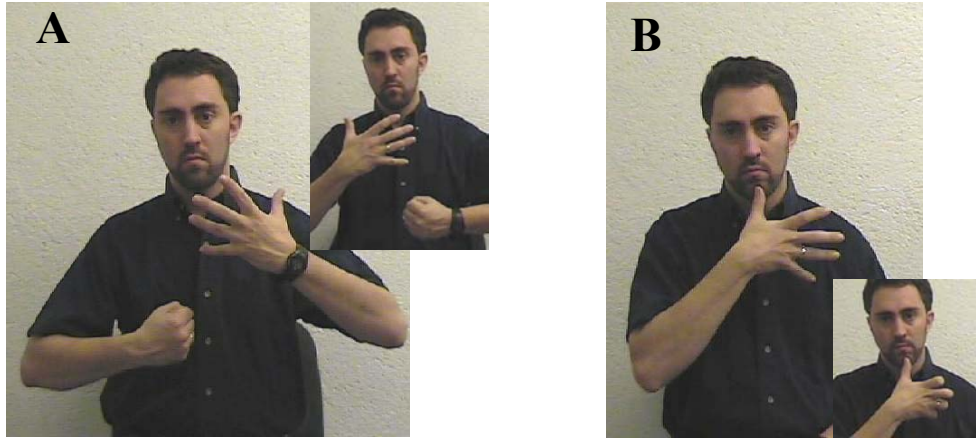


Figure 6: MILK

As expected, in every case, the similarity scores were lower (from 6 to 10 percentage points) than the cognate scores. A much larger sampling of unrelated languages is needed to make any reliable estimate of what is an average range of similarity and cognates for unrelated languages. Nevertheless, it appears that cognate scores will be slightly higher than similarity scores for unrelated languages. Appendix C displays similar results from the comparison of the nouns list and non-iconic vocabulary lists for both cognates and similarity.

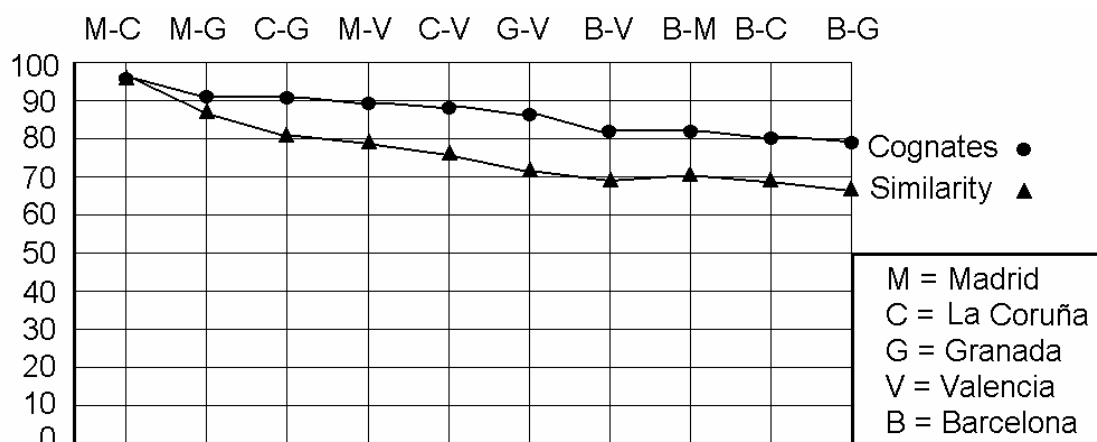
Next we compared cognate and similarity scores for five related sign language varieties. According to our previous work based on lexical similarity, intelligibility and sociolinguistic factors, we found that Madrid, La Coruña, and Granada showed some variation between each other but formed part of a larger cluster of closely related variations. The Valencian dialect was less similar to the first three and Barcelona was even more distinct from all others, yet all are clearly related.

Figure 7 and Graph 2 show the results of the comparisons of similarity and cognates for the related language varieties based on the 200 basic vocabulary lists.

Cognates						Similarity					
200 Basic Vocabulary						200 Basic Vocabulary					
	M	C	G	V	B		M	C	G	V	B
M		96	91	89	82	M		96	87	79	71
C			91	88	80	C			81	76	69
G				86	79	G				72	67
V					82	V					69
B						B					

M = Madrid  
 C = La Coruña  
 G = Granada  
 V = Valencia  
 B = Barcelona

Figure 7: Similarity and cognate scores based on a list of 200 basic vocabulary items between related languages.



**Graph 2: Similarity and cognate scores based on a list of 200 basic vocabulary items between related languages.**

Again, cognate scores were consistently higher than similarity scores by similar degrees as we found for unrelated languages. With the exception of Madrid-La Coruña and Madrid-Granada, the differences were between 10 and 14 percentage points higher. The two highest similarity scores, Madrid-La Coruña and Madrid-Granada, showed only 0 to 4 percentage points difference. It appears that if two languages are very similar, there is a good chance that the cognate scores will reflect similarity scores more closely. However, when the similarity drops to 80% or lower, there is a fairly even range of difference between similarity and cognate scores. As with the unrelated languages, the two scores closely parallel each other. Again our comparisons of the short lists in Appendix C followed this same pattern.

Studies by Woodward (1991, 1993, 1996) counted probable cognates<sup>8</sup>. Others, such as Parkhurst and Parkhurst (2001) and Bickford (1991, in preparation) counted similarity. If we wanted to hypothesize about the similarity between two languages that Woodward compared, assuming that they do not exhibit high cognate counts (above 90%), we could recalibrate the scores by lowering everything by approximately 10 percentage points. Likewise, if we wanted to approximate cognate scores for Bickford's data, we could expect that a recalibration of the scores would raise them by a similar amount. Of course this would only be an approximation since judgements of cognates and similarity are somewhat subjective. Nevertheless, the evidence so far suggests that this recalibration of the scores can enable meaningful comparisons of the two methods of comparison.

## 5. The role of iconicity

Now let us examine the same data with the objective of isolating the factor of iconicity. We mentioned before that the basic vocabulary list was not controlled for iconicity; the nouns list used vocabulary that is likely to be highly iconic, and the non-iconic wordlist attempted to eliminate as much iconicity as possible. Graph 3 shows how the unrelated languages compared for cognates using the 200-word basic vocabulary list, 50 non-iconic signs list and the 50 nouns list. Some clear patterns emerge. Figure 8 presents the scores for the non-iconic vocabulary and the nouns lists, and figure 5, above, gives the scores for the basic vocabulary lists.

<sup>8</sup>Woodward does not specify what criteria he used other than that he used a binary scale.

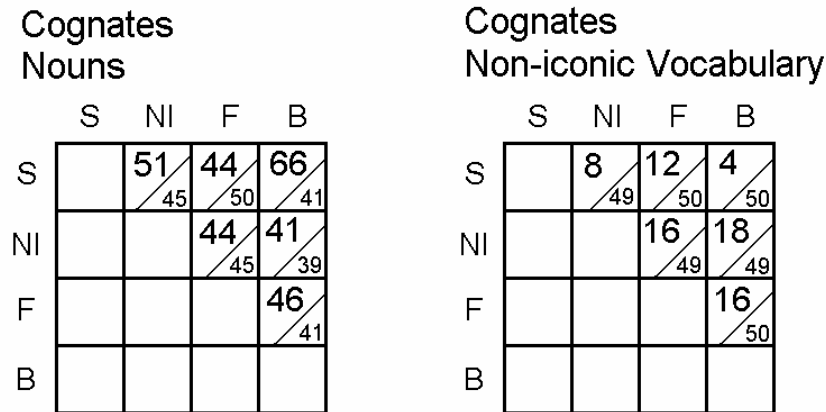
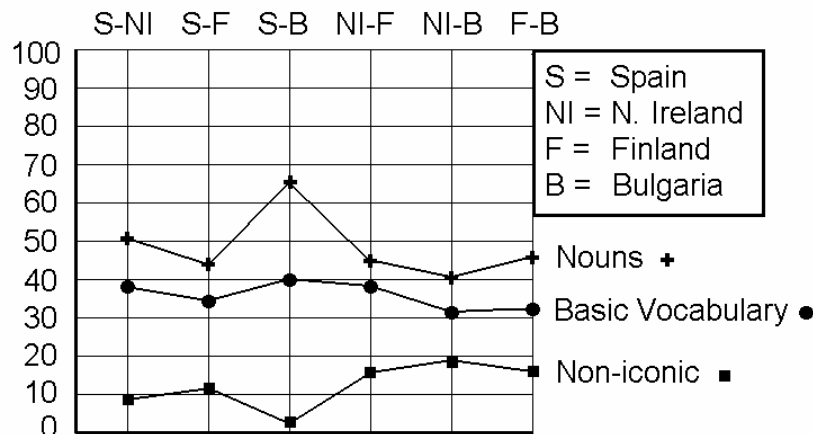


Figure 8: Cognate scores based on basic vocabulary, nouns and non-iconic vocabulary for unrelated languages<sup>9</sup>



Graph 3: Cognate scores based on basic vocabulary, nouns and non-iconic vocabulary for unrelated languages

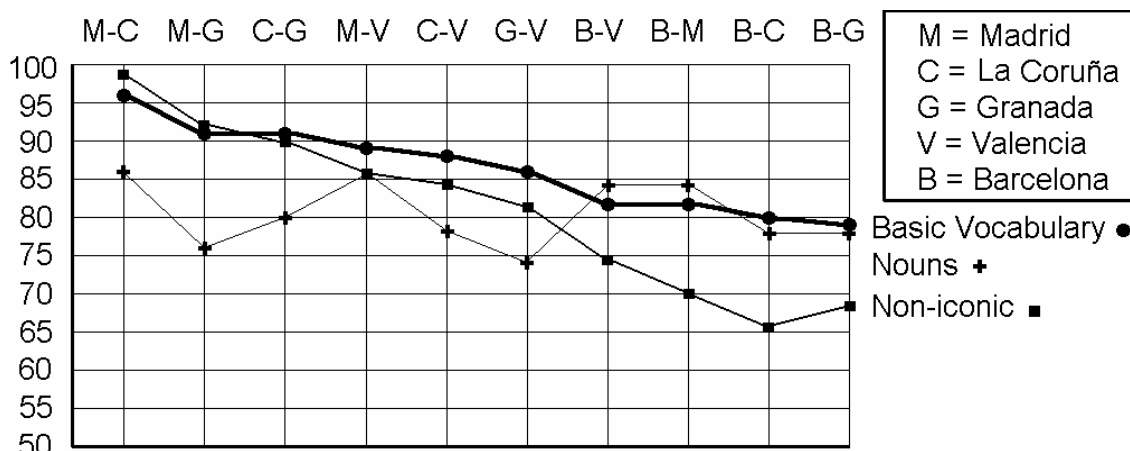
Since both the noun list and the non-iconic list only had approximately 50 items, the range of variation (14 percentage points for the non-iconic comparisons and 25 percentage points for the nouns) was greater than for the basic vocabulary (9 percentage points). Even so, we see clearly that the non-iconic list drops the chance cognates to a much lower level while the nouns (highly iconic signs) raised the score significantly. One comparison, Spain-Bulgaria, the number of apparent cognates among the 50 nouns is so high that one might be tempted to think that the two languages were related. Yet the same comparison with non-iconic words showed no relationship whatsoever.

Now let us look at the results of the comparisons between related languages based on these three lists. (Note: the scale on graph 4 is increased so that the differences can be seen more clearly.) Figure 9 presents the scores of the non-iconic vocabulary and nouns lists while figure 7 above gives the scores for the basic vocabulary comparisons.

<sup>9</sup>As before, the upper left corner shows the percentage of cognates; the lower right corner gives the actual number of signs tested.

Cognates Nouns						Cognates Non-iconic Vocabulary					
	M	C	G	V	B		M	C	G	V	B
M		86	76	86	84	M		98	92	86	70
C			80	78	78	C <td></td> <td></td> <td>90</td> <td>84</td> <td>66</td>			90	84	66
G				74	78	G <td></td> <td></td> <td></td> <td>82</td> <td>68</td>				82	68
V					84	V <td></td> <td></td> <td></td> <td></td> <td>74</td>					74
B						B <td></td> <td></td> <td></td> <td></td> <td></td>					

Figure 9: Cognate scores for non-iconic vocabulary and nouns between related languages.



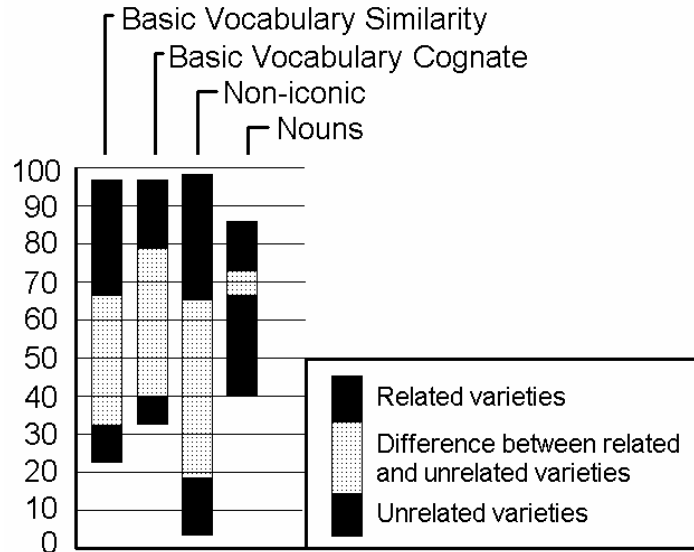
Graph 4: Cognate scores based on basic vocabulary, nouns and non-iconic vocabulary between related languages

With unrelated languages (Graph 3), we saw that comparing the non-iconic word list resulted in scores that were significantly lower than the basic vocabulary scores (between 13 and 36 percentage points lower). With related varieties that scored 85% or higher on basic vocabulary, the non-iconic scores were similar to the basic vocabulary scores (within 4 percentage points). With the most closely related varieties, the non-iconic scores were actually higher than the basic vocabulary scores, which is a very different pattern than we saw with unrelated languages. When the basic vocabulary scores dropped below 85%, the gap between the two increased significantly (8 – 14 percentage points).

When comparing highly iconic nouns from unrelated languages, we saw that the scores were significantly higher than the basic vocabulary scores (between 6 and 26 percentage points). With related languages, we saw that the scores were often lower than the basic vocabulary comparisons. We also saw that unlike the basic vocabulary and non-iconic comparisons, the noun comparisons showed no clear pattern. The scores ranged from 86% to 74%, a difference of only 12 percentage points. If the only information we had was based on the comparisons from the nouns list, it would be hard to say anything conclusive about the relatedness of these varieties. In fact, if we take the unrelated language scores for the nouns list, which ranged from 41% up to 66%, we would be hard pressed to prove that Spain and Bulgaria (66%) are significantly less related than Granada and Valencia (74%).

Any testing method should show a significant difference between languages that are related and those that are not. Graph 5 shows the ranges of scores for the basic vocabulary comparisons based on similarity

and cognates as well as for the comparisons of non-iconic vocabulary and nouns, all of these for both related and unrelated languages. We see that there is a 35-percentage point difference between the lowest similarity score for related languages and the highest similarity score for unrelated languages. Between basic vocabulary cognate scores, there was a gap of 39 percentage points, and 48 points between non-iconic vocabulary scores. Nouns, on the other hand, showed only 8 points difference.



**Graph 5: Comparisons of related and unrelated varieties and the difference between them**

## 6. Implications

As seen in Graphs 1 and 2 (and appendix C), similarity scores tend to be lower than cognate scores by 5 to 10 percentage points, but they tend to follow the same basic pattern. If our concern is to determine how similar one language is to another, then studying similarity of basic vocabulary is an appropriate tool. Similarity studies show enough difference between related and unrelated languages that we can make some clear judgements of those that are presumed related and those that are not.

However, if our goal is to look specifically at relatedness, then cognate studies, by definition, are the best tool. As we have seen, comparing non-iconic vocabulary results in a lower number of chance cognates. It also tends to make larger distinctions between closely related varieties and varieties that are more distantly related. As a result, we end up with a clearer picture of relatedness. By analyzing the data from Spain, we see that according to the non-iconic word list, Madrid, La Coruña, and Granada do create a fairly tight cluster with cognates at 90% or above. Valencia joins the first group at a level between 82% and 86%. Barcelona is the most distinct, with scores ranging from 66% to 74% with all the others. Unrelated languages scored between 4% and 18%.

Gudschinsky (1956) uses three levels of cognate scores to determine relatedness:

0–35%	cognates means separate language family
36–80%	cognates means separate language, same family
81% and above	cognates means it is the same language

According to these criteria, and if we use the scores from the non-iconic wordlist, the Valencian dialect is part of the larger language but distinct enough to be called a distinct dialect. Barcelona clearly is a separate but related language. The other European languages in this study would be classified as separate language families.

If we were to use the basic vocabulary cognate scores, all of Spain would likely be considered the same language (with scores ranging from 79% to 96%); for the European languages, data would be

inconclusive as to whether they were the same family or not (31% to 40%). However, iconicity definitely raises the number of chance cognates, thus skewing all the results.

It would be possible to recalibrate the criteria specifically for sign languages. When using basic vocabulary, any two unrelated sign languages would inherently have a higher degree of similarity, due to iconicity, than two unrelated spoken languages. We can also expect, again thanks to iconicity, that when comparing two closely related language varieties, basic vocabulary comparisons would generate more variation, or lower similarity scores. This is what some researchers have done. The recalibrated criteria that we used in our previous survey in Spain (Parkhurst and Parkhurst 2001) set the thresholds for similarity as follows:

0–40%	similarity means separate languages
41–60%	similarity means separate language, same family
61–70%	similarity shows inconclusive results and other testing is necessary but they are likely to be different languages.
71–80%	similarity shows inconclusive results and other testing is necessary but likely to be same language
81% and above	similarity means it is the same language

This was a range set up for similarity studies and is based on the work of Blair (1990) who states that the range between 60% and 95% should be considered doubtful and should be tested with intelligibility testing. The range for determining language family relatedness was raised from Gudschinsky's 35% to 40%.

By using cognate criteria instead of similarity comparisons, one would expect all the thresholds to be raised an additional 5 to 10 percentage points.

While these kinds of recalibration are possible, this paper has shown that it is valid to use the same thresholds that are used for spoken languages by using cognate criteria and limiting the lexical items to non-iconic vocabulary.

As we have seen, the exclusive use of highly iconic nouns skews the results even further, to the point where it is difficult to make any reliable conclusions based on that word list. Furthermore, there is no clear way that accurate results could be obtained by mere recalibration.

## 7. Suggestions for future lexical studies

For future studies we would like to see a list of 200 (or more) potentially non-iconic signs from which to make the comparisons. A list of only 50, as in this study, leaves a lot of room for error. The problem is that non-iconic words are hard to find. And what may not be iconic in one language may be iconic in another. From a list of 200 likely non-iconic signs, we could then remove from the database those signs that were still based heavily on iconicity, leaving a good number of signs on which to base our comparisons, thus strengthening the reliability of the data.

Admittedly, lexical studies only show a small glimpse of a language; however, as we refine our techniques for gathering information, we can increase the accuracy in which these studies represent the language as a whole.

## Appendix A: Long wordlist

*200 basic vocabulary Parkhurst list (used for comparisons within Spain)*

1. family	7. blood	13. to ask	19. child	25. rain
2. mother	8. meat	14. boyfriend	20. man	26. house
3. father	9. to live	15. brother	21. woman	27. city
4. spouse	10. to die	16. son	22. friend	28. book
5. police	11. strong	17. grandfather	23. teacher	29. paper
6. law	12. weak	18. cousin	24. deaf	30. money

31. to buy	65. name	99. seven	133. fly (insect)	167. bathroom
32. to sell	66. story	100. January	134. to go	168. all
33. to pay	67. shirt	101. Monday	135. to come	169. some
34. rich (money)	68. hot	102. 100	136. to sleep	170. other
35. rock	69. cold	103. 1,000	137. to need	171. nothing
36. water	70. God	104. to tell a lie	138. to read	172. many
37. land	71. devil	105. to play	139. to write	173. tired
38. mountain	72. sin	106. to sit	140. to believe	174. afraid
39. tree	73. to confess	107. to dance	141. Jesus	175. hungry
40. to work	74. poor	108. to eat	142. Virgin Mary	176. never
41. to help	75. priest	109. egg	143. angel	177. always
42. to sing	76. peace	110. fish	144. to bless	178. only
43. to understand	77. birthday	111. salt	145. to forgive	179. to sign
44. thank you	78. angry	112. carrot	146. church	180. to hate
45. mouse	79. happy	113. car	147. to love	181. envy
46. cat	80. sad	114. bus	148. flower	182. to look for
47. good	81. more	115. airplane	149. leaf	183. to meet
48. bad	82. apple	116. beautiful	150. river	184. to build
49. new	83. milk	117. ugly	151. ocean	185. to cook
50. old	84. wine	118. skinny	152. snow	186. to see
51. what?	85. chicken	119. dry	153. ice	187. full
52. who?	86. bread	120. wet	154. wind	188. free
53. when?	87. sweet	121. soldier	155. star	189. true
54. how many?	88. young	122. president	156. almost	190. false
55. where?	89. dirty	123. judge	157. now	191. door
56. how?	90. to fight	124. doctor	158. week	192. shoe
57. no	91. to kill	125. animal	159. month	193. bed
58. yes	92. fire	126. dog	160. summer	194. light
59. maybe	93. colors	127. snake	161. winter	195. knife
60. day	94. white	128. lion	162. year	196. garbage
61. night	95. black	129. elephant	163. wood	197. to dream
62. sun	96. red	130. horse	164. table	198. to continue
63. moon	97. blue	131. bear	165. window	199. to begin
64. Spain	98. green	132. bull	166. school	200. to end

*Additions to the Parkhurst list (used in comparisons with other European countries, based on Bickford, in preparation):*

corn	nun	clean	to exercise
Africa	stand	"you're welcome"	to listen

**Appendix B: Short word lists***50 non-iconic vocabulary word list*

1. family	11. good	21. poor	31. January	41. month
2. mother	12. bad	22. peace	32. Monday	42. year
3. father	13. new	23. sweet	33. to lie	43. afraid
4. to live	14. old	24. young	34. to play	44. never
5. to ask	15. what?	25. dirty	35. beautiful	45. always
6. brother	16. who?	26. color	36. ugly	46. hate
7. cousin	17. where?	27. white	37. to need	47. free
8. city	18. how?	28. black	38. ice	48. true
9. paper	19. name	29. blue	39. almost	49. false
10. thanks	20. story	30. green	40. week	50. to begin

*50 nouns word list*

1. rock	12. milk	23. dog	34. river	45. door
2. water	13. wine	24. snake	35. ocean	46. bed
3. mountain	14. meat	25. lion	36. snow	47. shirt
4. tree	15. chicken	26. elephant	37. rain	48. shoes
5. fish	16. bread	27. horse	38. wind	49. light
6. mouse	17. egg	28. bear	39. wood	50. knife
7. cat	18. salt	29. bull	40. book	
8. sun	19. carrot	30. bug	41. house	
9. moon	20. car	31. angel	42. city	
10. stars	21. bus	32. flower	43. table	
11. apple	22. airplane	33. leaf	44. window	

**Appendix C: Similarity and cognate comparisons for nouns and non-iconic vocabulary**

*Unrelated languages*

**Cognates  
Nouns**

	S	NI	F	B
S		51 45	44 50	66 41
NI			44 45	41 39
F				46 41
B				

**Similarity  
Nouns**

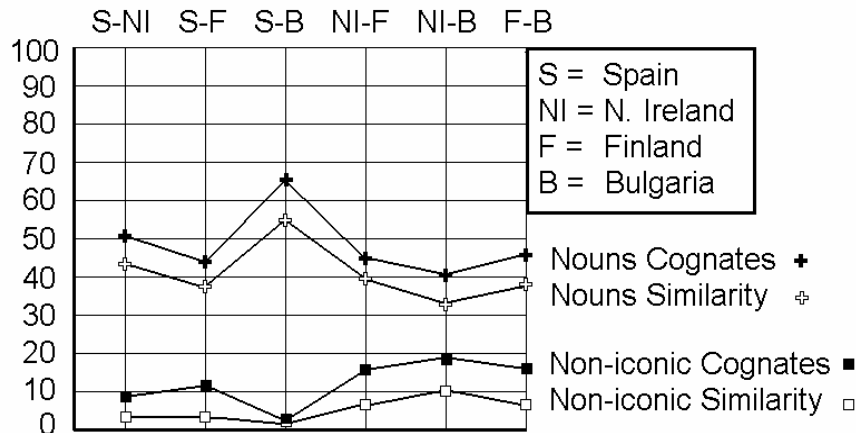
	S	NI	F	B
S		44 45	37 50	55 41
NI			39 45	33 39
F				38 41
B				

**Cognates  
Non-iconic Vocabulary**

	S	NI	F	B
S		8 49	12 50	4 50
NI			16 49	18 49
F				16 50
B				

**Similarity  
Non-iconic Vocabulary**

	S	NI	F	B
S		4 49	4 50	3 50
NI			6 49	10 49
F				6 50
B				



*Related languages within Spain*

**Similarity  
Nouns**

	M	C	G	V	B
M		89	74	68	71
C			65	62	65
G				59	61
V					62
B					

**Cognates  
Nouns**

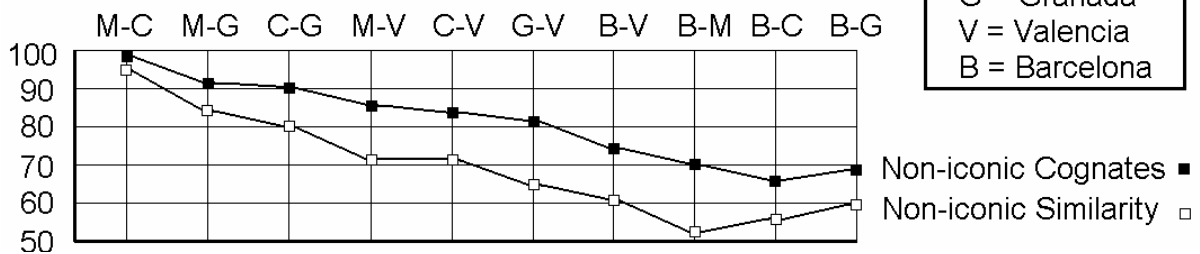
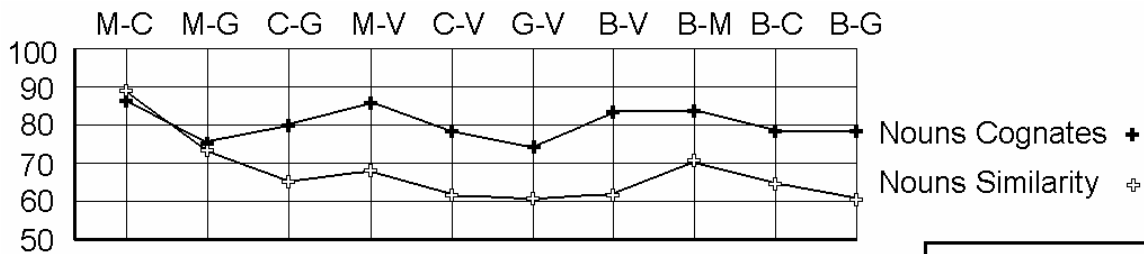
	M	C	G	V	B
M		86	76	86	84
C			80	78	78
G				74	78
V					84
B					

**Cognates  
Non-iconic Vocabulary**

	M	C	G	V	B
M		98	92	86	70
C			90	84	66
G				82	68
V					74
B					

**Similarity  
Non-iconic Vocabulary**

	M	C	G	V	B
M		95	84	72	53
C			80	72	56
G				65	59
V					61
B					



M = Madrid  
 C = A Coruña  
 G = Granada  
 V = Valencia  
 B = Barcelona

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