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NOUN INCORPORATIONS IN NAHUATL

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SIL

1. Introduction

The Náhuatl languages are rich in incorporational
constructions, with the incorporation of nouns into verbal stems
being especially common.[1] The nouns in such structures bear
different relationships to the verb stems:[2] we will concentrate
on incorporations of objects, subjects, secondary objects,
including instruments, and active zones (AZ's), aspects of
subjects or objects such as body parts, which enter directly into
the relationship specified by the verbal stem.

These incorporations exhibit a number of interesting
properties: in particular (1) many forms are susceptible to more
than one analysis, and (2) in many cases incorporations affect
verbal valences in curious ways. In this paper we will examine
these matters from the viewpoint of Cognitive grammar (CG: née
Space grammar; Langacker 1982, 1986, in press, Tuggy 1981).

1.1. Definitions

We will be using some familiar terms in slightly
non-standard ways, so it behooves us to define them.

Transitivity has several meanings (which are intimately
linked together): one is the occurrence of a verb with a direct
object, another is the expectation that a verb will be so used, a
third is a semantic quality or complex of qualities (see e.g.
Hopper & Thompson 1980, Bolinger 1977) saliently involving the
transfer of energy from a subject to an object, which is often
coded linguistically by using a verb with a direct object. Here
we adopt the second sense: when we say that a verb stem is
transitive we mean that it brings with it the strong expectation

of being used in construction with a direct object, whether or not it involves salient energy transfer or whether it is in fact used transitively in the construction at issue.

In Náhuatl (much more than in e.g. English) this is a very important characteristic of verb stems. Transitive stems always have a direct object (unless, and usually even when, they participate in derivational constructions such as incorporations); intransitive stems never do. Thus they bring with them a strong expectation, so strong that it could be called a requirement, that they will be so used.

Transitivity is equivalent to having an object valence. Both transitive and intransitive stems have subject valences as well. A subject valence is directly parallel to the object valence: it is a strong expectation that the stem will be used in construction with a subject.

In CG verb stems denote processes (relations tracked through time), and include in their designation one or more Things involved in the process. The most salient of these Things we will call the Internal Subject (the traditional term in CG is "trajector"), and where there is a second such Thing we will call it the Internal Object (traditionally "landmark"). An (external) subject is defined as a nominal which corresponds to the internal subject of a verb, and similarly a direct object (external object) is a nominal which corresponds to the internal object. The internal subject and object are almost always elaborated (i.e. put in correspondence with a structure which adds semantic specifications) by subject and object prefixes, which may in turn be elaborated by clausal nominals. The only exceptions are the above-mentioned derivational constructions. Constantly being elaborated in this way gives rise to a strong expectation of being elaborated, constituting a valence.

Besides the internal subject and object, other Things may be involved in one way or another with the process designated by the verb stem: these we will call secondary internal objects, and nominals corresponding to them secondary objects. Since we reserving the term "internal object" for Things bearing an object valence, prominent non-subject Things in the semantics of intransitive verbs (e.g. the place left in kīsa "emerge") are classed as secondary objects.

When two elements are construed together, one of them typically takes precedence over the other in that its designatum rather than its companion's prevails as designatum of the composite structure. This element we will call the head of the construction (traditionally the "profile determinant" in CG).

Thus in I saw a man, saw is the head, because the clause designates the past-time process of seeing rather than the seer or the seen thing; in the man I saw, man is the head.

In all the incorporational constructions we will be examining, the verb stem is the head: the whole construction designates a process identical to (though differing in detail from) the process designated by the component verb stem. Another characteristic shared by all these structures is the phonological ordering of the noun stem before the verb stem.

2. Object, subject, and secondary object incorporations

ON kahven-i (coffee-drink) "drink coffee" is an object-verb incorporational construction. The verb stem i designates a process in which an internal subject (prototypically a person) ingests a liquid (the internal object), typically from some sort of cup. The stem is transitive with respect to the liquid. kahven designates a liquid, with characteristic taste, smell, color, and consistency, and with other more or less important expectations associated with it. When the two stems are juxtaposed in the incorporational construction, the liquid designated by kahven is put in correspondence with (construed as being identical to) the internal object of i. Thus it is, by definition, a direct object of i. The resultant complex stem designates the same process as does i, rather than the liquid designated by kahven: i.e., i is the head of the construction. It differs semantically from i in two ways: (1) the nature of the internal object is elaborated: all the specifications of kahven are transferred to it; and (2) it is not transitive. i expects to be construed with a direct object, and in kahven-i it is; kahven-i itself, however, does not expect to be so construed. These specifications are diagrammed in Figure 1.[4]

Subject incorporations are not nearly so common as object incorporations, but they do occur.[5] TN tōnal-kīsa (sun-emerge) "the sun comes out" is an example. kīsa is an intransitive stem, designating the emergence of its internal subject from some enclosure. tōnal designates the sun, and tōnal-kīsa designates a process in which the sun emerges from behind something, typically (since that is what typically hides the sun) a cloud. kīsa, like virtually all other verb stems, expects to be put in construction with a subject; tōnal-kīsa does not.[6] The subject valence of kīsa is satisfied by the incorporated noun just as the object valence of i was satisfied in kahven-i.

Secondary objects may also be incorporated, and where they are, they typically (and naturally) leave the verb stem's subject and object valences unaffected. One type of special interest to
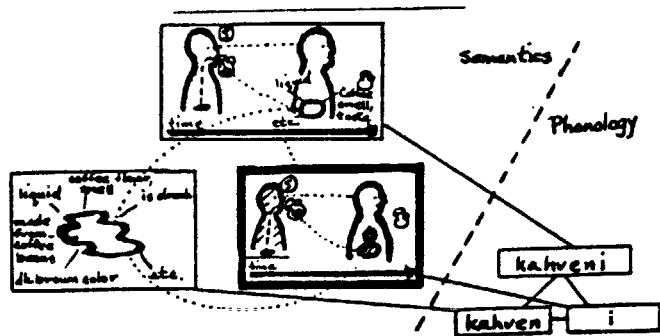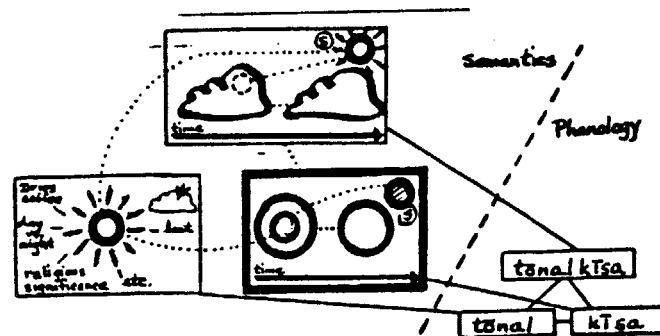
Figure 1: kahven-i (Object incorporation)

Figure 2: tōnal-kīsa (Subject incorporation)

us is instruments. An instrument is (at least prototypically) an inanimate Thing utilized by an internal subject in order to affect an internal object. In TN lāpis-k^wilowa (pencil-write) the transitive stem k^wilowa designates an internal subject manipulating a writing implement to cause a message (the internal object) to be recorded on a surface (typically paper). lāpis specifies that the implement is, in fact, a pencil. lāpis-k^wilowa is diagrammed in Figure 3: note that the composite stem is transitive with respect to the same object, and still expects the same external subject, as k^wilowa did.
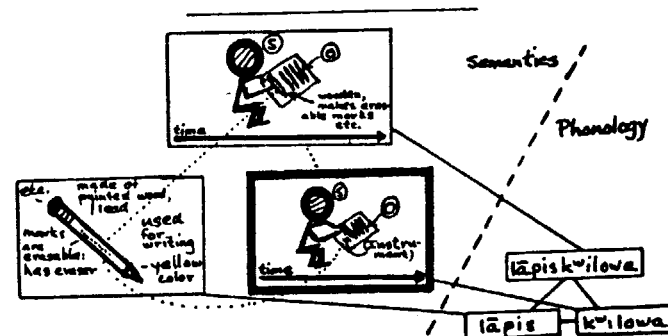
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Figure 3: lāpis-k^wilowa (Instrument incorporation)

3. Active zone incorporations

The most common Náhuatl noun incorporations are those in which the noun corresponds not to the internal subject or object of the verb stem, but to a body part of one or the other, which is directly involved in the action of the verb. These body parts, following Langacker (e.g. 1984), we will call active zones (AZ's). Thus in ON mā-k^wI (hand-grasp) "grasp in the hand", the composite stem specifies that the internal subject uses his hand in taking hold of the internal object; in TN kama-teriksa (mouth-kick) the portion of the internal object's body which the internal subject kicks is specified to be his mouth: the hand and mouth are the subject's and object's AZ's, respectively. In both cases the valences of the composite stem are the same as those of the naked verb stem: a subject is still expected to elaborate the grasper or the kicker, and an object to elaborate the grasped object or the kicked person.

It is easy to construe these cases as being parallel to the secondary object incorporations mentioned above. The AZ's of the subject and object can be seen as Things secondary in prominence to the internal subject and object themselves, but intimately involved with the process: when they are elaborated, they do not affect either the subject or the object valence of the verb stem. It is particularly easy to unite instruments and subject's AZ's: it is easy to construe an instrument as an extension of the wielder, in fact as his AZ, or a body part when used to affect someone or something else as an instrument. The line between

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using your hand to grasp something, and using a pencil to write
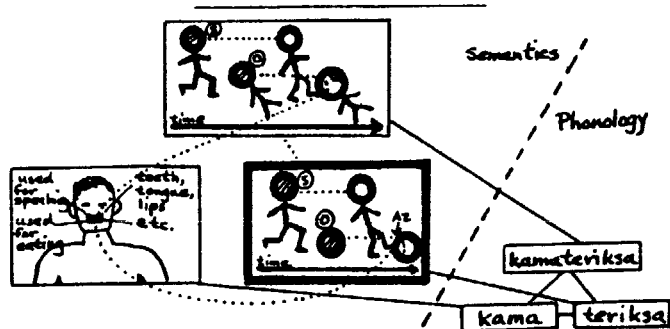something, need not be a sharp or immovable one.

Figure 4: **kama-teriksa** (Object's AZ incorporation)

4. Valence-changing incorporations

4.1 Abolishing and shifting valences

So far the incorporations we have examined have either left
the valence relations of the verb stem alone (instrument and AZ
incorporations) or have satisfied them (subject and object
incorporations). Some incorporations, however, change the
subject or object valences in less predictable ways.

In a few cases, incorporation of a secondary object destroys
an object valence. The TN stem **mōta** "hurl, shoot" is transitive
with respect to the missile. In **tōč-mōta** (rabbit-hurl) the
target (a secondary object, with respect to which **mōta** is not
transitive) is incorporated. We should expect the stem **tōč-mōta**
to remain transitive, as other secondary object incorporations
do. Instead, it is intransitive, meaning "hunt rabbits" rather
than "shoot (an internal object) at rabbits". Object
incorporations abolish transitivity by satisfying it; in this
structure the object valence disappears without ever being
satisfied. There are various reasons why this is natural or
understandable to some extent (e.g. once you know that a rabbit
is the target it is fairly certain that the missile is in fact a
bullet), but it is certainly not predictable, and runs counter to
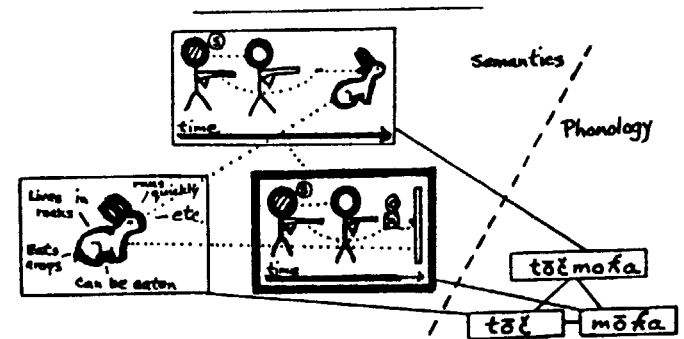strong patterns of Náhuatl.

Figure 5: **tōč-mōta**
(Secondary object, abolishes transitivity)[7]

More commonly a valence is changed. The ON stem **viwita**
"yank up" is transitive with respect to the thing yanked up.
When the stem **mā-** "hand" is incorporated as a subject's AZ, we
should expect **mā-viwita** to mean "yank up by hand" and to remain
transitive with respect to the thing yanked. Instead it means
"weed", and is transitive with respect to the place (field or
garden) being so weeded. Again, this is a quite unexpected
usage.

Similarly subject valences may be shifted. In TN **kwā-tepēwi**
(head-fall.off.particulately) "go bald" the incorporation of a
secondary (locational) object changes the subject valence from
the (particulate) thing which falls (hair, in this case) to the
owner of the head from which it falls.

This is an instance of a relatively common pattern for such
valence shifts: the incorporated noun includes as a necessary
part of its conceptualization the idea of a person, and that
person usurps a valence of the verb. You do not normally
conceive of a head without conceiving of a person of whose body
it is a part. And it is natural, once this person is thus
implied, to care more about who he is than about otherwise
important matters like (in this case) what fell. The person who
goes bald is drawn into the picture when his head is mentioned,
and takes over as internal subject. It is not irrelevant that
there is only one particulate thing that normally falls off
people's heads, but the usage is not really predictable, for all
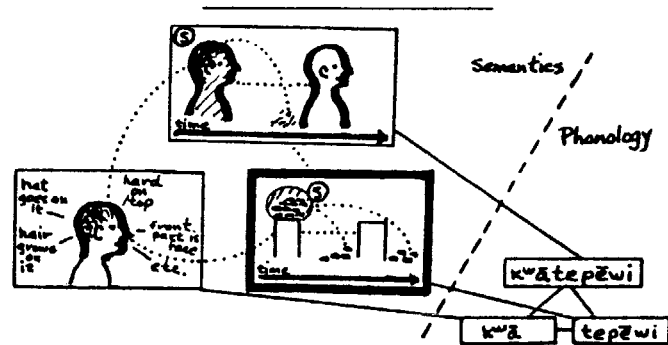that.

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Figure 6: kʷā-tepēwi
(Secondary object, changes subject valence)

Figure 7: sesek-kalaki
(Subject, changes subject valence)

The same pattern shows up with respect to the object valence in TN kwā-mōɬa "shoot/hurl something at someone's (the internal object's) head." As in tōc-mōɬa above, we have an incorporation of the target, and again mōɬa's valence to the missile is ignored. But this time the owner of the head at which the missile is hurled takes over as internal object; the composite stem is still transitive, but with respect to a different object.

4.2 Subject and object incorporations which change valences

Valences may shift also when subjects and objects are incorporated. In ON sesek-kalaki (cold-enter) the noun "cold" is construed as the subject of "enter". Yet the composite stem still has a subject valence, this time to the thing (unpredictably specified to be an animate being) into whom the cold enters: ni-sesek-kalaki (I-cold-enter) is probably best translated into English as "I get cold" or "I catch a chill", though Náhuatl speakers translate it into Spanish as "se me entra el frío" ("the cold enters me"). kalaki is intransitive; the place entered is not even internal object of the stem, though it is of course a salient secondary object: this makes the shifting of valence even more surprising.

The same sort of thing occurs with an object incorporation in TN kʷen-ɬāliya (furrow-place) "plow". ɬāliya is transitive with respect to the thing placed, and kʷen elaborates that internal object, making this an object incorporation. However, kʷen-ɬāliya remains transitive, with the valence expecting
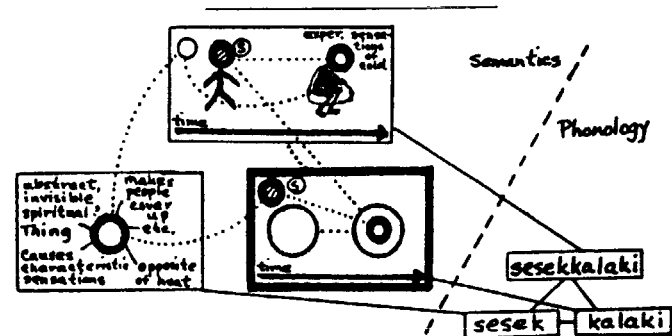
elaboration of the place (usually a field, of course) where the furrows are placed. Again, the usage is quite surprising—one would expect the applicative stem ɬāli-liya (place-applic) "put (something) on it" to be used, but this construction makes the valence shift directly.

Somewhat less surprising is the shift in ON tzom-tepēwi (hair-fall.off.particulate) "go bald". In kʷā-tepēwi "go bald" (discussed above), the incorporation is of the location from which the internal subject of tepēwi falls: here it is of the internal subject itself. Then, by the previously noted pattern of the person implied by a body part usurping a valence, the person whose hair falls off takes over as internal subject in the composite stem. In ON mo-tlāka-miki-lía (refl-man-die-applic) "have your husband die", a very similar pattern is seen. The mention of a husband (who dies) brings the wife into the semantic picture, much as the mention of a body-part brings its owner into the picture, and she takes over the subject valence in the composite stem.

In directly parallel fashion, ON pantalōn-ololowa (trousers-roll.up) is an object incoporation: pantlegs are construed as being rolled up. However, the composite stem remains transitive, with the valence to the one wearing the trousers (analogous to the owner of a body-part). Similarly in TN nān-tēnēwa (mother-mention) the construal is of mentioning a mother (derogatorily), but the stem is transitive with respect to the person whose mother is mentioned (who has received a grave offense in the process). Finally, in ON mo-ɬāl-namiki-h

(refl-land-meet-pl) "their lands adjoin" #āl is simultaneously the subject and also the object; land meets land, but it is the owners of the lands that take over the double subject-and-object valence.
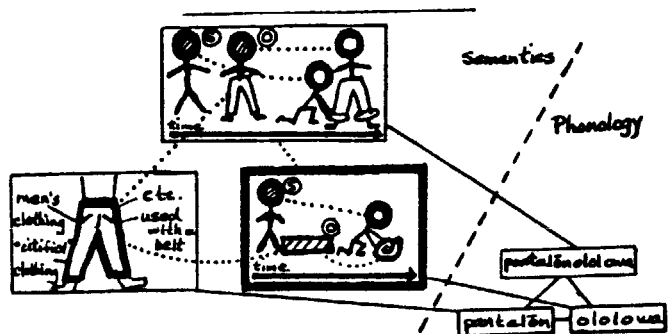

Figure 8: pantalōn-ololowa
(Object, changes object valence)

Finally, consider ON k^wā-totonía (head-heat) "study too hard", or more literally something like "overheat your head". Here k^wā is clearly an object incorporation, and it apparently satisfies the object valence: k^wā-totonía is intransitive. However, it is not clear what happens next. One possibility is that the owner of the head then usurps not the object valence (as in pantalōn-ololowa and nān-tēnēwa above), but the subject valence. This would yield a meaning like "have your head overheated (by some unspecified agent)". Another is that the subject valence remains with the "heater", and a specification is simply added in the composite structure that the owner of the head is in fact the heater as well; the meaning would then be "overheat your (own) head".

5. AZ incorporations revisited

An insight may have dawned by this point. Could we not analyze many of our subject's and object's active zone (AZ) incorporations like these transitivity-changing subject and object incorporations? For kama-teriksa "kick the internal object in the mouth", the construal would be that the mouth is the direct object of the verb stem (after all, it, not the whole person, is what gets kicked); then the by now familiar usurping

of the valence by the owner of the mouth takes place, yielding the composite stem with the attested transitivity pattern. Similarly, in mā-kwi "grasp with the hand", the hand can be seen as a subject incorporation (the hand, after all, is what does the grasping), and the subject valence shifts to the hand's owner. Even instrument incorporations can be so construed: in lāpis-k^wilowa it is (on this construal) the pencil that does the writing, and then its wielder takes over the subject valence.
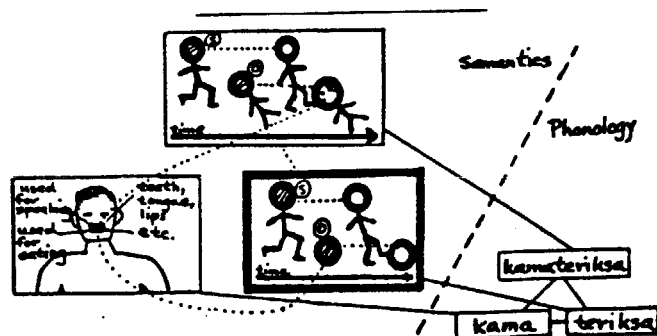

Figure 9: kama-teriksa
(Object, changes object valence: cf. Figure 4)

In support of this idea is the fact that some of the AZ incorporations involve verb stems that are easily construed as applying to the body part, but do not collocate well with people as wholes. txon-tepewi "go bald", discussed in the previous section, is an example: a person is not a particulate mass, and tepewi expects such a subject; a person's hair, however, is a particulate mass, and thus is naturally construed as its subject. Similarly in ON īš-ŧak^wa (eye-close) "close (object's) eyes", a person is not the sort of thing that can be closed, though his eyes can. It is reasonable then to analyze the stem as an object incorporation, with the owner of the eyes taking over the object valence.

Even when a person could be construed as the object of the verb stem, that construal often is not made in fact. A person can emerge, yet in ON es-kīsa (blood-emerge) "bleed" it is clearly his blood, not himself, that emerges: his body as a whole is rather the place from which the emerging occurs. Yet the composite stem retains a subject valence to the person. In

parallel fashion, in ON **mā-ahkok**^w**i** (hand-raise.up) a person's whole body can be raised up, but the construal is rather of the person's hand/arm alone being raised, yet the composite stem is transitive with respect to the person. And in one of my favorite examples, ON **Iik-tōk-tok** (umbilicus- bury-dur.pas) "be a native (of some place)", the incorporated noun can be taken either as object of **tōk** "bury" or as subject of **tōk-tok** "lie buried", but in either case only the umbilical cord, not the person himself, lies buried where he was born.

6. Summary and conclusions

We have seen a number of Náhuatl noun-incorporation patterns. In particular we have seen how AZ patterns can, by alternate construals, be classified with secondary object incorporations, in which the noun corresponds to a Thing in the stem which is neither internal subject nor internal object, or with valence-changing subject and object incorporations, in which the noun is a subject or object, but the valence shifts to another Thing, brought into the semantic picture by the incorporated noun. These alternate analyses would be expressed in CG by schemas uniting the two classes of elements, with the AZ cases being members of both groups. This double analysis is represented in Figure 10, where arrows point from schemas to their instantiations and the arrows relevant to the double analyses are darker. Figure 10 is a more fully-specified representation of a subpart of Figure 11, which shows the schematic (classificatory) relationships among all the kinds of incorporations we have discussed.
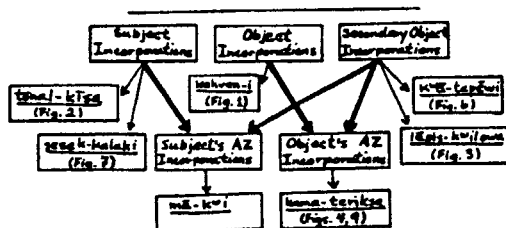
Figure 10: Double analyses of AZ incorporations
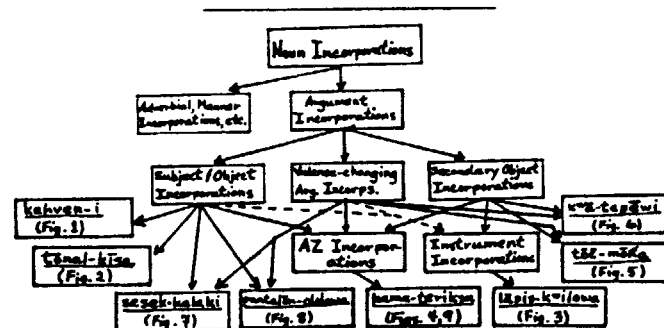
Figure 11: Schematic hierarchy of incorporational constructions

This is an important result. Many other theories, if they brought the matter up at all, would tend to make you choose one analysis or the other. In CG both can be correct, equally or in varying degrees, for a given case: placing the form in one paradigm does not mean it cannot go in another; seeing one pattern does not mean you have to stop seeing the other.

[1] Of 813 polymorphemic verb stems listed in a 2800-entry lexicon of Orizaba Náhuatl (ON) compiled by the author, noun incorporations amounted to 173, or over 21 %. This is an impressive number when you realize that it is competing with the prolific causatives, applicatives, and unspecified object constructions, among others.

Data in this paper are from the author's files on ON and Tetelcingo Náhuatl (TN), and from Brewer and Brewer (1971). Many of the forms are attested with minor phonological modifications in both languages, as well as in others.

[2] E.g., besides the types dealt with in the text: adverbial modification (TN īknō-ihta (orphan-see) "pity someone"); manner (ON mo-pino-łakentía (refl-urbanite-dress) "dress like a city slicker"); time (TN łahka-łakʷā (half-eat) "eat at noon"); location (ON īš-temowa (face-descend) "descend (intrns) the face of the mountain"); goal (TN ilwikak-łehko (heaven-ascend) "rise up into the sky"); source (TN puro-tepešiwi (burro-dump) "dump something off a burro"); cause (ON apis-miki (famine-die) "die of hunger, be very hungry"); etc. (ON ih-činowa (smell-burn) "burn garbage", mo-kia-palevía (refl-rain-help) "protect oneself from rain").

[3] A Náhuatl direct object may correspond in translation to an indirect object or other nominal dependent of a verb: e.g. the verb stems maka "give" and (i)lía "tell" are transitive with respect to the recipient and addressee, not the thing given or said.

[4] In diagrams boxes enclose cognitive material which has been thoroughly mastered as a unit by the speakers and hearers of the language. Symbolic units are represented by a line joining a phonological to a semantic unit. Semantic material is represented in various ways, often somewhat ad hoc, including crude pictorial representations. The entity designated is boldfaced, as contrasted with other (backgrounded) specifications of the unit. Verbal concepts (processes) are distinguished by a boldfaced arrow marked "time" beneath one or more depictions of representative states from the process. Internal subjects and internal objects are labelled by a circled S and O, respectively. Valences are indicated by cross-hatching the internal subject or object which expects to be elaborated. A correspondence relationship (identity construal) is represented by a dotted line connecting the identified elements. The head of a construction is marked by the fact that it as a whole

corresponds to (and is elaborated by) the composite structure; it is also (following CG tradition) redundantly marked by boldfacing the box enclosing it.

[5] Of 173 incorporations in the ON lexical file, 22, or 12.5 %, were object incoporations (9 of them with i or its derivative on-i "drink"), whereas only 7 (4 %) were subject incorporations. Subject's AZ incorporations were the most numerous (63, or 36.5 %), followed by object's AZ (45, or 26 %, though a number of these might be taken as subject's AZ on a stem which was later causativized). Instrument incorporations numbered only 8 (4.5 %), and other categories (locative, time, adverbial, etc.—see footnote 2) were the same or fewer.

[6] Sapir (1911:278) maintains that such incorporations never occur, that subject incorporations never destroy the subject valence. It is conceivable that tōnal-kīsa does occur with a third person subject analogous to the "weather" it in it rains or (better) it earth-quakes: the third person subject prefix would be a zero morpheme. However I know of no evidence compelling such an analysis.

[7] The verb stem is represented as head of the structures in Figures 5-9, but its headship is non-prototypical, in that important specifications (viz. internal subject and object-hood) of the two structures conflict. Prototypically the head is, in Langacker's terms, fully schematic for its construction: here the relationship is one of partial schematicity.

[8] The reflexive-applicative combination serves an honorific function: cf. miki "it (usu. non-human) dies" vs. mo-miki-lía "he (human) dies".

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TABLE 4: RESULTS OF RASCH ANALYSIS

	Number With English Response	% With English Response	Logits	Fit
HE	1104	97%	-2.73	1.65
IS	916	81%	0.28	-5.83
LOOK1	1048	92%	-1.34	0.05
-ING1	547	48%	3.02	-2.52
AT	862	76%	0.77	-5.89
ME	1066	94%	-1.68	-1.64
I	1112	98%	-3.09	-0.28
AM	905	80%	0.39	-5.84
LOOK2	1021	90%	-0.92	0.61
-ING2	514	45%	3.23	-2.06
FOR	961	85%	-0.18	-0.41
HIM	1101	97%	-2.61	2.07
HEHIM	789	70%	1.36	5.93
IME	992	88%	-0.54	1.05
AMIS	937	83%	-0.08	-2.25
LOOK3	410	36%	3.96	16.29

Figure 1 shows a scatterplot of logits against fit statistics as found in Table 4.

The horizontal axis in Figure 1 represents the degree of English of the given responses; the vertical axis represents how well the items fit the model's expected probabilities. Relating to the horizontal axis, the left side of Figure 1 represents units that occur in both ASL and English signing. The further units are to the right side of the scale, the more English they are.

Figure 1
Plot of logit values against fit statistics
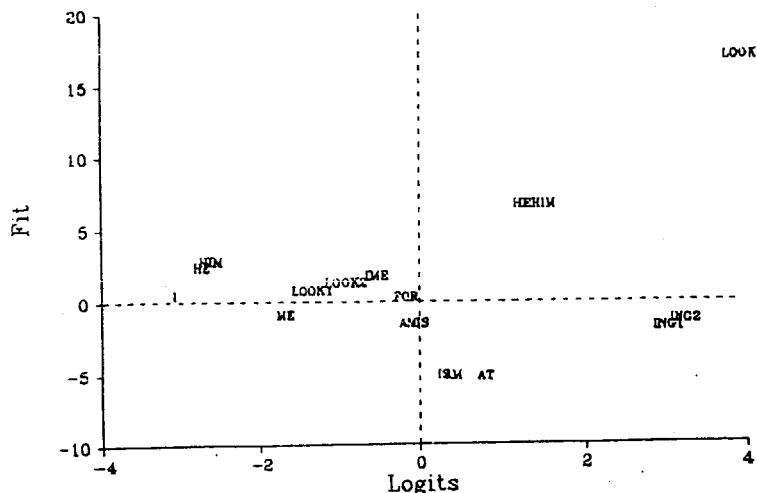
In general, the following can be observed:

Subjects of sentences require the "least" English,
  i.e., the elements are signed or fingerspelled
  separately by virtually everyone;
then objects;
then verbs;
then the preposition "for";
then copulas;
then separate lexicalization for "am" and "is";
then the preposition "at",
then separate lexicalization for "he" and "him";
then the progressive "ing";
finally, the same lexicalization for "look" in
    both sentences.

While there is regularity in the order of the occurrence of items, the analysis indicates that there are two problems with the data, one relating to the horizontal axis and one relating to the vertical axis. The problem in the horizontal axis is that too many of the items scale to the left of center and too few to the right. This indicates: 1) there is a problem with the type of items chosen for the scale or 2) a different sample of signers is needed. The answer we choose relates to the primary purpose of our analysis. If our primary purpose was solely to distinguish the types of signing used by different teachers, more "English-y" items, such as inflections, are needed, since most teachers used a great deal of the English in their signing. On the other hand, if we obtained a sample that contained more deaf people (only 10% of the sample is deaf), whom we would expect to sign less English and more ASL, we might find that the items are satisfactory to discriminate among different types of signers.

In addition to the problem in the horizontal or "English-y" axis, there are problems in the vertical axis, which illustrates the fit statistics of the items. A fit statistic equal to 0 indicates a perfect fit of an item to a scale, i.e., the actual probabilities of signers with specified logit values giving English responses to items with perfect fit are precisely those predicted by the Rasch model. When the fit statistic for a given item deviates from 0, lack of fit can be noted. Two different kinds of fit problems can be described: high positive values and high negative values. High positive values occur when an element with a high English score is given an English response by low scorers on the scale, or when an element with a low scale value is not given an English response by high scorers on the scale. The scale value assigned to the element does not appropriately discriminate signers with high and low English scores.

High negative values occur for signs that are too discriminating, i.e. if a person is assigned a scale value of 1 logit, they will actually demonstrate English signing greater than 50% of the time to elements which are also assigned a logit value equal to 1. A plot of the relationship between logit differences between signers and linguistic elements with high negative fit statistics would show a steeper slope than would be evident from plotting the numbers in the logit difference chart presented earlier.

In the current scaling, a number of the items included showed poor fit. In Figure 1, it can be noted that there is a "conical" shape to the scatter of elements. This indicates that lack of fit is more closely associated with items that are higher on the scale, i.e., are only given an English response by the more English signers.

Elements with high positive fit statistics (>2.5) include "hehim" (i.e., signing he and him differently in similar semantic contexts) and "look3" (i.e., signing look similarly in different semantic contexts). These fit statistics suggest that the preference for signing in English is multidimensional. It might be argued that there is a single dimension dictated by whether or not specific grammatical units will be signed or fingerspelled separately, but this grammatical continuum does not account for decisions about preference for English or ASL- like lexicalization. There needs to be a separate scale which looks only at this issue.

Elements with high negative values (<-2.5) include "is", "ingl", "at", and "am". These include both occurrences of the verb to be, a preposition, and one of the two uses of the progressive "-ing" inflection. These fit statistics suggest that the use of these items are more categorical than other items, i.e. they are probably better described as discrete than as an intrinsically variable part of a continuum.

In addition to the above information, Rasch analysis also gives information about probability of various levels of English signing. To do this, we need to use the following formula from Wright and Stone (1979):

$$P = exp(D) / 1 + exp(D)$$
where P = probability of an English response to a sign, and D = (signer logit - sign logit)

First, subtract the logit value of a given sign in Table 4 from the logit value of the a given group of signers shown in Table 5. Second, take the exponent of the answer in step one. Third, divide the number obtained in step two by 1 + itself. The result will be the probability of the given group of signers signing the given sign. (It should be noted that 181 of the 1135 signers (16%) provided English responses to all 16 grammatical and lexical elements. Since they have "perfect" English scores, there is no way to

assign a probability level of English signing for these signers. Therefore, these signers are not assigned logit values.)

TABLE 5: LOGIT VALUES FOR SIGNERS

Logit Value	Number of Signers	Percent of Signers
4.27	249	21.9%
3.24	140	12.3%
2.44	158	13.9%
1.77	99	8.7%
1.21	63	5.6%
0.72	37	3.3%
0.29	40	3.5%
-0.13	42	3.7%
-0.54	53	4.7%
-0.95	29	2.6%
-1.39	20	1.8%
-1.86	11	1.0%
-2.39	11	1.0%
-3.02	1	0.1%
-3.90	1	0.1%

Table 6 illustrates a probability chart that can be derived for the above calculations. The probabilities of signing or fingerspelling "he", "me", "is", "at", and "-ing" for signers with the highest (most English) logit value of 4.27 are shown on the top line; the probabilities for signers with the next highest logit value (3.24) are shown on line 2; the probabilities for signers with the lowest logit level (least English) of -3.90 are given on the last line.

TABLE 6: PROBABILITIES GENERATED BY THE RASCH MODEL FOR
SIGNING "HE", "ME", "IS", "AT", "-ING"

Signer Logit	HE	ME	IS	AT	-ING	Number of Signers
4.27	1	1	.98	.97	.79	249
3.24	1	.99	.95	.92	.55	140
2.44	.99	.98	.88	.85	.35	158
1.77	.99	.97	.82	.73	.21	99
1.21	.98	.95	.71	.60	.14	63
.72	.97	.92	.60	.53	.10	37
.29	.95	.88	.50	.38	.06	40
-.13	.93	.83	.40	.29	.04	42
-.54	.88	.75	.31	.21	.03	53
-.95	.86	.67	.23	.10	.02	29
-1.39	.79	.57	.15	.10	.01	20
-1.86	.71	.45	.10	.07	.01	11
-2.39	.57	.33	.06	.04	0	11
-3.02	.43	.21	.04	.02	0	1
-3.90	.23	.10	.01	.01	0	1

4.0 Comparison of the Two Analyses

Both the scalogram and Rasch models show similar results in scaling the same linguistic data. Both models indicate that grammatical and lexical items should be represented on different scales. Both models agree on the order of scaling in the grammatical and the lexical scales. For the grammatical scale, the use of English inflections implies the use of English function words, which implies the use of English content words. For the lexical scale, the English representation of "look" implies the English representation of pronouns, which implies English representation of copulas.

While the analyses scale the data in similar ways, there are several important advantages to the Rasch analysis. First, the Rasch analysis intrinsically indicates that the test items or the sample need to be modified. This has to be inferred from the scalogram analysis. Second, the fit statistics in the Rasch model immediately indicate that the items with unacceptable fit statistics must be scaled multidimensionally. The scalogram analysis requires a number of tries before this is evident. Third, the fit

statistics in the Rasch model immediately indicate that items with negative fit statistics are more discrete than other items. This information must be inferred from the scalogram analysis. Finally, the Rasch model gives information about the probability of various levels of English signing. The scalogram analysis cannot provide probabilities.

In summary, Rasch analysis not only provides the same descriptive information as scalogram analysis, it also provides information not available through scalogram analysis. Moreover, it is possible to convert information obtained from the Rasch model into a scalogram model. Since Rasch analysis is a much more powerful tool for analyzing variation along a continuum than scalogram analysis, it would be useful for linguists analyzing language variation along a continuum to begin using Rasch analysis with or instead of implicational scales.

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