ETTHNOCLASSIFICATION OF BODY PARTS - A 3-CULTURE STUDY

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Journal
ANTHROPOLOGICAL LINGUISTICS, 21(8)

ISSN
0003-5483

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Publication Date
1979

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Peer reviewed
ETHNOCLASSIFICATION OF BODY PARTS:  
A THREE-CULTURE STUDY

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0. Introduction
0.1. Taxonomies vs. semantic networks
0.2. Partonomies
1. A comparative study in three cultures
1.1. Procedure
1.2. Data analysis
2. Results
2.1. Correlational analysis
2.2. Hierarchical clustering analysis
2.3. Semantic network analysis
2.4. Multidimensional scaling analysis
3. Statistical tests

0. The body is a central part of human experience. All cultures construct models of the body which are used in cultural belief systems concerning disease, sexual identity, child development, conception and contraception, sex roles, and mental illness. Understanding these and related phenomena requires exploration of culture-specific models of the human body, a task which has barely begun. The purpose of this paper is to offer a paradigm for cross-cultural studies of human anatomic classification using data from three linguistic communities: Maasai, Kikuyu, and American English.

0.1. Cognitive anthropology has tended to focus on the structure of taxonomic relations among words. The most notable examples of this emphasis are studies of folk biology (Berlin, et al. 1974, Hunn 1975, Brown, et al. 1976, Randall 1976). Even in these most successful cases, the folk taxonomy incorporates only a small part of a people's cognition of life forms. The most important facts about these life forms (that hyenas eat human corpses, wolves run in packs, and donkeys are stubborn) often find no place in such a taxonomic structure. Nor do the features which are most important to identifying the life forms: the elephant's trunk, hyena's strange noises, or the rabbit's ears. Thus, although a folk taxonomy is subsumed as part of a folk model of life forms, it may not be the most important part of such a model.
A particular limitation of taxonomies is their use of only one kind of semantic relation, inclusion. There exist other kinds of semantic relations which should be important to the study of anatomical parts. Casagrande and Hale (1967) list 13 semantic relations, and Evens et al. (n.d.) add several more relations to that list. Of the relations listed by these authors, five seem particularly relevant to the cognition of body parts:

1. Constituent: X is defined as being a constituent or part of Y (finger: hand, blood cell: blood, lip: mouth, trunk: elephant)
2. Spatial proximity or attachment: X is oriented spatially so as to be proximal to or attached to Y (tongue: mouth, hair: head, arm: shoulder, trunk: mouth)
3. Function: X is defined as a means of effecting Y (heart: circulation, mouth: speech, trunk: trumpeting)
4. Comparison: X is defined in terms of its similarity and/or contrast with Y (leg: arm, eye: ear, wrist: ankle, wing: fin, trunk: nose)
5. Inclusion: X is a kind of Y (mouth: orifice, arm: limb)

Several of these relations as well as others not on this list may be required to describe any cultural model of the human body. Using all of the appropriate relations one will arrive at a semantic network which describes the semantic relations which are perceived among pairs of body part labels. This is the kind of model which we will attempt to construct in the present paper.

A partonomy (Brown 1976) is a hierarchical structure based on the part-whole relation. In a partonomy any entity can have many parts, but it can be a part of only one immediately superordinate entity. This constraint is analogous to the taxonomic restriction that a whale can be either a kind of fish or a kind of mammal, but not a kind of both (using a fuzzy set approach, the latter is partially possible). For example, the arm has several parts (wrist, elbow, hand), but each of these is a part only of the arm and of entities superordinate to the arm:

```
   Body
  /   \
Head  Arm  Leg
 /  \\  /  \\
wrist elbow hand
```

The wrist, being part of the arm, cannot also be part of the leg. Examples of partonomies are Saunders and Davis (1974), Liston (1972) and Stark (1969).

Brown (1976) has published a cross-cultural study of human anatomic partonomies, along with some generalizations about the 'growth' of partonomic nomenclature. His study is facilitated by the fact that he only deals with surface body parts, which are most easily perceived. As long as one deals only with the surface of the body one can justifiably claim to have an etic grid on which to make comparisons. ²

Anatomic systems in general have only a partial etic grid. Although the surface of the body is perceivable (and relatively uniform) cross-culturally, there is great cross-cultural variability in familiarity with what lies inside.
Two factors of great importance to this cultural difference in familiarity are (a) the presence or absence of butchering as an activity which is carried out by ordinary people rather than by craft specialists and (b) the presence of and wide dissemination of a system of medical anatomy based on dissection or autopsy. In general, people have more freedom to invent arbitrary categories and explanatory systems for the internal organs than they do for the surface parts. Thus studies of only the surface will be of little use for areas such as nutritional or medical anthropology, since most of the interesting beliefs have to do with the interior. It is necessary to probe beneath the surface to gain a complete understanding of a corpus of anatomic terms.

Brown has demonstrated that it is possible to construct partonomies of surface body parts. If one goes beneath the surface of the body, the task becomes more difficult. Take for example, the parts: heart, torso, circulatory system. Most readers will agree that these are cognitively salient anatomic parts in America. The heart is part of the torso, and is also part of the circulatory system. However, the torso is not part of the circulatory system, nor is the circulatory system part of the torso. Thus, one can not construct a partonomic structure among these three entities. A diagram of the partonomic relations among the three concepts branches from the bottom up:

```
circulatory system
   /\                                 /\                                 /\
torso     heart                       heart     torso
       /\            /
      /   \         /   \         /
     /     \       /     \       /
    /       \     /       \     /
   /         \   /         \   /
   |          |   |          |   |
   |          |   |          |   |
   |          |   |          |   |
   |          |   |          |   |
   |          |   |          |   |
```

whereas a partonomy would branch from the top down:

```
head
  /\  /
ear  mouth  trunk
```

That this is not an isolated example can be shown by the ready availability of another example involving the concepts head, digestive tract, and mouth. The mouth is part of both the head and the digestive tract, but the head is not part of the digestive tract, nor is the digestive tract part of the head.

Although the preceding two examples each use concepts pertaining to overlapping systems (e.g. circulatory system, digestive system) we do not think that this invalidates the argument. It is difficult to imagine how one could construct a reasonable model of partonomic relations within a body if systems were to be excluded from the list of parts, since most body parts are in fact biological systems.

More generally, it is easy to show that there are many overlapping ways to cut up a body or any other physical entity. A square can be cut into 4 quadrants A, B, C, and D, which can be combined in four alternative ways into halves: AB, AC, BD, and CD:
A is a part of AB and is also a part of AC, but AB is not a part of AC, nor is AC a part of AB. It is not possible to construct a tree structure to represent the paronomic relationship among the quadrants of this square and the four halves of the same square.

In conclusion, although part-whole relations (the constituent relation) are important to body parts, it may not always be possible to organize such relations as a hierarchy. Rather, the part-whole relations may have to be organized in a more general kind of semantic network, one which allows for overlapping elements. Later in this paper we will examine data from three cultures to see to what extent they make use of paronomic relations.

1.0. Here we discuss the results of a study of anatomic classification among Kikuyu, Maasai, and American English speakers. We study the three systems of classification using two triads experiments. A first experiment (Test A) was administered in the local languages to Massai, Kikuyu, and Southern Californians. This test deals with 12 surface body parts plus the more general concept 'body'. A second experiment (Test B) was administered to Kikuyu and Maasai. This test deals with 11 external and internal anatomic parts. We will analyze data from these tests using multidimensional scaling, hierarchical clustering, and semantic network analysis. Discussion will focus on the issues raised above.

1.1. To provide data on the cognitive organization of body parts across three contrasting cultures, similarities judgments were elicited through triads testing of Maasai and Kikuyu in Kenya, and Americans in Southern California. Judgments of relative similarity among pairs of body parts were then compared to models of semantic relations among the parts.

In a triads test, stimuli are presented to respondents three at a time. For each triad, respondents are asked to select from the three stimuli the one which is most different in meaning from the other two. A triads test typically consists of a number of such items, chosen so as to make systematic similarity comparisons within a set of stimuli. Triads tests have been used extensively in cognitive anthropology using verbal stimuli (Romney and D'Andrade 1964, Kirk and Burton 1976, Burton and Kirk 1976, Kirk and Burton 1977, Truex 1975). A standard triads test uses all possible triadic combinations among the words which comprise a semantic domain. In the present study a balanced incomplete block design (Burton and Nerlove
1976) was used with Test A (administered to Maasai, Kikuyu, and English speakers) in order to permit inclusion in the test of a greater number of stimuli with negligible distortion in the reliability of the test, yet with manageable test length. Balanced block designs require that each pair of stimuli appear in the same number of triads. With the present design each pair of terms was included in two triads, producing a set of 52 triads comprised of 13 body part terms. The 52 triads were randomized and presented in the same order for each consultant in each of the three languages.

For Test B (administered to Maasai and Kikuyu speakers) a standard design was utilized which was incomplete, but not balanced. Eleven terms were presented in a total of 51 triads. All but one of the pairs of anatomic terms appeared in two or more triads.

Each of the five triads tests was administered to a discrete set of from 35 to 39 consultants. The terms included in each of the tests are listed below:

<table>
<thead>
<tr>
<th>American English (N = 39 respondents)</th>
<th>Test A Maasai (N = 38 respondents)</th>
<th>Kikuyu (N = 35 respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. arm</td>
<td>1. enkaina arm</td>
<td>1. guoko arm</td>
</tr>
<tr>
<td>2. body</td>
<td>2. osesen body</td>
<td>2. muiri body</td>
</tr>
<tr>
<td>3. face</td>
<td>3. enkomon face</td>
<td>3. uthiu face</td>
</tr>
<tr>
<td>4. elbow</td>
<td>4. oloidolol elbow</td>
<td>4. kigokora elbow</td>
</tr>
<tr>
<td>5. mouth</td>
<td>5. enkutuk mouth</td>
<td>5. kanua mouth</td>
</tr>
<tr>
<td>6. cheek</td>
<td>6. eseder cheek</td>
<td>6. ikai cheek</td>
</tr>
<tr>
<td>7. hand</td>
<td>7. endap enkaina arm</td>
<td>7. ruhi palm, hand</td>
</tr>
<tr>
<td>8. foot</td>
<td>8. endap enkeju foot</td>
<td>8. ikinya foot</td>
</tr>
<tr>
<td>10. finger</td>
<td>10. olkimojino finger, toe</td>
<td>10. karu finger, toe</td>
</tr>
<tr>
<td>11. ear</td>
<td>11. enkiok ear</td>
<td>11. gutu ear</td>
</tr>
<tr>
<td>12. leg</td>
<td>12. enkeju leg</td>
<td>12. kuguru leg</td>
</tr>
<tr>
<td>13. head</td>
<td>13. elukunya head</td>
<td>13. mutue head</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test B Maasai (N = 38 respondents)</th>
<th>Kikuyu (N = 36 respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. olarasi</td>
<td>1. rubaru rib</td>
</tr>
<tr>
<td>2. ilpapit</td>
<td>2. rucuirir hair</td>
</tr>
<tr>
<td>3. ilpapat lengkongu</td>
<td>3. rubutu eyelash</td>
</tr>
<tr>
<td>4. oltagiligil</td>
<td>4. ruthia jaw</td>
</tr>
<tr>
<td>5. olnegejep</td>
<td>5. suririmi tongue</td>
</tr>
<tr>
<td>6. enkongu</td>
<td>6. riitho eye</td>
</tr>
<tr>
<td>7. olalae</td>
<td>7. igego tooth</td>
</tr>
<tr>
<td>8. oloito</td>
<td>8. ihindi bone</td>
</tr>
<tr>
<td>9. olgos</td>
<td>9. mumero throat</td>
</tr>
<tr>
<td>10. elukunya</td>
<td>10. mutue head</td>
</tr>
<tr>
<td>11. enkutuk</td>
<td>11. kanua mouth</td>
</tr>
</tbody>
</table>
All testing was done in the consultants' first language, and each test was administered by a member of the consultants' ethnic group.

1.2. For each triads test a matrix of similarities measures was computed. Similarity between any pair of words is defined as the number of times that a third word is chosen as most different, divided by the maximum number of times this could happen. In the Kikuyu version of Test A, for example, arm and foot appear together in two triads, once with hand and once with body. In the first triad, two respondents out of 35 chose hand as most different from arm and foot, thereby lumping arm and foot. In the second triad, 23 out of 35 respondents chose body as most different from arm and foot. Thus out of 70 triads there were 25 in which a third concept was chosen as most different so that the similarity of arm to foot is calculated to be 25/70.

Two kinds of analysis—multidimensional scaling and hierarchical clustering—were performed for all five data sets. In multidimensional scaling, words are represented as points in a multidimensional space so that words similar in meaning are proximal in the space, and words dissimilar in meaning are distant in the space. A measure of badness of fit ('stress') is computed as the difference between the rank ordering of the similarities measures and the rank ordering of the distances in the multidimensional space. In hierarchical clustering analysis as formulated by Johnson (1967), a binary tree is built from the bottom up. In general, more similar words are closer together in the tree.

2.1. To assess the degree to which people in the three cultures converge in their triads judgments, cross-cultural correlations were computed among the similarities measures for parallel tests. The correlation between the Kikuyu and Maasai for Test B is .618, indicating a fairly high degree of sharing between the two cultures in cognitive organization of the anatomic concepts. The intercultural correlations for Test A are entered in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Kikuyu</th>
<th>Maasai</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>.810</td>
<td>.533</td>
<td></td>
</tr>
<tr>
<td>Kikuyu</td>
<td>.810</td>
<td>.531</td>
<td></td>
</tr>
<tr>
<td>Maasai</td>
<td>.533</td>
<td>.531</td>
<td></td>
</tr>
</tbody>
</table>

Here we see that the English and Kikuyu tests are very strongly correlated, and that both have much weaker correlations with the Maasai test.

2.2. If body parts are cognitively organized in a hierarchical manner either as a partonomy or as a taxonomy, then a hierarchical clustering analysis of the triads data should reveal aspects of that hierarchical structure. We have done hierarchical clustering analyses using the all-possible-pairs cluster analysis program (D'Andrade 1978). Results of these analyses are depicted in Figures 1 through 5.

The hierarchy of Figure 1 pertains to the English version of Test A. The first distinction contrasts body to all parts of the body. Two interpretations
of this distinction are possible, (1) that it is a contrast of the whole body with its parts and (2) that the focal meaning of body in English is torso, so that the first distinction contrasts the torso to the extremities (head and limbs). 6

Figure 1. Hierarchical Cluster Analysis of English Body Parts Triads Data

In contrast to the English hierarchy, the hierarchical structures for Kikuyu and Maasai versions of Test A (Figures 2 and 3) place body within one of the major clusters of body parts. For Kikuyu a primary distinction contrasts the head and its parts with body and the limbs. Body is included in a sub-cluster with the leg and its parts. For Maasai, a primary distinction contrasts the limbs with head and body. Here body is included in a sub-cluster with mouth.
and ear, suggesting that for Maasai the focal meaning of body pertains to the sensory or nervous system.

None of the three hierarchies are pure partonomies. For example, the English hierarchy has a distinction among limbs between (a) arm, elbow, leg, and knee and (b) hand, finger, and foot. This distinction is based on a classification of parts into kinds of parts — limbs vs. ends of limbs — and adds a taxonomic relationship to the part-whole relationship. Focusing on the Maasai hierarchy, we see that the primary distinction among parts of the head is a contrast between sense organs (mouth and ear) and other parts of the head, again a taxonomic relationship.

Figure 3. Hierarchical Cluster Analysis of Maasai Body Parts Triads Data

Figure 4. Hierarchical Cluster Analysis of Kikuyu Anatomic Triads Data
Hierarchical representations of Kikuyu and Maasai versions of Test B appear in Figures 4 and 5. These two hierarchies are strikingly similar to each other. Both show a primary distinction between external parts and internal parts. They differ in that Maasai classify eye with the internal parts whereas Kikuyu classify eye with the external parts (hair, head, and eyelash). Both hierarchies contain a secondary distinction among internal parts between bones (rib, tooth, and bone) and other parts. Within the cluster of non-bone parts, Maasai and Kikuyu differ to some extent: the Maasai hierarchy contains a cluster of sense organs (tongue, eye, mouth) whereas the Kikuyu hierarchy does not.

From the hierarchical clustering results, we can conclude that there is a great amount of similarity between Maasai and Kikuyu in their classification of body parts, but that the two cultures differ (a) in the focal meaning of body and (b) in that Maasai recognize a cluster of sense organs (ear, mouth, tongue, eye) while Kikuyu do not. In Test A, Maasai cluster ear and mouth together while Kikuyu do not, and in Test B Maasai cluster eye, tongue and mouth together while Kikuyu place eye with external parts. The Maasai focal meaning of body places it within the cluster of sense organs.

2.3. In this section we examine specific semantic relations among pairs of words. To do this we isolate all pairs of words which were judged to be similar more frequently than would be expected by chance. For each pair we provide an interpretation in terms of possible semantic relations that could have led that pair of words to be judged to be similar.

To assess which words were judged to be similar more frequently than would be expected by chance we use the binomial test. For example, there were 35 respondents to the Kikuyu version of Test A. Since we used a balanced incomplete block design in which each pair of words appeared in two triads, each consultant made two independent judgments of the similarity of each pair,
for a total of 70 independent judgments of each word pair. If responses were random, we would expect each word pair to be classified together in 1/3 of 70 judgments. Such responses would be binomially distributed with a mean of 70/3. Using the binomial distribution, we can test the null hypothesis that the observed similarities between word pairs could have been obtained by means of random responses to the triads. We find that there is less than 1 chance in 20 that two words would be classified together in more than 30 of the 70 judgments. We use this criterion to mark those pairs of words which appear to be linked together in a way that would not be likely to have been obtained by chance.

Figure 6 is a relational network for the Kikuyu version of Test A. Lines are drawn between all pairs of words which were classified together more than 30 times. The number beside each line is the proportion of the 70 choices for which the two words were classified together. From Figure 6 we can see that there are two sharp clusters of Kikuyu body parts: (a) head and its parts and (b) limbs and body. There are 8 significant links within the cluster of head parts and 13 significant links within the body-limb cluster. There are no significant links between the two clusters. If judgments had been made by chance we would have expected 1 link in 20 to be significant. Since there are 78 pairs of words, we would have expected 3.9 links. With 23 significant links in Figure 6, we can safely conclude that there are many more than would have been obtained through random responses to the triads.

Figure 6. Relational Network for Kikuyu Body Parts Triads Data

Three semantic relations can be seen within the Kikuyu semantic network:
1. part: whole (ear: head, face: head, cheek: face, mouth: face, foot: leg, elbow: arm, hand: arm, knee: leg, foot: body, elbow: body)
2. spatial proximity (ear: face, ear: cheek)
3. comparison (ear: mouth)
This leaves 7 links within the body-limbs cluster that are not accounted for by semantic relations. Three of these could be interpreted as coordinate parts of a larger structure (finger: elbow, toe: foot, elbow: hand). However, it is not clear that any of these links should be interpreted as semantic relations. Rather, it seems that several pairs of body-limb parts are linked only because they were presented in triads where they contrasted with parts of the head. Here the specific links are a consequence of the major binary distinction between the head and the rest of the body.

The Maasai relational network for Test A appears in Figure 7, and is quite different from the Kikuyu network. There is no longer a sharp contrast between the head and other body parts. All 13 words are linked into a single structure within which one can see a contrast between the arm and the rest of the body. Parts of the head are inter-mixed with parts of the leg. For example, head is linked to cheek, face, and leg, and mouth is linked to cheek, knee, ear, and body. The Maasai network appears to distinguish arm, which is lateral from the center, from head and leg, which are on the same vertical axis. As in the Maasai cluster analysis, body is linked to the two sense organs, mouth and ear.

Figure 7. Relational Network for Maasai Body Parts Triads Data

```
HAND
  | .477 .500
  | .513
  │
  │ ARM .526 ELBOW
  │
  │ .462
  │
  │ FINGER/TOE
  │
  │
  │ CHEEK .579 FACE
  │
  │ .447 .526
  │
  │ HEAD
  │
  │ .434 .467 FOOT
  │
  │ .474 .434
  │
  │ LEG
  │
  │ .592
  │
  │ KNEE .520
  │
  │ MOUTH .488 EAR
  │
  │ .434
  │
  │ BODY .434
```
Within the Maasai network there are 17 significant links, whereas only 3.9 would be expected by chance.

Semantic relations which appear to be recognized by Maasai are as follows:

1. part: whole (elbow: arm, hand: arm, finger/toe: arm, cheek: head, face: head, knee: leg, foot: leg, mouth: body, ear: body)
2. spatial proximity (cheek: face, face: ear, cheek: mouth)
3. comparison (mouth: ear)

One other link could be interpreted as coordinate parts of a higher structure (the arm) hand: elbow. Three links (arm: cheek, head: leg, and knee: mouth) are difficult to interpret. They may be links which were obtained through chance events, or they may have meanings to Maasai which are not presently understood.

Semantic networks for the Kikuyu and Maasai versions of Test B appear in Figures 8 and 9. The two networks are very similar. Relations which are found in both include:

1. part-whole (eye: head, tongue: mouth)
2. class inclusion (eyelash: hair, rib: bone)
3. spatial proximity (jaw: mouth, eyelash: eye, hair: head)
4. shared attribute (boniness) (tooth: rib)

Figure 8. Relational Network for Kikuyu Anatomic Triads Data
Figure 9. Relational Network for Maasai Anatomic Triads Data

RIB —— .632 —— TOOTH —— .605 —— JAW

.509

BONE —— .477 —— MOUTH

.500

EYE —— .461 —— HEAD

.500

TONGUE —— .465

.500

.559

EYELASH —— .467 —— HAIR

Relations which occur only within the Kikuyu network include:
1. part-whole (jaw: head, tooth: head)
2. spatial proximity (jaw: throat, throat: mouth)
3. shared property (boniness) tooth: bone)
4. common noun class membership; i.e., Leakey’s class 5 (eye: tooth, tooth: bone)

Relations which occur only within the Maasai network include:
1. comparison (sense organs, or organs used in communication)
   (eye: tongue, mouth: eye, mouth: tongue)
2. shared property (boniness) (tooth: jaw)
3. spatial proximity (tooth: mouth, mouth: tongue)
4. part-whole (mouth: tongue, tooth: jaw)

It should be noted that alternative interpretations are possible for some of the relations. For example, the relation of tongue to mouth could be one of part to whole, or of spatial proximity, or of comparison.

2.4. All five data sets were subjected to multidimensional scaling using the TORSCA program (Young and Torgerson 1968). After examining stress patterns and comparing results from three- and two-dimensional scalings, we concluded that two-dimensional scalings produced adequate representations of the data.

Figure 10 is a two-dimensional representation of the English version of Test A. The first dimension is a contrast between head and limbs, with body intermediate to the two. In the second dimension ‘whole body’ (as conceptualized in English) is at one extreme (negative pole), the intermediate parts are in the middle, and the smallest parts are at the opposite extreme (positive pole). The foot and knee are more positive than is leg, and elbow, hand, and finger are more positive than arm. Face is more positive than head, and ear, cheek and mouth are even more positive. Thus there is a strong correspondence between the partonomy of English body parts and the multidimensional condification of English body parts. Part-whole relations have been superimposed on the multidimensional configuration.
Figure 10. Two-Dimensional Scaling of English Body Parts Triads Data.
Stress = .157. Part-whole relations superimposed.

Figure 11 is a two-dimensional representation of the Kikuyu version of Test A. Again we see the first dimension as a contrast between head and limbs, with body now included among the limbs. Some partonomic structuring can be seen in the second dimension: as with the English structure, body and head take the most negative values on this dimension. Unlike the English structure, limbs in the Kikuyu structure are distinguished not by partonomic relations, but by a contrast between arm and leg: all leg parts are negative on the second dimension (resulting in the placement of body within the cluster of leg parts), while all arm parts are positive on that dimension. Finger/toe is included with the arm parts.

In order to facilitate comparison between the Kikuyu relational network and the multidimensional scaling of Kikuyu body parts, we have superimposed the relational network on the multidimensional configuration of Figure 11. Lines have been drawn between pairs of words which are connected in the Kikuyu network. It is easy to see that there is a high degree of correspondence between the two structures.
Figure 11. Two-Dimensional Scaling of Kikuyu Body Parts Triads Data. Stress = .158. Relational network superimposed.

Figure 12 is a two-dimensional representation of the Maasai version of Test A. Although the first dimension is again a contrast between head and limbs, the clustering is not as sharp as in the Kikuyu case. Body is now included among the head parts, proximal to mouth and ear. With the Maasai data there is no evidence at all of a partonomic structure. Within the limbs there is a contrast between leg parts (negative on dimension 2) and arm parts (positive on dimension 2); the same contrast was seen in the Kikuyu structure. Finger/toe is included with the arm parts; it was included with the leg in the cluster analysis of the same data. For head parts, the second dimension is a contrast between sense organs and other parts of the head.

We have again superimposed the Maasai relational network upon the Maasai body parts scaling, to show that there is a close correspondence between the two structures.
Figure 12. Two-Dimensional Scaling of Maasai Body Parts Triads Data.
Stress = .225

Multidimensional scaling configurations for the Kikuyu and Maasai versions of Test B appear in Figures 13 and 14. The two configurations are very similar to each other. In both cases the first dimension indicates a contrast between internal parts (positive values on the horizontal axis) and external parts (negative values on the horizontal axis). In both structures, rib, tooth, jaw, and bone are internal parts. In Kikuyu tongue and throat are also internal, whereas they are intermediate in Maasai. In Maasai mouth is internal, whereas it is intermediate in Kikuyu. In both structures hair, eyelash, eye, and head are external.

The second dimension of both configurations appears to be a contrast between (a) living tissue (mouth, tongue, eye, throat) and (b) bone or hair (rib, bone, tooth, eyelash, hair). In Maasai throat, tongue, eye, mouth, and jaw contrast with hair, head, bone, and rib. In Kikuyu mouth, tongue, eye, jaw, and throat contrast with rib, tooth, bone, eyelash, and head.
Figure 13. Two-Dimensional Scaling of Kikuyu Anatomic Triads Data. Stress = .165

Figure 14. Two-Dimensional Scaling of Maasai Anatomic Triads Data. Stress = .191
Superimposition of the semantic networks on the two multidimensional scalings shows a high degree of correspondence between the networks and the multidimensional scaling configurations. The degree of correspondence between the two structures is noticeably higher for the Maasai data than it is for the Kikuyu data.

3. Some of the generalizations which emerge from the preceding results are here subjected to statistical tests.

(A) First, we have concluded that while English speakers distinguish body from the parts (head and limbs), Kikuyu assign a focal meaning to body which causes it to be clustered with the limbs, and Maasai assign a focal meaning to body which causes it to be clustered with parts of the head. This contrast between Kikuyu and Maasai in the meaning of body can be tested statistically using an analysis of triads responses in those triads which contain one part of the head, one part of the limbs, and the concept body. For these critical triads there are three possible choices:

(a) Select body as most different.
(b) Select the head part as most different, thereby classifying body with the limbs.
(c) Select the limb part as most different, thereby classifying body with the head.

Within the Test A there are four such critical triads. Table 1 tabulates the results for these four triads. Two generalizations emerge from this table: (a) although the least frequent response in both samples is to select body as most different, Maasai make this choice with significantly higher frequency than do Kikuyu ($X^2 = 9.45, p < .005$); (b) among choices in which body is classified with the head or limbs, there are strong tendencies for Kikuyu to classify body with the limbs and for Maasai to classify body with the head ($X^2 = 36.2, p < .0001$).

Table 1. Tabulation of Triads Responses for Four Critical Triads Pertaining to the Classification of Body with Head or Limbs

<table>
<thead>
<tr>
<th></th>
<th>Kikuyu</th>
<th>Maasai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body most different</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>Body classified with limbs</td>
<td>102</td>
<td>49</td>
</tr>
<tr>
<td>Body classified with head</td>
<td>22</td>
<td>63</td>
</tr>
</tbody>
</table>

This tendency for Kikuyu to make a strong distinction between body and head can also be seen within responses to three triads containing the word body together with two parts of the head. Aggregated frequencies from these three triads are tabulated in Table 2.

Table 2. Tabulation of Triads Responses for Three Critical Triads Consisting of the Word Body and Two Parts of the Head

<table>
<thead>
<tr>
<th></th>
<th>Kikuyu</th>
<th>Maasai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body most different</td>
<td>72</td>
<td>47</td>
</tr>
<tr>
<td>Body classified with one part of the head</td>
<td>33</td>
<td>67</td>
</tr>
</tbody>
</table>

Here it can be seen that there is a greater tendency for Kikuyu to distinguish body from the two head parts ($X^2 = 15.39, p < .0005$).
(B) A second generalization is that Maasai associate eye, ear, and mouth as a cluster of sense organs, whereas in Kikuyu these entities fall into disparate categories. This tendency is demonstrated by responses to one of the triads from the Test A (mouth, eye, and head). Response frequencies for this triad are listed in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>Kikuyu</th>
<th>Maasai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head most different</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Mouth most different</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Eye most different</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>

We see from this table that Maasai tend to classify mouth and eye together, whereas Kikuyu tend to separate mouth and eye ($X^2 = 7.41$, $p < .01$).

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NOTES

1. Research on which this paper is based was done in Kenya between July 1973 and June 1974, and in California during the spring of 1975. Maasai data were collected in the Loita Hills, Narok District, by Joseph Ole Kipelian and Moses Ole Simel. Kikuyu data were collected in Ngecha Location, Kiambu District, by Lydia Wangome and Rose Maina. The Kenya research was supported by a grant from the Carnegie Foundation to the Child Development Research Unit of the University of Nairobi. American data were collected at the University of California, Irvine, and data analysis was done using the Irvine computer system. We are grateful to Doug White, Stuart Plattner, Oswald Werner, Cecil Brown and Marshall Durbin for comments on earlier versions of this paper.

2. An opposite point of view is taken by Saunders and Davis (1974), who de-emphasize surface parts, concentrating on head bone parts, since "bones are relatively discrete in that they are detachable or that their articulations, hence their boundaries, are manifest in most instances." (p. 175). Not while the patient is alive, though.

3. One could argue that the mouth is not a part but a hole.

4. Maasai words are marked for gender by en- feminine or ol- masculine, which assimilate in some contexts to e- and o-.

5. Maasai terminology for hand and foot demonstrate an exception to principles 6 and 7 of Brown's article on partonomic nomenclature: "The parton /hand/, if labeled, is always labeled by an unanalyzable primary lexeme." And "The parton /foot/, if labeled, is always labeled by an unanalyzable primary lexeme." It is clear that hand and foot in Maasai are labeled by secondary lexemes.

6. A parallel phenomenon is seen in Stark (1969) where the Quechua word kirpu refers both to the whole body and to the trunk.

7. A possibly parallel kind of classification is the Maasai classification of territory, which seems to contrast the center of Maasai territory to the periphery (Galaty 1977).

8. Cf. Burton and Kirk (1976), Leakey (1959). This class is described by Leakey as pertaining to objects or beings of supernatural significance.