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The Neighbor Factor: Basket Designs in Northern and Central California

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THIS paper is a test of the use of symmetry analysis of basket design to measure interaction among northern and central California Indian cultures. Although long-distance trade networks and casual exchanges at ceremonies have long been known as vehicles for cultural interchange, anthropologists have not systematically used criteria other than language for studying affiliations. Differences in language classically have been used to define tribal entities, but the subsequent consideration of other cultural information within these linguistic units has masked the fact that much information and actual interaction crosses these "unintelligible" boundaries.

I suggest that the structure of repeated patterns, that is, the geometric arrangement of motifs in a design, can be used to study interaction and affiliation patterns. The medium chosen for this study is basket design. I shall show that: (1) consistencies in California Indian basket design structures do not necessarily map out on a one-to-one basis with linguistically defined tribal designations; and (2) certain kinds of interaction and activity patterns apparently foster similarities and differences in design structure.

THE METHOD OF SYMMETRY ANALYSIS

While a complete discussion of the method of symmetry analysis is available in Washburn (1977) and Washburn and Crowe (n.d.), the basic principles will be reviewed here. Symmetry is a geometric property which describes the equivalence of parts of a repeated pattern. We shall consider symmetries of the two-dimensional plane (patterns on flat surfaces), as opposed to those in three dimensions, such as a crystal. In the plane there are three axial categories: finite, one-dimensional or band designs; and two-dimensional or all-over wallpaper patterns. In each category there are a finite number of geometric motion classes, or symmetries, which repeat (superimpose) the parts upon themselves along the line axes or around the point axis. There are four basic motions which occur singly or in combination in these axial categories: translation; rotation; mirror reflection; and glide reflection. Thus, for one-dimensional designs there are seven different motion classes, or combinations of the four motions, which repeat the pattern parts; for two-dimensional patterns there are 17 different motion classes which repeat the pattern parts.

Examples of the four most frequently occurring motion classes (*p112*, *pma2*, *pm11*, *pmm2*) used by California tribes are illustrated here schematically in Figures 1a, 2a, 3a, and 4a respectively. Figure 1a shows how the motion of bifold rotation, *p112*, repeats the right triangles by rotating each triangle twice around a point until it superimposes upon itself. The points of rotation are indicated by small ellipses. Figure 2a shows how the motion of mirror reflection, indicated by solid lines, is added to a pattern with bifold rotation to produce the pattern class *pma2*. Figure 3a shows a schematic pattern with only mirror reflection across the vertical planes of reflection (class *pm11*). Figure 4a shows a schematic pattern with mirror reflection across both the ver-

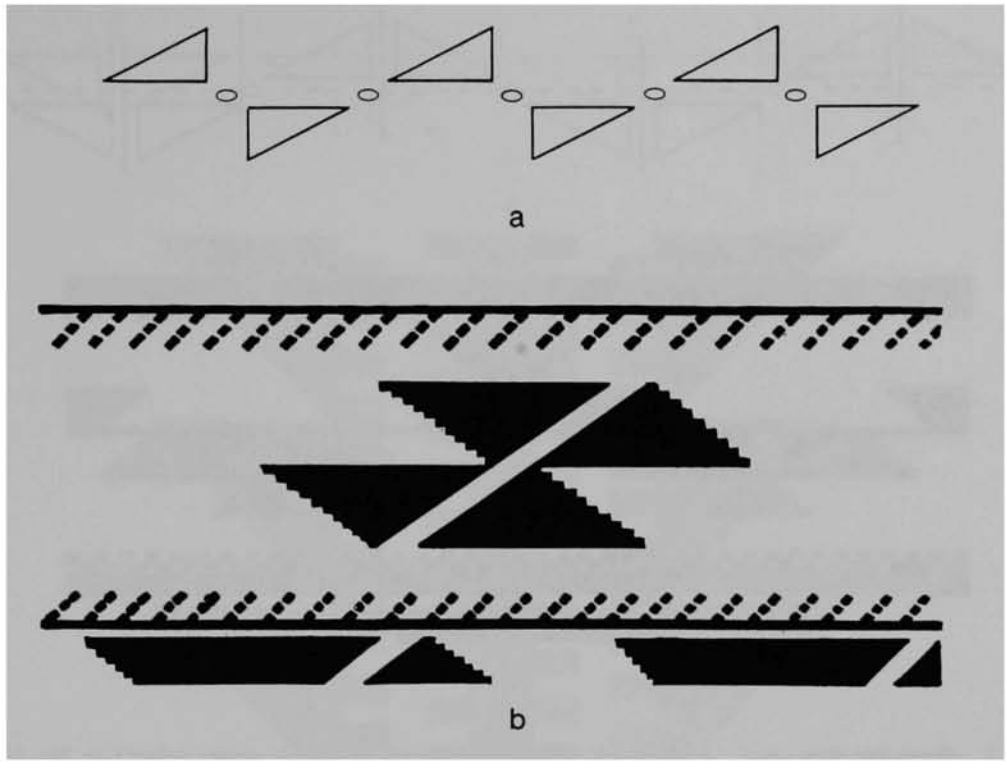

Fig. 1. Symmetry class *p112*. a, schematic drawing; b, Yurok basket hat design (after O'Neale 1932:Pl. 24).

tical and horizontal planes of reflection (class *pmm2*). Photographs or drawings of actual designs on decorated baskets with these symmetries are illustrated in Figures 1b, 2b, 3b, and 4b respectively.

In a number of different studies (described extensively in Washburn and Crowe n.d.) it has been shown that cultural groups preferentially use only several of these symmetry classes to structure designs when they decorate material objects in their cultural repertoire. Archaeological studies (see discussion in Washburn and Crowe n.d.) have shown how design structure rather than design element studies are more sensitive to cultural change over time and space. Preparatory to this study, a reanalysis of O'Neale's (1930) data confirmed that pattern structure is a significant factor in native design production (Washburn 1986). This paper shows how similarities in design structure relate to lines of intertribal interaction regardless of similarities or differences in linguistic affiliations.

THE DATA BASE

California Indian data were chosen for this analysis because of the wealth of historical and ethnographic information that could be used to clarify factors that affect the homogeneity and heterogeneity of design structure on baskets. Definite homogeneities of design structure were observed on Anasazi ceramics (Washburn 1977), but given that the data are prehistoric, it was not possible to determine whether these similarities represented the work of an ethnic group, different peoples having a close trading,

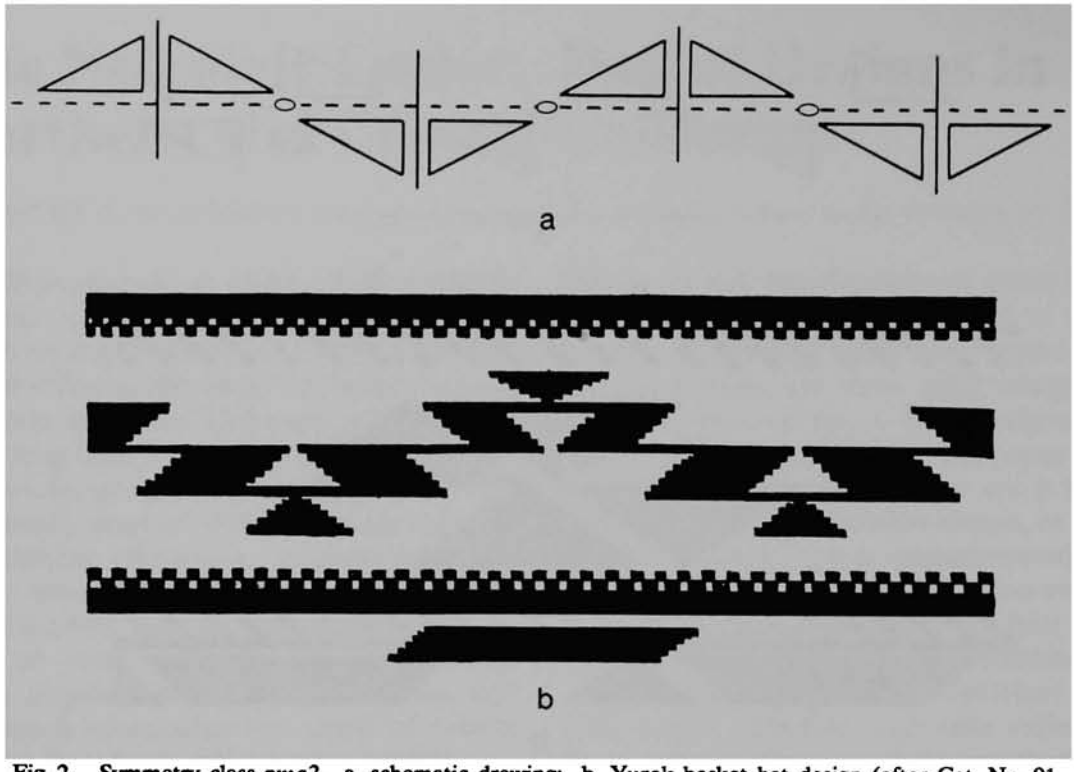

Fig. 2. Symmetry class *pma2*. a, schematic drawing; b, Yurok basket hat design (after Cat. No. 91, collections of the California Academy of Sciences, San Francisco).

visiting, and perhaps intermarrying network, or some arrangement between these two extremes. Clearly, an ethnographic situation where other social, political, economic, and environmental factors were known would enable better definition of the factors affecting the similarities and differences of design structures.

However, examination of archival records suggested that the basket collections that Kroeber and others made at the turn of the century were heavily affected by large-scale amateur collecting and patron activities (Washburn 1984). In order to determine how these events affected the design system, I reanalyzed the designs on baskets from the Yurok, Karok, and Hupa, which were collected by Kroeber (1905) and analyzed by O'Neale (1932). Informant commentary obtained by O'Neale (1930) indicated that mark (i.e., motif) name and mark arrangement (i.e., design structure) were the two criteria used by weavers to judge "good" designs, that is, designs stated as being traditional and acceptable for tribal use.

Further, since collector demand encouraged the Indians to duplicate the old patterns, the *same* design structures were used both for baskets for home use and for those made for sale to whites. (The makers and users, however, could easily distinguish the "for sale" baskets because they were further embellished with more colors and added design elements which the Indians felt would appeal to the collectors' Victorian aesthetic tastes.) This preservation of traditional design structures allows us to use post-contact baskets for this study.

Symmetry analysis of the mark arrangement of Yurok, Karok, and Hupa designs revealed that these peoples consistently used symmetries *p112* and *pma2*, and that these

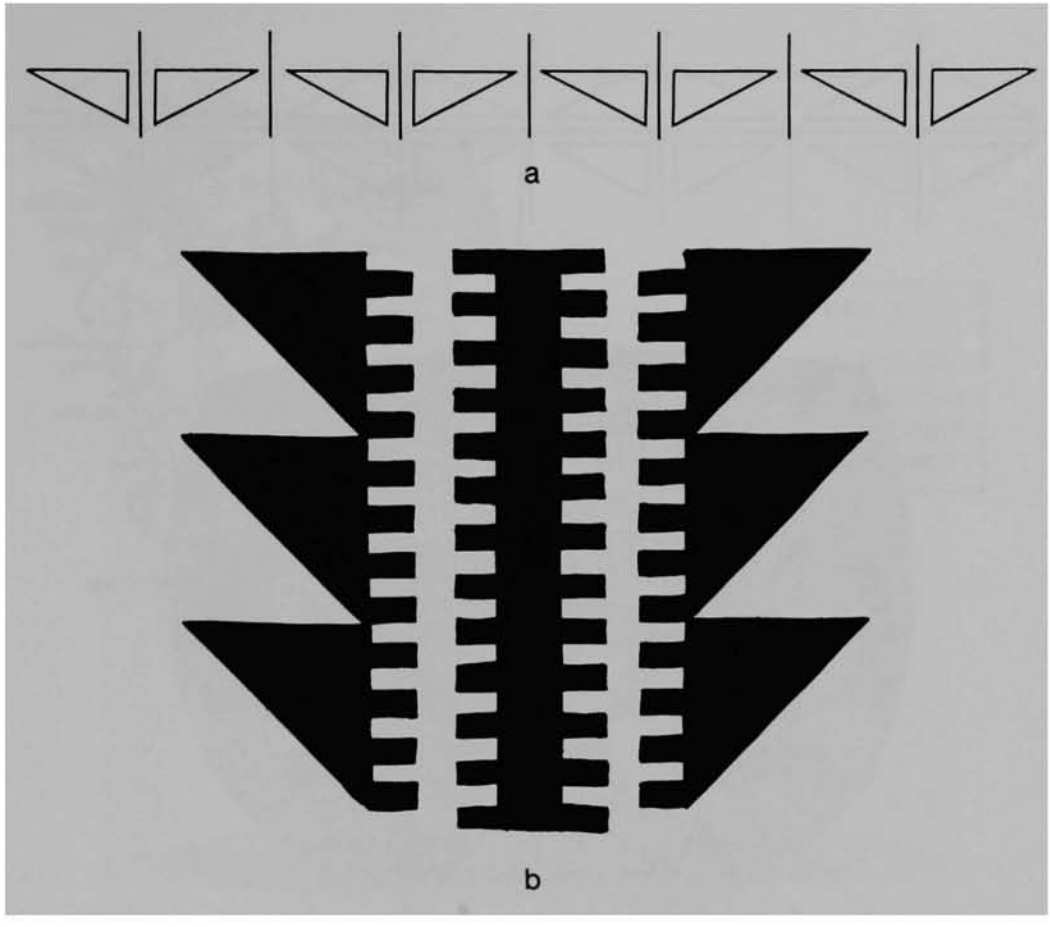

Fig. 3. Symmetry class *pm11*. a, schematic drawing; b, Pomo basket design (after Barrett 1908:Pl. 31, #120).

symmetries were used in proportions that were not significantly different, so that baskets from any one of the groups are indistinguishable from those of another (Washburn 1986).

The study of the attribute of design structure, then, seemed appropriate since both the makers agreed on its importance and analysis of its presence revealed highly consistent, non-random usage. For the northwestern California groups this homogeneity in design arrangement seems to agree with well-known similarities in other aspects of their material and social culture. In other words, these groups shared a self-sufficient lifeway that led to participation at each other's ceremonials, intermarriage systems, and in other visiting and exchange relationships. These interaction activities along their "riverine" roads apparently provided the conditions which fostered a unified, homogeneous design system.

In an effort to more systematically determine what specific factors/activities are related to the observed consistencies and distributions of design structures, this project was expanded to a comparative study of the design structures of native groups in northern and central California. The distributions observed were related to ethno-

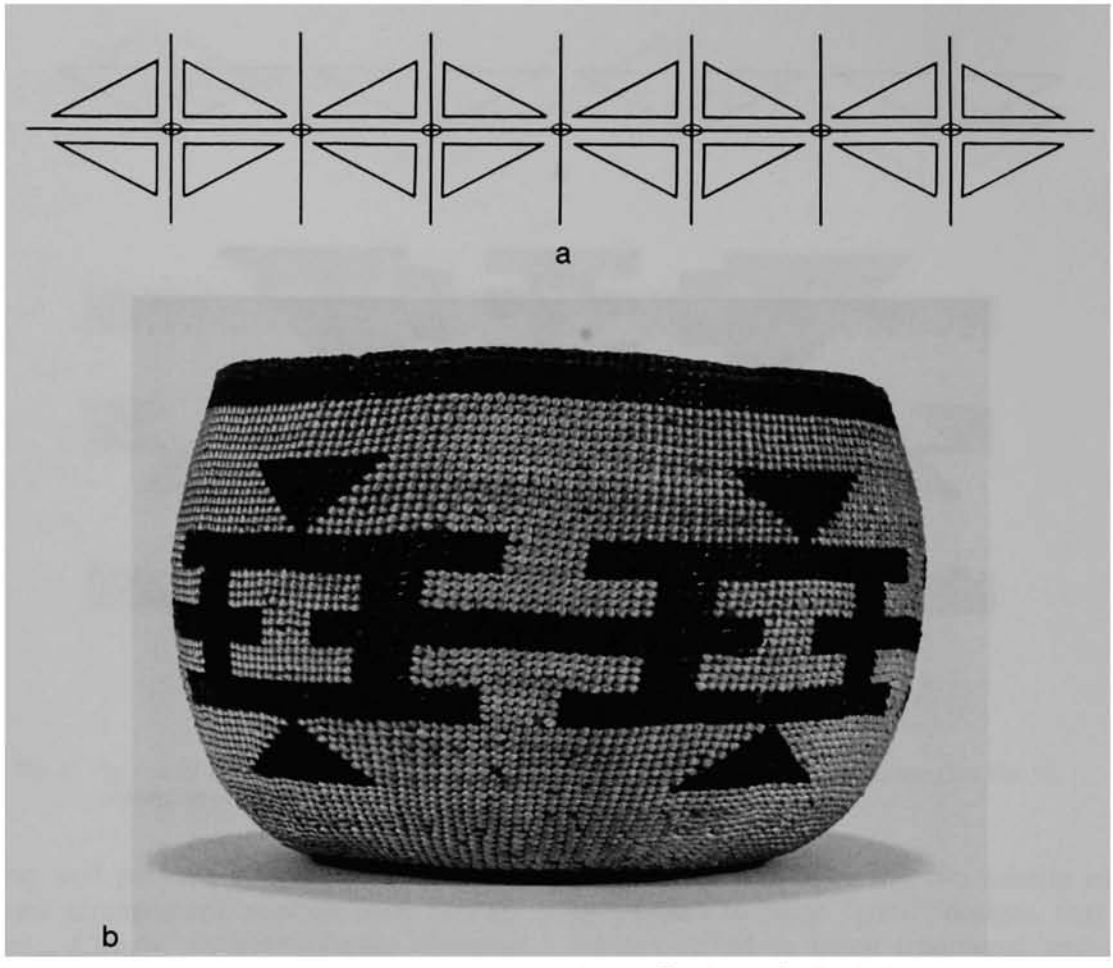

Fig. 4. Symmetry class *pmm2*. a, schematic drawing; b, Northwest California Indian basket (after Cat. No. 370-759, collections of the California Academy of Sciences, San Francisco).

graphic and historical information about two kinds of interactions--trade and marriage--which might result in the design structure similarities observed.

The data for this study of basket designs were obtained from 858 baskets in the collection of the Robert H. Lowie Museum of Anthropology, University of California, Berkeley, and 216 baskets in the collection of the Department of Anthropology, University of California, Davis. The study sample was limited to provenienced baskets. Unfortunately, a sufficient sample with accurate provenience and affiliation was not available for every northern and central California group. The blanks in Figures 5-8 represent the lack of data rather than the absence of the practice of decorating baskets.

In any study of artifactual material, even that which is systematically collected and well provenienced, researchers are plagued with the knowledge that unless the informant was actually observed making the object, it may have been procured from another tribe through trade, gift, or some other mechanism. Thus a record of purchase of the item from that informant will not be an accurate record of its original place or period of manufacture. Such exchange activities certainly occurred in California. If,

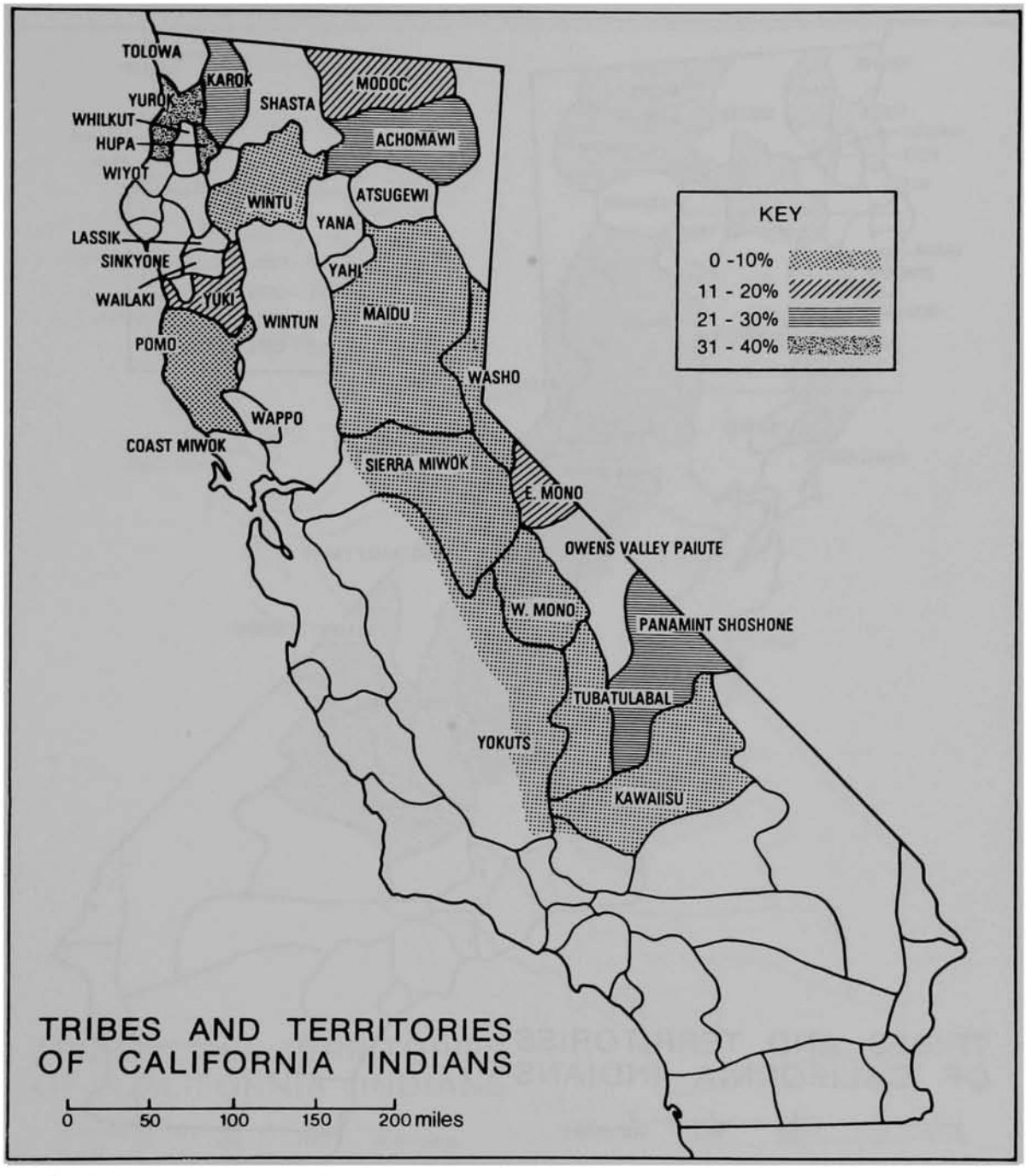

Fig. 5. Percentage frequency of symmetry class *p112* on northern and central California Indian basket design.

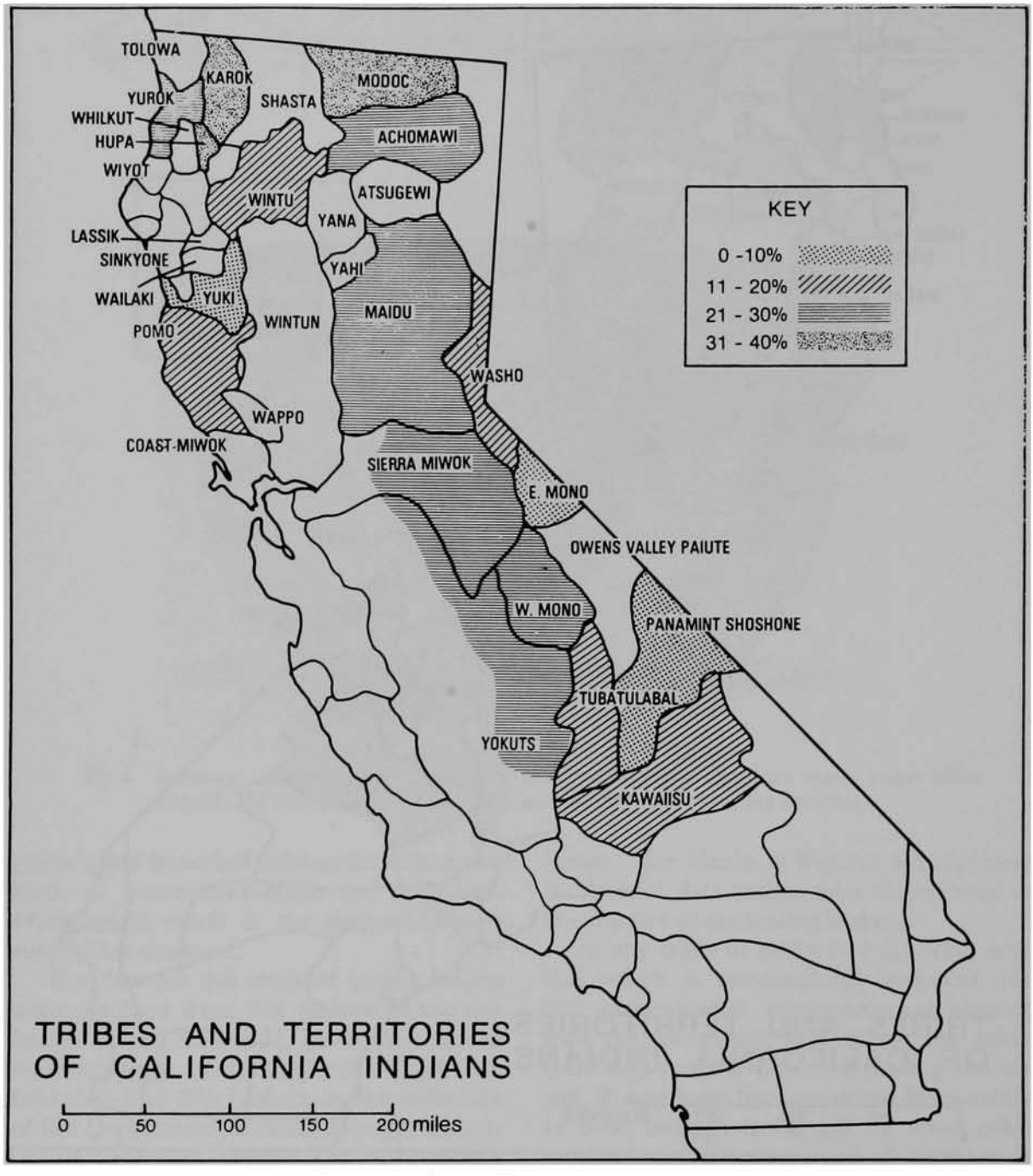

Fig. 6. Percentage frequency of symmetry class *pma2* on northern and central California Indian basket design.

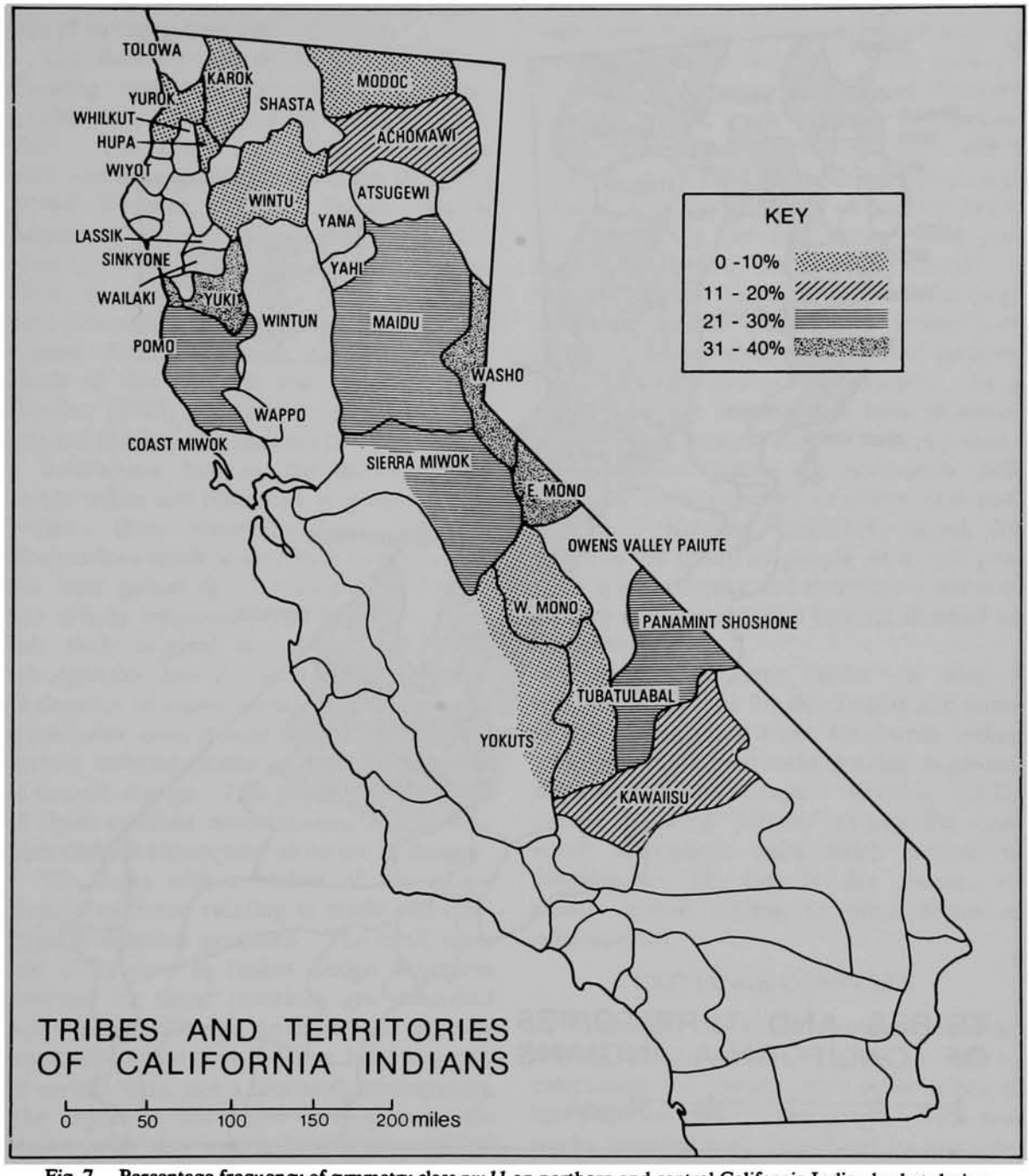

Fig. 7. Percentage frequency of symmetry class *pm11* on northern and central California Indian basket design.

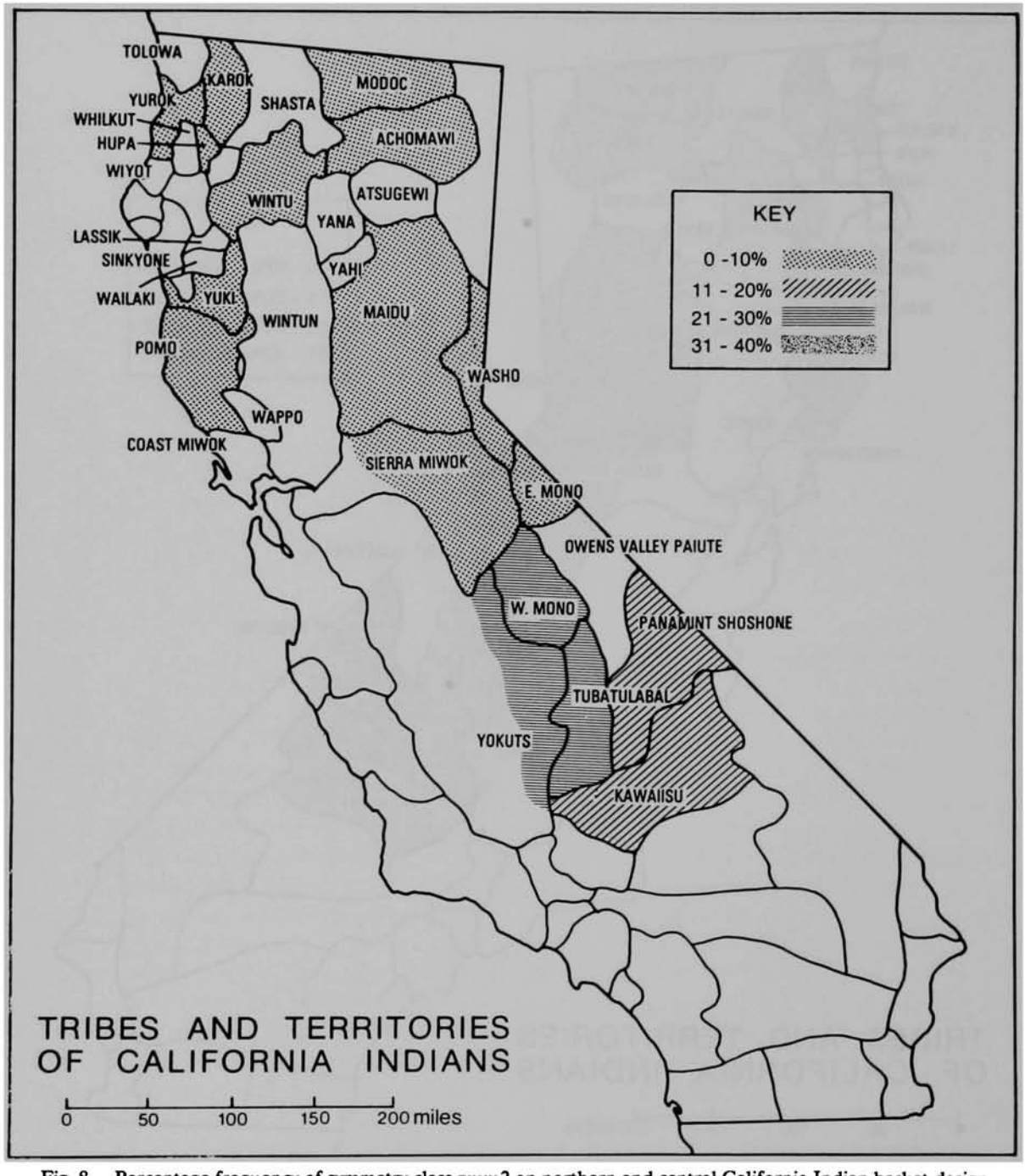

Fig. 8. Percentage frequency of symmetry class *pmm2* on northern and central California Indian basket design.

however, the study sample is of a sufficient size, such anomalies should be evident in the face of strong patterning in the data.

The data for the review of the factors affecting basket design are from ethnographic reports covering the years ca. 1900-1940. The first turn-of-the-century fieldwork was done principally by Pliny Goddard, Alfred Kroeber, Roland Dixon, Samuel Barrett, John P. Harrington, C. Hart Merriam, and their associates. Later, in the 1930s, Kroeber mounted a second series of field investigations to produce check lists of culture items for each California tribe. Much of this material was summarized by Kroeber (1925) and resummarized with subsequent fieldwork in Heizer (1978).

Interaction data on the northern California tribes are discussed in greater depth because these were first-hand, long-term observations made in the field, as opposed to the later gathering of recollections from a few elderly informants who often lived outside their original homeland. While the ethnographic data discussed span some several decades of observations, one of the most remarkable consistencies is the resilience of certain cultural practices, even in the face of drastic change. This paper examines one of those resilient domains--interaction practices and the consequent structure of design.

We begin with a review of the ethnographic evidence relating to trade and marriage interaction practices. The similarities and differences in basket design structures fostered by these practices are described below under "Design Analysis." It must be emphasized that this is but a brief synopsis of certain data, not a thorough ethnography. The object of the paper is to present the reader with this initial, broad geographical comparative study of interaction based on the systematic study of one attribute, design structure, and to urge its application and testing in future, more in-depth studies.

At the outset, two important characteristics of California Indian culture which pervade both factors (trade and intermarriage patterns) must be discussed. First, although I will be referring to practices of different cultural groups, each claimed no specific name. The tribal names used were either given to them by a neighboring group (e.g., "Hupa" is a Yurok term), or was the result of attempts by the first explorers to pronounce and spell the word "persons" or "people" in the language of the tribe (e.g., "Nisenan" means "people" or "Indian"), or related them to their geographical position (e.g., "Karok" means "upstream"). In a very real sense these names have ill-served anthropology because they have emphasized a distinctiveness that is not necessarily indicated by their culture's practices and possessions. Kroeber (1925:444) noted, for example "A group of people as a unit possessing an existence and therefore a name of its own is a concept that has not dawned on the Miwok."

Second, the term "tribe" is also a misnomer. Except for the Yokuts and some of their neighbors, most California Indian peoples had minimal socio/political organization beyond the village. Kroeber (1932) coined the word "tribelet" to describe these small, amorphous units which seemed to function on kin ties in the absence of chiefs, ranked classes, or other forms of organization.

EXCHANGE CONTEXTS

Exchange networks involved contact among villages within an entity as well as extraterritorial contacts with other tribes of the same or different language. Such networks included both formalized trading relationships between tribes for the procurement of *Dentalium* shells and other luxury items, and more informal contact situations among villages within a tribe where gifts of proper-

ty and food were exchanged, marriages were arranged, and much visiting and gambling occurred.

In fact, these informal contacts were probably more important than formalized trading networks for the exchange of information related to basket design because: (1) more people were involved; (2) the actual persons who made the items purchased or given as gifts were present to make the transaction; (3) the seven- to ten-day long celebrations offered extended rather than brief opportunities for observation, contact, informal visiting, and exchange; (4) the regularized rather than chance nature of the celebrations insured repeated contact with the same people; and (5) the kin- and extended kin-based participation enabled the transmission of facets of overt and covert symbols and signs of cultural unity and thus identity throughout a group of related individuals. The nonkin who did attend were largely from neighboring tribes and their participation in the same pool of ideas as well as other aspects of culture served to make the cultural, if not geographic, boundaries between groups fuzzy.

At the time of Goddard's residence on the Hoopa Valley Reservation in the Trinity River Valley at the turn of the century, the Hupa lived in villages each less than a mile apart. This was a relatively well-defined and circumscribed territory: to the east and west were mountains; travel and contacts were mainly north and south along the river. The Hupa, almost uncontacted by Europeans before the Gold Rush, were saved from major disruptions after this time because the reservation authorized by Congress in 1864 encompassed most of this homeland.

Goddard (1903:8) summarized the relationships of the Hupa with their neighbors, the Yurok to the north and Karok to the northeast:

> The Hupa and the two tribes on the Klamath held frequent intercourse, traded with each other, attended one another's dances, and sometimes intermarried. Trade was carried on especially with the Yurok, who held not only the lower Klamath but the mouth of Redwood creek and the coast south beyond Trinidad. From them the Hupa bought canoes, "smelt" and other salt water fish, mussels, and seaweed. In return they gave acorns and other inland food. The Yurok were always greeted with terms of relationships and counted as friends. The Hupa probably came into direct relation also with the Athapaskan villages along the coast northward from the mouth of the Klamath. Very little intercourse seems to have been held with the Athapaskans on Mad river, or with the Indians about Humboldt Bay.

The Yurok were also a river-oriented people living on the lower 36 miles of the Klamath from the Pacific southeast to Weitspec and then north for a short distance to Red Cap Creek, where they met their neighbors, the southernmost of the Karok villages. In general, contacts were a function of distance along the river with neighboring villages having had more contact than distant villages, regardless of linguistic affiliation. The Yurok were "more intimate in every way with the Karok and Hupa, who lived above them on the river, than they were with the Tolowa who lived 20 miles up the coast" (Waterman 1920:184).

Waterman, who worked with Kroeber among the Yurok in the first decade of the twentieth century, cogently summarized the consequences of their riverine geography (Waterman 1920:186).

> In material culture the Yurok are practically identical with their neighbors, and their relations with them seem to have been somewhat free and easy, in spite of the fact that the languages are different. The river system was not only a highway for the Yurok but up and down its length there was a good deal of intertribal traffic and unlimited visiting. For religious

> ceremonies especially people were likely to gather from a number of "foreign" places, traveling sometimes over considerable distances. Thus Yurok know a good deal of country besides their own. They even assign Yurok names to all the important places in the territory of their neighbors . . . These Yurok names indicate that the whole world, so far as the Yurok know it intimately, was about 150 miles in greatest diameter. This was equivalent to 10 or 12 days journey by canoe, going up-stream. Beyond the limits thus set, the Yurok knew vaguely that other tribes of human beings existed, but he did not consider that there were many such tribes. His conception was that the boundary of the world was not far beyond the area of which he knew the place names.

Nevertheless, these riverine peoples encountered persons outside their daily sphere of activities at a number of regularly recurring events. For example, the Fish Dam ceremony (as practiced around the turn of the century [Waterman and Kroeber 1943]) was an intervillage effort for the workers and an intertribal fete for the guests. The dams were constructed by teams of workers sent by each village, salmon were caught for 10 days, and then groups of dancers moved from village to village performing the Deerskin Dance. Waterman and Kroeber (1943: 61) observed that for a final dance at Pekwan, Tolowa came from Crescent City, Karok from Orleans, Hupa from the Trinity, and Yurok from as far south as Trinidad.

One of the most distinctive aspects of Yurok, Karok, and Hupa life was the focus on wealth and aristocratic heritage. The "Yurok concerns his life above all else with property" (Kroeber 1925:2). Wealth was measured by the lengths of *Dentalium* shell necklaces, strings of flints, and headbands of woodpecker scalps a Yurok owned. One of the prime occasions for the display of this wealth was at their dances. At these multivillage affairs persons from the hometown and from one to five neighboring villages performed, each attempting to outdo the other in song and dance.

It is significant, however, that in Kroeber's list of valued items (1925:27), baskets were not mentioned. They apparently fell into the class of utilitarian objects. They were neither special nor difficult and costly to obtain because they were produced everywhere locally. However, although not considered as wealth, it is notable that the female observers wore their finest decorated basket hats to these dances. Thus, presumably the women attending such functions, who were the basket weavers, would have had the opportunity to observe and perhaps make a mental note to copy a number of new design ideas.

In sum, the life of these northern riverine peoples typified by the "core" tribes --Yurok, Karok, and Hupa--was characterized by a fairly restricted world of little travel and unvarying daily routine punctuated by periodic trading for luxury goods, visits to nearby ceremonies, and trips for food not locally available.

While "poorer" in material culture, the peoples living in the interior areas peripheral to the "core" tribes were, in fact, often the suppliers of their wealth. In this way they developed contacts through which some cultural similarities with the core group were fostered.

The Shasta were famous for the middleman role in passing obsidian blades obtained from the Achumawi, and deerskins, pine nuts, and beads obtained from the Wintu to the "core" groups. In return, the Shasta obtained *Dentalium*, acorns, and, most importantly, baskets (Holt 1946). Although they were reported to have made baskets in the past, even Dixon found during his fieldwork between 1900 and 1904 along the Klamath River in the Scott and Shasta valleys that "scarcely a single basket is made by the Shasta, all that they use or sell to collectors

are bought from the Karok and other lower Klamath peoples" (Dixon 1907:399).

However, to the south of the Shasta were the Wintu, who admired and copied Shasta hat designs and preferred to buy Shasta hats rather than make their own (DuBois 1935: 131).

To the east of the Shasta lived the Achumawi and the Atsugewi. Both were related culturally to the northwestern Indians, but their less generous environment modified their wealth concept such that beads were their only luxury item and utilitarian items such as baskets became symbols of wealth (Garth 1978:237). Intermarriage among the Achumawi and Atsugewi was common; bilingualism facilitated communication, although Olmstead and Stewart (1978:230) suggested that the language facility was one-sided: more Atsugewi knew Achumawi than vice-versa.

Frequent interactions among the Atsugewi, Achumawi, Yana, and Maidu for group salmon fishing and feasts, or to collect acorns and roots, led to intermarriage and thus strong intertribal bonds (Garth 1978: 238). Indeed, many Atsugewi trading partners in neighboring tribes were often relatives who had married out. The Atsugewi traded principally with the Yana, northeast Maidu, and Achumawi but had unfriendly relations with the Wintu and little contact with the Shasta (Garth 1953:131). The Maidu exchanged their coiled baskets, skins, and beads for Atsugewi twined baskets, bows, and furs. Most exchanges, however, occurred at intertribal gatherings. Visitors from surrounding villages brought gifts. If these gifts were contained in a basket, the basket was given as well (Garth 1953:183). One of Garth's Atsugewi informants claimed to have had more relatives at Big Meadow (Maidu territory) then he had on Hat Creek itself. He stated (Garth 1953:131) that it was common for individuals to have and visit relatives in other tribes.

When Garth did his fieldwork in 1938 and 1939, his informants told him that the Atsugewi customarily ventured no further than friendly Achumawi, Maidu, and Yana territory. But within this area, contact was frequent, with apparently lasting results in the form of material culture similarities, as is illustrated by the following account of covering bottles with basketry.

> According to [Sarah Brown], a Western Achomawi woman named Ellen Halsey invented the process and taught it to [Sarah Brown's] daughter who, in turn, taught it to [Sarah Brown]. [Sarah Brown] then introduced the process to other Hat Creek basketmakers [Garth 1953:148].

Sarah Brown also introduced the technique of coiling to the Atsugewi.

> "We started making coiled baskets when I was young. I went to Big Meadows [Northeastern Maidu] for a visit. I admired their coiled baskets, and one day one of my friends there taught me how to make them. When I returned to Hat Creek all the women my age used to come and sit around and watch me make coiled basketry. Before long they learned how to make it themselves" [Garth 1953:150].

To the south of the northern riverine peoples and their neighbors lived the Pomo, peoples who made both twined and coiled baskets. Because each Pomo village held rights to certain territory for acorns, fishing, and hunting, the villages became fairly self-sufficient entities (i.e., see Theodoratus [1974] on the Bokeya area Pomo before contact). The territorial boundaries of a group were largely determined by features of the terrain and degree of diversity in resources: rich environments allowed smaller village land claims; less diverse environments required larger claims. Barrett's informants claimed (1908:17) that "the population of a community confined themselves very strictly to this [land] and

permitted no trespassing upon it by populations of other communities."

> Formal visits might be exchanged between villages for trade or for attendance at ceremonials, but informal visiting back and forth was rare even where neighboring villages were involved. Fear of witchcraft made the Pomo dubious as to advisability of venturing alone or in small groups into strange villages, especially as few had kinship ties beyond their own village. Intermarriages between villages are rare, and usually involved families which provided messengers or interpreters. Others commonly married within their own village [Colson 1974:17].

However, unlike the northern riverine groups where the small size of villages, often composed only of one extended family, required intervillage exchange of marriage partners, a single Pomo community could number 100 persons and thus be an endogamous unit.

Despite the fact that many of these communities spoke mutually unintelligible dialects, they were united in a variety of contact networks.

> . . . two or more villages speaking different dialects [read "language"--see McLendon and Oswalt 1978:274] or even belonging to different linguistic stocks might unite in war, ceremonials . . . if their geographical positions tended to associate them [Barrett 1908:20].

Some of these kin groupings and alliances could become quite large. For example, along the Russian River a confederation of several tribelets controlled 16 miles of the river and adjacent lands.

Regardless of linguistic similarities or differences, the Pomo generally interacted with the groups living closest to them. Thus, Coast and Valley Pomo interacted with coast and inland Yuki; Eastern Pomo interacted with Lake Miwok, Wappo, and Patwin; and Southern Pomo interacted with Coast Miwok. The Central Pomo were well established as middlemen between the Eastern, Northern, and Southern Pomo groups, moving both food and raw materials between these different resource zones.

For most individual Pomo, the opportunity for personal contacts within these interaction networks came with attendance at the Big Times when acorn, fish, or seed harvests had been particularly abundant. Beads of clam shell disks were used as money with which the guests purchased extra food at the end of the feasts. Trade fairs would also be organized between villages. At these celebrations, as well as at other ceremonials, many goods were available for exchange: food, salt cakes, basketry material, bows and arrows, obsidian blades, magnesite beads, shells, snares, feathers, skins, etc.

Similarly, people of the four Yuki dialect groups had more contact with their neighbors who spoke different languages than with other Yuki. The Coast Yuki rarely visited the Round Valley Yuki, as they claimed to fear molestation in route (Gifford 1939). The Wappo dialects were separated by 40 miles of mountainous terrain from other Yuki. This geographical separation "tended to produce the dissimilarity found between Wappo and other Yuki dialects" (Barrett 1908:111). Most Yuki trade was with their neighbors, the Pomo, who were their source of clam shell beads, salt, kelp, and *Dentalium* shells (Foster 1944). Although the Yuki intermarried with both the Pomo and Wailaki to the north, the "poverty" of the Wailaki environment caused them to have little interchange of goods. It is not surprising, then, from the close Yuki-Pomo associations that Yuki baskets, and particularly those of the Wappo, are closely comparable to those of the Pomo (Kelly 1930:422). Kelly (1930:431) observed of Yuki basketry from the main population centers to the north that "in most instances one could point out similar, if not exact, prototypes

from baskets of neighboring tribes."

The Sierra foothill and central valley tribes had extensive regional exchange networks for both food and status articles. Dixon, who visited the area between 1899 and 1903, observed that individual northern Maidu stayed close to home.

> The Maidu seem not to have been travelers. They rarely went far from home, even on hunts. It seems that 20 miles was an unusual distance to go . . . This restriction was in part due to the rugged nature of the terrain and in part to the hostility of different villages toward each other. Villages were at times abandoned, but the move was but a few miles at most and after several years the original site was often reoccupied. The inhabitants of any one village thus knew only a small section of country, and all lying beyond was *terra incognita* [Dixon 1905:201].

In fact, Kroeber (1925:395) claimed that even "the western-most Maidu had only the vaguest cognizance, if any, of the most easterly Pomo . . . Even within a man's ken [sic], half the villages were likely to be hostile or under suspicion." The Maidu only had contact with, and showed cultural affiliation most closely with their neighbors, so northern Maidu probably differed as much from the southern Maidu as the Patwin differed from the Wintu (Kroeber 1929:254). Similarly, Beals (1933:337) found that the Hill and Mountain Nisenan differed as much from the Valley Nisenan as they did from the Maidu to the north and the Miwok to the south.

However, although Maidu individuals never traveled far, they were involved with their immediate neighbors in an extensive "down-the-line" trade network that brought goods from both near and distant tribes. Despite tribal and linguistic differences, groups in different but adjacent environmental zones formed close ties. Kroeber (1929:256) observed, for example, that the River Patwin knew more about the Valley Maidu and Nisenan than about the Wintun upriver or their own Patwin kinsmen back in the hills.

The Valley Maidu traded with the Wintun, particularly for beads, and the Northern Maidu traded with the Achumawi for obsidian. Since the Maidu occupied such an extensive area, much of the trade was internal. The foothill peoples exchanged salt, game, and fish for acorns and pine nuts from the mountain peoples, and the foothills and mountain peoples exchanged their products for beads from the valley peoples.

The Southern Maidu foothills people traveled to the valley to trade with their relatives. However, these trading parties were large (100-200 men), they traveled at night, and great effort was made to return the same day so that overnight stays in foreign territory were avoided.

> The average Nisenan had few contacts outside his community. They were limited to trade, war, and visits to ceremonial gatherings, the latter being much more important. Chiefs and important people were more apt to have relatives outside the community and so to make social visits outside of those connected with big times [Beals 1933:365].

"Big Times" were opportunities for visiting, feasting, gambling, casual trading, and establishing social contacts, some of which led to intermarriage. Invitations would be sent to villages within a 15-20-mile radius.

The Wintun participated in a west-to-east trade network, exchanging hill products for river products, and in a north-to-south trade network, exchanging pelts from the north for clam shells from the San Francisco Bay area. "As these articles moved in the trade route, the value of each was enhanced in proportion to the increased scarcity of each" (Goldschmidt 1951:337).

As was the case for the Maidu who also

lived over a large area, the Wintun were split into very localized village groups that tended to be more similar to their neighbors, whether or not they were Wintun. Kroeber (1925:357) observed that "It is probable that the northern, the central, and the southern Wintun differed more from one another than the Pomo did from the Yuki." Long Valley Patwin (Southern Wintun) frequently visited the Clear Lake Pomo area to fish, hunt, and gather acorns and, in turn, Clear Lake Pomo visited Long Valley to gather seeds (Johnson 1978:352). In fact, northern Wintun (Wintu) along the McCloud River made overlay twined baskets similar to those of the Achumawi, and the central Wintun made baskets that were "in a generic way of Pomo type" (Kroeber 1925:358).

Similarly, Miwok tribelets "owned" definite territories in four main ecozones in central California: the valleys in the Coast Range; the delta plains of the Central Valley; the Sierra foothills; and the Sierra Nevada mountains. However, because none of the zones encompassed all necessary resources, a large trade network was maintained. An east-west trade network involved the Costanoans, Miwok, Yokuts, and Eastern Mono (Owens Valley Paiute). Levy (1978: 412) reported that basketry was an "important item of exchange, usually moving in both directions between contiguous groups of people."

In addition, the Eastern Miwok maintained formal trade relations with the Mono on the eastern side of the Sierras. Bates (1982: 4-5, 8) noted a mixing of Miwok and Mono basket styles reflecting a long history of trade between the two groups.

The Yokuts lived in large tribal units, each numbering several hundred persons, with their own name, dialect, and territory averaging about 300 square miles--a "half day's foot journey in each direction from the center" (Kroeber 1925:474). Gayton (1948a, 1948b) recorded that during ceremonies frequent intertribal visits occurred among the northern foothills Choinimni, Michahai, and Entimbich tribes, and that the Choinimni made annual visits to the Yokuts living around Tulare Lake. Gayton, in fact, concluded (1948b:263) that this constant intercourse between the Yokuts and Western Mono (Monache) groups resulted in the high degree of similarities in technique, shape, and ornament of Yokuts and Western Mono basketry. Later, writing of the "External References in Yokuts Life," she again stressed that despite the Penutian language base of the Yokuts and the Numic language base of the Western Mono, they "may be considered culturally one" (Gayton 1976:81). Likewise, contact of the most northerly Yokuts tribe, the Chukchansi, with their neighbors the Southern Sierra Miwok, resulted in extratribal ties and even confusion about tribal affiliation in some border villages (Spier 1978a:472).

North-south contacts occurred in the vast valley floor area along water courses. East-west contacts were more seasonally regulated: winter storms in the coast ranges temporarily halted Yokut-Chumash commerce, and similar inclement weather in the Sierra Nevada halted exchanges between the Western and Eastern Mono. In good weather the Western Mono crossed the mountains to gather pine nuts in Eastern Mono territory, and, according to Gifford (1932), sometimes remained for several years.

The Western Mono acted as middlemen between Eastern Mono and Yokuts relatives on the both sides of the Sierras.

> All the Monache maintained close relationships with their neighbors, whether Monache or not. These external contacts included trading, traveling, intertribal assemblies for ceremonies, visiting, incursions into other's territories or common territory for resource exploitation and marriage [Spier 1978b:427].

One of Gayton's informants insisted (1948a:17) that the Tulare Lake Yokuts did not make coiled baskets in "old times" but obtained them in trade from the Foothill Yokuts. The Foothill Yokuts obtained bows, moccasins, rock salt, pine nuts, and jerked deer meat from the Eastern Mono in return for their baskets or beads (Gayton 1948b: 181).

Similar in culture to the Yokuts, but speaking different languages, were the Tübatulabal who lived in the foothills east of the Yokuts and north of the Kawaiisu. Their basketry is scarcely distinguishable from that of the Kawaiisu. In fact, the early basket collecters often labeled baskets from both tribes as "Kern County," so similar were they in appearance.

In this very brief review of how environmental resources and geographic proximity affected exchange patterns, the evidence suggests that individuals, whether living within villages, large communities, or tribal units, generally kept within their territorial boundaries and traveled little except to local ceremonials where marriage partners were acquired and food and other goods were exchanged. The contacts and exchanges within and between neighboring tribes at these gatherings blurred absolute distinctions between tribal units defined as distinct linguistic entities and led to the clinal "nearest-neighbor" relationships that can be seen in the frequency distributions of basket design structures (Figs. 5-8) and, more specifically, in the multidimensional scaling map of the symmetries used by each tribe (Fig. 9).

MARRIAGE PRACTICES

Marriage rules and practices were a second factor affecting exchange and transfer of ideas about basket designs. Data describing sources of marriage partners suggest that localization or movement of wives upon and after marriage seem to correlate with homogeneous, localized or widespread, regional design styles. Descriptions of several situations follow.

Two forms of marriage existed for the Yurok: full-marriage where a man bought a wife and took her to his home (patrilocality); and half-marriage where a poorer man may have only been able to pay half the bride price and so went to live with his wife and work for her father (matrilocality). The 1909 census taken by Waterman and Kroeber (1934) revealed that 97 of 413 marriages (23.4%) were half-marriages.

Since the average Yurok town had a population of only 45 people (Waterman and Kroeber 1934:6, fn. 3), and since most of these would be kin, there would be few women acceptable for a man to marry. Nevertheless (for 390 marriages), 35.6% of the men found wives in their home district (a town and the seven towns adjacent); 34.9% married outside the home district to wives in one of the two adjacent districts; and 29.4% found wives in the other Yurok districts or outside Yurok territory. Thus, there was a tendency for men to marry women close to home (Waterman and Kroeber 1934:10-11).

Groups peripheral to this northern "core" group were also involved in supplying wives. For example, the Wiyot lived along the coast between the Eel and Mad rivers and shared their northern boundary and closest cultural identity with the Yurok. Loud (1918) reported that Wiyot villages were frequent sources of wives for Yurok men. Since, however, women were purchased and the Yurok were far wealthier than the Wiyot, the export of Wiyot women to Yurok men was greater than the import of Yurok women by Wiyot men (Loud 1918:250). Not surprisingly, Wiyot basketry is very similar in form, technique, and design to that of the Yurok.

Gifford's (1926) study of the Clear Lake (Eastern) Pomo revealed that marriage part-

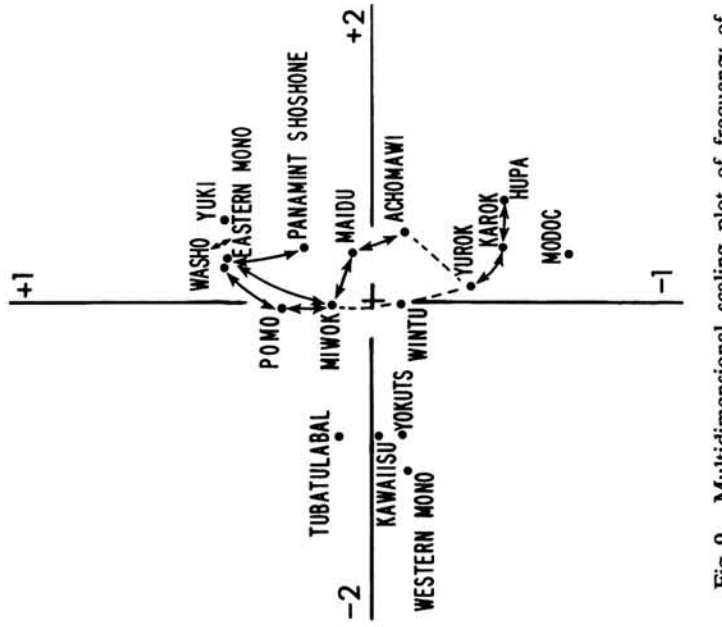

Fig. 9. Multidimensional scaling plot of frequency of 10 symmetry classes (*p112, pm11, pmm2, pma2, pm, cm, pmm, cmm, pmg,* and *p2*) for 17 California Indian tribes. Vectors 1 and 2 account for 64.5% of the trace.

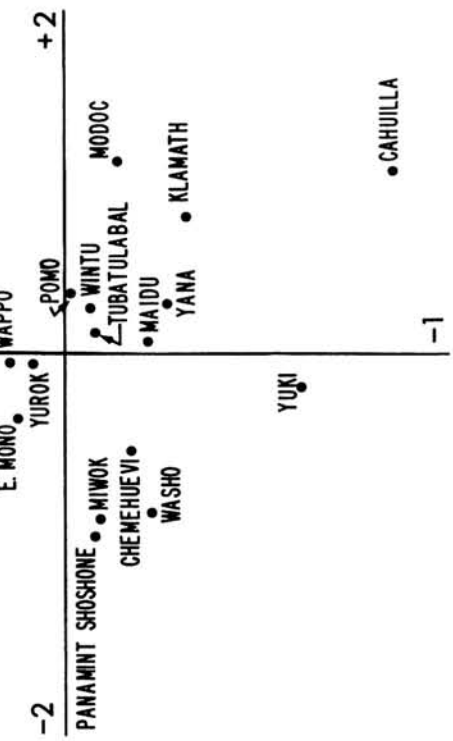

Fig. 10. Multidimensional scaling plot of frequency of design orientation on all basket forms for 24 California Indian tribes. Vectors 1 and 2 account for 98% of the trace.

ners were found in both local and neighboring communities. Of 139 marriages noted by Gifford at the village of Cigom, 70 were to fellow villagers and 69 were to a person from another village. Of the latter, 27 married another Eastern Pomo, 18 a Northern Pomo, six a Southeastern Pomo, three a Central Pomo, three a Wappo, and 12 a Hill Patwin. Although half the marriages were to individuals outside Cigom, marriage among individuals speaking the same dialect (i.e., neighboring Eastern Pomo villages) was most favored (Gifford 1926:297). The case histories indicate that marriages with "foreign" Pomo often resulted when families came to Clear Lake to fish and while there individuals met their future spouse.

In contrast to the Yurok data, which show a preference for patrilocal residence (more than 75%), the reverse characterizes the Pomo at Cigom: 75 matrilocal versus 24 patrilocal marriages. A significant factor in the Pomo marriage rule relative to potential influences on basket design is that it was customary for a woman to first live briefly with her husband's family and only later move back to her parents' village. Further, subsequent to the establishment of her matrilocal residence, there was continual traveling and visiting throughout the couple's married life back and forth between the husband's and wife's parents villages (Gifford 1926:231).

These studies suggest that traditional marriages were generally arranged as close to home as blood relations would allow. Spouses were found in neighboring villages or within the community or tribe. With contact, however, and relocation to reservations and rancherias, the Indians expanded their sphere of personal contacts and exposure to new ideas. Further, increased demand from the white community for labor and baskets gave the Indians an economic base but, not insignificantly, in the process provided the setting which accelerated the shift from local to regional design styles.

DESIGN ANALYSIS

From the above brief review of cultural practices related to trade and marriage interactions, three trends are apparent. First, the "known" world of most peoples was generally confined to a restricted area where they gathered food and engaged in other essential activities. Second, whether goods were obtained from far afield through an elaborate "down-the-line" trade network or locally, the actual exchange activities were usually with neighboring peoples, regardless of language or tribal affiliations. And finally, most marriages were preferentially intratribal. In cases where small numbers of locally available acceptable spouses forced men to obtain wives from outside their own community, they looked to neighboring tribes. In sum, despite the fact that most individuals lived a fairly isolated life pattern, each community had cultural mechanisms that brought villages or tribes in contact with their neighbors, and these contacts were developed and maintained regardless of mutual linguistic intelligibility.

The analysis of basket design structure which follows clearly reveals the "nearest neighbor" aspect of these interaction patterns. Although each basket design structure was plotted within its original tribal designation, display of the similar use frequencies of the four principal symmetries (Figs. 5-8) indicates the tribal areas encompassed and thus shows how common structure use crosscuts linguistic boundaries. The different types of interaction situations will be reviewed and correlated with different kinds of design structure similarities and differences.

We would expect that groups living in multiresource zones who developed an economic self-sufficiency, yet who interacted

with other neighboring tribes for marriage partners would display highly homogeneous design systems within this interaction sphere. Thus, in northern California, well-established trade relationships provided the necessary status items and an active cycle of ceremonial dances and visiting led to intermarriages and, not unexpectedly (particularly along riverine "roadways"), a highly similar design system.

Indeed, Kroeber (1905:116) observed long ago that "The basketry of the Yurok, Karok, and Hupa is virtually identical" and that this style is identifiable south to the Wailaki, east to the Achumawi, and north to the other Athapaskan tribes in southern Oregon (Kroeber 1925:90). This includes the Shasta, Tolowa, Wiyot, Whilkut, Nongatl, Lassik, and Wailaki.

Symmetry analysis of basket designs from these tribes confirms this observation. The three "core" groups produced designs predominantly structured by one-dimensional classes *p112* and *pma2*. Figures 5 and 6 show the percentage frequencies of symmetries *p112* and *pma2*, respectively.

The Achumawi, Wintu, and Modoc used equivalent or slightly lesser frequencies of these two symmetries. Figures 7 and 8 show that mirror reflection symmetries (*pm11* and *pmm2*) were not often used by these northern groups (except for the Achumawi showing 20% use of *pm11*).

In contrast are the Pomo who lived in large endogamous communities. We would expect that such a situation would foster the development of design styles particular to each community or regional grouping. Indeed, Pomo baskets are decorated with a number of different layouts; multiple narrow horizontal bands, diagonal bands, vertical bands, all-over two-dimensional patterns, and single wide horizontal bands. Since illustrations of baskets in Russian collections made among the Pomo in the 1840s show several of these layouts in use (diagonal, vertical, and horizontal [Kojean 1979]), we can surmise that the variety in layouts characterized the pre-contact situation. Further, Kroeber (1925: 234) suggested that the self-sufficiency of a given community was dependent on the variety of environments in its domain and self-sufficiency led to a cultural homogeneity within that area. Thus, it may well be that the origin of the several different design layouts found on Pomo baskets was related to the isolated situation of the various Pomo communities. Later, after white contact and increased mobility, the localization of styles was diluted as ideas were exchanged freely among the several Pomo regional divisions.

A chi-square test of data from the Northern and Eastern Pomo divisions shows a significant difference in the use of symmetries to structure their basket designs (χ^2 = 7.79 for 4 d.f.; Table 1). It is, further, even more interesting that a chi-square test on the same designs from these same two divisions, but on descriptive criteria of design orientation rather than design structure, shows no significant difference between the two groups (χ^2 = 2.2 with 4 d.f.; Table 2). Theoretically, all five of the descriptive labels for design orientation listed in Table 2 could be on a pattern structured by the same symmetry. For example, *p112* could appear on any of the five orientations. These results suggest that the distinctions between groups are apparently not indicated by orientation, but in the specific way in that the marks are arranged in the layouts. This latter characteristic can be described by mathematical symmetries.

We would expect groups who lived in an environmental situation that promoted economic symbiosis, such as the foothill and valley areas of central California, to display similarities in design structure over this wide interaction area. In examining Figures 5-8, we see that the Eastern Maidu and Sierra

Miwok used the four symmetries in similar frequencies. Further, it is interesting that for patterns with mirror reflection (*pm11* and *pmm2*), the Eastern Maidu and Sierra Miwok differed in their preferences for use of these two symmetries from the more southerly Mono and Yokuts. But all these groups--the Maidu, Miwok, Mono, and Yokuts--used similar frequencies of patterns with bifold rotation (*pma2* and *p112*).

Sometimes environmental barriers apparently slowed the flow of goods and ideas. The groups on the eastern side of the Sierra differed in their design symmetries from those on the west side. The Washo and Eastern Mono used different frequencies of *pm11* and *pma2* than did the groups on the west side of the Sierras. The Panamint Shoshone differed in their use of *p112*, *pma2*, and *pm11* from the Tübatulabal and Kawaiisu. A chi-square test on symmetries used by the Eastern and Western Mono shows a significant difference in use of four symmetry classes (χ^2 = 47 for 5 d.f.; Table 3).

Although we have focused on using symmetry analysis to measure similarities or differences between groups, it is also possible to use symmetry analysis to study design homogeneity or heterogeneity within one cultural group. Two types of possible analyses are briefly mentioned here.

First, symmetry analysis can highlight the importance of geographical distance as an isolating factor between population clusters within a given culture. A chi-square test of the designs produced by Eastern Mono weavers living in the Mono Lake-Bridgeport area versus designs produced by weavers living in the Bishop area to the south shows a significant difference between the two areas (χ^2 = 11.4 with 6 d.f.; Table 4).

Second, symmetry analysis can also highlight the integrating forces of political unity displayed by well-organized social units. For example, a chi-square analysis of the use of symmetry classes *pmm2* and *pma2* by five Foothill Yokuts tribes indicates their design structures are significantly different (χ^2 = 18.32 for 4 d.f.; Table 5). Among the Yokuts there is a high degree of endogamy within each tribe and, coupled with a high degree of political organization and identity within a given tribal unit, one would expect to find that discrete design systems characterize each tribe.

Table 1
COMPARATIVE USE OF SYMMETRY STRUCTURES BY NORTHERN AND EASTERN POMO[a]

Symmetry	Northern Pomo # cases	Eastern Pomo # cases
pm11	9	13
p2	4	9
pma2	9	2
other one-dimensionals	5	5
two-dimensionals	11	11

[a] χ^2 = 7.79 for 4 d.f.

Table 2
COMPARATIVE USE OF DIFFERENT ORIENTATIONS BY NORTHERN AND EASTERN POMO[a]

Orientation	Northern Pomo # cases	Eastern Pomo # cases
Multiple horizontal bands	4	2
Diagonal bands	6	10
Vertical bands	5	5
All over two-dimensional	6	4
Single wide band	11	8

[a] χ^2 = 2.2 for 4 d.f.

Table 3
COMPARATIVE USE OF SYMMETRY STRUCTURES BY EASTERN AND WESTERN MONO[a]

Symmetry	Eastern Mono # cases	Western Mono # cases
p112	9	5
pmg	7	13
pm11	27	0
pmm2	8	20
pma2	7	20
other classes	23	15

[a] χ^2 = 47 for 5 d.f.

Table 4
COMPARATIVE USE OF SYMMETRY STRUCTURES BY TWO GROUPS OF EASTERN MONO[a]

Symmetry	Mono Lake-Bridgeport Area # cases	Bishop Area # cases
pm11	16	11
p112	3	6
pmm2	4	4
pma2	5	2
pmg	5	2
pm	3	6
other classes	3	11

[a] $\chi^2 = 11.4$ for 6 d.f.

Table 5
COMPARATIVE USE OF SYMMETRY STRUCTURES BY FIVE FOOTHILL YOKUTS TRIBES[a]

Symmetry	Chukchansi # cases	Choynimni # cases	Entimbich # cases	Mitchai # cases	Wikchamni # cases
pmm2	6	4	7	5	7
pma2	17	4	4	0	2
other classes	16	4	11	4	12

[a] $\chi^2 = 18.3$ for 4 d.f.

All of these "nearest neighbor" relationships can best be seen in a multidimensional scaling plot (Fig. 9) of the frequencies of use of 10 symmetry classes (*p112*, *pm11*, *pmm2*, *pma2*, *pm*, *cm*, *pmm*, *cmm*, *pmg*, and *p2*) for 17 tribes. While it must be said that a better test would have been of symmetry usage by specific communities, rather than by whole tribes (especially as I have shown that peripheral villages of one tribe are often more like their nearest neighbor, even if they are of a different tribe), this test was not feasible because of small sample size and only general (i.e., tribal) provenience data. Nevertheless, the "nearest neighbor" affiliations clearly show even on this general tribal plot. These affiliations are with their geographical and/or exchange neighbors, rather than with their linguistic kin.

Many (64.5%) of the data are represented by vectors 1 and 2 (Fig. 9). To the left of Vector 1, the four central and southern valley groups--Tübatulabal, Kawaiisu, Yokuts, and Western Mono--all are arranged along a short curve in a proximity that reflects their interaction patterns. Above and to the right of Vector 1, beginning in the lower right quadrant, are the northern groups, Yurok, Karok, and Hupa, known to be closely affiliated. Solid lines with arrows are drawn to show these ties. Dotted lines connect these three groups to the Wintu and Achumawi, because although ethnographic evidence suggests that they were in contact via the Shasta, insufficient data on Shasta baskets prevented their inclusion in this plot. I would predict, however, that the Shasta would fall between the Yurok-Karok-Hupa cluster and the Wintu and Achumawi, their southern and eastern neighbors, respectively. The Achumawi appear close to the Maidu, as suggested by ethnographic evidence of their close trade relationships. The Wintun should appear between the Wintu and Miwok, but since no data were available, the relationship is shown by a dotted line. The Miwok-Pomo ties are well-known and their common use of the same symmetries is reflected in their close juxtaposition on this plot.

As we move further south and east, solid arrows connect the Pomo and Washo, the Miwok and Eastern Mono, and the Eastern Mono and the Panamint Shoshone. These ties are confirmed by ethnographic accounts of exchange relationships. The Yuki seem out of position, being closer to the Eastern Mono and Washo on the east side of the Sierras, rather than the Pomo. However, this is understandable when the data set is reexamined since only coiled baskets were available for analysis. The Yuki, like the Pomo, made both coiled and twined baskets, and it is predicted that if twined baskets were available for analysis, the position of the Yuki would be closer to the Pomo.

In short, the general curve from lower

right to upper right quadrants moves from north to central California with each tribe generally positioned next to its exchange partners. Thus, the nearest neighbor changes in the way designs are structured on baskets accurately reflects the pattern of nearest neighbor interactions in trade and marriage practices of these California tribes. Symmetry analysis thus offers the anthropologist an alternative, non-linguistic measure of and insight into activity patterns of interacting communities.

The above analysis has shown that similarities and differences in basket design structures parallel "nearest neighbor" relationships of California Indian tribal associations established for the exchange of people and goods. It is reasonable to ask whether a similar correlation would have resulted if the relative frequencies of marks (design elements) used by each tribe were studied instead of the relative frequencies of symmetry structures, particularly since the recognition of named marks was the other criterion used by O'Neale's informants.

Although over 600 motifs (after Kroeber 1905) were recorded on the baskets studied, the relative frequencies of each was too low for meaningful statistical tests unless motifs generally similar in shape were lumped together. There is no way to systematically lump elements and motifs to obtain a statistically usable sample, yet, at the same time, maintain the unique differences that characterize the motifs of each locality. Design elements are either so general and widespread in their occurrence throughout California and/or their combination into motifs is restricted to only a few localities. Additionally, because many motifs were borrowed and elaborated to meet the tastes of non-Indian collectors (Washburn 1984), distributional studies of motifs alone are not reliable.

Nevertheless, multidimensional scaling plots of motifs were first attempted on separate basket form categories: high bowls, trays, hats, etc., but sufficient data existed only for a plot on the high bowl form (not shown here). In this case, no discrete clusters--geographical, linguistic, or nearest neighbor exchange partners--appeared. All tribes in this plot (Tübatulabal, Pomo, Miwok, Yokuts, Klamath, Western Mono, Eastern Mono, Cahuilla, Yuki, Maidu, and Washo) seemed to fall around the intersection of vectors 1 and 2. Further, because the data on vectors 1 and 2 only accounted for 49% of the motifs, this relatively low accounting for all the variation is not a reliable indicator of group association.

If the *individual* element or motif cannot be compared with objectivity, is it possible to describe the layout of these motifs (i.e., the structure) in terms *other than* by symmetry classes, and if so, do these structural units show the same tribal relationships as do the symmetry classes? One alternative way to describe design layout is to characterize the orientation of the design on the basket. California Indian designs, which are placed either in narrow or wide bands, can be described as having patterns parallel to the rim, perpendicular to the rim, both parallel and perpendicular to the rim, or slanted toward the rim.

A multidimensional scaling plot (Fig. 10) of the orientation of basket designs on all basket forms from 24 tribes however, shows no discrete geographic clusters. Northern and southern groups are juxtaposed (Karok and Yokuts; Wintu and Tübatulabal) and most of the tribes are simply clustered around the intersection of vectors 1 and 2. The groups are positioned according to the frequency of use of the four kinds of orientation. From the upper to the lower sections of the plot along Vector 1 there is a decreasing frequency of use of the orientation parallel to the rim. At the top are the

Hupa which have 97.7% of their designs parallel to the rim. At the bottom of the plot are the Cahuilla which have 68.9% of their designs parallel to the rim. The presence of groups on the +2 or -2 sides of Vector 1 represents design systems characterized by a mixture of the orientation types. The orientations were also analyzed by separate basket forms, but no difference was discernable, suggesting that basket shape was not a controlling factor in design orientation. The factors related to this distributional preference for different orientations are unknown, but we can now exclude language, geography, or nearest neighbor exchange relationships.

The difference in tribal distributions obtained by plotting different ways to describe design layouts is of fundamental analytical importance. Simply mapping the design orientation shows no correlation with nearest neighbor exchange relationships. We might conclude that similarities and differences in design layout measured by this feature are unrelated to the contact networks. However, describing design layouts by their symmetries does seem to produce distributions which relate to ethnographically documented exchange relationships.

DISCUSSION

Analysis that focuses on the symmetries used to structure designs suggests group interaction patterns that separate northern and central California into three general divisions: a northern riverine component centered around the Yurok, Karok, and Hupa with influence extending east to the Achumawi and Atsugewi, south to the Wintu and Waliaki, west to the Tolowa, and north to the Shasta and Klamath; a central component of the Pomo, Maidu, and Miwok with the Yuki and Washo peripheral; and a central and southern component along the Sierra foothills which unites the Mono, Yokuts, Tübatulabal, Kawaiisu, and Panamint Shoshone. Not all of the groups within each of the three general divisions used exactly the same symmetries in the same frequencies, but in general, neighboring tribes used the same symmetries to structure basket designs (Table 6).

It should not pass unnoticed that these general divisions correspond with remarkable similarity to Kroeber's (1936:102) cultural foci. He listed three climax areas for all of California: Northwest, Central, and Southern. Despite the fact that this paper describes only data from northern and central California, we can still see that Kroeber's Northwest climax included the three "core" groups (Yurok, Karok, and Hupa) and the subclimax included the groups listed as peripheral to the core groups. Kroeber's central climax groups were the Pomo of Clear Lake and Russian River and the Patwin, Maidu, and Nisenan of the Sacramento River. His "remainder" subcategory included all the other foothill groups: Yokuts, Mono, Tübatulabal, Kawaiisu, and Wintu. These divi-

Table 6
PERCENTAGE FREQUENCY USE OF THE FOUR PREDOMINANT SYMMETRIES BY 17 CALIFORNIA INDIAN TRIBES

Tribe	*p112*	*pm11*	*pmm2*	*pma2*
Modoc	18	6	0	48.5
Achumawi	23	20	3	30
Karok	25	10	6	36
Hupa	33	14	4	32
Yurok	36	6	9	25
Yuki	12	43	7	9.5
Pomo	9	24	6	15
Northern Wintun	5	9	5.5	20
Maidu	8	28	7	28.5
Washo	7	38	8	11
Sierra Miwok	4.5	25	7.5	30
Eastern Mono	11	33	10	8.6
Western Mono	7	0	27	27
Foothill Yokuts	5	7	28	26
Panamint Shoshone	21.5	29	17.6	10
Tübatulabal	8	10	25	17
Kawaiisu	7	11	11	20

sions parallel the basket design subdivisions described in this paper.

Kroeber (1905) published a lengthy analysis of basket design in northern California. However, he actually described the general orientation of the design rather than the specific arrangement of the design elements. For example, both his "zigzag arrangement" and his "diagonal arrangement" are bifold rotational patterns. As a consequence, the tribal divisions and groupings derived from his analysis differ substantially from the results presented in the present study.

The question is which of the two approaches--Kroeber's design layouts or symmetry structures--is the most useful and culturally meaningful analytical approach. Any classification that can be substantiated by distributions of other cultural factors probably is closer to the actual cultural situation. I have shown in this paper that both environment and proximity strongly affected exchange and marriage practices which, in turn, resulted in similarities and differences in design structures. The interdependence of these factors suggests that the structural analysis of design symmetries more accurately reflects the interactions and affiliations of California Indian groups.

Clarke (1968:374-388) reexamined the cultural element distribution data collated by Kroeber and others for the California tribes to demonstrate the polythetic nature of element sharing among communities within a tribe and the fairly abrupt fall-off of assemblage identity between communities of different tribes. Clarke used Pomo data to show that communities share from 95% to 65% of their assemblages.

> When this marginal fall-off of proportional content has reached the threshold of the cultural level, c. 65-50%, the assemblages can no longer be regarded as ethnographically or archaeologically Pomo in character [Clarke 1968:375].

This fall-off zone marks the boundary of one tribal group with another.

> Where the pattern of internal artefact assemblage variation produced a gentle curve, falling away at the tribal boundary . . . the pattern outside the tribe falls extremely steeply from the 65% to the 30% level of shared elements [Clarke 1968:376].

However, because the percentage frequency distributions Clarke cited were based on *total* artifact assemblages and this analysis is based on one aspect of one artifact type, the conclusions will necessarily vary, probably significantly so. Clarke admitted that exceptions to his pattern of 65-95% assemblage homogeneity within a tribe and fall-off to 30% outside the tribal boundary will occur.

> Such exceptions are clearly related to unusually good or bad lines of intercommunication and interconnection introduced by unusual topographic, linguistic, historic, or sociocultural ties and barriers [Clarke 1968:388].

In fact, the topographic and sociocultural factors he cited as being related to the exceptions (trade and marriages as regulated by environment) are precisely those found in this paper to be responsible for the homogeneities and heterogeneities in design structure. Thus, in plots of assemblages of northwest California tribes from the Tolowa south to the Yuki (Clarke 1968:380, Figs. 67 and 68), he found that linguistic identity rather than proximity explained the most closely similar groups. That is, despite intervening tribes of different linguistic background, two tribes of the same linguistic background had more similar assemblages. However, my analysis of the structure of basket design for these northwest coast groups suggests the reverse--that proximity is more of a factor than language. The near identity in use of classes *p112* and *pma2* among the Yurok, Hupa, and Karok, tribes

which speak three different languages, suggests that environment and interaction are critical factors in determining cultural similarity.

While the general determinants of culture areas observed by Kroeber (1936) and Clarke (1968) are enormously valuable for first order groupings of complex situations, second order hypotheses and research on the occurrence, distribution, and changes in *single attributes* can reveal insights about specific cultural relationships. That is, while linguistic units may be the most powerful descriptor of whole-assemblage similarity, they do not seem to accurately coincide with specific interaction patterns. Analysis of one particular attribute shows that environment, proximity, trade, and marriage requirements were important factors which determined similarities and differences in the design structures, as measured by symmetry classes, used on baskets made by different California Indian tribes.

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