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On human social intelligence

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Arguments for social intelligence in primates require that individuals be able to perceive and recall complex patterns of social relationships among the members of their communities. Indirect evidence suggests that non-human primates possess such ability, but, so far, little is known about the extent of human ability to process information about their social relationships. The present results show that, at least with regard to stable patterns of alliance and division in a community, humans are remarkable for their accuracy in processing such social information.

In a recent review article, Cheney, Seyfarth & Smuts (1986) distinguished between social and non-social intelligence. They suggested that among non-human primates the ability to deal intelligently with social relationships is quite distinct from the use of intelligence in dealing with physical objects and their relations. And they went on to argue that among non-human primates, 'selection for intelligence has acted particularly strongly in the social domain'.

To these authors, social intelligence is expressed in an animal's ability to perceive, recall and use information about social relationships among members of its own species. And, although their evidence was necessarily indirect, Cheney *et al.* presented a convincing argument that these animals do exactly that. While primates seem to be fairly unsophisticated in recognizing relationships among objects in the physical world, they are apparently capable of sophisticated analogical reasoning when it comes to recognizing their own and their neighbour's social relationships.

According to their argument, individual primates can and do develop stable long-term social affiliations with particular other individuals. And members of a primate community seem to be aware of the general pattern of such social alliances and divisions in the communities in which they live. Cheney *et al.* (1986, p. 1364) concluded that, 'adult primates not only recognize the close associates of other animals but also recognize that certain sorts of relationships share similar characteristics, regardless of the particular individuals involved'.

Such intellectual development in the social realm suggests, as Lachman & Lachman (1979) have argued, that a (perhaps *the*) major problem in primate adaptation and reproductive success involves dealing with conspecifics. Presumably such development is necessitated by the flexibility and range of variation in patterns of social form among primates. Insects like wasps and bees, for example, are social creatures. But the patterning of their social relationships is constant; it shows practically no within-species variation from community to community. These insects, therefore, have no need to be

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adaptable in dealing with their fellows. In contrast, primates display considerable within-species variation in social patterning from community to community (Maryanski, 1987). Any individual's adaptation, under such varying conditions, would be expected to depend in large part on that individual's skill in understanding and manipulating the local form of social structure.

Cheney *et al.*'s attention was centred on non-human primates. But since the patterns of social relationships among humans display even more variation than those among non-human primates (Murdoch, 1949), we might speculate that social intelligence should be even more important for human adaptation than it is for primates. As a matter of fact, the discussion by Cheney *et al.* wound up with an explicit statement of 'the intriguing hypothesis that primate intelligence—including our own—originally evolved to solve the challenges of interacting with one another'.

Obviously, social intelligence is a complex phenomenon. It includes a wide range of skills involving perception, intention, attribution and memory organization. In their analysis, Cheney *et al.* stressed particularly the display of intelligence in perception of, and memory for, the long-term patterns of linkages among individuals—their social structure. We will follow their lead. In studying human social intelligence, we will focus on the particular kind of intelligence that is displayed when a person demonstrates that he or she has an accurate perception of overall patterns of who is affiliated to whom in the community.

Recognition of who is affiliated to whom is a very basic social skill. One of the fundamental problems individuals face in interacting with their fellows is that of differentiating between those others who may be supporters and those who are (at least potential) antagonists. The solution to this problem requires first that individuals be able to recognize particular others. Moreover, it requires also that they be aware of, and able to recall, which individuals are socially close—linked by ties of affiliation—to which others. Humans, even more than their primate cousins, should be relatively adept at these tasks.

This is the question of the present study. We are concerned here with one particular manifestation of social intelligence, the ability to perceive and recall the pattern of alliances in a community. We will explore the extent of human ability to perceive and recall information about that pattern. We begin in the next section with a review of existing knowledge, most of which turns out to be indirect and inconclusive. We will turn then to the description of some new data that bear directly on our question.

Human social relationships and their recall

It could be argued that the answer to the question of whether humans can see and remember who is linked to whom is obvious. Everyone has had experience with collections of people who get together regularly and show every sign of affiliation and mutual support. We use words like 'gang' and 'set' and 'circle' and 'crowd' to describe such collections. Certainly (the argument might run), people are perfectly aware of these kinds of alliances.

There is, however, no evidence that our perceptions or memories of these alliances are accurate. Indeed, we have a great deal of research-based evidence to suggest that humans cannot even accurately recall the particular others with whom they have interacted on a specific occasion. By both observing and collecting recall data on the same subjects, Bernard, Killworth, and later Sailer (Killworth & Bernard, 1976, 1979; Bernard & Killworth, 1977; Bernard, Killworth & Sailer, 1980, 1982), have demonstrated that

humans are inadequate as processors of this sort of social information. Two kinds of errors are made. First, the subjects fail to remember others with whom they *have* interacted, and second, they falsely recall interacting with others with whom they *have not*. Overall, according to Bernard *et al.* (1985), these experiments show that 'about half of what informants report is incorrect in some way'.

In the context of the current problem, it is tempting to take this result as evidence that humans are really quite unintelligent in this aspect of the social realm. Since they cannot even recall those others with whom they themselves have interacted on a particular occasion, it seems unlikely that they could come up with accurate reports of overall long-term interaction patterns.

The Bernard *et al.* research (1976, 1977, 1979, 1980, 1982), however, was focused exclusively on recall of specific instances of interaction. More recent findings (Freeman & Romney, 1987; Freeman, Romney & Freeman, 1987) suggest that these 'inaccurate' responses may be taken as evidence for, rather than against, the kind of human social intelligence we are considering here. While it is true that people cannot accurately remember the others with whom they interacted on a specific occasion, they forget those with whom their interaction has been infrequent on similar occasions, and they falsely recall those with whom their interaction has been frequent. It seems that, when asked to recall specific interactions, human subjects bias their responses in such a way that they display their awareness of the long-term patterns. Their errors all strain in the direction of the long-term stable patterns.

This conclusion is encouraging in its implications for the kind of human social intelligence we are studying here. It must be stressed, however, that these findings do not provide any *direct* evidence pertaining to the problem of human ability to see the broad patterns of affiliation and division in the community. The data were collected in such a way that the subjects were not required to display any general knowledge of that sort. Moreover, the groups studied in this research displayed no clear patterns of alliance and division; they were simply undifferentiated collections of individuals.

What is needed, then, is a set of data that directly confront the problem of human perception and recall of overall patterns of social affiliation and division in a context where such patterns are clearly present. Such data were collected for the present study. The research setting and procedures of data collection will be described in the next section.

The data: social relationships on the beach

In searching for an appropriate setting in which to collect data on human social intelligence, we imposed two conditions: (1) that the subjects be in a natural setting and (2) that they be more or less differentiated into two or more subgroups. The first condition was needed to ensure realistic and generalizable findings, and the second to permit the explicit examination of people's ability to perceive and recall patterns of social alliance and separation.

We settled on studying windsurfers on a beach in southern California during the fall of 1986. The authors had all been participant observers and windsurfers at the beach for several years. We had all developed a 'sense' of the windsurfing community and were certain that it was fairly clearly divided into at least two subcommunities. Moreover, we knew the people involved well enough to be sure that they would co-operate in the systematic collection of data.

The beach in question is part of the Orange County Park system and is located in Dana Point, California. Facilities include a large grassy picnic area, rest rooms, restaurants

and a small sandy beach facing an area of protected water inside a breakwater. The beach includes a roped-off area for children's swimming, and the remainder is used for launching canoes, kayaks and windsurfers. Because of the protected water, the setting is ideal for beginners in any of these activities.

We will begin here with an informal description of the community based on participant observtion. This will provide background for the description of data collection and analysis that follows. Then we will describe how the systematic observations and interviews were conducted.

Windsurfing began at the beach in 1977, nine years before this study was conducted. It started slowly, but gradually, as more people got into the sport, a group of 'regulars' was established. These people spent time together and almost totally avoided interacting with other beach users who were not windsurfers. In effect, they developed a 'community' bound together by their common activity.

People came and went, but newcomers were quickly integrated into the community and long-term close relationships were established. A racing fleet was set up, and races were held regularly, but purely social relationships among the windsurfers also emerged. Beach picnics were common, and the whole group frequently gathered for 'pot luck' dinners at one windsurfer's house or another.

By 1983, the windsurfing group was well established and had a fairly stable membership of about 25 to 30. But that year, the sport of windsurfing experienced an upsurge of interest. Beginners took it up in increasing numbers and many began to flock to this particular beach. By that time, most of the established group were fairly expert and a little less tolerant of the foibles of beginners than they had once been. Moreover, their group had reached a size where additional growth would have cut into the pattern of easy informality that they had built up. Bernard & Killworth (1973, 1979) have suggested that growing groups reach a critical size where further growth leads to splitting. In the beach setting, adding new members would have required that people expend more effort keeping up with the task of maintaining relationships than they were willing to. So, for the first time at the beach, the established windsurfers refused to welcome new windsurfers into the group.

There was still a small amount of turnover in group membership. Some people left for new places or for different activities. But an interest in windsurfing alone was no longer enough to provide an avenue for access to group membership. New members were people who already had established relationships with existing group members in some context other than windsurfing. They were already established friends or long-time acquaintances who decided to try the sport. In effect, a newcomer could gain entry into the existing group only by finding a member who was willing to act as a 'sponsor'. Beginning windsurfers who were not already known began to be more or less systematically ignored by the old-timers on the beach.

At first, the new wave of beginners were social isolates; at best, they were marginal to the established windsurfing group. Then, gradually, as their numbers grew, these newcomers began to drift together to form a second informal group. And, over a period of time, they too formed friendships, joined in picnics and parties and established themselves as a more or less coherent social collectivity. During the study period, in the early fall of 1986, the new group numbered about 30 to 40 members, some of whom were far more active than others. And, unlike the old group, the new group continued, during the study period, to welcome new members.

Members of each group seemed, to some degree, to limit their interaction to fellow group members. Contacts between members of the two groups occurred, but these

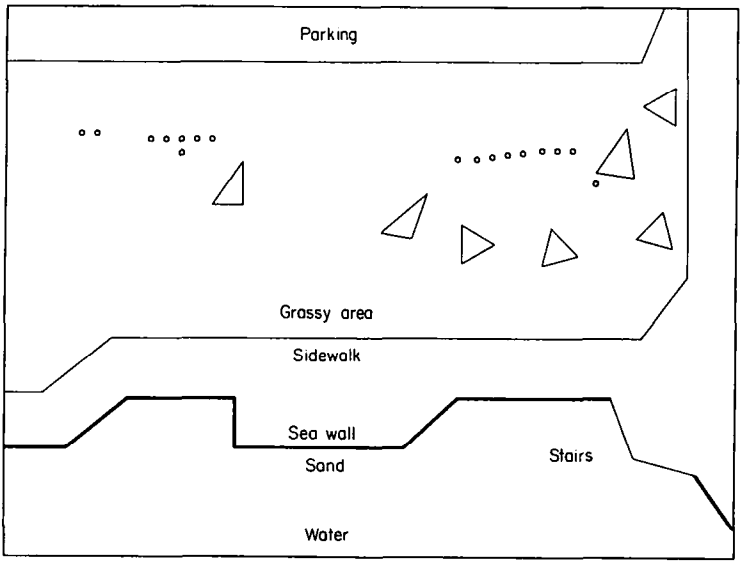

Fig. 1. Location of old group and new group on the beach at noon on 27 September

were less frequent. In addition, the physical space in the grassy area above the beach was sometimes divided up. Members of each group tended to sit together. Individuals might cross from group to group, but at least sometimes there was a noticeable gap between the space occupied by the old group and that filled by the new group. Figure 1 shows where people (and their sails) were located on the beach at noon on 27 September and illustrates this separation.

Thus, group identities seemed, to some degree, to be visible, both through the tendency to limit interaction primarily to in-group members and the tendency for members of each group to locate themselves in a more or less compact physical area. Notwithstanding this separateness, neither group was ever formally organized or named and group membership was seldom mentioned. Occasionally, an individual in one group or the other may refer to another person as one of 'us' or one of 'them', but no sign of intergroup conflict has ever been displayed.

This, then, was the beach setting at the time the systematic data were collected. There seemed to be at least two groups, but like the groups in any human community, their boundaries were far from clear. We wanted information on the regular patterns of interaction between pairs of people, both within and between groups. Moreover, since space seemed regularly to be used as a symbolic statement of group membership, we decided also to collect data on people's physical location.

We established 31 days as a suitable period for systematic observation. Then, since attendance tended to be high at mid-day and near the end of the day, we selected two half-hour periods, 12:30 to 1 p.m. and 4 to 4:30 p.m., as periods for systematic observation of people's locations and their interactions. At least one of the authors was present each day for these periods and unobtrusively recorded the needed information. Many days permitted additional observation, but at the very least, data were collected for the designated two half-hour periods each day.

All in all, during the 31 days of observation, 95 windsurfers were recorded as having been at the beach. Many of these, however, were one-time visitors who were just passing through. We set out to specify a subset of those that would include the regulars and

at the same time maintain enough variability in attendance to include some of the people who were only rarely involved. To get the regulars, we included all those who had attended three or more days during the period of observation. And to make sure we had some infrequent attenders, we included everyone who had attended at any time on the final day of observation. This procedure yielded a list of 54 names.

All 54 windsurfers on the list were interviewed in the period between one and two weeks following the end of observation. Basic face sheet data (age, gender, etc.) were collected along with data on each individual's perception of social affiliations. The perceptual data were generated by asking each subject to perform a card sorting task.

Each subject was presented with a deck of 54 cards. Each card displayed the name of a windsurfer from the list. Subjects were asked to sort the deck into two piles: those whom they recognized and those they did not know. Subjects were told that if they had a question about a name they could ask. In order to avoid biasing responses, questions were answered by reading a pre-set description of the person named. One of these descriptions, for example, ran, 'house painter—blond'.

Once this main sort was made, further questions addressed to each subject were restricted to those others that were known to that subject. The set of cards representing known people was presented, with the following instructions:

There are lots of ways to think about groups. One way has to do with sets of people who are really very close—they like each other, they spent a lot of time together, they're a tight-knit group, like a clique. I want you to sort these cards into piles, where those in a pile are all really close in that way. Use as many piles as you want, but remember that any cards in the same pile must be people who are in one of those really tight groups. You can also have singletons, that is, you should leave people who have no really close ties on the beach in piles by themselves. So try it.

The results of this sort were recorded, then subjects were instructed again:

Fine. Now let's relax our idea of tight group a little bit. Think of groups that are still close—people interact quite a bit and, in general, they like one another—but they are not quite as close as the groups we were talking about before. Now put any piles together that make up groups of this new kind. You can merge piles or put singletons together or in piles. The idea is close groups, but a little looser than we were talking about before. Try it.

Again, the results were recorded, and subjects were told to relax the idea of group still a little more and merge piles again. This sequence of instruction and recording was repeated until either the subject was unwilling to do any more merging or a single pile had been created.

In the present analysis, our interest is in perceptions of broad categories of subgroups. We focused, therefore, on each subject's ultimate sort (or, if the ultimate sort consisted of a single pile, his or her penultimate sort). This gave us the broadest set of two or more subgroups that each subject was willing to define. The actual numbers of groups into which subjects sorted the community ranged from two to 35. Most subjects, however, used relatively few groups; the modal response (exhibited by 21 subjects) was to assign individuals to just two groups.

These sorts, one for each of the 54 subjects, are the perceptual data for the present study. In the next section, they, along with the data from observations, will be examined to determine the degree to which subgroups were present and the degree to which our subjects 'saw' those groups.

Seeing subgroup patterning in social relationships

Before we can address the question of perception, we must first assess the degree to which the observed patterns of physical space use and interaction reveal the presence of

subgroups. Specifically, we are concerned with the question of the extent to which our measures of proximity and interaction display the kind of broad subgroup structure that seemed, intuitively, to be present at the beach.

Ideally, the construction of subgroups based on proximity and interaction should parallel the perceptual task we assigned our subjects. A natural way of constructing such a parallel involves using hierarchical clustering. We used the procedure based on *average* linkages between clusters (Sokol & Michner, 1958). It begins by defining each of the 54 individuals as a separate cluster. It proceeds, then, through a series of steps. In each step two clusters are merged. Those that are merged are the two that are closest, on average, in terms of the measure being used. This process is repeated and continues until finally all of the individuals are merged into a single cluster.

We applied this procedure first to the data on the use of physical space. A measure was created by computing the average distance between each pair of people who were present at the beach at the same time. Then, in order to index proximity, clustering was done by merging those clusters with the smallest average distance between them.

This analysis of proximities produced results consistent with our intuitive expectations. At the next to last step in the process of merging clusters the procedure revealed two broad subgroups. One subgroup contained 22 individuals and the other had 32.

Each of these subgroups displayed a centre–periphery structure. Each had a core of individuals all of whom were typically quite close to each other. They were merged together early in the process. Each subgroup also contained some marginal individuals who were not as close and who therefore were merged into their respective clusters later in the process. It is important to note that the two main clusters were merged at the very last step. This indicates that, in terms of physical proximity, the two subgroups were quite distinct.

The same kind of cluster analysis was used for the data on interaction. The number of minutes of interaction observed over the 31 days was calculated for each pair of persons. The clustering procedure was run, but this time the results were more complicated. The same two main clusters were found, but this time they were merged together several steps before the process ended.

Four individuals had not been merged into either of the main clusters at the point when the two clusters were put together. In terms of their interactions, these four are peripheral to both groups. In fact, the two groups are closer to one another than either of them is to these four marginals. Two of the four confine most of their interaction to each other and distribute the remainder more or less equally between members of each of the main subgroups. The other two do not interact much at all, but in the limited interaction they do have, they seem also to be unable to choose between the subgroups. Clearly, these four play some sort of linking role; they are not classifiable into one subgroup or the other.

Overall, the results for the two cluster analyses are quite similar. The broad classifications produced by analysis of interaction were for the most part identical to those produced by looking at physical proximity. Two large clusters emerged near the final step in the process. Moreover, all but two individuals were classified just as they had been in the analysis of proximity. These two individuals switched 'sides', they were classified into one group in terms of their interaction and the other group according to their physical proximity to others. Apparently, these two locate themselves in proximity to the members of one subgroup but have most of their conversations with people in the other subgroup. Like the four individuals described above, whose interaction patterns showed them to be marginal, these two 'switchers' seem to provide some sort of bridge linking the two subgroups. They are not clearly classifiable in terms of the pair of clustering procedures.

As a whole, then, the data on interaction and on physical proximity agree on classifying 48 of our 54 individuals into two main clusters. One of these, the *old group*, consists of 19 people and corresponds to the set of established windsurfers and their friends described above. The other, the *new group*, consists of 29 people, who are relative newcomers to the sport. And the remaining six people seem to move between the two subgroups. These six we shall call *links*.

The data generated by systematic observation, then, support our earlier intuition that most of these windsurfers are split into two separate subgroups. This division provides the basis for addressing the central focus of the present inquiry: we want to know the degree to which a subject's perceptions of subgroup structure are consistent with the subgroups revealed by data based on observations of proximity and interaction.

An approach based on individual judgments, however, does raise some special problems. We are not dealing here with a situation where experimental controls have been imposed—where subjects have all experienced exactly the same events. Instead, each subject has appeared at the beach only intermittently, and no two subjects have displayed exactly the same attendance pattern. To some extent, then, the experience of each subject is unique. Thus, we cannot reasonably expect any individual subject to have 'seen' exactly the same patterns of affiliation and division as those revealed in our systematic observations.

A second problem here is technical. Arabie & Boorman (1973) have shown that when objects are assigned to categories, and the number of categories is unrestricted, evaluations of agreement between different assignments cannot be made. Such evaluations turn out to be almost completely an artifact of differences between the numbers of categories used by the different assignment procedures. In the present case, this means that the agreement of any subject's judgments with the assignments made on the basis of observation would depend more on the number of categories the subject used than on his or her classification of individuals.

Both of these problems can be eliminated if we combine the perceptions of our 54 subjects. The effects of individual differences in experience as well as those resulting from individual tendencies to use a larger or a smaller number of categories all cancel out. This approach permits us, in effect, to pool the wisdom of our subjects.

To combine our subjects' perceptions, we constructed a measured of perceived social proximity. We built a 54 by 54 symmetrical matrix where both rows and columns were labelled with the names of our 54 individuals, considered this time as objects of perception. Each cell, then, was assigned an index of the perceived proximity of the person designated by the row label to the person designated by the column label. The entry in the cell was a proportion, the number of subjects who assigned the row person and the column person to the same class in their ultimate (or penultimate) card sort, divided by the number who recognized both persons. The result is simply a matrix of perceived social closeness based on the judgments of the 54 subjects involved in the study. It is a collective 'mental map' of the windsurfers' pattern of social affiliation.

Next, in order to get a clear picture of this collective view, we used a multidimensional scaling procedure (Shepard, Romney & Nerlov, 1972) to map our matrix into a two-dimensional Euclidian space. The results of this scaling are shown in Figure 2 where the subgroup structure (based on the observations of proximity and interaction) is overlaid.

It is immediately apparent from the dense clusters of points on the right and the left sides of the picture that our subjects collectively see the windsurfer community as consisting of two distinct subgroups. Individual subjects exhibit some variation in their perceptions of patterns of affiliation and division, but they agree that there are two

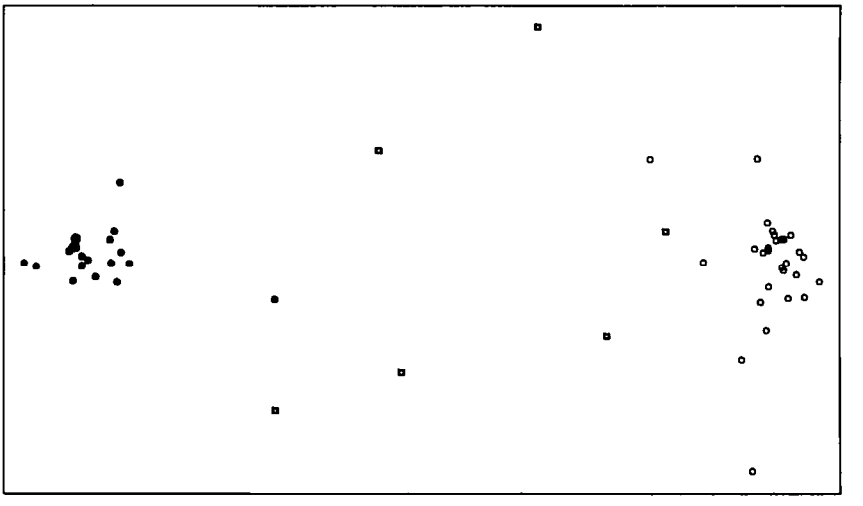

Fig. 2. Results of multidimensional scaling procedure, showing subgroup structure. ●, Old group; ○, new group; □, links

subgroups and they agree on the assignment of the core members of each subgroup. Peripheral members are those that surround each cluster. They are located around the core members simply because the subjects showed less agreement in classifying them; some subjects classified them with the core and some left them out. Those we have called link people are distinguished by the fact that they are placed between the two cores; some subjects classified them with the members of one core subgroup and some with the other.

From looking at Figure 2, it is clear that the subjects' perceptions are in almost total agreement with the classifications based on our observations of behaviour. The observed old group is on the left of the collective mental map, the new group is on the right and the links fall in between. Thus, what we have with this mental map is a nearly perfect representation of observed patterns of proximity and interaction. The correspondence between observed social behaviour and people's perceptions here is startingly close. The Pearsonian correlation between the partition based on observations and locations on the horizontal dimension of the mental map is 0.97. Collectively, humans apparently perceive and are able to remember a clear and accurate picture of subgroups and their membership. They can see patterns of alliance and division and they can tell who is centrally involved and who is peripheral.

Summary and conclusions

The research discussed here was designed to explore an intriguing notion suggested by Cheney *et al.* (1986). They proposed that intelligence in dealing with social phenomena evolved earlier than intelligence in dealing with the physical world. They confined their attention to primate studies, but indicated that humans too might be expected to exhibit an ability to perceive and recall patterns of social relationships.

We reviewed the literature on human perception of social arrangements and found little in the way of direct evidence for or against human ability to 'see' their social world. The review established that humans have poor memory for particular occasions of interaction, but that they seem to bias their recall in the direction of general patterns. To

us, this finding suggested that they might indeed accurately recall those general patterns if asked to do just that. So we set about the task of collecting data on humans that would confront the issue directly.

Our subjects were a natural, activity-oriented collection of people—windsurfers on a Californian beach. We recorded their patterns of interaction and their use of physical space on the beach for 31 days. We also asked them each to assign everyone to a minimal set of subgroups. Then we compared the subgroupings displayed in interaction and space use to those perceived by the subjects themselves.

The results were dramatic. There was an almost perfect match between the observed subgroups and those perceived by the participants. At least these humans are profoundly perceptive in the domain of social affiliation and division. As a matter of fact, at this point we have a conjecture about the degree to which humans are socially intelligent. We suspect that the slight differences between the observed patterns and the perceptions of our subjects are probably more a consequence of our relatively short period of observation than of inadequacies in the subjects' perceptions. Thus, we are suggesting that any 'errors' that exist are apt to be the result of sampling variation in the observations; human social perception of this sort seems to be virtually error-free.

All in all, then, humans turn out to be remarkably good at processing information about alliances and divisions in their social worlds. We have suggested elsewhere (Freeman, Freeman & Michaelson, 1988) that people possess built-in cognitive mechanisms that facilitate exactly the kind of perception and memory displayed here. These mechanisms tend to inhibit the recall of specific instances of interaction. But at the same time, they facilitate the recall of the sorts of general categories of social proximity that were examined in the present study.

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