

Some Neo-Darwinian Decision Rules for Altruism: Weighing Cues for Inclusive Fitness as a Function of the Biological Importance of the Decision

Eugene Burnstein, Christian Crandall, and Shinobu Kitayama

A neo-Darwinian heuristic for decisions involving altruism is hypothesized in this article. Following W. Hamilton's (1964) analysis of inclusive fitness, the assumption of this study is that tendencies to help another person are selected against, except when the donor and recipient are related and share genes underlying these tendencies. An important social psychological implication of Hamilton's formulation is that in group-living individuals (a) natural selection favors those who are prone to help others as a function of the latter's relatedness, potential fecundity, or other features indicating a recipient's capacity to enhance the donors' inclusive fitness, and (b) this effect is especially strong when help is biologically significant (e.g., the recipient will not survive otherwise). Such a heuristic is demonstrated in several studies involving hypothetical decisions to help: In life-or-death situations, people chose to aid close kin over distant kin, the young over the old, the healthy over the sick, the wealthy over the poor, and the premenopausal woman over the postmenopausal woman; whereas when it is a matter of an everyday favor, they gave less weight to kinship and opted to help either the very young or the very old over those of intermediate age, the sick over the healthy, and the poor over the wealthy.

Several times a year the Carnegie Hero Fund Commission bestows awards on individuals for unusual bravery in coming to the aid of another. Since 1904 the commission has recognized close to 8,000 people for acts of heroism. A striking feature of this sample is that the acts rarely involve relatives. The absence of kin is no accident. Until about a decade ago individuals who helped a family member, however brave the action, were deliberately excluded from consideration; even nowadays those who help kindred are subject to a different standard and are recognized only when the sacrifice is extraordinary. For example, the *Ann Arbor News* in December of 1992 reported that 22 people had been recently cited by the commission. Only 2 of the cases described in the article involved relatives. Both were parents who had attempted to rescue their children and both died in the effort. Whereas all of the persons cited for heroism who survived

unscathed were unrelated to the recipient of their actions. Evidently, the Carnegie Hero Fund Commission believes that helping kin is less worthy than helping nonkin, unless it results in serious injury to the actor. On the face of it this belief is puzzling. If a foundation dedicated to rewarding heroism excluded cases in which the recipient of help was the same gender or nationality as the donor, it would be widely questioned. Why is discrimination based on kinship more acceptable? Perhaps because the commission recognizes that the fate of offspring, siblings, and parents is more significant to most people than that of acquaintances or strangers. After all, few are surprised that in natural disasters people's uppermost concern is their family (Cunningham, 1986; Drabek, Key, Erickson, & Crowe, 1975; Quarantelli, 1960); and should they be away from home, it is the group they think about first and the one they make the greatest effort to contact (Killian, 1952). Would the denouement of *Sophie's Choice* have been as poignant if the heroine had instead to decide between the lives of two strange children? Indeed, people's feelings are probably much more precise in these matters so that, for example, they sense that the death of a daughter is a greater cause for grief than the death of a cousin or of an old, sickly mother (Littlefield & Rushton, 1986). But whether or not humans can parcel out grief with this degree of precision, the fact is that the tendency to mourn intensely over the death of kindred is universal and probably species specific (Murdock, 1945; Rosenblatt, Walsh, & Jackson, 1976).

The notion that concern about others' fate increases with their relatedness is a key social psychological corollary of the

Eugene Burnstein, Institute for Social Research, University of Michigan; Christian Crandall, Department of Psychology, University of Kansas; Shinobu Kitayama, Department of Psychology, University of Oregon.

We thank C. Daniel Batson, David Buss, Warren Holmes, and Barbara Smuts for their valuable comments. In addition, we are very grateful to Junko Matsukawa of Shimane University and Shinichiro Okamoto of Aichi-Gakuin University in Japan for their help in carrying out Study 2.

Correspondence concerning this article should be addressed to Eugene Burnstein, Institute for Social Research, University of Michigan, Ann Arbor, Michigan 48106-1248.

neo-Darwinian theory of biological evolution, particularly in its analysis of inclusive fitness (Hamilton, 1964; Maynard Smith, 1964; also see Fisher, 1930/1958; Haldane, 1932). In classic Darwinian theory, fitness was measured in terms of individual reproductive success. However, according to the inclusive fitness model, individual reproductive success is significant for natural selection only because it reveals something about genetic continuation, that is, the likelihood of the person's genes being replicated over succeeding generations; and from the point of view of genetic continuation individual reproductive success is not the sole or may not even be the most important determinant. Because an individual shares genes identical by descent with relatives, the latter's reproductive success also must be taken into account. In any case, Hamilton's demonstration that natural selection is primarily a matter of genetic continuation has been persuasive and, as a result, there followed numerous arguments, widely known by now, that it is more parsimonious as well as more precise to say that the individual is merely a gene's vehicle for making another gene, a machine for replicating itself, and the like (Dawkins, 1976, 1982).

Social psychological theory needs to take into account Hamilton's (1964) inclusive fitness formulation because it offers the best explanation of the conditions under which genetic structures and the behaviors they give rise to benefit and become widespread as the result of social transactions. To wit, suppose, first, that an actor does something to help a recipient and the action costs the former C while benefiting the latter B , costs and benefits referring to decreases and increases, respectively, in individual reproductive success and, second, that there is a genetic structure mediating the action. In traditional Darwinian theory, a tendency that causes its possessor reproductive harm will be selected against. Hamilton's insight is that the genes underlying such a tendency experience no reproductive benefit but only a cost and as a result must decrease in frequency unless the actor and recipient are related, in which case there is some likelihood that they share the genes in question. Hence, a genetic structure in the actor can in fact experience a net benefit, that is, its chances of replication are improved, if the cost of helping to the actor is less than the benefit to the recipient weighted by the degree of relatedness, r , that is, if $Br > C$. To spell this out a bit more, note that according to Hamilton's model, for it to produce a net genetic profit for the actor and be favored by natural selection, an action whose recipient is a sibling ($r = .5$) must benefit the latter more than twice what it cost the former, an action whose recipient is an aunt ($r = .25$) must benefit her more than four times the amount that it cost the actor, and so forth.

That the inclusive fitness model has implications for the psychological analysis of social norms, cooperation and competition, and interpersonal attraction, is not news (e.g., Alexander, 1987; Axelrod & Hamilton, 1981; Buss, 1989; Caporael, Dawes, Orbell, & van de Kragt, 1989; Kenrick & Trost, 1988). In the present article we are concerned with the broader issue of constraints imposed by the model on the encoding of social information. The nature of these constraints may be outlined in terms of two processing principles. The more general principle concerns a capacity labeled *social acuity*. It asserts that natural

selection favors a tendency in actors to distinguish between potential partners according to the cost and benefits of a transaction. The more specific principle has to do with what is usually called *kin selection*. Here the model offers scientific support for the Carnegie Hero Fund Commission's intuition that heroism on behalf of relatives is different from heroism on behalf of non-relatives. It implies that when people need help, natural selection favors a tendency in the donor to discriminate among potential recipients according to their degree of relatedness. We first briefly discuss some of the psychological evidence regarding social acuity, evidence that is unsystematic but more plentiful than one might expect. Then in the remainder of the article we present several studies bearing on kin selection, especially the encoding of kinship and the impact of this information on hypothetical decisions to help.

Recognizing the Cost and Benefits of a Social Transaction

If nothing else, the concept of inclusive fitness suggests that any group-living species will have developed mechanisms allowing them to detect early the costs and benefits of interacting with a conspecific. The evidence in the standard social psychological literature for such a heuristic seems considerable, especially in light of the fact that it was produced inadvertently—none of these researchers, as far as we know, were interested in the matter. For example, group members are sensitive to individual differences in the possession as well as in the expenditure of resources (see reviews in Hare, 1976; McGrath, 1984); they readily categorize each other according to the capacity to contribute (e.g., members with many good ideas vs. members with few good ideas, intelligent members vs. unintelligent members, active members vs. passive members, etc.) and the likelihood that these resources will be used to another's benefit (e.g., cooperative members vs. competitive members, friendly members vs. hostile members, warm members vs. cold members, etc.). Moreover, the individual differences in behavior that allow such categorization as well as the sensitivity in recognizing these differences appear quite early in the interaction, probably within the first few minutes (Fiske & Ofshe, 1970; Willard & Strodtbeck, 1972). Categorization according to members' resources also seems to occur automatically, given that it has been found in encoding and decision tasks where transactions with the stimulus persons are out of the question and where individual differences in the latter's resources are irrelevant to performance (DeSoto & Albrecht, 1968; DeSoto & Bosley, 1962). Finally, in more natural settings Cheyny and Seyfarth (1985) observed that children and young primates deduce status in a group merely by watching a limited number of transactions between members: As a result of noticing that A, say, is related to, cooperates with, or dominates B and B is related to, cooperates with, or dominates C, they infer that A is related to, cooperates with, or dominates C. Indeed, these researchers find that monkeys are adept at inferring causality, transitivity, and reciprocity in social relations early in life, before they are skilled in recognizing comparable relationships between physical events of considerable biological significance (e.g., that a particular pat-

tern of tracks is produced by the python, a common predator of the monkey and, thus, should be taken as a warning).

Individuals playing a prisoner's dilemma game who believe their unseen partner is a person instead of a computer are inclined to adopt a cooperative strategy, which depends on their understanding of the other's outcomes, whereas those who believe the partner is a computer are not, even though under either condition the partner plays a flexible, forgiving, and nice strategy like tit for tat (Abic, Faucheux, Moscovici, & Plon, 1967). Similar effects are observed in pure coordination games (see the minimal social situation in Sidowski, Wycoff, & Tabory, 1956). Kelley and his colleagues (Kelley, Thibaut, Radloff, & Mundy, 1962; Rabinowitz, Kelley, & Rosenblatt, 1966) had individuals engage in a long series of transactions with a partner who, again, was said to be either a person or a machine. The task required participants to ascertain which of their actions helped and which harmed the partner. Once this was determined coordination could be achieved and from then on both individuals would benefit; otherwise, both would continue to experience costs. The results were comparable to those in the mixed-motive studies: Individuals who believed they were interacting with another person figured out the consequences of their actions more readily—interestingly enough, they did so for the most part by assuming the partner used the equivalent of a tit for tat heuristic (win-stay/lose-change) in responding to their actions—and, as a result, solved the coordination problem with greater frequency than those who believed they were interacting with a machine.

Some of the most recent evidence that humans by nature are prepared to encode the costs and benefits of social transactions is found in Cosmides (1989; Cosmides & Tooby, 1989; but see Cheng & Holyoak, 1989; Pollard, 1990; Politzer & Nguyen-Xuan, 1992). She observed in several experiments that formally identical problems of logical reasoning are relatively easy to solve when they are presented in the form of a social transaction, but are difficult to solve otherwise. On the basis of these findings Cosmides argued that humans have specialized mental capacities for encoding and elaborating on the costs and benefits of social relationships and that these capacities reflect built-in encoding mechanisms (for more specific social transactions such as mating and parenting, see Buss, 1988, 1989; Buss & Barnes, 1986; Daly & Wilson, 1988; Daly, Wilson, & Weghorst, 1982; Kenrick & Trost, 1988; Symons, 1979, 1987).

Although conceptually and methodologically disparate, these studies are surprisingly consistent with the general thrust of Hamilton's model: Natural selection favors encoding mechanisms that are vigilant in respect to the costs and benefits of a social transaction. The upshot, we think, is a general heuristic for detecting who possesses what resources and whether they are likely to use them in a cooperative or competitive fashion that is activated whenever a social transaction is in the offing. Our own research attempts to demonstrate this in cases where individuals decide how to use their resources to help others who vary in kinship.

Study 1: Perceived and Actual Kinship

Whereas it may be true that people pay special attention to kinship and its correlates, this does not mean that there is a one-

to-one correspondence between biological and perceived relatedness. People's capacity to discriminate between a very close and a moderately close relative (e.g., mother vs. aunt) may be different from their capacity to discriminate between a moderately close and distant relative (e.g., aunt vs. second cousin). In fact, from the point of view of inclusive fitness the difference between a parent, sib, or offspring and an aunt, uncle, niece, or nephew is more significant than the difference between any of the latter set and a cousin. Hence, theory as well as intuition (plus the psychophysics and social judgment literatures) suggest that Weber's law is likely to hold for relatives: Differences between close kin appear greater than differences between distant kin. The implication, of course, is that the robustness of kinship effects depends on whether the relatives in question are close or distant. In addition to psychophysical processes there are likely to be cultural meanings associated with particular kin terms that have little to do with shared genes but that nevertheless affect one's perception of relatedness (e.g., "He's not heavy, Father, he's my brother.") and are likely, at least from the point of view of inclusive fitness enhancement, to distort decisions involving kin. To determine the relationship between perceived and actual kinship, a small study was carried out.

Subjects and Procedure

Twenty-six undergraduates at the University of Michigan were asked to indicate how closely related they felt to a large number of kindred ranging from biologically close, such as parents and siblings, to biologically distant, such as cousins and great-grandparents; also included were fictive kin (e.g., step-parents) and acquaintances. Respondents anonymously filled out a short questionnaire containing 19 questions in the form of "How closely related do you perceive yourself to be to your sister?" One question referred to a genetically identical relative ($r = 1.0$), namely, an identical twin. Four questions referred to very close relatives ($r = .5$), namely, mother, father, sister, and brother; 6 questions referred to moderately close relatives ($r = .25$), namely, aunt, uncle, grandmother, grandfather, niece, and nephew; 3 questions referred to distant relatives ($r = .125$), namely, cousin, great-grandmother, and great-grandfather; 4 questions referred to fictive kin ($r = .00$), namely, step-mother, step-father, step-sister, and step-brother; and 1 question referred to an unspecified acquaintance. Respondents indicated the degree of perceived relatedness by writing a number from 0 (*completely unrelated*) to 100 (*extremely closely related*) in a space immediately to the left of the question.

Results and Discussion

An analysis of variance (ANOVA) indicated a significant decline in perceived relatedness with actual relatedness, $F(5, 100) = 216.9, p < .001$. More important, multiple comparisons using Dunn's test demonstrated that the drop in perceived relatedness between each pair of adjacent points was reliable and that the most precipitous declines occurred (a) between very close kin (.5) and moderately close kin (.25) and (b) between distant kin

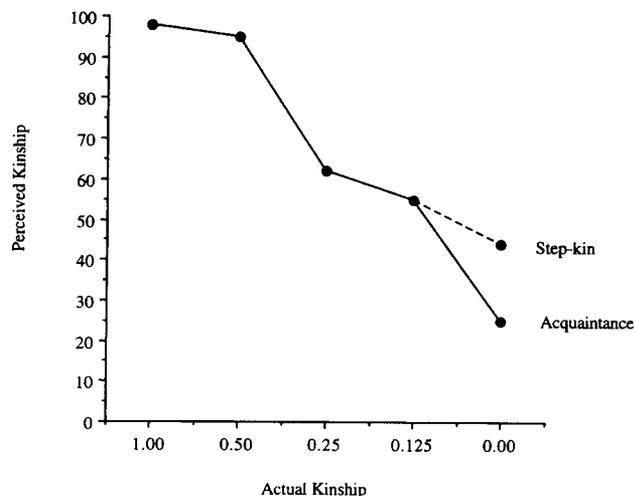


Figure 1. Perceived kinship as a function of actual kinship.

(.125) and acquaintances (.00). All of the effects were reliable at the .01 level (see Figure 1).

Suppose we have to decide which of two recipients to help and the latter differ in how closely related they are to us. To the extent that our decision depends on perceived relatedness, kinship should have the greatest impact when one recipient is either a very close relative ($r = .5$) or is unrelated ($r = .00$) to us. Finally, the difference in perceived relatedness between fictive kin and acquaintances suggests that the cultural definition of who is and who is not a relative has considerable influence.

Inclusive fitness increases not only with the actor's own reproductive success but also with the reproductive success of kin, which is why individuals who do costly things to benefit a relative benefit themselves, genetically speaking. So it takes no great leap of imagination to see how this notion could become the theoretical foundation for the evolution of cooperation (Axelrod & Hamilton, 1981): A person inclined to cooperate with kindred so as to increase their reproductive success ensures the persistence of the genetic structures underlying such an inclination (for proximal psychological mechanisms, see Batson [1987, 1990] and Lanzetta & Englis [1989]). Be that as it may, when it comes to deciding whom a person should help, heuristic thinking informed by inclusive fitness concerns generates a two-part rule that, roughly, says "Help those most closely related to you who have the greatest reproductive value and be especially diligent in this respect when the benefits to the recipients' reproductive success are large." Such a rule is important because it allows the person to distinguish those social transactions in which inclusive fitness plays a major role from those in which it does not. To take the most obvious case, one that will preoccupy us throughout the article, it implies that help as a matter of life or death is significantly different from help as an everyday favor. Chagnon and Bugos (1979), describing an ax fight in a Yanomamo village in southern Venezuela, made the point that it is when individuals are in peril that

some of the essential and rock-bottom characteristics of kinship

... reveal themselves ... Here ... the axiomatic qualities of human kinship as prescriptive altruism take on form and substance ... If we are interested in examining individual human behavior with an eye toward understanding the extent to which that behavior is "tracking" biologically relevant dimensions of kinship relationships, it seems that crisis or conflict situations involving potential hazards to the actors are a reasonable place to begin. (p. 215)

From this perspective it is useful to distinguish between an everyday heuristic that is primed by biologically trivial social transactions—that is, transactions with minimal significance for reproductive success—and, we hypothesize, is driven by a desire to do what is moral or socially approved (see below) versus a life-or-death heuristic that comes into play when social transactions are biologically significant (in that they have important consequences for reproductive success) and is driven by mechanisms that serve to enhance inclusive fitness. We assume that under everyday conditions need, worthiness, or obligation is the default value for deciding whom to help; other things being equal, morality, manners, and reputation are best served by helping persons who are most deserving or least able to help themselves. In the case of the life-or-death heuristic what is important is the *fitness value* of the recipients, that is, their potential fecundity or reproductive value plus other capacities that can contribute to a donor's inclusive fitness. The features an individual actually uses as cues in deciding whether to help another no doubt would correlate imperfectly with their importance as specified in a normative theory of fitness value. Of course, kinship (or its correlates) is of necessity such a feature and a critical one (e.g., see Essock-Vitale & McGuire, 1985). In addition, there are various other features relevant to inclusive fitness in that they affect the recipient's capacity to produce and nurture offspring (or to contribute to the well-being of the donor's offspring). Our studies examine some of the most obvious: the recipient's age, state of health, wealth, sex, and environment.

Clearly, a person who is old, impoverished, in poor health, or lives in a malignant environment is less likely to produce viable offspring than a person who is young, rich, in good health, or lives in a benign environment. Some of these features also signal need and obligation in an everyday context. Our conjecture is that the very young and very old are perceived as less able to help themselves than those of intermediate age; similarly, individuals who are in poor health or impoverished are seen as more vulnerable than those who are in good health or rich; and in all likelihood, females are still considered more deserving in this respect than males. Finally, and oddly enough, sex is a feature whose reproductive significance is less straightforward. As a main effect, males might be seen as having greater value than females because they are capable in principle of having more offspring. Females, however, might be considered more valuable because they set the upper limit on reproduction. Moreover, the risk and uncertainty associated with female reproduction is less than that associated with male reproduction; in virtually all pre-modern communities the variance in the number of offspring of males is greater than that of females so that only the most fecund males have more offspring than females of average fecundities. In short, women produce more children on the average than men (Chagnon, 1979, 1988; Dickemann, 1979; Har-

tung, 1976, 1982).¹ At best, however, differences between the sexes in reproductive value depend on context. One relatively clear instance of this is examined in our next study, that is, the interaction between age and sex: The male capacity to have offspring persists to some degree into old age, whereas the female's capacity ends abruptly in late middle age with the onset of menopause.

Study 2: Recipient's Age, Sex, and Relatedness

This analysis has several implications for decisions to help. First, it suggests that altruism and kinship are linearly related; when actors are obliged to choose, they help their closest relative. Second, actors give more weight to kinship in life-or-death than in everyday situations—in light of our findings on perceived and actual relatedness, we expect this effect to be more robust when one of the potential recipients is close kin or non-kin. Third, under life-or-death conditions altruism and age are linearly related, that is, actors help the youngest; under everyday conditions, however, they are curvilinearly related, that is, actors help the very young or the very old over those of intermediate age. Fourth, in everyday situations actors help females over males; in all likelihood, however, this preference attenuates under life-or-death conditions. Fifth, after late middle age the decline in help for females is more precipitous than that for males when help is a matter of life or death, whereas females and males have comparable rates of decline with age when it is a matter of an everyday favor. Our second study examines these predictions.

Respondents

The respondents were 158 Japanese and American undergraduates. The Japanese sample consisted of 82 male and 4 female students at Shimane University, Shimane Prefecture, and the American sample consisted of 28 male and 44 female students at the University of Michigan.

Procedure

The respondents were randomly assigned to answer one of two forms of a questionnaire. Each contained 24 cases, 1 per page, involving triads of individuals. In the life-or-death condition the three target individuals are described as being in grave peril and in need of help. The respondent's task is to decide which one to help. The perilous state of affairs is depicted as one where (a) the triad members who do not receive help will not survive and (b) the actor has time or resources enough to help only one. As an example of how to perform the task, respondents were asked to imagine the three targets, who varied in age, sex, and relatedness (e.g., their 7-year-old female cousin, their 75-year-old grandfather, and a 21-year-old acquaintance); each is asleep in different rooms of a rapidly burning house, and the respondent has time to rescue only one of them. Once participants had this picture in mind, they were to rank the targets, that is, to encircle the member of the triad that they were most likely to help and to cross out the member that they were least likely to help. The former target was given a score of 3; the latter,

a score of 1; and the intermediate target, a score of 2. It was stressed that only the person who received help would survive and that the others would perish. The everyday form asked respondents to think of situations in which help would be useful to the recipients but was by no means a life-or-death matter. Again, to illustrate the task, respondents were to imagine that they were on their way to an appointment; as they were about to leave, three target individuals asked them to do a small favor, say, pick up items at a store, and, again, there was time to help only one member of the triad. The respondents then had to decide which of the triad they would most likely help and which they would least likely help. The scoring was identical. Both forms of the questionnaire noted that respondents were unlikely to have all the relatives described in the questionnaire (e.g., a 3-day-old sister or a 75-year-old grandfather), in which case they were to imagine that they did.

A total of 36 different targets were created by filling out a 2 (condition: life or death vs. everyday) \times 2 (country) \times 2 (sex of subject) \times 2 (sex of target) \times 5 (age of target) \times 4 (kin) \times 2 (repeated measures) matrix with four cells missing. The matrix for male targets is shown in Table 1 (the matrix for female targets was identical except for the sex labels). Two cells of each matrix were left empty in the 75-year-old column. Both the .5 and .125 kin at that age, corresponding to a 75-year-old parent and a 75-year-old cousin, respectively, were in our judgment too far from our respondents' experience and, hence, were omitted. In the .25 kin cells the exact lineage of the target was not completely determined, an 18-year-old nephew could be a sister's or brother's son. In these cases, sex was kept consistent so that nephews were labeled as a brother's son and nieces as a sister's daughter. Lineage was clear in all other cases except cousins, aunts, and uncles, where it was not specified. The triads were constructed so that both sexes were always represented and neither the same degree of kinship nor age appeared within the same triad. A total of 24 triads were presented to each respondent. Each particular cell of the matrix was presented twice. This constitutes a partially balanced incomplete block design for the three within factors (Kirk, 1968). We were unable to find a balanced incomplete block design plan for a set-up of this size, and because a completely balanced block design would have required a total of 7,140 triads, we chose to construct the triads without overlap of age or kin. This forces us to assume transitivity, rather than to demonstrate it empirically, but considering the time and fatigue involved in making over 7,000 choices, it seems a reasonable trade-off.

¹ According to the inclusive fitness model, donors with great resources, enough to enhance the reproductive career of a recipient to the point of pushing the latter into the ranks of the extremely fecund, ought to help male kin, whereas donors with moderate or small resources, insufficient to enhance extraordinarily a recipient's reproductive career, ought to help female kin (Trivers & Willard, 1973). This hypothesis is not without support. In a study of the inheritance of wealth in Vancouver, British Columbia, Smith, Kish, and Crawford (1987) found that for estates valued up to about \$111,000, which constituted 75% of the sample, daughters received a more generous bequest than sons; only for the 25% of the estates larger than this amount were bequests to sons greater than those to daughters.

Table 1
Experimental Design: Male Targets by Sex and Age

Kinship	3-day-old	10-year-old	18-year-old	45-year-old	75-year-old
0.50	Your 3-day-old younger brother	Your 10-year-old younger brother	Your 18-year-old brother	Your 45-year-old father	Cell left empty (see text)
0.25	Your brother's 3-day-old son (your nephew)	Your brother's 10-year-old son (your nephew)	Your brother's 18-year-old son (your nephew)	Your 45-year-old uncle	Your 75-year-old uncle
0.125	Your 3-day-old male cousin	Your 10-year-old male cousin	Your 18-year-old male cousin	Your 45-year-old male cousin	Cell left empty (see text)
0.0	A 3-day-old male, an acquaintance's son	A 10-year-old male, an acquaintance's son	An 18-year-old male acquaintance	A 45-year-old male acquaintance	A 75-year-old male acquaintance

Results and Discussion

A $2 \times 2 \times 2 \times 2 \times 5 \times 4 \times 2$ ANOVA was calculated. To properly calculate interaction effects, the 75-year-old cells were excluded from the ANOVA. Therefore, although their results appear in the figures below, these cells are not a part of the initial analysis. Finally, because the design of the experiment yielded 128 independent F tests, we have simplified the reporting of results to some degree. First, because of the scoring procedure, namely, ranking, none of the main effects associated with the between factors (i.e., country and condition) nor their interactions are statistically meaningful, and so these tests are not reported. Thus, the only main effects that are reported are those due to within factors (sex of target, kin, and age of target) plus the interaction effects among these within factors and among the between and within factors. Also for the sake of simplicity we have excluded the repeated measures factor from discussion.

Surprisingly, neither sex of respondent nor country interacted significantly with any of the within factors. The patterns of helping were not significantly different in any measurable respect between Japan and the United States, nor were there any differences between men and women. All three within main effects (i.e., those associated with kin, age, and sex) were significant. There was a very large effect for relatedness, $F(3, 430) = 108.60, p < .001$, with help increasing as distance decreased. All values of r differed from each other at the .001 level by Dunn's test. The effect of target's age was appreciable, $F(3, 450) = 17.22, p < .001$, so that younger targets received more help than older targets. All ages differed significantly from each other at the .05 level by Dunn's test. And, finally, both male and female respondents favored female over male targets as recipients of help, $F(1, 150) = 27.71, p < .001$.

The pattern of responding on all three within factors under life-or-death conditions was significantly different from that under everyday conditions. To begin with, the interaction with kinship, $F(3, 450) = 5.86, p < .001$, is consistent with the inclusive fitness hypothesis: The weight given to kinship when help was a matter of life or death was greater than when it was an everyday favor. As is shown in Figure 2, helping decreased with relatedness more rapidly in the former than in the latter circumstances; moreover, in line with the findings of Study 1, this effect was more robust between r values of .5 and .25 and .125 and .00 than between intermediate values. A similar pattern was re-

ported in Cunningham (1986), where the percentage of subjects volunteering to help in an everyday task (loading furniture during a move) declined more slowly as a function of kinship than the percentage of subjects volunteering to help in a life-threatening situation (entering a burning building to rescue someone). For example, 91% of participants said they would help a "favorite brother" and 79% a "favorite uncle" load furniture; when it came to entering a burning building to rescue someone, 93% still said they would do it for their "favorite brother" but only 67%, for their "favorite uncle."

The Age \times Condition interaction, $F(3, 450) = 2.88, p < .05$, was striking. When help was biologically significant, individuals allocated it according to the recipient's fitness value—here indicated by age—so that the old received less help than the young. When help was biologically insignificant we assume that individuals were concerned with morality and civility, that such concerns led them to allocate help according to need or worthiness, and, finally, that subjects inferred need and worthiness from features such as the recipient's age and sex, among others. Our conjecture was that both the very young and the very old are perceived as more worthy than individuals of intermediate age and females, by default, as more worthy than males. In other

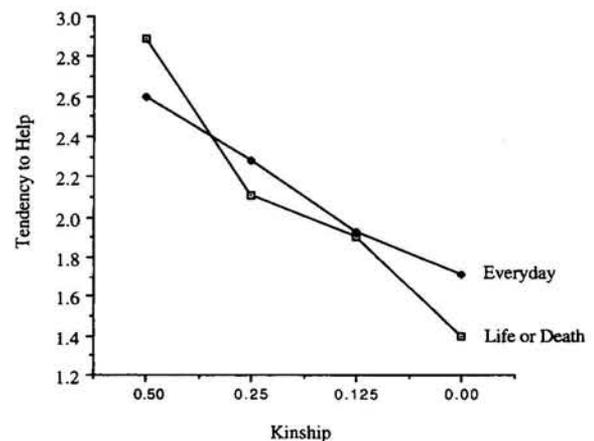


Figure 2. Tendency to help kin under life-or-death versus everyday conditions.

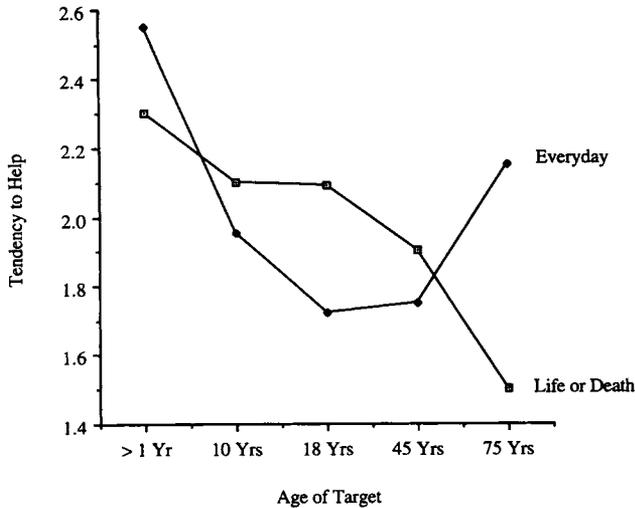


Figure 3. Tendency to help as a function of the recipient's age under life-or-death versus everyday conditions.

words, according to the inclusive fitness model, tendencies to help should decrease linearly with the age of the recipient under life-or-death conditions. However, under everyday conditions these tendencies should be curvilinear with the age of the recipient (see Figure 3). Finally, from Hamilton's point of view the Sex \times Age \times Condition interaction, $F(3, 450) = 3.88, p < .04$, is gratifying. When altruism is biologically significant the preference for females over males disappears after late middle age, at which point there is a trivial preference in favor of males (see Figure 4). This effect does not occur for everyday help (see Figure 5).

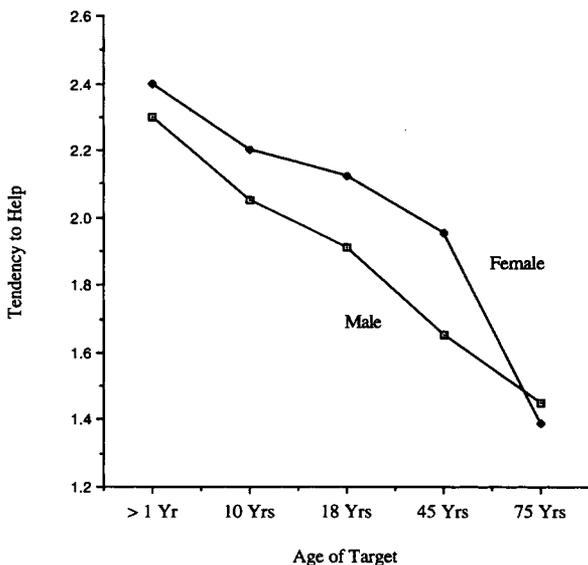


Figure 4. Tendency to help as a function of target's sex and age under life-or-death condition.

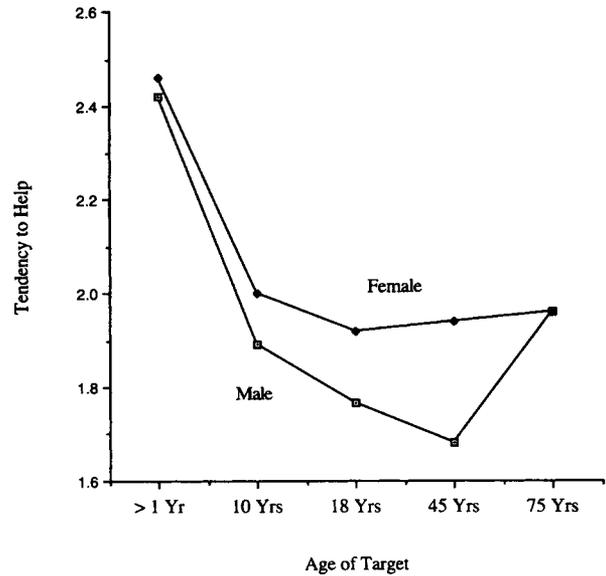


Figure 5. Tendency to help as a function of target's sex and age under everyday conditions.

Study 3: Malignant Environments and Reproductive Value

Helping infants is riskier than helping adolescents because there are more opportunities for harm to befall infants before they can begin their reproductive career. An interesting implication of the findings in Study 2 is that respondents seem to ignore the risk and to assume that infants have at least as much likelihood of a reproductive career as do 10-year-olds even though one is much closer to engaging in reproductive activity than the other. Probably in benign environments such as those of our participants, well-off young adults (which describes the vast majority of our respondents) do not think of infant mortality, childhood diseases, accidents of the nursery, and the like and give little weight to the possibility that an infant may not survive to reproduce. Otherwise, they ought to have preferred investing in a 10-year-old over an infant. And if they had, the tendency to provide biologically significant help as a function of recipient's age would show some signs of curvilinearity in the form of an inverted U (opposite in direction to that obtained when help is biologically trivial), which it did not (see Figure 3).² Be this as it may, it should be possible to produce such curvilinearity by priming respondents to consider factors like infant mortality, illness, and trauma that are characteristic of malignant environments.

² To examine the notion that people believe that in modern society the capacity to procreate is continually being enhanced so that a newborn actually has greater reproductive potential than a person born a generation earlier—a belief that would cause respondents to discount the risks of infancy—we have asked over a score of undergraduates to estimate the length of reproductive careers, physical health, and longevity of the average person born in the United States in 1950, 1975, and 2000. More

Respondents and Procedures

Sixty-one undergraduates filled out a short questionnaire involving hypothetical questions about whom to help in a life-or-death situation, described in the same way as in Study 2. While doing so they were to try to imagine that they were living in an environment where life was uncertain and short. To understand what this meant, respondents were asked to picture themselves as citizens of a sub-Saharan country that has suffered widespread famine and disease. As a result, infant mortality is very high, with a large proportion of the newly born dying during the first 6 months of life; in addition, the average life span is short so that few people survive into their 60s. Instead of triads, respondents were presented with 20 pairs of target individuals that varied in age as in the preceding study, namely, less than 3 months old, 10 years old, 18 years old, 45 years old, and 75 years old. Half of the pairs consisted of female targets and half of male targets. All targets had the same degree of relatedness to the respondent, that is, $r = .25$ (e.g., your 75-year-old grandfather vs. your 3-month-old nephew). After encircling the member of the pair they preferred to help, respondents indicated their certainty about the choice on a 3-point scale (i.e., 3 = *definitely*, 2 = *very likely*, and 1 = *probably*). The chosen target, therefore, received a score of 3, 2, or 1, depending on the rating, and the nonchosen target received a score of 0.

Results and Discussion

A one-way ANOVA indicated a significant main effect of age, $F(4, 240) = 28.73, p < .001$. However, in contrast with the preceding study, the tendency to help was approximately curvilinear with age. When individuals must assume a malignant environment, we observed less tendency to come to the aid of an infant than of a 10-year-old, a difference significant at the .001 level by Dunn's test (see Figure 6). There were no reliable effects associated with the sex of the targets. It seems, therefore, if the context emphasizes the risks associated with helping someone who is incapable of producing offspring until a point far in the future, actors discount the potential recipient's reproductive value and are less inclined to help.

Study 4: Health and Fitness Value

Physical health is a straightforward sign of the recipients' reproductive value as well as her or his status in the group and, hence, potential for enhancing a donor's inclusive fitness. At the same time it is an unequivocal indication of need: The healthier the person, the greater his or her fitness value and the sicker the person, the greater his or her need. State of health, therefore, ought to be an especially good feature to demonstrate the

than 75% of these respondents thought a female or male born in 2000 will live longer, be subject to fewer illnesses or traumas, receive more effective medical treatment for the illnesses and traumas that do occur, and be capable of producing a greater number of viable offspring and do so over a longer period in their lives than will someone born in 1975 and that the latter individual in turn is better off in these same respects than someone born in 1950.

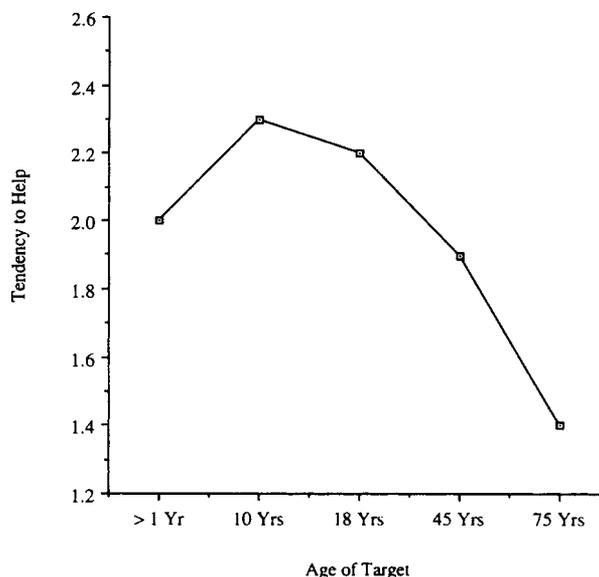


Figure 6. Tendency to help under famine conditions.

difference between allocating help that is biologically significant and, thus, is guided by a recipient's fitness value and allocating help that is biologically insignificant and, thus, is guided by a recipient's need.

Respondents and Procedures

Two hundred ninety-two undergraduates at the University of Michigan answered one of four forms of a questionnaire. As in the previous study approximately half of the questionnaires had to do with helping under life-or-death conditions and half with helping under everyday conditions. Within each of these conditions half dealt with female targets and half with male targets. Respondents decided between two targets that varied in their relatedness to the respondent as well as in health. For example, the choice might be between helping a niece who is in excellent health and a sister who is in very poor health. Immediately after choosing, respondents indicated their certainty. The chosen target received a score of either 3, 2, or 1, depending on the respondent's certainty (i.e., 3 = *definitely*, 2 = *very likely*, and 1 = *probably*). Each questionnaire contained 15 cases consisting of all nonredundant pairs of brother (or sister, depending on the form), nephew (or niece), and cousin. Each member of a pair was said to be either in excellent health or very poor health; that is, kin and health were varied orthogonally, except in the three pairs where the targets were identical relatives (i.e., two sister, two nieces, and two cousins), in which case their states of health always differed.

Results and Discussion

Preliminary analysis indicated that target's sex did not interact with condition, kin, or health; hence, it is ignored hereafter. A 2 (condition: life or death vs. everyday help) \times 2 (state of

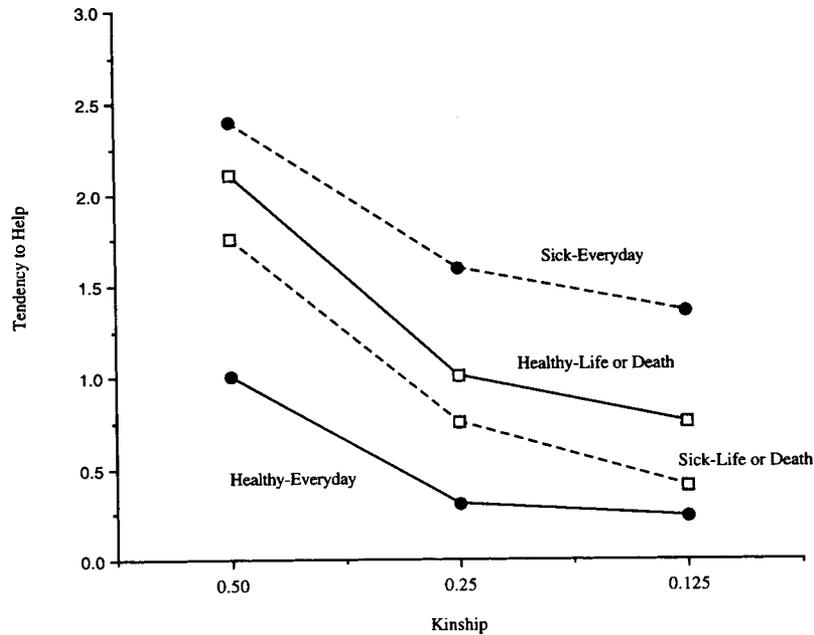


Figure 7. Tendency to help healthy versus sick kin under life-or-death versus everyday conditions.

health: excellent vs. very poor health) \times 3 (kin: .5 vs. .25 vs. .125) ANOVA replicated two of the earlier findings, namely, the main effect of kinship, $F(2, 576) = 717.98, p < .001$, and the Kin \times Condition interaction (see Figure 7). Once again the slope for helping as a function of relatedness was steeper when help was biologically significant than when it was biologically trivial, and the decline in help from (*r*) .5 to .25 was more precipitous than that from .25 to .125. In addition, there was a main effect of health, $F(1, 288) = 165.18, p < .001$, so that overall the tendency to help individuals in very poor health was greater than the tendency to help those in excellent help, particularly under everyday conditions (see Figure 7). Most important, we found good support for the inclusive fitness hypothesis in that there was a significant Kin \times Condition \times Health interaction, $F(2, 576) = 10.65, p < .001$, indicating that under life-or-death conditions individuals are more likely to help someone who is in good health than someone who is in poor health, whereas under everyday conditions the reverse is true (see Figure 8).

Study 5: Wealth, Kinship, and Fitness Value

Resources such as wealth are likely to be perceived differently from age and health. Wealth is transferable, whereas age and health are not. Transferable resources are under the owner's control and can be used deliberately to benefit another and their offspring directly (i.e., via the enhancement of classic Darwinian fitness), whereas nontransferable resources can affect others' fitness only indirectly to the extent that the owners themselves benefit from them and are related to the others (i.e., via the enhancement of inclusive fitness). A sibling's wealth, for example, can be invested in one's own offspring but a sibling's health

cannot; the latter resource enhances one's fitness only if the sibling uses it to produce offspring of his or her own (or to acquire transferable resources). People in almost all societies assume wealth is shared with others as a function of their relatedness so that close kin are perceived to have a stronger legitimate claim on this resource than distant kin do. That this assumption reflects reality is demonstrated in a variety of studies, a recent one being the Smith, Kish, and Crawford (1987) analysis of inheritance in Vancouver where of the bequests to kin (excluding

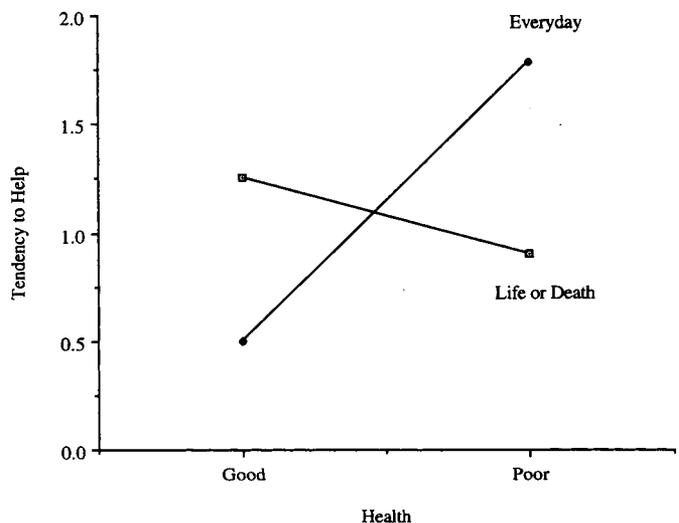


Figure 8. Tendency to help as a function of the health of the recipient under life-or-death versus everyday conditions.

spouse), 84% went to offspring and siblings, 15% to nephews, nieces, and grandchildren, and 1% to cousins. Hence, in the case of wealth, as relatedness decreases, actors perceive that the return for help is contingent on feelings of goodwill or indebtedness on the part of the recipient—if I know *x* is rich, I am sure *y*, her brother, shares in the riches; but I am not sure *z*, her cousin, does unless she especially likes him or is obligated to him.

This suggests that in social transactions where recipients possess a transferable resource such as wealth, decisions to help reflect the following heuristic: Individuals benefit automatically from (or have legitimate claim to) the recipient's resources to the extent that they are related to the recipient. In other words, people believe that they share in a close relative's riches as a matter of course but not in a distant relative's riches; to participate in the latter's prosperity requires that the relative feel considerable obligation or gratitude toward them. Generally speaking, help ingratiate to the extent that it is beneficial to the recipient and costly to the actor. Therefore, under biologically significant conditions, where costs and benefits are high, the tendency to help prosperous kin over impoverished kin (and thereby establish a claim to his or her resources) increases as their relatedness to the actor decreases. Briefly put, in life-or-death circumstances people are not inclined to discriminate between helping a rich and a poor sibling, but they are inclined to discriminate between helping a rich and a poor cousin. Wealth is also a sign of need, however, and morality as well as reputation demand that one helps those who are poor rather than those who are rich. Again we assumed that being moral and approved are dominant concerns when help is biologically trivial. In its strongest form, the hypothesis is as follows: If it is a matter of an everyday favor, individuals help poor kin over rich kin; however, if it is a matter of life or death, they do not discriminate between rich and poor unless the recipients are distant kin, in which case actors help those who are rich over those who are poor.

Respondents and Procedures

Forty-seven female and 32 male undergraduates at the University of Michigan answered a 15-item questionnaire similar in structure to that used in the preceding study. The items contained pairs of target individuals and were constructed so as to vary orthogonally the target's wealth (i.e., rich vs. poor) and his or her relatedness to the respondent (i.e., brother, nephew, or cousin). The respondents were randomly assigned to one of two forms of the questionnaire. One form involved deciding which target to help under life-or-death conditions and the other, under everyday conditions. Again, on each item respondents indicated which member of the pair they would help and then rated their degree of certainty on a 3-point scale (3 = *definitely*, 2 = *very likely*, and 1 = *probably*).

Results and Discussion

A 2 (conditions: life-or-death vs. everyday) \times 2 (wealthy vs. poor) \times 3 (kinship) ANOVA indicated a significant main effect for kinship, $F(2, 385) = 40.37, p < .001$, and a significant Condition \times Kinship interaction, $F(2, 385) = 21.64, p < .001$, once

again demonstrating that the tendency to help decreased with relatedness and that the decrease was more rapid under life-or-death than under everyday conditions. Finally, there was a significant Condition \times Kinship \times Wealth interaction. That is to say, when it was biologically significant, the help given to a rich brother or nephew was not appreciably different, by Dunn's test, from that given to a poor brother or nephew, whereas a rich cousin received more help than the poor cousin, significant at the .01 level by Dunn's test. However, when it was biologically trivial, the help given to rich kin was consistently and markedly less than that given to poor kin (see Figure 9). At the same time we found that the difference between the help given to rich and poor brothers was significantly greater, at the .01 level by Dunn's test, than the difference between that given to rich and poor cousins, although the latter difference remained appreciable, and to the eye, not greatly different from the former. In any case, this suggests that the remarkable tendency to favor the poor over the rich diminishes slightly with relatedness. Overall, there was good support for the assumption that the return for helping close relatives is less contingent on their goodwill than that for helping distant relatives; hence, when help was biologically significant the tendency to discriminate in favor of the richer of two brothers, say, was less than the tendency to discriminate in favor of the richer of two cousins. However, when help was biologically trivial, actors focused on the recipient's need so that they discriminated in favor of the poorer relative independent of the degree of kinship.

Study 6: Testing J. B. S. Haldane's Criteria for Altruism

To lend substance to the idea of inclusive fitness, Haldane (1955) made a facetious and pithy remark that he would willingly sacrifice his life to save nine of his cousins (and by extension, five of his nieces or nephews, three of his siblings, etc.). A remarkable and nonfacetious psychological implication of Haldane's statement is that humans are sensitive to the fitness value of collectivities. Our final study examined whether this is true. We assumed that if a social transaction is biologically significant, the participants would evidence a concern with enhancing inclusive fitness. It follows then that when individuals decide between two or more groups to help they take into account each group's overall fitness value, roughly, by summing the number of members in each weighted by members' relatedness to the actors. As in the case of individual recipients, the group's fitness value is a more important consideration when help is biologically significant than when it is biologically trivial. Fitness value, however, may be calculated differently for groups than for individuals. A group that otherwise would have a low value because its members are only distantly related to the actor can raise this value by increasing its membership. If we sum the *r* values of members to indicate the group's fitness value, then, for example, three nieces will not receive help over two sisters, but five nieces will. Therefore, Haldane's criteria for altruism lead us to hypothesize that when comparing biologically significant and biologically trivial help with collectivities as recipients, kinship per se is unimportant to the actor; rather, it is the combination of relatedness and group size that is critical. Statistically, this means that if Haldane is right the Kin \times Condi-

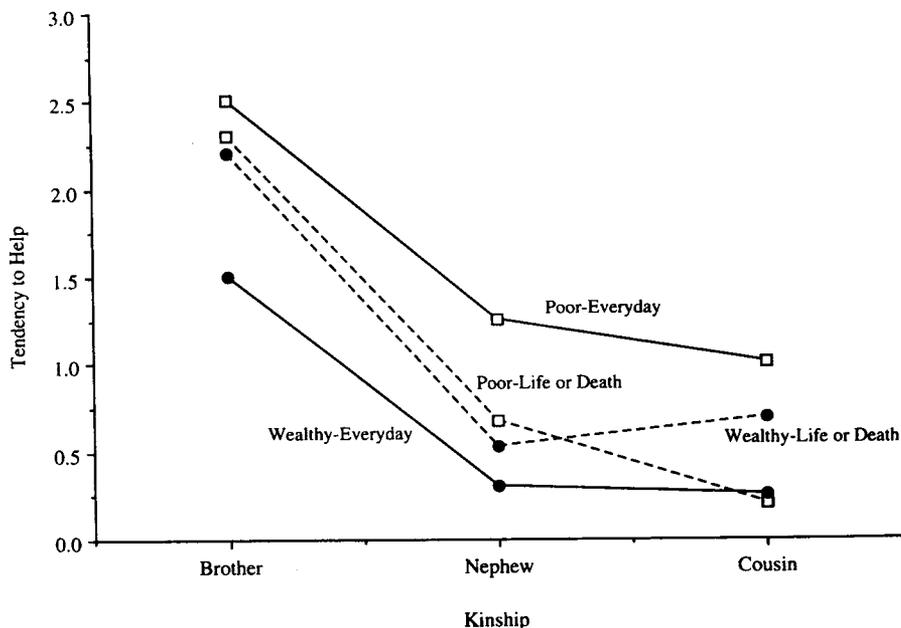


Figure 9. Tendency to help as a function of kinship and wealth under life-or-death versus everyday conditions.

tion (i.e., life or death vs. everyday) should disappear, to be replaced by an interaction between the group's fitness value and the biological significance of help.

Respondents and Procedures

Fifty-three undergraduate volunteers answered an everyday or life-or-death form of a questionnaire similar in structure to that used in the preceding study. Each form contained 36 pairs of targets. In this case the targets consisted of collections of individuals that varied in size and relatedness to the respondent so as to produce three levels of fitness value (i.e., sums of r s = 0.5, 1.0, and 1.5) and three kinds of kin (i.e., brother, nephew, and cousin). More specifically, the $r = .5$ targets were 1 brother, 2 nephews, and 4 cousins; the $r = 1.0$ targets were 2 brothers, 4 nephews, and 8 cousins; and the $r = 1.50$ targets were 3 brothers, 6 nephews, and 12 cousins. All nonredundant pairs of the nine targets were presented. As in the preceding study, on each item respondents encircled the member of the pair they would help and then indicated their certainty on a 3-point scale.

Results and Discussion

An ANOVA performed on the scores revealed significant main effects for kin, $F(2, 102) = 50.4, p < .001$, and fitness value, $F(2, 102) = 65.6, p < .001$, as well as a significant interaction between condition (i.e., everyday help vs. life-or-death help) and fitness value, $F(2, 102) = 9.78, p < .001$. These results are shown in Figure 10. Clearly, Haldane's (1955) remark, or rather the general hypothesis implied therein, has merit. Actors do take into account the overall fitness value pos-

sessed by a group of individuals who need help to the extent that the help is biologically significant. As a result, in allocating help over groups they give a group's fitness value considerably more weight under life-or-death than under everyday conditions. And we see once more that the cultural meaning of kin categories had appreciable impact on the actors' choices. In general, independent of a group's fitness value, close relatives are more likely to be given help than are distant relatives, except for large groups of distant kindred, that is, cases involving 12 cousins and 6 nephews. As was suggested by the findings in Study 1, individuals discriminate more finely among close than among distant kindred.

General Discussion

We reason that if humans evolved rules for encoding a social transaction, it should be possible to describe their structure by analyzing the adaptive problems that the transaction presented to participants. For well over 95% of their history as a species, people have lived in simple societies. As an environment of evolutionary adaptation this means low-intensity hunting-gathering in small, nomadic bands with decentralized authority, generalized reciprocity, little wealth, adult male status equality, and diffuse, flexible interband alliances (Knauff, 1991). A key feature, perhaps even a functional prerequisite, of a low-intensity hunting-gathering system is intra- and, to some extent, interband cooperation. For example, the !Kung have over the years been pushed by more warlike tribes ever farther into the barrens where food, game, and water are scarce (Silberbauer, 1972). An important reason for their successful adaptation has

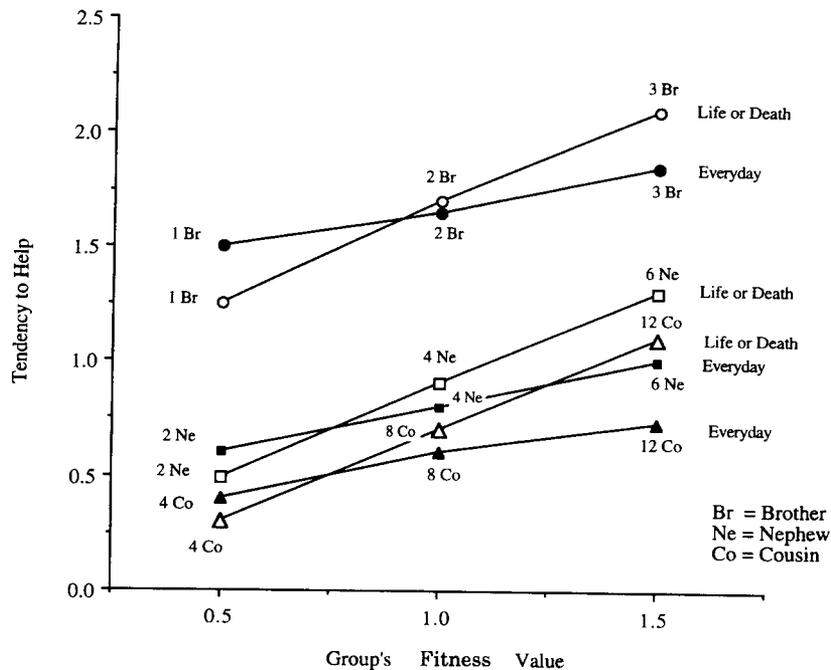


Figure 10. Tendency to help a group of individuals as a function of its fitness value.

been the development of norms prescribing generalized reciprocity: Valuable resources are readily shared within the band, with only a vague expectation of repayment at some indefinite point in the future and not necessarily to the original donor. Ethnographers report that it seems unthinkable to the !Kung to do otherwise and that the custom of sharing is perceived as intrinsic to human nature. More generally, in all simple societies that ethnographers know about, cooperative sharing, especially in respect to prized commodities such as meat, is commonly extended to all others within the band and is considered a symbol of being human (Cashdan, 1980, 1985; Knauff, 1991; Testart, 1985, 1987). Marshall (1979) reported that

The !Kung are quite conscious of the value of meat-sharing and the talk about it, especially about the benefits of the mutual obligations it entails. The idea of sharing is deeply implanted and very successfully imposes its restraints . . . The idea of eating alone is shocking to the !Kung. It makes them shriek with an uneasy laughter. Lions could do that, they say, not men. (pp. 363, 357; also see Thomas, 1959; Turnbull, 1961)

Some theorists have argued persuasively that in simple societies subsistence constitutes less of a difficulty than defense against hostile out-groups. Alexander (1974, 1979), for instance, compared the benefits to individual reproduction of group living under different adaptive problems such as scarcity or disease and concluded that the pressures toward mutual help and cooperation among low-intensity hunter-gatherers must have been generated primarily by the need for alliances with other bands as a means of protection against dangerous neighbors. In support of this line of reasoning, Wrangham's (1987) comparative analysis of primate sociality indicates that in-

tergroup hostility is common not only in humans but also in closely related species, namely, gorilla, bonobo, and chimpanzee, suggesting to him that animosity toward out-groups, whether the result of fear or greed, is likely to be a conservative feature, reflecting a propensity of the common ancestor; as a result, Wrangham argued, it served to create strong selection pressures for cooperative and protective relationships within human groups (also see Ember, 1978; Rodseth, Wrangham, Harrigan, & Smuts, 1991). Nonetheless, for our purposes it makes no difference if the primary adaptive problem has to do with meager resources or hostile out-groups. The critical point is that the environment of adaptation typical of low-intensity hunting-gathering puts a premium on cooperative transactions. Indeed, such an environment meets virtually all the theoretical preconditions for the evolution of cooperation, such as low dispersal rate, long life span, living in small, interdependent, stable groups, and a long period of parental care leading to extensive noncompetitive contact with close relatives over many years (Axelrod, 1984; Axelrod & Hamilton, 1981; Trivers, 1985).

Cooperation depends above all on the ability to take into account the interdependence between own and others' outcomes (Abric et al., 1967; Axelrod & Hamilton, 1981; Rabinowitz et al., 1966). However, to say that in the environment of evolutionary adaptation individuals with the capacity to do so are positively selected is to assert a truism, if not a tautology. To go beyond this the adaptive problem has to be formulated more precisely. Hence, we examined the representation of a social transaction in terms of enhancing inclusive fitness. Hamilton's (1964) model implies that to the extent that organisms are

group living, natural selection favors donors who are sensitive to (a) the recipients' outcomes as well as their own, (b) their relatedness, and (c) the recipients' fitness value. Information in these three domains allows individuals to decide when costly transactions are worthwhile, and if a choice needs to be made, it tells them whom to help. Needless to say, the proximal (or conscious) decision about others' desirability as a recipient is rarely if ever based on features explicitly signaling that a person who possesses them will improve the actor's fitness. Rather, at the subjective level choice is primarily guided by culturally given and, usually, ecologically valid correlates, especially in respect to reproductive value. Some are relatively direct correlates, such as recipients' age or health; others, indirect and based on social comparison, such as their status or reputation. In any case, from the point of view of neo-Darwinian theory, the ultimate function of this information is clear: It permits actors to make the biologically important distinction between recipients who are likely to enhance fitness and recipients who are unlikely to do so. Operationally, we take this to mean that if help is a matter of life and death to the recipient, the weight actors give to kinship, age, sex, health, wealth, or other features indicating reproductive value is predictably different from the weight given to these features if help constitutes an everyday favor.

At the same time, however, the inclusive fitness formulation says nothing about how these features determine the granting of everyday favors, except that information about kindred and potential fecundity will be given less weight. If not according to the recipient's relatedness and reproductive value, how then is help allocated when its biological costs and benefits are trivial? Our hypothesis is that in these circumstances donors worry less about kinship to the recipient and distribute help to enhance reputation or to satisfy conscience—in fitness terms, even when the immediate consequences of altruism are insignificant, appearing civil or moral is likely to rebound eventually to the donor's benefit or to that of relatives—and that this state of affairs is experienced by the donor as a need to do what is good or admirable. In short, we argue that the nearest thing to universal criteria for granting favors of no great significance to donor or recipient are conscience and politesse, both of which in default can be satisfied using the recipient's degree of need or worthiness. Hence, inclusive fitness predicts that under life-or-death conditions, if a choice has to be made, people pay a lot of attention to relatedness so as to benefit close kin ahead of distant kin; in addition, people help the young over the old (when the environment is benign), the healthy over the sick, the wealthy over the poor (when potential recipients are distant kin), and the premenopausal over the postmenopausal female, whereas under everyday conditions, conscience and politesse encourage people to help either the young or the old over those of intermediate age, the sick over the healthy, the poor over the wealthy, and females over males. The studies presented in this article support these ideas.

Although our findings are consistent with the hypothesis that there exist psychological mechanisms for encoding fitness cues, they say little about their origins, except the heuristic that informs these decisions does reflect a type of social reasoning that ought to be positively selected for in group-living animals. In

short, the results we presented, namely, the complex interactions of kinship, age, sex, health, wealth, or collective fitness value with the biological significance of help follow naturally from a minor extrapolation of the inclusive fitness model, whereas none of the purely psychological analyses of altruism seem capable of predicting these effects—nor, as is sometimes overlooked, should they be given that psychological and evolutionary models of altruism provide complementary explanations, the former being primarily concerned not with why a particular mechanism (e.g., empathy) was or was not favored by natural selection in the ancestral environment but rather with how it works under present conditions to produce altruistic behavior and the latter, not with how the mechanism actually functions but why it was positively or negatively selected for in the ancestral environment.

However, if one asks whether reasoning of this kind informs real as opposed to hypothetical decisions, we have to fall back on supposition and case histories but not a great deal of systematic evidence. For instance, it is reasonable to suppose that in experiments on bystander intervention (Latané & Nida, 1981), the impact of group size would have been negated were the victim related to at least one of the bystanders. Similarly, Milgram's (1974) studies of obedience in all likelihood would not have turned out as they did had the "learner" been related to the "teacher"; we might even venture that proximity and contact had the impact they did because they are ecologically valid correlates of kinship. Most studies that have compared altruism with nonaltruistic forms of help such as reciprocity (i.e., tit for tat) suggest that altruism is considered appropriate and reciprocity, inappropriate in primary group or communal relationships, whereas reciprocity is appropriate and altruism, inappropriate in more formal exchange relations (Litwak & Nessler, 1989; Mills & Clark, 1982). Needless to say, in our ancestral environment the primary group was kindred, although even in a modern urban sample unrelated males who have a close long-term friendship were found to be genetically more similar to each other than randomly paired individuals (Rushton, 1989). In the anthropological literature one of the best known case studies of kinship and helping in an actual life-or-death situation stems from the fortuitous filming by Chagnon and Bugos (1979) of an ax fight between two genealogically overlapping Yanomomo villages mentioned earlier. The dispute arose during an excessively prolonged visit when a female of the host village was insulted by a male of the visiting village. The initial clash was relatively innocuous by Yanomomo standards and consisted of a figure of authority in the host village, who was also a kinsperson of the insulted woman, wielding a club against the insulting visitor, who flailed back with a bowstave. The affair quickly escalated to a murderous level, however, when supporters of these two combatants began laying on with machetes and axes. As Chagnon and Bugos recognized, the situation lent itself nicely to illustrating kin selection theory. By comparing genealogical histories, these researchers determined that, within each group of combatants, the members were more closely related among themselves than they were to their opponents. Moreover, they were not a random set of adults from their respective villages; within each group of combatants, individuals were more

closely related than they were to those in their respective villages who did not join in the fighting. Finally, each of the individuals who initiated the battle had relatives in both villages; nonetheless, those who actually took up machete or axe on his behalf were more closely related to him, 780% more in one case and 210% more in the other, than to his opponent.

A less well-known but equally powerful analysis of the relationship between kinship and altruism was carried out by Sime (1983). It involves a fire at a large seaside vacation complex on the Isle of Man during 1973 in which 50 people died. The findings are based on detailed statements from 148 individuals who were in the central building when the fire broke out. Sime's theory of escape behavior predicted that

when faced by . . . an impending physical threat to people's lives and access to an escape route diminishing rapidly . . . individuals will not be concerned solely with self-preservation. They will be even more concerned than usual to retain contact or make contact with other group members with whom they have close psychological ties and who are also threatened (p.21).

Operationally, by "close psychological ties" Sime means kindred. Hence, his hypothesis, in fact, pits Darwinian fitness (i.e., self-preservation) against inclusive fitness (i.e., helping kin to escape). Or, more concretely, he asks the following question: Under what conditions do individuals in a life-threatening situation simply remove themselves to safety as quickly as possible without waiting for anyone else and under what conditions do they delay in order to help others escape with them? Out of the 148 individuals studied, 128 of them had gone to the central section of the complex with a group, 87 with their immediate family and 41 with friends or a combination of friends and relations. Among other things, the research distinguishes those groups in which all the members exited from the burning structure together from those in which all the members did not exit together. At the moment they recognized their danger, about 66% of the families and 54% of the nonfamilies were together in the central section. Of these initially "together" groups, over two thirds of the families and only about a quarter of the nonfamilies actually emerged together as a group. In addition, there were 30 families and 19 nonfamilies that had been separated at the time members perceived themselves in peril. Of these initially "separated" groups, 50% of the families took time to find each other and emerge from the building together, whereas none of the nonfamily groups did so.

Researchers explicitly concerned with kin selection and who systematically test the neo-Darwinian formulation in human groups have a different approach. They generally ask questions about how people behave in roles that permit or oblige them to help others. For example, suppose individuals occupy a social position that confers wealth and power. To what extent do they use these resources to enhance fitness, say, through nepotism? Or suppose their position prescribes that they use their resources in a manner that diminishes fitness. To what extent are they inclined to deviate from these prescriptions to enhance fitness? A fair summary of the ethnographic research in non-Western cultures is that individuals whose social role allows them to benefit another do so in a manner that enhances their fitness as measured by the number, fecundity, survivorship, so-

cial rank, and wealth of their offspring (also see Betzig, 1986, Betzig, Borgerhoff Mulder, & Turke, 1988; Borgerhoff Mulder, 1988; Chagnon, 1988; Turke & Betzig, 1985; Daly & Wilson, 1983; Hrdy, 1981; Irons, 1979); similar effects are observed in Western societies ranging from 15th-century Tuscany to 19th-century Canada, United States, and Germany (Becker, 1991; for cases in 18th- and 19th-century Germany where female offspring benefit more as a result of their parents' status than male offspring do, see Volland, Siegelkow, & Engel, 1991); contrary to conventional wisdom, this relationship has not totally disappeared in today's ultra-urbanized, meritocratic community (e.g., Essock-Vitale, 1984; Essock-Vitale & McGuire, 1985).

Let us now turn to the question of how individuals react in roles that oblige them to help another even though doing so would detract from fitness. A classic instance of this dilemma has to do with the problem of paternal uncertainty. According to Hamilton's (1964) model a man should prefer to help his own children ($r = .5$) rather than those of his relatives ($r < .5$), *ceteris paribus*. Among the most significant of these other things is the person's confidence that he is the father, otherwise the coefficient of relatedness is weighted by a probability of less than one. This feeling of confidence is sufficiently important in determining the level of male investment in child rearing that Daly and Wilson (1982) had little trouble discovering one clear proximal mechanism for reducing paternal uncertainty: In North American maternity wards there is a conversational norm to the effect that when describing the newborn, speakers remark that its features are similar to those of father. The alternative explanation is that rather than being a reassuring ploy, similarity to the father is mentioned more often than similarity to the mother (or other relatives) because in fact the average infant is more similar to the father than to the mother. This is an even more intriguing possibility that makes much evolutionary sense given that it implies that there is positive selection for paternal similarity.

In any case, if the probability of paternity is low, husbands reduce inclusive fitness by helping their wives' children. Hence, it is no surprise that many cultures with high paternal uncertainty also have norms that sanction male investment in sisters' offspring instead of spouses'. In this respect the Nayar, a group of castes in the region of southern India known as Central Kerala, are especially interesting in that their history roughly approximates a "before-after" experimental design for testing the relationship between paternal investment in child rearing and paternal uncertainty (Gough, 1961). Prior to British colonial rule the demands of military service required Nayar men to be absent from home frequently and for prolonged periods during their wives' most fertile years. It is no accident, therefore, that the marital or sambandham relationship demanded little more than that the participants take the role of lovers. Each was able to terminate the arrangement at will and was free to enter a number of similar relationships at the same time. An offspring was seen as belonging to the mother's kindred, and its only institutionally prescribed relationship with a man of the mother's generation was with the mother's brother, who was obliged to rear and educate the child; these obligations were quite compatible with mother's brother's fitness because a sister's child's r value was certain and appreciable, namely, at least .125, be-

cause the mother was often really a half-sister, or at most .25, whereas the r value of his own children was unknown. However, when the armies of the precolonial petty kingdoms were disbanded and the benefits of a military career vanished, monogamy became the rule. The result was, naturally, a marked decrease in paternal uncertainty and, as predicted by Hamilton's model, a switch in the role of husband and mother's brother in respect to paternal investment. Within 30 years after the arrival of the British, an amazingly short period for a change of this magnitude especially because the colonial administration did not go to great lengths to support it, Nayar husbands assumed responsibility for the rearing of their own children and abandoned responsibility for the rearing of their sisters' children.

The Nayar case illustrates the way in which the expectations associated with the roles of husband and mother's brother track paternal uncertainty so as to enhance fitness. The tracking, however, is inherently imperfect; changes in expectations in one domain occur at a different rate from those in another domain (e.g., the religious responsibilities of the parents toward their offspring may change more slowly than their legal responsibilities). Hence, at any point some role prescriptions are slow in catching up and for the moment are inconsistent with individual fitness. Hamilton's (1964) model predicts that persons who occupy these roles are tempted to resolve the inconsistency so as to enhance fitness. There is a sizable body of research on one such case, parental investment by step-parents. Both fathers and mothers everywhere have been prematurely widowed, and women are often forsaken with dependent children. Should the surviving parent attempt to forge a new marital relationship, the fate of the children becomes problematic. From the point of view of inclusive fitness, the step-parent's dilemma is similar to that of the Nayar husband: Whereas helping step-children increases spouse's fitness, it decreases the fitness of the step-parent. However, if the parents' commitment to a new spouse is strong, then absent institutions like the avunculate, where the responsibilities for investing in offspring fall to the mother's brother, or the levirate, where a widow and her children become part of the family of the dead man's brother, or simply the leaving of children with postmenopausal matrilineal kin (e.g., maternal grandparents), a world-wide custom, to protect their fitness interests step-parents may act in a manner that actually imperils the well-being of the children.

The popularity of the Cinderella theme in the folklore of most cultures suggests that the threat to children from step-parents is ubiquitous (Thompson, 1955). That a minority of step-parents in Duberman's (1975) Cleveland sample as well as in Flinn's (1988) sample of Trinidadian villagers admits to or acts so as to demonstrate "parental feeling" toward their step-children and even fewer indicate "love" toward them suggest that such tensions occur in almost any society where the spousal role obliges helping unrelated children (also see Hill & Kaplan, 1988). That husbands in Tikopia and Yanomamo can demand the death of their new spouses' earlier children or that Ache children, who, after their father's death, are raised by other men have much higher mortality than those raised by their biological father and mother suggests that the consequences of these tensions can be tragic. Some of the clearest evidence for this comes from mod-

ern societies. In North America the likelihood of a child being abused is many times greater when there is a step-parent rather than two biological parents. For example, in Ontario, Canada, during 1983 the rate of per capita child abuse for children up to 4 years old living with one biological and one step-parent was over 13 per 1,000, whereas the comparable rate for children living with two biological parents was much less than 1 per 1,000 (Daly & Wilson, 1988). To avoid reporting biases, we could focus on the most unequivocally abused: In 87,000+ instances of maltreatment of children identified by the American Humane Association in 1976, there were 279 fatalities. Of these, 43% lived with step-parents. According to Daly and Wilson (1988) this means that an American child—they report similar data for Canadian children—living with at least one step-parent in 1976 was about 100 times as likely to be fatally abused as a child residing with biological parents only. This is the dark side of the altruistic heuristic: When role obligations require that biologically significant help be given to unrelated others individuals are inclined to renege and occasionally do so in horrendous fashion.

References

- Abric, J. C., Faucheux, C., Moscovici, S., & Plon, M. (1967). Role de l'image du partenaire sur la coopération en situation de jeu [Impact of partner's image on cooperation in a game]. *Psychologie Française*, 12, 267-275.
- Alexander, R. D. (1974). The evolution of social behavior. *Annual Review of Ecology and Systematics*, 5, 325-383.
- Alexander, R. D. (1979). *Darwinism and human affairs*. Seattle: University of Washington Press.
- Alexander, R. D. (1987). *The biology of moral systems*. Hawthorne, NY: Aldine de Gruyter.
- Axelrod, R. (1984). *The evolution of cooperation*. New York: Basic Books.
- Axelrod, R., & Hamilton, W. D. (1981). The evolution of cooperation. *Science*, 211, 1390-1396.
- Batson, C. D. (1987). Prosocial motivation: Is it ever truly altruistic? In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 20, pp. 65-122). San Diego, CA: Academic Press.
- Batson, C. D. (1990). How social an animal: The human capacity for caring. *American Psychologist*, 45, 336-346.
- Becker, G. (1991). *A treatise on the family* (Enlarged ed.). Cambridge, MA: Harvard University Press.
- Betzig, L. L. (1986). *Despotism and differential reproduction: A Darwinian view of history*. Hawthorne, NY: Aldine.
- Betzig, L. L., Borgerhoff Mulder, M., & Turke, P. (Eds.). (1988). *Human reproductive behaviour: A Darwinian perspective*. Cambridge, England: Cambridge University Press.
- Borgerhoff Mulder, M. (1988). Reproductive success in three Kipsigis cohorts. In T. H. Clutton-Brock (Ed.), *Reproductive success: Studies of individual variation in contrasting breeding systems* (pp. 419-435). Chicago: University of Chicago Press.
- Buss, D. M. (1988). The evolution of human intrasexual competition: Tactics of mate attraction. *Journal of Personality and Social Psychology*, 54, 616-628.
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, 12, 1-49.
- Buss, D. M., & Barnes, M. F. (1986). Preferences in human mate selection. *Journal of Personality and Social Psychology*, 50, 559-570.
- Caporael, L. R., Dawes, R. M., Orbell, J. M., & van de Kragt, A. J. C.

- (1989). Selfishness examined: Cooperation in the absence of egoistic incentives. *Behavioral and Brain Sciences*, 12, 683-739.
- Cashdan, E. A. (1980). Egalitarianism among hunters and gatherers. *American Anthropologist*, 82, 116-120.
- Cashdan, E. A. (1985). Coping with risk: Reciprocity among the Basarwa of northern Botswana. *Man*, 20, 454-474.
- Chagnon, N. A. (1979). Mate competition, favoring close kin, and village fissioning among the Yanomamo Indians. In N. A. Chagnon & W. Irons (Eds.), *Evolutionary biology and human social behavior*. North Scituate, MA: Duxbury Press.
- Chagnon, N. A. (1988). Life histories, blood revenge, and warfare in a tribal population. *Science*, 239, 985-992.
- Chagnon, N. A., & Bugos, P. E., Jr. (1979). Kin selection and conflict: An analysis of a Yanomamo ax fight. In N. A. Chagnon & W. Irons (Eds.), *Evolutionary biology and human social behavior: An anthropological perspective* (pp. 213-238). North Scituate, CA: Duxbury Press.
- Cheney, D. L., & Seyfarth, R. M. (1985). Social and non-social knowledge in vervet monkeys. *Philosophical Transactions of the Royal Society of London*, 308, 187-201.
- Cheng, P., & Holyoak, K. J. (1989). On the natural selection of reasoning theories. *Cognition*, 33, 285-313.
- Cosmides, L. (1989). The logic of social exchange: Has natural selection shaped how humans reason? Studies with the Wason Selection Task. *Cognition*, 31, 187-276.
- Cosmides, L., & Tooby, J. (1989). Evolutionary psychology and the generation of culture, Part II. Case study: A computational theory of social exchange. *Ethology and Sociobiology*, 10, 51-91.
- Cunningham, M. R. (1986). Levites and brother's keepers: A sociobiological perspective on prosocial behavior. *Humboldt Journal of Social Relations*, 13, 35-67.
- Daly, M., & Wilson, M. (1982). Whom are newborn babies said to resemble? *Ethology and Sociobiology*, 3, 69-78.
- Daly, M., & Wilson, M. (1983). *Sex, evolution and behavior* (2nd ed.). Boston: Willard Grant Press.
- Daly, M., & Wilson, M. (1988). *Homicide*. New York: Aldine de Gruyter.
- Daly, M., Wilson, M., & Weghorst, S. J. (1982). Male sexual jealousy. *Ethology and Sociobiology*, 3, 11-27.
- Dawkins, R. (1976). *The selfish gene*. New York: Oxford University Press.
- Dawkins, R. (1982). *The extended phenotype: The gene as the unit of selection*. New York: Oxford University Press.
- DeSoto, C. B., & Albrecht, F. (1968). Cognition and social orderings. In R. P. Abelson, M. J. Rosenberg, & R. H. Tauntenbaum (Eds.), *Theories of cognitive consistency: A sourcebook* (pp. 504-511). Chicago: Rand McNally.
- DeSoto, C. B., & Bosley, J. J. (1962). The cognitive structure of a social structure. *Journal of Abnormal and Social Psychology*, 64, 303-307.
- Dickemann, M. (1979). Female infanticide, reproductive strategies, and social stratification: A preliminary model. In N. A. Chagnon & W. G. Irons (Eds.), *Evolutionary biology and human social behavior: An anthropological perspective* (pp. 321-367). North Scituate, MA: Duxbury Press.
- Drabek, T. E., Key, W. H., Erickson, P. E., & Crowe, J. L. (1975). The impact of disaster on kin relationships. *Journal of Marriage and the Family*, 34, 481-494.
- Duberman, L. (1975). *The reconstituted family: A study of remarried couples and their children*. Chicago: Nelson-Hall.
- Ember, C. R. (1978). Myths about hunter-gatherers. *Ethology*, 17, 439-448.
- Essock-Vitale, S. (1984). The reproductive success of wealthy Americans. *Ethology and Sociobiology*, 5, 45-49.
- Essock-Vitale, S. M., & McGuire, M. T. (1985). Women's lives viewed from an evolutionary perspective. II. Patterns of helping. *Ethology and Sociobiology*, 6, 155-173.
- Fiske, M. H., & Ofshe, R. (1970). The process of status evolution. *Sociometry*, 33, 327-346.
- Fisher, R. A. (1958). *The genetical theory of natural selection*. New York: Dover Press. (Original work published 1930)
- Flinn, M. V. (1988). Parent-offspring interactions in a Caribbean village: Daughter guarding. In L. Betzig, M. B. Mulder, & P. Turke (Eds.), *Human reproductive behavior: A Darwinian perspective* (pp. 189-200). Cambridge, England: Cambridge University Press.
- Gough, K. (1961). Nayar: Central Kerala. In D. M. Schneider & K. Gough (Eds.), *Matrilineal kinship*. Berkeley: University of California.
- Haldane, J. B. S. (1932). *The causes of evolution*. New York: Longmans, Green & Co.
- Haldane, J. B. S. (1955). Population genetics. *New Biology*, 18, 34-51.
- Hamilton, W. D. (1964). The genetical evolution of social behavior, Part I and II. *Journal of Theoretical Biology*, 7, 1-52.
- Hare, A. P. (1976). *Handbook of small group research* (2nd ed.). New York: Free Press.
- Hartung, J. (1976). On natural selection and the inheritance of wealth. *Current Anthropology*, 17, 607-622.
- Hartung, J. (1982). Polygyny and inheritance of wealth. *Current Anthropology*, 17, 607-622.
- Hill, K., & Kaplan, H. (1988). Tradeoffs in male and female reproductive strategies among the Ache: Part 1. In L. Betzig, M. B. Mulder & P. Turke (Eds.), *Human reproductive behaviour* (pp. 277-290). Cambridge, England: University of Cambridge Press.
- Hrdy, S. B. (1981). *The woman that never evolved*. Cambridge, MA: Harvard University Press.
- Irons, W. G. (1979). Investment and primary social dyads. In N. Chagnon & W. Irons (Eds.), *Evolutionary biology and human social behavior* (pp. 181-212). North Scituate, MA: Duxbury Press.
- Kelley, H. H., Thibaut, J. W., Radloff, R., & Mundy, D. (1962). The development of cooperation in the "minimal social situation." *Psychological Monographs*, 76, No. 19.
- Kenrick, D. T., & Trost, M. R. (1988). A reproductive exchange model of heterosexual relationships: Putting proximate economics in ultimate perspective. In C. Hendrick (Ed.), *Review of personality and social psychology* (Vol. 10, pp. 92-118). Newbury Park, CA: Sage.
- Killian, L. M. (1952). The significance of multiple-group membership in disaster. *American Journal of Sociology*, 57, 309-314.
- Kirk, R. E. (1968). *Experimental design: Procedures for the behavior sciences*. Monterey, CA: Brooks/Cole.
- Knauff, B. M. (1991). Violence and sociality in human evolution. *Current Anthropology*, 32, 391-428.
- Lanzetta, J. T., & Englis, B. G. (1989). Expectations of cooperation and competition and their effects on observers' vicarious emotional responses. *Journal of Personality and Social Psychology*, 56, 543-554.
- Latané, B., & Nida, S. (1981). Ten years of research on group size and helping. *Psychological Bulletin*, 89, 308-324.
- Littlefield, C. H., & Rushton, P. J. (1986). When a child dies: The sociobiology of bereavement. *Journal of Personality and Social Psychology*, 51, 797-802.
- Litwak, E., & Nessler, P. (1989). Organizational theory, social support, and mortality rates: A theoretical convergence. *American Sociological Review*, 54, 49-66.
- Marshall, L. (1979). Sharing, talking, and giving: Relief of social tensions among !Kung Bushmen. In R. B. Lee & I. DeVore (Eds.), *Kalahari hunter-gatherers: Studies of the !Kung San and their neighbors* (pp. 349-372). Cambridge, England: Cambridge University Press.
- Maynard Smith, J. (1964). Group selection and kin selection. *Nature*, 201, 1145-1147.

McGrath, J. E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, NJ: Prentice Hall.

Milgram, S. (1974). *Obedience to authority*. New York: Harper & Row.

Mills, J., & Clark, M. S. (1982). Communal and exchange relationships. In L. Wheeler (Ed.), *Review of personality and social psychology* (Vol. 3, pp. 121-144). Newbury Park, CA: Sage.

Murdock, G. P. (1945). The common denominator of cultures. In R. Linton (Ed.), *The science of man in the world crisis*. New York: Columbia University Press.

Politzer, G., & Nguyen-Xuan, A. (1992). Reasoning about conditional promises and warnings: Darwinian algorithms, mental models, relevance judgements or pragmatic schemas? *The Quarterly Journal of Experimental Psychology*, 44, 401-421.

Pollard, P. (1990). Natural selection for the selection task: Limits to the social exchange theory. *Cognition*, 36, 195-204.

Quarantelli, E. L. (1960). A note on the protective function of the family in disasters. *Marriage and Family Living*, 22, 263-264.

Rabinowitz, L., Kelley, H. L., & Rosenblatt, R. M. (1966). Effects of different types of interdependence and response conditions in the minimal social situation. *Journal of Experimental Social Psychology*, 2, 169-197.

Rodseth, L., Wrangham, R. W., Harrigan, A. M., & Smuts, B. B. (1991). The human community as a primate society. *Current Anthropology*, 32, 221-254.

Rosenblatt, P. C., Walsh, R. P., & Jackson, D. A. (1976). *Grief and mourning in cross-cultural perspective*. New Haven, CT: HRAF Press.

Rushton, J. P. (1989). Genetic similarity, human altruism, and group selection. *Behavioral and Brain Sciences*, 12, 503-509.

Sidowski, J. B., Wycoff, L. B., & Tabory, L. (1956). The influence of reinforcement and punishment in a minimal social situation. *Journal of Abnormal and Social Psychology*, 52, 115-119.

Silberbauer, G. (1972). The G/wi Bushmen. In M. Bicchieri (Ed.), *Hunters and gatherers today*. New York: Holt.

Time, J. D. (1983). Affiliative behaviour during escape to building exits. *Journal of Environmental Psychology*, 3, 21-41.

Smith, M. S., Kish, B. J., & Crawford, C. B. (1987). Inheritance of

wealth as human kin investment. *Ethology and Sociobiology*, 8, 171-182.

Symons, D. (1979). *The evolution of human sexuality*. New York: Oxford University Press.

Symons, D. (1987). Can Darwin's view of life shed light on human sexuality? In J. H. Geer & W. T. O'Donohue (Eds.), *Approaches and paradigms in human sexuality* (pp. 91-122). New York: Plenum Press.

Testart, A. (1985). *Le communisme primitif: Economie et ideologie* [Primitive communism: Economy and ideology]. Paris: Maison des Sciences de l'Homme.

Testart, A. (1987). Game sharing systems and kinship systems among hunter-gatherers. *Man*, 22, 287-304.

Thomas, E. M. (1959). *The harmless people*. New York: Knopf.

Thompson, S. (1955). *Motif-index of folk-literature* (Vols. 1-6). Bloomington: Indiana University Press.

Trivers, R. (1985). *Social evolution*. Menlo Park, CA: Benjamin/Cummings.

Trivers, R. L., & Willard, D. E. (1973). Natural selection of parental ability to vary the sex ratio of offspring. *Science*, 179, 90-92.

Turke, P., & Betzig, L. L. (1985). Those who can do: Wealth, status, and reproductive success on Ifaluk. *Ethology and Sociobiology*, 6, 79-87.

Turnbull, C. M. (1961). *The forest people*. New York: Simon & Schuster.

Voland, E., Siegelkow, E., & Engel, C. (1991). Cost/benefit oriented parental investment by high status families. *Ethology and Sociobiology*, 12, 105-118.

Willard, D., & Strodbeck, F. L. (1972). Latency of verbal response and participation in small groups. *Sociometry*, 35, 161-175.

Wrangham, R. W. (1987). The significance of African apes for reconstructing human social evolution. In W. G. Kinzey (Ed.), *The evolution of human behavior: Primate models* (pp. 51-71). Albany: State University of New York Press.

Received October 5, 1993
 Revision received March 23, 1994
 Accepted March 25, 1994 ■

UNITED STATES POSTAL SERVICE Statement of Ownership, Management, and Circulation (Required by 39 U.S.C. 3685)

1. Publication Title: JOURNAL OF PERSONALITY AND SOCIAL PSYCHOLOGY

2. Issue Frequency: MONTHLY

3. Publication No.: 0022-3415

4. Issue Date: OCTOBER 1994

5. Annual Subscription Price: \$95/Member, \$249/Inst. \$495/Inst.

6. Complete Mailing Address of Known Office of Publication (Street, City, County, State, and ZIP+4) (Not for Leave Blank): 750 FIRST STREET, NE, WASHINGTON, DC 20002-4242

7. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not for Leave Blank): 750 FIRST STREET, NE, WASHINGTON, DC 20002-4242

8. Publication Title, Issue Frequency, and Complete Mailing Address of Publisher: AMERICAN PSYCHOLOGICAL ASSOCIATION, 750 FIRST STREET, NE, WASHINGTON, DC 20002-4242

9. Complete Mailing Address of Publisher: AMERICAN PSYCHOLOGICAL ASSOCIATION, 750 FIRST STREET, NE, WASHINGTON, DC 20002-4242

10. Owner: American Psychological Association, 750 First Street, NE, Washington, DC 20002-4242

11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities: NONE

12. For completion by nonprofit organizations authorized to mail at nonprofit rates: This publication, title, and complete mailing address of the organization and the name and title of the person in charge of the publication: AMERICAN PSYCHOLOGICAL ASSOCIATION, 750 FIRST STREET, NE, WASHINGTON, DC 20002-4242

13. Publication Title: JOURNAL OF PERSONALITY AND SOCIAL PSYCHOLOGY

14. Issue Date for Circulation Data Below: SEPTEMBER

15. Extent and Nature of Circulation	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
a. Total No. Copies (Net Press Run)	7,449	7,603
b. Paid and/or Requested Circulation (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales (Net Amount)	2,394	2,396
(2) Paid or Requested Mail Subscriptions (Include Advertisers' Proof Copies/Exchange Copies)	3,028	3,107
c. Total Paid and/or Requested Circulation (Sum of 15b(1) and 15b(2))	5,422	5,503
d. Free Distribution by Mail (Samples, Complimentary, and Other Free)	320	332
e. Free Distribution Outside the Mail (Carriers or Other Means)	---	---
f. Total Free Distribution (Sum of 15d and 15e)	320	332
g. Total Distribution (Sum of 15c and 15f)	5,742	5,835
h. Copies Not Distributed (1) Office Use, Leftovers, Spoiled	1,707	1,768
(2) Return from News Agents	---	---
i. Total (Sum of 15g and 15h)	7,449	7,603
Percent Paid and/or Requested Circulation (15c / 15a * 100)	94.4	94.5

16. This Statement of Ownership will be printed in the DECEMBER issue of this publication. Check box if not required to publish

17. Signature and Title of Editor, Publisher, Business Manager, or Owner: *Jack Klaczynski, S. Director, Publishing Services* 10/24/94

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including multiple damages and civil penalties).

Instructions to Publishers

- Complete and file one copy of this form with your postmaster on or before October 1, annually. Keep a copy of the completed form for your records.
- Include in items 10 and 11, in cases where the stockholder or security holder is a trustee, the name of the person or corporation for whom the trustee is acting. Also include the names and addresses of individuals who own or hold 1 percent or more of the total amount of bonds, mortgages, or other securities of the publishing concern. In item 11, if none, check box. Use blank space if more space is required.
- Be sure to furnish all information called for in item 15, regarding circulation. Free circulation must be shown in items 15c, d, and f.
- If the publication had second-class authorization as a general or requester publication, this Statement of Ownership, Management, and Circulation must be published; it must be printed in any issue in October or the first printed issue after October, if the publication is not published during October.
- In item 16, indicate date of the issue in which this Statement of Ownership will be printed.
- Item 17 must be signed.

Failure to file or publish a statement of ownership may lead to suspension of second-class authorization.