ness of striate cortex did not appear to vary systematically with eccentricity. Therefore, magnification was calculated from measurements of cortical surface area. The total area of the pial surface of striate cortex was 286 mm^2.

12. The point of maximum ganglion cell density which corresponds to the center of gaze is located 10 degrees nasal of the geometric center of the retina (*6*). Thus the visual field for the owl monkey extends out 90 degrees superior and inferior from the center of gaze along the vertical meridian, and 100 degrees out along the horizontal meridian. The formula for the proportion of the area of a sphere contained within the zone defined by two isoeccentricity contours is $A(\phi_1,\phi_2) = \cos\phi_1 - \cos\phi_2$. The application of this formula is complicated slightly by the position of the center of gaze. On the retina, $A(\phi_1,\phi_2) = (\cos\phi_1 - \cos\phi_2)\,A_{tot}$ for $\phi_2 \leq 80°$; $A(80°, 90°) = (\cos 80° - \cos 90° - 1/18)\,A_{tot}$, and $A(90°, 100°) - A_{tot}/18$. In the visual field, the proportion of the total area contained within a zone for $\phi_2 \leq 90°$ equals $0.9(\cos\phi_1 - \cos\phi_2)$, and the proportion for the zone from 90° to 100° equals 0.1.

    One degree of visual angle corresponds to 0.15 mm of retina (*6*). Although in some species the optics of the eye produce a nonlinear projection of the visual field onto the retinal surface, this does not appear to be the case in the owl monkey. The distance from center of gaze to blind spot is 20° and the contralateral visual field extends out 100° along the horizontal meridian (*12*). The length of the arc on the retina from center of gaze to optic disk is one fifth of the arc from center of gaze to retinal margin [A. E. Jones, *J. Comp. Neurol.* **125**, 19 (1965); (*8*)]. Therefore the number of millimeters per degree of visual angle must be approximately constant across the retina.
13. T. E. Ogden, *J. Comp. Neurol.* **163**, 193 (1975).
14. J. M. Allman, *Prog. Physiol. Psychol.*, in press; J. M. Allman and J. H. Kaas, *Brain Res.* **31**, 85 (1971); *ibid.* **76**, 247 (1974); *ibid.* **100**, 473 (1975); J. H. Kaas, R. W. Guillery, J. M. Allman, *Brain Behav. Evol.* **6**, 253 (1972); R. H. Lane, J. M. Allman, J. H. Kaas, F. M. Miezin, *Brain Res.* **60**, 335 (1973).
15. J. M. Allmar and J. H. Kaas, *Science* **191**, 572 (1976).
16. Owl monkey striate cortex has been described as an example of peripheral scaling based on a proportional relation between linear magnification (millimeters of cortex per degree of visual field) and ganglion cell density (*6*). Peripheral scaling, however, requires either that linear magnification be proportional to distance between ganglion cells, or that ganglion cell density be proportional to number of cortical neurons per degree^2.
17. Malpeli and Baker (*9*) demonstrated that the proportion of the rhesus lateral geniculate nucleus devoted to central vision is greater than the comparable proportion of retinal ganglion cells. A mathematical description of the system is impeded, however, because only ganglion cell counts along the horizontal meridian are available in the rhesus monkey [E. T. Rolls and A. Cowey, *Exp. Brain Res.* **10**, 298 (1970)]. These yield biased estimates of magnification owing to the asymmetry of the macaque retina [J. M. Van Buren, *The Retinal Ganglion Cell Layer* (Thomas, Springfield, Ill., 1963)]. The displacement of ganglion cells about the fovea causes additional difficulties.
18. Equation 2 may be rewritten: $M_C(\phi_1,\phi_2) = aM_R(\phi_1,\phi_2) \times M_R(\phi_1,\phi_2)^{1.35}$; rearranging gives $M_R(\phi_1,\phi_2) \div M_C(\phi_1,\phi_2) = M_R(\phi_1,\phi_2)^{-1.35} \div a$. Substituting the definition of magnification and cancel'ing terms results in Eq. 3 with $k = [N_R(\text{tot})^{0.35} \cdot A(\text{tot})^{1.35}] \div aN_C(\text{tot})$.
19. A. H. Bunt, A. E. Hendrickson, J. S. Lund, R. D. Lund, A. F. Fuchs, *J. Comp. Neurol.* **164**, 265 (1975).
20. J. J. Norden, *Soc. Neurosci. Abstr.* **4**, 365 (1974).
21. D. H. Hubel, T. N. Wiesel, S. LeVay, *Cold Spring Harbor Symp. Quant. Biol.* **40**, 581 (1975); H. Van der Loos and T. A. Woolsey, *Science* **179**, 395 (1973); T. N. Wiesel and D. H. Hubel, *Soc. Neurosci. Abstr.* **4**, 478 (1974); T. A. Woolsey and J. R. Wann, *J. Comp. Neurol.* **170**, 53 (1976).
22. J. M. Allman and J. H. Kaas, *Brain Res.* **81**, 199 (1974); Malpeli and Baker (*9*).
23. R. H. Wurtz, *J. Neurophysiol.* **32**, 727 (1969).
24. J. H. Kaas, C.-S. Lin, V. A. Casagrande, *Brain Res.* **106**, 371 (1976).
25. J. Tigges, M. Tigges, A. A. Perachio, *J. Comp. Neurol.*, in press.
26. J.M. thanks C. N. Woolsey for advice and help. This work was supported by NIH grants NS 12131 and NS 00178, an NIH research fellowship and a Spencer Fellowship to J.M., and an Alfred P. Sloan Fellowship to J.M.A. P.B.M. is now at the Department of Neuroscience, University of Florida College of Medicine, Gainesville 32610.

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Panhandling as an Example of the Sharing of Resources

The study of panhandling by Lockard *et al.* (*1*) provides a good example of how the ethological approach can be used in field studies of human behavior. However, there are some difficulties in interpreting their data.

Of the two studies reported, the first was conducted in the spring, the second in the fall. Lockard *et al.* concluded that there was a possible sex-by-season interaction since males were overall more successful in the spring than they were in the fall and since females were more successful than males in the fall. However, this finding is confounded. (i) The male confederates for the fall study were the same as those employed in the spring, but the females had not been previously employed. The amount of experience the confederates had could certainly affect the outcome of a request. (ii) The types of targets were different in the two studies in that family groups were also included in the fall study. From their second study only, it may be concluded that a possible sex-by-season interaction can be observed in panhandling. To generalize further, as the authors appear to do, would imply a four-way interaction: sex-by-season-by-target-by-experience.

Lockard *et al.* interpret nonfamilial sharing in terms of reciprocal altruism. In using altruism as an explanation, they indicate that giving a panhandler money is adaptive for the human species under certain conditions and important for survival. There are severe difficulties with this interpretation. Trivers (*2*) has noted that altruistic behavior is characterized by a relatively small cost to the donor and a great benefit to the recipient. If one considers the experimental manipulations of Lockard *et al.*, this condition does not appear to be met. It is not evident why only a dime was used as the amount requested. Aronson and Carlsmith (*3*) have argued that experiments designed to assess social processes must contain a balance of mundane and experimental realism. This means that the subjects must take the experimental context seriously, which these subjects apparently did. It also means that the experimental context must correspond to actual social processes as the subject is likely to view them. It is not reasonable to assume that a significant number of subjects in this experiment would view giving a dime to a panhandler as of great cost to them while greatly benefiting the panhandler. Even if the dime were given out of sympathy and that sympathy viewed as reciprocal altruism, one must still be cognizant of the cost-benefit ratio involved, as a variety of studies have shown [cited in (*2*)]. Further, reciprocal altruism is behavior that increases the fitness of both individual organisms and the social group, rather than increasing the fitness of one organism at the expense of another. Further, they do not provide a clear connection between an increase in fitness and the responses of their subjects.

Families were less willing targets than other groups, a phenomenon accounted for by Lockard *et al.* by the concept of kin selection. However, Wilson (*4*, p. 587) has argued that such a process involves the selection of genes from one or more individuals favoring or disfavoring the survival and reproduction of relatives (who are not offspring) possessing the same genes by common descent. Lockard *et al.*'s experiment does not present a situation in which there is great expense to the donor that would decrease his fitness while increasing that of the recipient (*4*). The experimental procedure is not at all analogous to the relevant processes. An explicitly social psychological interpretation of altruism that emphasized the motivational aspects of the targets' responses would be more appropriate. Lockard *et al.* do note that there are social psychological explanations for the refusal of groups to give a panhandler the requested dime (*5*). There are more cognitive explanations, which are difficult to relate to comparative research on the sharing of resources and to discussions of the evolution of sharing among humans. However, few other interpretations seem reasonable in light of the experimental design and the data reported.

Given the range of contexts within which panhandling can occur and the genetic diversity of the human species, it would not be unreasonable to presume that the responses of targets to panhandlers would vary as physical loca-

tions were changed. If data were collected from a number of different sites, the generality of the findings and the strength of the arguments would be increased. The restriction to one site (or similar sites) might partially account for the finding that some of the targets who were eating when approached also offered the panhandler some food. This observation would seem to be most likely on a college campus when college-aged confederates approached college-aged subjects.

It is certainly not unreasonable to assume that human behavior has evolved both socially and biologically to its present form (*4*). A danger in many discussions of the biological bases of behavior results from the amount of backtracking required. Changes in species fitness are not observed in one experimental session. Thus, one cannot, after demonstrating that human behavior is similar to that of nonhuman species on some dimension, infer that it must therefore be adaptive. Researchers must be aware that social behavior involves a complex interaction between organisms and the environment. With respect to the human species, social behavior is also characterized by a high degree of plasticity. Such plasticity allows the organism to adjust to environmental changes, which occur with varying degrees of rapidity. It is probably more reasonable to view adjustment, rather than individual types of behavior, as adaptive. To study how adaptive any given type of behavior is requires far greater control than that exercised by Lockard *et al.* It also requires a clearly elucidated statement of which processes will occur as a function of biologically determined factors and which will occur as a function of learned responses to environmental stimuli.

Despite its problems, this study should not be overlooked. It is an example of a good field-research technique. It also demonstrates that field studies of human beings can be designed so that they are comparable with field studies of other species. Repeating the study with an appropriate experimental design could provide clear data concerning the possible interaction between the panhandler's sex and the season. An extension of these basic findings would be provided by more carefully examining social customs under such conditions. Certainly, such modifications would not weaken the findings and would be consistent with many ethological investigations.

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References and Notes

1. J. S. Lockard, L. L. McDonald, D. A. Clifford, R. Martinez, *Science* **191**, 406 (1976).
2. R. L. Trivers, *Q. Rev. Biol.* **46**, 35 (1971).
3. E. Aronson and J. M. Carlsmith, in *Handbook of Social Psychology*, G. Lindzey and E. Aronson, Eds. (Addision-Wesley, Reading, Mass., 1968), vol. 2, p. 1.
4. E. O. Wilson, *Sociobiology: The New Synthesis* (Harvard Univ. Press, Cambridge, Mass., 1975).
5. B. Latane and J. M. Darley, *Am. Sci.* **57**, 224 (1969).

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No research project is all-encompassing; initial studies are usually conducted to establish a phenomenon for subsequent, more sophisticated investigation. The panhandling research by Lockard *et al.* (*1*) illustrates this systematic approach. A pilot study provided empirical credence to a hypothesis concerning resource sharing, and a more extensive second study ascertained the reliability of the preliminary findings. Replication is also an essential ingredient of science, as unique events are not amenable to further inquiry.

The main study used a balanced design to test possible sex differences in panhandling success. Taken alone, the data indicated that in autumn, females were more successful than males in acquiring 10 cents. In combination with the springtime pilot study, in which the same male panhandlers were used, a possible seasonal difference in success rate was suggested. In neither study were the findings confounded; on the contrary, it was essential to use the same male panhandlers in both studies in order to reveal possible seasonal differences. Moreover, for Knowles to intimate that the data were confounded across studies is to misuse the statistical term, wherein simultaneity of two (or more) inseparable variables is implied. Also, the "experience" effect to which he refers is in a direction opposite to that which would be predicted: the male panhandlers were less successful in the second study (autumn) than in the first study (spring). The possible "sex-by-season-by-target-by-experience" interaction that he proposes is only apparent because of these initial studies, which have served well their intent, namely, providing ideas and direction for further research.

The discussion by Knowles of the cost-benefit ratio in donating to panhandlers affords an opportunity to expound on a research strategy which I have found fruitful for conducting human ethological studies, including the one on panhandling. Specifically, in spite of the fact that a donated dime is a small cost in our society today and would probably not be viewed by the donor as either a great expenditure or as a great benefit to the recipient, the various target groups were differentially resistant to giving to a panhandler. The assumption of behavioral scientists that human behavior be "reasonable" has delayed, in part, actual observations of how people do behave. There has been considerable bias in studies on human behavior against distal explanations (for example, evolutionary and historical) since largely proximal questions (for example, situational and physiological) are asked. If social scientists were to take more seriously the organistic component of the ". . . complex interaction between organisms and the environment" to which Knowles refers, they may find that distal explanations of many human social behaviors are low in face validity but high in construct validity (*2*). Distal and proximal explanations of the same behavior may often be superficially inconsonant with one another. It may well have been that a good portion of more recent human evolution has entailed deceiving the organism into increasing its fitness by providing proximal reasons (via cultural experiences and immediate physiology) which the organism can champion to explain why it behaves in certain ways. For example, to say "We eat because we are hungry" or "We take care of our children because we love them" are proximal reasons and may have little intuitive similarity to distal relationships (with which they are undoubtedly intimately correlated) of food availability and survival, or parental investment and reproductive success.

The salient points of the panhandling research are missed if the reader focuses mainly on situational interpretations of the data. The resistance of family groups to being panhandled and the importance of food consumption by the targets for successful panhandling are findings compatible with distal explanations such as kin selection. Although the panhandlers were college students, the target groups were not, and the panhandling was done at locations for the general public (not on a college campus), such as on street corners, at a zoo, and at a large outdoor recreational center.

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References

1. J. S. Lockard, L. L. McDonald, D. A. Clifford, R. Martinez, *Science* **191**, 406 (1976).
2. A. Anastasi, *Psychological Testing* (Macmillan, New York, 1976).

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