Fair Treatment in International Politics:
The Psychological Microfoundations of Fair Play

Roland Stephen
Department of Political Science and Public Administration
North Carolina State University, Box 8102
Raleigh, NC 27695
(919) 513-1786
stephen@social.chass.ncsu.edu

William Boettcher
Department of Political Science and Public Administration
North Carolina State University, Box 8102
Raleigh, NC 27695
(919) 515-5096
boettche@social.chass.ncsu.edu

Paper prepared for presentation at the Department of Political Science, University of North Carolina at Chapel Hill, November 20, 2002.

Abstract

What accounts for the surprising amount of fair treatment in international politics? There exists exploitation and conflict, but also a willingness to divide benefits and costs evenly among some players, together with a willingness to punish those who won't reciprocate. We argue that this is because humans have a strong inherited disposition for fair play, part of a battery of specialized psychological dispositions shared by all, that gives rise to these observed behaviors. This disposition was forged over evolutionary time and is now part of our psychological furniture. This view of human nature, known as evolutionary psychology, allows us to develop expectations about the link between a disposition for fair play and the behavior of humans in political situations in the modern world. We formulate these expectations as hypotheses that can be tested using the ultimatum game. This is a well-known game in experimental economics in which humans behave much more altruistically than an orthodox economist would predict. We find that human subjects often propose the 50/50 division of resources in political scenarios, and will sanction chiselers at some cost to themselves. Further, we find that although these two pro-social behaviors vary as the conditions under which humans choose vary. As losses in the game increase, so pro-social behavior declines. However, the decline slows as the number of iterations rises, suggesting that these behaviors vary within a restricted range. In short, while the environment matters, it cannot swamp inherited dispositions. This is a novel and revealing way to look at politics, the basis for a substantial shift in the psychological micro-foundations of political science.

Introduction[1]

In November 1995 the United States finally brought the warring parties of Bosnia-Herzogovina to the negotiating table in Dayton, Ohio. The central purpose was a peace treaty between the Serb Republic, represented by its patron Slobodan Milosevic, and the Bosnian-Croat Federation, represented by the Bosnian leader Alija Izetbegovic and the Croatian President Franjo Tudjman. Peace depended upon the physical division of the province, which was an herculean task. Even after three years of war, 250,000 deaths and widespread ethnic cleansing by every side, the map of the area remained tremendously complicated, with various population pockets linked by tenuous land corridors. However, the negotiations finally centered on a remarkably simple formula–the total percentage of land controlled by each side. Simply stated, while Milosevic knew that recent military victories by the Croats (with barely concealed assistance from the West) placed him in a weak position, he nonetheless insisted on a 49%-51% territorial split (this discussion relies on Holbrooke 1998: 293-304).[2]

Why was a nearly perfect division of the territory so desirable? (The latest geographic information systems were used to calculate the total with extraordinary precision). We know that the fifty-fifty split of a candy bar in a play ground has the effect of avoiding conflict, but could this be true of territory under wartime conditions? Indeed, the fact that territory is inherently a heterogeneous good (in other words, some bits are much more desirable than others) makes the insistence on dividing the total equally, based only on square kilometers, even more striking.[3] Yet negotiations hinged on concessions from the Croats and the Bosnians that met the required percentage. Milosevic, the author of so much of the misery of the Balkans in the 1990s, could not hold his head up unless the province of Bosnia-Herzogovina was *seen* to be fairly divided. Less would have undermined his nationalist credentials with his domestic supporters.

In fact, there is a surprising amount of even-handed treatment of others in international politics, although, of course, it exists alongside plenty of unfair treatment. In issue areas as diverse as

commercial treaties, arms control agreements and environmental limitations, costs or concessions are often quite strictly balanced. Indeed, this is so common that it hardly warrants comment. Yet the dominant post-war view of international politics, Realism, implies that concessions and costs should be assigned on the basis of the distribution of power. Clearly this cannot explain the fact that the U.S. deals with Canada in a relatively even handed way, notwithstanding the disparity in bargaining power between the two countries, or the fact that Canada has often been willing to refuse anything but fair treatment by the U.S., regardless of the short run costs. In other words, international politics is characterized by a mixture of unfair treatment and even handed treatment among countries, with a persistent willingness by governments to propose and insist on even handed treatment, regardless of the distribution of power.

What accounts for the prevalence of so much simple division of costs and benefits in international politics? (In the paper that follows we refer to the fifty-fifty division of a resource as simple division, to be distinguished from the mathematical literature on fair division, addressed in Brams and Taylor 1996) In order to investigate this question, we begin with a straightforward but important claim: the desire for simple division as the solution to a bargaining problem will be more likely where domestic ratification (tacit, informal or formal) plays an important role (on the problems created for international negotiations by ratification see Milner 1998). In such cases, leaders and governments need to make and accept agreements that are domestically legitimate. We argue that in such cases the appearance of fair treatment, i.e. simple division, is crucial because it has some inherent and broad appeal.

However, this poses a second problem. Why wouldn't citizens of any country, even bourgeois democracies, view the unfair treatment of foreigners with equanimity? Furthermore, why do leaders, governments and citizens resist unfair treatment by others with such determination and at such cost to themselves?

This paper argues that it is not simply realism that is inadequate to answer these questions. We argue

that both rational choice and constructivist views of politics are also fundamentally deficient in their view of the psychological micro-foundations of human behavior, and so cannot account for the widespread acceptance of simple division. Instead, we use the insights made available by evolutionary psychology to explain the existence of a taste for simple division and the appearance of fair play. We also investigate the conditions under which this proclivity for simple division and this willingness to sanction unfair division may be weakened. We support our analytical claims by reporting the findings from a series of psychological experiments.

In summary, our argument is as follows. Standard views of human nature in the social sciences are inconsistent with what is now known about our evolved psychological characteristics. Our minds are not the all-purpose super-computers of *homo economicus,* nor are they the *tabula rasa* implied by constructivists, struntured by the pathways of social interaction. Instead, they have inherited a distinct structure, the product of an evolved history, with specialized dispositions and abilities derived from that inheritance. These abilities include well-known ones such as the language instinct, and less well-known ones such as our ability to detect cheating in social interactions (Pinker 1994, Cosmides & Tooby 1992).

We argue here that there is also a disposition for fair play in social interactions, which gives rise to two behaviors: a proclivity to propose the simple division of resources, and a disposition to sanction (no matter the cost) those who propose a one-sided division of resources. This disposition exists alongside other dispositions–for example, to cheat–and the balance among them may be altered by culture, the strategic environment, or the way in which problems are framed. That is to say, the social and political context or culture may shape the degree to which this disposition matters for political outcomes. But the underlying psychological capacity persists and systematically structures outcomes no matter the specific conditions governing any particular social encounter.

The paper proceeds in six parts. We begin with a short overview of evolutionary psychology (EP) and

the contribution it makes to social science. In particular we specify the requirements for any explanation of human behavior that draws on EP. In the next section we argue that in many cases humans have a disposition for fair play. We argue that this disposition gives rise to two specific examples of pro-social behavior that served as a complex and efficient solution to social problems prevalent in the environment of evolutionary adaptation. We also argue that this disposition plays an important role in politics today, albeit under very different social conditions. In the fourth section we show how the so–called "ultimatum game" captures the problem of fair play. We go on to specify a series of hypotheses about fair play in the ultimatum game consistent with our overall argument. These hypotheses are designed to show how specific political and social contexts alter the mix of pro-social behavior–that is the willingness to propose simple division, and the willingness to sanction chiselers. In the fifth section we report on the design, administration and results of a series of experiments that test the proposed hypotheses. We find modest but significant support for several of our claims. We conclude with a discussion of the implications for the study of international politics, and for political science more generally, of incorporating the psychological micro-foundations made available by EP.

Evolutionary Psychology and Human Behavior

Many people have little or no trouble accepting the general idea that the complex biological world is the product of a single, elegant process–evolution. However, they are often troubled by the unavoidable implication that humans are equally a product of their evolutionary past. But this is the fundamental point of departure for EP. It follows that any explanation of human behavior must be consistent with (although not necessarily reduced to) what we know of our evolved biological and psychological selves. EP is simply a framework for understanding this.

This approach to the way the mind works takes William James' view of human instincts as its starting point. He argued in his *Principles of Psychology* that human behavior was intelligent and flexible not because we were governed by reason, but because we had more, and more complex, instincts than

other animals. (What follows relies heavily on a widely accepted presentation of EP in Tooby and Cosmides 1992). We do not need to overcome the combinatorial challenges that confront a supercomputer, nor do we need to process all the sense data supplied by the social world, before we can act. We enjoy an inherited psychological endowment that makes us natural experts at the tasks which typically fall to humans. For example, very small children exhibit an innate understanding of the physical properties of objects long before they can actually manipulate them (Small 1998). From the point of view of an evolutionary biologist, this is unsurprising. Nature designs an organism with tremendous precision.[4] It fits into the world, indeed into a specific niche in the world, as a key into a lock.

Humans appear unique, however, because of the tremendous flexibility alluded to above. We are much less restricted than any other animal to a biological niche. We have spread over the whole planet, almost without regard to climate or topography. We perform a variety of tasks with great skill. Above all, we are highly social, living and evolving in a rich cultural environment as well as a natural environment. (Of course other primates also have culture, ours merely exhibits greater complexity. See de Waal 2001). From that it follows that our highly specialized evolved psychology is as much a product of social interactions as of interactions between mankind and the rest of nature.

A core requirement is that these evolved dispositions must enhance individual fitness. Fitness is an attribute which increases the probability of an individual, or of closely related individuals who share the same attribute, successfully reproducing. In other words, an increase in the probability of an individual, or of a close relative of that individual, having children who themselves also have children. In short, EP argues that humans have acquired specialized psychological dispositions over evolutionary time (hundreds of thousands of years at least) that confer reproductive advantage of one kind or another.

At this point a crucial distinction must be made clear, analogous to the difference between a genotype and its phenotype.[5] While EP suggests that we all share common instincts, or a common mental “meta

culture", there are, obviously, many different actual cultures jostling against each other in the world. By the same token, while a common instinct for language exists, yet we all speak many different languages. How does EP reconcile the tension between the common evolutionary inheritance of mankind, and the highly variable cultures within which men and women actually live? The answer is that EP is not a deterministic view of human behavior. It does not argue that reason, or strategy, or the environment play no part in human accomplishment (see Dennett 1995, 481-493), or that socialization plays no part in human preferences. The relationship between a genotype and the social world is complex, indirect and reciprocal (see, for example, the discussion of stress, cortisol and the activation of genes in Ridley 1999, 147-160).

Some shared preferences are evident across all cultures--men and women generally prefer kind and intelligent mates--while some preferences vary widely across cultures--chastity is prized by some but not by others (Buss 1992). More confusingly, while male jealousy is thought, reasonably, to be a constant disposition (in other words, a candidate for an explanation based on EP), its consequences for the role of women in society vary dramatically from the enlightened to the infamous. The analytical task is to employ a framework or test which distinguishes between these two elements of any particular behavior: that part which varies as the environment or culture varies, and that part which persists regardless of changes in the environment. We expect the phenomena we are interested in–behaviors associated with a disposition for fair play–to vary within limits. The variance is explained by circumstance, the limits are explained by EP.

Such a framework is possible by adhering closely to the logic underlying evolutionary biology (see Tooby and Cosmides 1992, 73-77). It can be divided into four requirements: 1) The disposition or psychological regularity in question should give rise to behavior that is an efficient, complex solution to an adaptive problem. A solution that enhances the propagation of the genotype associated with the particular psychological disposition. 2) The adaptive problem must have been a recurring feature of the ancestral environment–that is an environment that persisted for a minimum of several hundred thousand

years. This is often referred to as the environment of evolutionary adaptation (EEA) 3) The psychological regularity must, in principle, imply the existence of some specific neuropsychological design. In practice the operating pathways of the brain are only now beginning to be understood, however, the tasks, inputs and outputs that the imputed design performs should be closely specified. 4) The disposition should be closely enough specified so as to yield predictions about observed behavior under real-world conditions. For example, supposed psychological mechanisms to do with mating should yield expectations about actual preferences over mates in various real world conditions.

In summary, a specialized psychological disposition that represents part of our evolutionary inheritance must be a complex, efficient and adaptive solution to a commonly encountered problem in the past. Further, we should be able to develop a reasonably precise description of its properties and the way it performs, and to generate specific expectations about behavioral outcomes. Evolutionary biology also tells us that such a disposition should be universally present among humans, even if specific cultures mediate behavioral outcomes in idiosyncratic ways. In the section that follows we argue that a proclivity for simple division and a willingness to sanction chiselers are behaviors fostered by just such a psychological disposition, a disposition for fair play. We go on to apply the test outlined above to this disposition and its associated behaviors.

The Disposition for Fair Play

As we will discuss in much greater detail below, there is a divide-the-dollar game, known as the "ultimatum game" (UG), that has been the subject of numerous experiments. The outcomes all suggest that there exists a widely shared proclivity for fair treatment among humans. In it one player offers another a division of some resource. If the proposal is accepted then each is paid accordingly, if not, no one gets anything. Rationality dictates that the minimum is proposed and always accepted. In practice that is never the case. In particular, many players make 50/50 offers, and many players punish low proposals, even though to do so imposes costs on themselves. In fact, the tendency for people to

be unreasonably annoyed by chiselers is widely noted in the literature. The willingness of people to sanction chiselers serves an undeniably valuable collective purpose. This is described in the literature as "pro-social" behavior. But the costs to an individual of imposing the punishment outweighs the immediate benefit, making it truly altruistic behavior, behavior which falls outside the two standard explanations for altruism.

The first explanation for altruism relies on the notion of "inclusive fitness" (Hamilton 1964). Relatives share your attributes with some probability. If that probability is high enough, and the relatives numerous enough, and if the attribute leads to altruistic behavior by *you* that enhances *their* reproductive prospects, even at the expense of your own, then such an attribute is deemed inclusively fit. Your prospects may be dimmed (from the point of view of propagation) but the prospects of others who share your genetic endowment have been enhanced.[6] The second explanation, often described as reciprocal altruism, is familiar to political scientists as it is based on the work of Axelrod (1984) among others (see also Williams 1966, Trivers 1971). Given information and iteration individuals will pay the costs necessary to sanction chiselers, counting on the fact that the chiselers in question, and perhaps others, will learn to make better offers later.

However, as we see below, individuals in anonymous, single plays of the game, where reciprocation is impossible, still pay to punish chiselers. They just can't help themselves. In modern society this doesn't make sense. We argue, in keeping with many others (see Gintis 2000, and Wright 1994, 189-209 for an overview) that it did make sense in the past. In addition, our argument adds a refinement to the general theory of reciprocal altruism. The simple, 50/50 division of a resource has a strong, intuitive appeal to humans. Below we advance our argument and apply the four part test outlined above.

1) We and many others argue that while the modern world is anonymous and structured by market transactions, our ancestors practiced reciprocal altruism in relatively small group settings for at least hundreds of thousands of years.[7] We extend this claim further. Social interactions often centered on sharing resources Dividing resources was a complex activity, and one fraught with danger. Failure led

to intra-group conflict, which, of course, hurts propagation. In response, mankind made division more efficient and more transparent by the adoption of a rule of thumb: simple division. This rule of thumb had two significant benefits. First it was an effective signal to others of fair play--50/50 is an unambiguous signal. Second, the adoption of this rule of thumb made it easier to detect chiselers. In short, this rule of thumb reduced the likelihood of conflict and so conferred a reproductive advantage.

2) We do not know much about the EEA. Speculation about many of the conditions that existed hundreds of thousands of years ago (even supposing they were stable over time) would be just that, and a weak basis for building theory. However, we may say one thing with certainty. We evolved in the presence of others, that is in a socially structured environment. We also make two other reasonable claims about the EEA. First, resources (food) were heterogeneous, lumpy and only sporadically available. That is, our ancestors were faced with the division of prey or gathered resources that ranged from the small to the very large, and that only occurred at uncertain intervals. Second, the relevant social group, while varying in size from a large family to a small tribe, probably numbered a few hundred people at most, although with groups joining and breaking apart with some regularity. This means that reputation and iteration were significant features of social interaction. These two conditions gave rise to two kinds of problems. First, many different kinds of heterogeneous resources had to be efficiently and peacefully divided among groups of different sizes. Second, given uncertainty in the environment, there was a strong imperative to sanction chiselers, especially in times of dearth. A disposition for fair play, characterized by the adoption of simple division, is an efficient, functional response to these problems.

3) We are not qualified to make any claims about the neural pathways forged by this behavior. However, we can say something about the way in which information was gathered. The beauty of simple division, for example making several piles of stuff of equal size, is that visual inspection is a quick if imperfect way to evaluate who gets what. No measuring or weighing was necessary, which were difficult or impossible tasks in the EEA. It is true that in any particular play of the game you might do

badly under simple division–you might get more than your fair share of gristle–but under iteration the payoffs from simple division should converge on the payoffs yielded by strictly fair division (of the kind discussed by Brams and Taylor, 1996).

4) If there exists a disposition for fair play, and the associated behaviors of simple division and sanctioning, then we expect to make the following observations in the contemporary world. First, we should observe the adoption of rules for the division of a resource which are simple and easily understood. In other words, summary measures should be preferred. They might be visual, but they could be numeric if the numbers in question were very simple. We should also expect to observe an important role for symbolic concessions. That is, symbolic concessions may contribute to the appearance of fair play. Finally, we should observe anger and efforts to sanction where there is the appearance of unfair treatment, as much as where there is a substantive reason for complaint.

The foregoing is an argument in favor of a general disposition for fair play, and for its two associated behaviors, proposals that feature simple division, and a willingness to sanction chiselers. We believe that it meets the test for an evolved psychological disposition as outlined in the previous section. In the next section we identify the way in which this disposition should manifest itself in contemporary politics. We go on to show how reports in the literature of several experiments using the ultimatum game are consistent with the presence of this disposition. We then specify a series of hypotheses about human behavior in the ultimatum game, given various contemporary political scenarios

Politics and the Ultimatum Game

While our disposition for fair play was formed in a small group setting, the contemporary world is very different. We are disposed to play as if engaged in reciprocal altruism, but the reality is that we are often in encounters that are one-shot and/or anonymous. This makes chiseling more likely. The consequence is straightforward, as we noted at the outset. The fair treatment of others exists alongside

plenty of unfair treatment. As a result, we live in a world filled with the rage of the cheated altruist. We are arguing, in a sense, that our disposition for fair play is a maladaptation, a liability, given that we now live in a world with so many opportunities for cheating.

The task is to find a way to elicit behavior in a controlled setting which will allow us to judge the actual prevalence of this disposition for fair play. The ultimatum game is just such setting. This game represents one of the most striking and universal departures from orthodox economic behavior known to experimental economics. It has been played in every region of the world (Roth, Prasnikar, Okuno-Fujiwara, and Zamir 1991). The incentives have been altered (Hoffman, McCabe, and Smith 1994). Yet the variance among results is relatively low, whereas the difference between these results and the baseline expectation of orthodox economic behavior is striking. *Homo economicus* would propose the minimum, which would always be accepted. *Homo reciprocans*, as some have termed him, makes offers on average above 40%, and often has them rejected when they fall below 20% (Bowles, Boyd, Fehr and Gintis 1997; Camerer and Thaler, 1995). When formal analysis of the game incorporates the possibility of iteration and a role for reputation, equilibrium outcomes are discovered close to these experimental findings (Nowak, Page and Sigmund 2000). But the experimental findings noted above do not rest on the well-known consequences of repeated play.

Rather than investigate the consequences of iteration and reputation, we believe the first step should be to devise political frames for the game that elicited the same disposition for fair play as observed in the monetary games reported widely in the literature. The next step is to confirm that this disposition persists in group settings. Finally, although UG experiments among students all over the world have yielded very stable outcomes (perhaps only suggesting that undergraduates are the same everywhere), a recent and exhaustive study of the UG under more widely varying social and cultural settings suggests that there is much more variation in behavior than previously suspected, although the study provides no support for the presence of *homo economicus* (Heinrich et. al. 2001).

The question of variation is crucial to the argument for an inherited disposition. Such a disposition must be present universally among all humans or it cannot be the product of an evolutionary process. Yet in the study noted above mean offers and mean rejected offers have been shown to vary significantly across cultures (see Heinrich et.al. 2001, table 3). Our argument is that the underlying disposition for fair play persists universally, while giving rise to two behaviors, simple division and a willingness to sanction, which may vary within limits.

The different balance that can exist between simple division and a willingness to sanction is illustrated by two groups of foragers, the Aché and the Hadza (what follows relies on Heinrich et.al. 2001, 30). The Aché distribute prey equally among households, the hunter receiving nothing and taking care to avoid boastfulness. When they played the UG, 80% of offers were between 60/40 and 50/50, with 16% offering more than 50/50 (so-called hyper-fair offers). None, needless to say, were rejected. By contrast the Hadza share meat only when they must, smuggling it into camp themselves if they can, and relying on gossip and social sanctions to extract shares from others. Not surprisingly, their average offer was very low, with the modal offer being 20%, and the level of sanctions–the mean of rejected offers–was high. One task, therefore, is to explore the limits to this variation in a controlled setting.

What follows are a series of hypotheses about the way individuals and groups play the game consistent with our overall argument about the disposition for fair play. The ultimatum game is usually framed as the division of a dollar or of some other explicit sum of money. We argue that the willingness of humans to systematically depart from strict rationality in this game is evidence for a disposition rooted in a socially structured environmental history. Therefore, when the game is framed as a social or political encounter rather than a monetary encounter, the same willingness to offer a simple division of the resource should be evoked, in combination with the same willingness to sanction low offers. (A different experimental design to the one proposed also produced results consistent with a desire to *appear* fair, see Kagel, Kim and Moser 1995).

H1 If the ultimatum game is framed as a social encounter, then the average offer, and the average of rejected offers, will be the same as in monetary encounters.

It is also generally observed that the modal offer in the ultimatum game is 50-50. This is itself evidence for a human disposition for simple division and the appearance of fair play. 50-50 is an easy-to-understand summary measure with which to solve the problem of division. Therefore, if a scenario could be devised which was especially effective at evoking a disposition for the appearance of fair treatment, then the incidence of 50-50 offers should rise. We propose to do that by framing the game as a division of territory. Dividing territory is a task instantly understood by players, and may be one that taps into other deeply felt responses. Some have argued that territoriality itself is an inherited disposition. (See Wilson 1978, 107). We take no position here on the likelihood of territorial instincts. We make the less demanding claim that, whether for reasons of culture or of inheritance, humans simply have strong feelings about territory, and that a game over territory will elicit an instinct for simple division. Further, given that territory does tap into strong feelings, we should expect people to be more eager to sanction chiselers.

H2a If the ultimatum game is framed as a game involving the division of territory, then the incidence of 50-50 offers should rise.

H2b If the ultimatum game is framed as a game involving the division of territory, then the difference between the mean offer and mean rejected offer should narrow.

We also argue that an important way in which fair play manifests itself is when choices are subject to group processes--i.e. politics, especially democratic politics. Political debates are infused with appeals to fairness. Individual participants are constrained to appear fair. Therefore, if the ultimatum game is played by groups, who discuss the problem and come to group decisions we should observe a greater attention to the appearance of fairness and a greater eagerness to sanction chiselers.

H3a If the ultimatum game is played by groups, then the incidence of 50-50 offers should rise.

H3b If the ultimatum game is played by groups then the difference between the mean offer and mean rejected offer should narrow.

We also accept that culture and the strategic environment may damp down the proclivity for simple division, even though the behavior is generally very stable. For example, this could be accomplished by structuring payoffs so as to put all players in the domain of losses, given that humans are more sensitive to losses than gains (Quattrone & Tversky 1988). The sensitivity to losses should affect players in different ways, depending on their role in the game. Prospect theorists have demonstrated that loss-framed choices tend to elicit risk acceptant behavior (Kahneman and Tversky 1979). Thus, proposers in the iterated losses ultimatum game should make consistently lower offers (taking the risk that their offers will be rejected, but avoiding a certain loss). Responders make their choice under the condition of certainty not risk. Since prospect theory predicts a general trend toward loss avoidance (Levy 1992), responders should accept consistently lower offers (accepting a loss to avoid the certainty of a larger loss).[8] These tendencies reinforce one another so we should observe the continued acceptance of declining offers.[9]

H4a If the payoffs in the UG are such that all players seek to minimize losses, then the level of mean offers should fall.

H4b If the payoffs in the UG are such that all players seek to minimize losses, then the incidence of simple division should fall.

H5 If the payoffs in the UG are such that all players seek to minimize losses, then the mean of rejected offers should fall.

H6 If the payoffs in the UG are such that all players seek to minimize losses, then the gap between the mean offer and mean rejected offer should increase.

The Experiments

In order to test the hypotheses laid out above, two carefully controlled experiments were constructed. The first phase of the first experiment involved individual responses to hypothetical resource division scenarios (see Appendix A) We will refer to this as the Standard Ultimatum Game (SUG). Student subjects were presented with scenarios involving the division of trade quotas or an adjoining territory. The subjects were asked to play the role of an appropriate minister in a fictitious country who was responsible for the division of this resource. In order to approximate the classic dollar division scenario, subjects were told that some outside authority had designated one country as having the right to propose a division of the resource. The designation of one country as a "proposer" was justified by past positive interactions between the fictitious state (Ruritania) and the outside authority. All of the subjects were asked to read the appropriate scenario, the students randomly chosen to represent Ruritania were then asked to write their proposals down on a response form. Multiple dyadic "games" were run simultaneously to reduce the chances of individuating factors (friendships, gender, race, etc...) affecting either proposals or responses. Once the proposals had been made, the response forms were randomly distributed to the responders who were then asked to simply indicate their acceptance or rejection.

From past experimental research we expected that most of our student subjects would find it hard to empathize with their fictitious constituents. In order to provide an incentive structure to make subjects care more about the resource division game we distributed lottery tickets based upon the agreed resource division. (If a dyad agreed on a 70:30 split of the resource, the proposer received seven lottery tickets while the responder received three.) The subjects were not told of the actual number of lottery tickets at stake, they were simply notified that more of the resource meant more chances to win a specified amount of money ($60). In order to avoid making this a lottery ticket division game, we

urged subjects to focus on the details of the scenario and the best interests of their respective countries.

The second phase of the first experiment involved small-group responses to one of the two resource division scenarios. Subjects were divided into three-person groups and asked to play the role of decision makers in the appropriate government ministry. A five-minute minimum discussion time was enforced to ensure that at least some semblance of a group process emerged. The group members were asked to come to a consensus on their proposal or response, but in some rare cases a two to one majority was allowed to end prolonged discussion. Multiple groups of proposers or responders participated in the experiment simultaneously, but they were spatially separated to avoid between-group contamination. Given space and logistical constraints the dyadic games were run in separate sessions, thus the responder groups never met the proposers (again avoiding the impact of individuating factors). The groups were presented with the same incentive system as the individuals, slightly reducing the potential payoff for the individual group member should they win the lottery.

The group discussion format allowed the experimenters to gain insight regarding the thought processes of the student subjects. While no formal protocol analysis was conducted, anecdotal evidence suggests that the subjects took the resource division scenarios somewhat more seriously than expected. We were surprised to find that a number of our groups engaged in feisty arguments over their proposals or responses. Of particular interest was the degree to which subjects ignored the lottery tickets and their own personal gain, instead focusing on the needs of their state.

The three-hundred and ten subjects that participated in both phases of the first experiment were volunteers from a Political Science Research Subject Pool (PSRSP) composed of North Carolina State University students enrolled in an introductory American Politics course (PS201). The students received course credit for their time and four lucky subjects received monetary compensation from our incentive lottery.

The second experiment also involved individual responses to hypothetical resource division scenarios (see Appendix B). We will refer to this game as the Iterated Losses Ultimatum Game (ILUG). However, here students were presented with repeated play of four scenarios in which they had to divide losses among themselves. The scenarios involved pollution clean-up costs, reduced trade quotas, the costs of a security alliance and the ceding of territory. The subjects were asked to play the role of an appropriate minister in a fictitious country who was responsible for the division of these losses.

In order to approximate the classic dollar division scenario, subjects were told that some outside authority had designated one country as having the right to propose a division of the resource. The designation of one country as a "proposer" was justified by past positive interactions between the fictitious state (Algo) and some outside authority. All of the subjects were asked to read the scenarios, they then played all four scenarios in sequence (A - D). One set of students were randomly chosen to represent Algo, the proposer, on the first play, thereafter the students either alternated, or proposed twice and responded twice. In all, each student played two games as the proposer and two as the responder.

Proposers were asked to write their proposals down on a response form. Multiple dyadic "games" were run simultaneously to reduce the chances of individuating factors (friendships, gender, race, etc...) affecting either proposals or responses. Once the proposals had been made, the response forms were randomly distributed to the responders who were then asked to simply indicate their acceptance or rejection. The same procedure was used for each of the four games.

Again, from past experimental research we expected that most of our student subjects would find it hard to empathize with their fictitious constituents. Furthermore, giving students endowments and then taking away part of what was given may not be interpreted as losses by the subjects. To get over this problem we proceeded as follows. Each student was advised before they signed up for the game that

participation would be worth two credits towards their participation in the PSRSP. Each student must earn four credits during the course of a semester, and each episode is viewed as something of a burden. When the students arrived for the experiment we then told them that they were guaranteed only one credit, and had to save the other credit by minimizing their losses from the game. Further, it was explained that to save this credit their total score (total losses) would be compared to the losses of all others who played the game. To save their credit they would have to score in the highest third (least losses) of all players. They kept score as they went along, and although they had no idea how their scores compared to the scores of others, they were conscious of their accumulating losses.

Four-hundred and forty four subjects participated in the second experiment. They were also volunteers from a Political Science Research Subject Pool (PSRSP) composed of North Carolina State University students enrolled in an introductory American Politics course (PS201).

Results

As Hypothesis 1 indicates, we expected that our ultimatum games framed as social encounters would elicit offers comparable to the offers reported from games using strictly monetary payoffs. As Table 1 indicates, the overall mean of offers was 42.4% of the resource being divided. This mean falls into the range identified by previous researchers. The second element of Hypothesis 1 is also supported by our data. The overall mean of rejected offers was 36.5%, again within the range identified in previous experiments. Further evidence of "fair play" in response to these scenarios is the fact that no offer fell below 20%.

<<<Insert Table 1 About Here>>>

Hypotheses 2a & 2b focused on differences between the substantive areas addressed by the three scenarios. We expected the territory scenario to elicit more 50-50 simple divisions and also anticipated

the narrowing of the overall means of offers and the means of rejected offers. Table 2 shows the distribution of simple divisions and the differences between the overall means of offers and the means of rejected offers across the different scenarios. Neither hypothesis is supported by our data. Instead, Table 2 demonstrates the remarkable stability of the incidence of simple division (50-50 offers) and of offers and rejected offers across the trade and territory scenarios.

<<<Insert Table 2 About Here>>>

Hypotheses 3a & 3b focused on differences between the individual and small-group resource division games. As in Hypotheses 2a & 2b we hoped to discern some change in the number of simple divisions and the spread between overall means of offers and the means of rejected offers. Table 2 also shows the distribution of simple divisions and the differences between the overall means of offers and the means of rejected offers for individuals versus groups. While not statistically significant we do observe an increase in simple divisions from 27.6% to 34% (when hyper fair offers are included) as we move from individuals to groups. Hypothesis 3b also receives support from our data as the gap between overall means of offers and the means of rejected offers shrinks from 6.7 to 3.7. These are not huge contrasts, but they suggest that there may be some meaningful differences between individual and group approaches to resource division.

Overall, however, subject response to the SUG is incredibly stable. The best illustration of this can be seen in Figure 1 where the incidence of offers in the territory scenario for both individuals and groups are depicted.. We observe two clear modes, one at 50/50 and one at 60/40. (In the game subjects could set their offers anywhere along a continuous scale). To the left are a few hyper-fair offers, and to the right a range of exploiters. We believe that these two modes capture two sub-types of players, those who practice “strict division” (50/50) and those who practice “entitled division” (60/40). Proposers in all our scenarios have somehow earned the right to make the offer, and so a 60/40 proposal may simply reflect an acceptable premium within the bounds of fair play. Clearly these types

are distributed in the same way across individuals and groups.

<<<Insert Figure 1 About Here>>>

When we turn our attention to the Iterated Losses Ultimatum Game (ILUG) we observe in Table 3 a statistically significant drop-off of mean offers as the game progresses and losses accumulate, although a plateau seems to be reached between the third and fourth plays of the game. This is evidence in support of Hypothesis 4a.

<<<Insert Table 3 About Here>>>

In other words, by placing subjects in this painful circumstance, we can depress the level of their offers. This suppression of fair offers is also confirmed by the incidence of simple division. The steady decline in the combined total for 50/50 and 40/60 divisions is notable, and is consistent with Hypothesis 4b, although once again there appears to be a limit reached at the third play of the game at which point this decline stops. In summery, although behavior in the UG is generally very stable, it is possible to shift it by altering the frame and the strategic environment, as we have done in the ILUG.

Finally, Hypothesis 5 suggests that given the certainty of losses when rejecting offers, the mean of rejected offers should also decline under iterated play. In Table 4 we see just such a persistent decline. Furthermore, Hypothesis 6 suggests that the gap between the mean of offers and the mean of rejected offers will increase relative to the baseline established in the SUG. Table 4 reveals that the minimum gap is 9.5 and the maximum 12.3, whereas in Table 2 the gaps in the SUG range from 3.7 to 6.7. It is interesting to note, as shown in figure 2, that the gap does not increase across iterated play, but is significantly larger from the first play.

<<<Insert Table 4 About Here>>>

<<<Insert Figure 2 About Here>>>

Although subjects did sanction more as offers became less generous, the most significant finding is that they began sanctioning at significantly lower levels from the first play of the game. In short, these findings are consistent with our claim that the persistent disposition for fair play exhibits itself as a mix of two behaviors: a willingness to practice simple division and a willingness to sanction chiselers. Both behaviors can be suppressed by change in the strategic environment, but limits to this suppression are quickly reached. Furthermore, the pro-social behavior of sanctioning seems to be more sensitive to the environment than the tendency to make fair offers.

Conclusion

Our results are consistent with our overall argument. Social encounters elicit offers similar to those observed in monetary encounters. Groups may be slightly more generous, but the evidence is not significant. People seem to be perfectly insensitive to the kind of scenario being played. In summary, there is tremendous stability in subject behavior when playing the ultimatum game. However, we have designed a version of the UG, the ILUG, which does shift subject behavior, but only within limits. In other words, this experiment goes some way towards mapping the degree to which our disposition for fair play is contingent on environmental variables, as opposed to the degree to which it persists regardless.

By employing the insights made available by EP we believe that we have come up with a novel approach to an aspect of international politics that has been overlooked. There is a surprising amount of fair play in politics, involving simple agreements lubricated by symbolic concessions. We not only have an explanation for this phenomenon, but also for why it has been overlooked. Humans have an inherited disposition for fair play. It is often but not always thwarted in the modern world, leading to anger and a sense of victimization. However, where legitimacy is needed--i.e. among democracies--

simple division can flourish. We would also argue that this phenomenon has been little commented on because social scientists themselves share in the disposition and, thinking it obvious, they have made little effort to understand it.

To many political scientists this will appear to be a novel and perhaps suspect line of reasoning. However, EP is widespread among many other sub-fields in the social and biological sciences, including psychology and anthropology. In fact, we argue that any work in political science must rest upon assumptions about human psychology that are consistent with the accumulated findings of evolutionary psychology. Any work inconsistent with what we now know of our evolved selves is fundamentally flawed. It would be as if a scientist proposed a biological explanation for some phenomenon inconsistent with the basic findings of chemistry. Indeed, by making political science consistent with psychology and biology we join a chain of scientific explanations for natural and physical phenomena stretching from physics to politics. This represents the foundation for a true science of society.

Bibliography

Axelrod, Robert 1984 *The Evolution of Cooperation* (New York: Basic Books)

Brams, Steven J. and Alan D. Taylor 1996 *Fair Division: From Cake-Cutting to Dispute Resolution* (Cambridge: Cambridge University Press)

Bowles, Samuel, Robert Boyd, Ernst Fehr and Herbert Gintis 1997 "*Homo Reciprocans*: A research initiative on the origins, dimensions and policy implications of reciprocal fairness" Unpublished mss.

Buss, David M. 1992 "Mate preference mechanisms: Consequences for partner choice and intra-sexual competition" in Barkow, Cosmides and Tooby eds. *The Adapted Mind; Evolutionary Psychology and the Generation of Culture* (Oxford: Oxford University Press)

Camerer, Colin and Richard Thaler 1995 "Ultimatums, Dictators and Manners" *Journal of Economic Perspectives* 9, 2:209-219

Cosmides, Leda and John Tooby 1992 "Cognitive adaptations for social exchange" in Barkow, Cosmides and Tooby eds. *The Adapted Mind; Evolutionary Psychology and the Generation of Culture* (Oxford: Oxford University Press)

Dennett, Daniel C. 1995 *Darwin's Dangerous Idea: Evolution and the Meaning of Life* (New York: Simon and Schuster)

de Waal, Frans 2001 *The Ape and the Sushi Master: Cultural Reflections of a Primatologist* (New York: Basic Books)

Gintis, Herbert, 2002 *Game Theory Evolving* (Princeton: Princeton University Press).

Hamilton, William D. 1964 "The genetic evolution of social behavior" *Journal of Theoretical Biology* 7:1-52

Heinrich, Joseph, Robert Boyd, Samuel Bowles, Colin Camerer, Enst Fehr, Herbert Ginits, Richard McElreath, Michael Alvard, Abigail Barr, Jean Ensminger, Kim Hill, Francisco Gil White, Michael Gurven, Frank Marlowe, John Q. Patton, Natalie Smith, and David Tracer, 2001, 'Economic Man' in Cross-cultural Perspective: Behavioral Experiments in 15 Small-scale Societies, Santa Fe Institute, Working Paper # 01-11-063.

Hoffman, Elizabeth, Kevin McCabe, and Vernon Smith 1994 "On expectations and the monetary stakes in ultimatum games" *International Journal of Game Theory* 23

Holbrooke, Richard 1998 *To End a War* (New York: Random House)

Kagel, John H., Chung Kim and Donald Moser 1996 "Fairness in ultimatum games with asymmetric information and asymmetric payoffs" *Games and Economic Behavior* 13:100-110

Kagel, John H. and A.E. Roth, 1995, *Handbook of Experimental Economics* (Princeton: Princeton University Press).

Kahneman, D. & Tversky, A. (1979) Prospect theory: An analysis of decision under risk. *Econometrica, 47*, 263-291.

Levy, J. S. (1992a) An introduction to prospect theory. *Political Psychology, 13*, 171-186.

March, J. G. & Shapira, Z. (1987) Managerial perspectives on risk and risk taking. *Management Science, 33*, 1404-1418.

Milner, Helen V. 1998 *Interests, Institutions, and Information: Domestic Politics and International Relations* (Princeton: Princeton University Press)

Nowak, Martin A., Karen Page and Karl Sigmund 2000 "Fairness versus reason in the ultimatum game" *Science* 289:1773-1775

Pinker, Steven, 1994 *The Language Instinct* (New York: Harper Collins)

Quattrone, George A., and Amos Tversky, 1988, Contrasting rational and psychological analyses of political choice. *American Political Science Review* 82, 719-736.

Ridley, Matt 1999 *Genome: The Autobiography of a Species in 23 Chapters* (New York: Harper Collins)

Roth, Alvin E., Vesna Prasnikar, Masahiro Okuno-Fujiwara, and Shmuel Zamir 1991 "Bargaining and market behavior in Jerusalem, Ljubljana, Pittsburgh and Tokyo: An experimental study" *American Economic Review* 81, 1:1068-1095

Small, Meredith 1998 *Our Babies Ourselves: How Biology and Culture Shape the Way We Parent* (New York: Anchor Books)

Tooby, John and Leda Cosmides 1992 "The psychological foundations of culture" in Barkow, Cosmides and Tooby eds. *The Adapted Mind; Evolutionary Psychology and the Generation of Culture* (Oxford: Oxford University Press)

Trivers, Robert 1971 “The evolution of reciprocal altruism” *Quarterly Review of Biology* 46: 35-56

Wlliams, George C. 1966 *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought* (Princeton: Princeton University Press)

Wilson, Edward O. 1978 *On Human Nature* (Cambridge: Cambridge University Press)

Wright, Robert 1994 *The Moral Animal: Evolutionary Psychology and Everyday Life* (New York: Vintage Books)

Table 1
Means of Offers and Rejected Offers, Standard Ultimatum Game

Overall Mean of Offers-		42.4
Overall Mean of Offers by Scenario-		
Trade	(n=29)	40.7
Territory	(n=51)	42.8
Territory (Group)	(n=50)	43.1
Overall Mean of Rejected Offers-		37.3
Overall Mean of Rejected Offers by Scenario-		
Trade		34
Territory		37.2
Territory (Group)		39.4
Minimum Offer-	20	
Maximum Offer-	80	

Table 2
Number of Simple Divisions (50:50) and Gap Between Overall Means of Offers and Means of Rejected Offers, Standard Ultimatum Game

Overall Simple Divisions-	40/146 (27.4%)	
Simple Divisions by Scenario-		
Trade	8/29 (28%)	
Territory (Individual)	17/51 (33%)	2 hyper-fair offers
	19/51 (37%)	including hyper-fair offers
Territory (Group)	11/50 (22%)	6 hyper-fair offers
	17/50 (34%)	including hyper-fair offers
Overall Means Gap (Rejected Offers-Offers)- 5.2		
Means Gap by Scenario (Rejected Offers-Offers)-		
Trade	6.7	
Territory (Individuals)	5.6	
Territory (Groups)	3.7	

Table 3
Means of Offers and Incidence of Simple Division, Iterated Losses Ultimatum Game
n= 222

Mean of Offers by Scenario-

Pollution	41.3
Quotas	38.6
Security	35.2
Territory	34.2

Incidence of Simple Division % (strict or 50/50/entitled or 40/60/total)

Pollution	29.7%	47.3%	77%
Quotas	23%	40.5%	63.5%
Security	14%	34.7%	48.7%
Territory	12.2%	36.9%	49.1%

Table 4
Mean of Rejected Offers and Gap Between Overall Means of Offers and Means of Rejected Offers, Iterated Losses Ultimatum Game
n= 222

Mean of Rejected Offers by Scenario-

Pollution	29
Quotas	28.3
Security	25.7
Territory	23.3

Means Gap by Scenario (Rejected Offers-Offers)-

Pollution	12.3
Quotas	10.3
Security	9.5
Territory	10.9

Figure 1
Distribution of Offers by Individual and Group

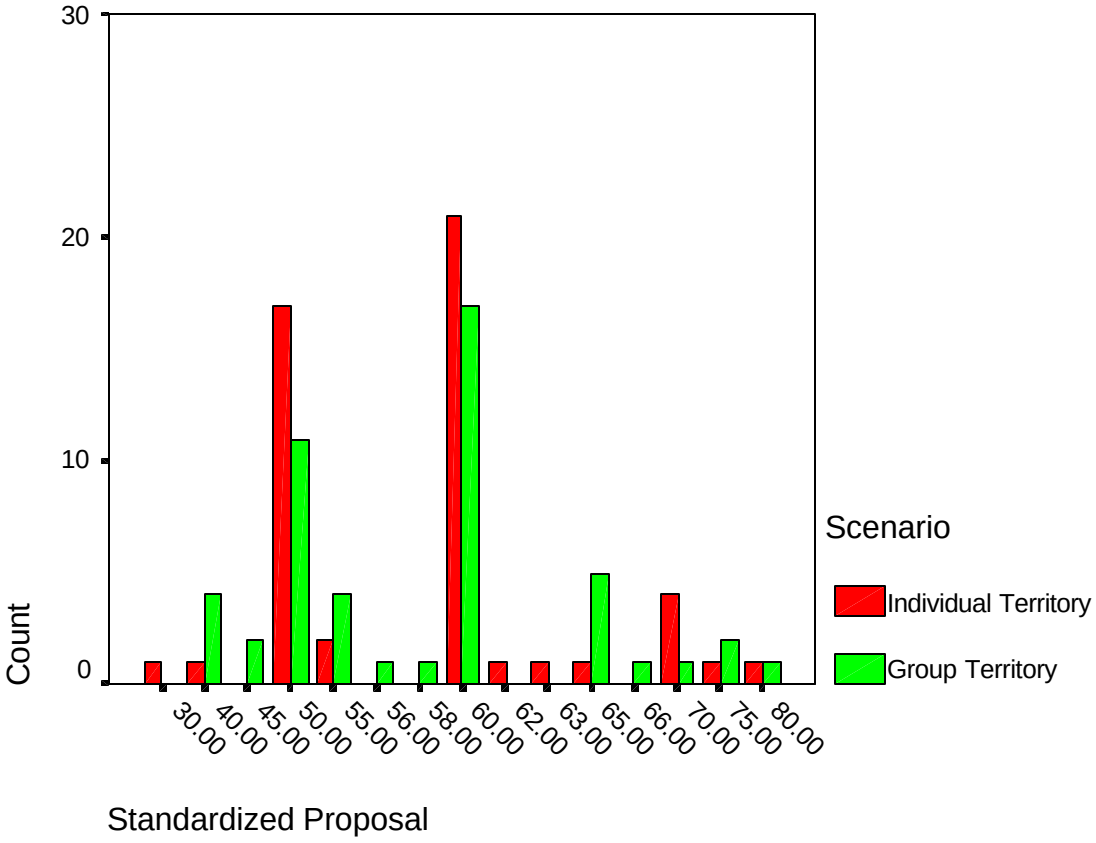


Figure 2
Gap Between Overall Means of Offers and Means of Rejected Offers, SUG

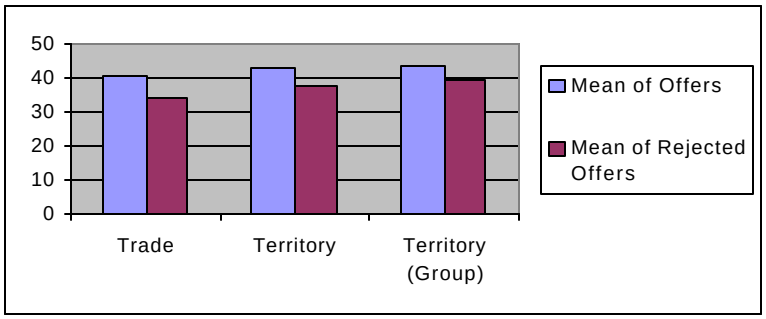
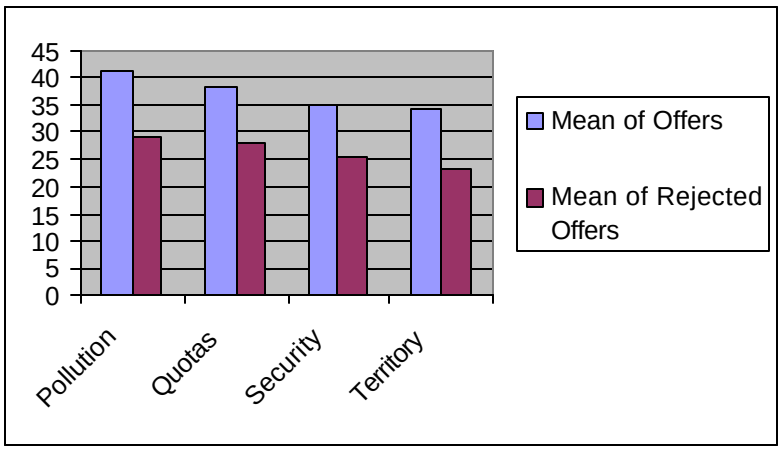


Figure 3

Gap Between Overall Means of Offers and Means of Rejected Offers, ILUG



Appendix A
Resource Division Scenarios

Scenario A (Trade-Ruritania) You are the trade minister for Ruritania, a developing country in Southern Europe. Your country, and your neighbor, Mauritania, sell cheap textiles in the U.S. market under a quota system in which both countries each have the right to sell 250,000 children's pants each year. The U.S. has proposed an overall increase in the quotas of 100,000 units, to be divided between both countries. Because Ruritania has supplied diplomatic help on other issues, U.S. trade officials will accept any division of this increase in the quota that Ruritania proposes, so long as Mauritania, your neighbor, accepts the proposal. If Mauritania refuses, then no one gets the increase–it will be allocated to some other region of the world. What division of the increased quota will you propose to Mauritania?

Scenario A (Trade-Mauritania) You are the trade minister for Mauritania, a developing country in Southern Europe. Your country, and your neighbor, Ruritania, sell cheap textiles in the U.S. market under a quota system in which both countries each have the right to sell 250,000 children's pants each year. The U.S. has proposed an overall increase in the quotas of 100,000 units, to be divided between both countries. Because Ruritania has supplied diplomatic help on other issues, U.S. trade officials will accept any division of this increase in the quota that Ruritania proposes, so long as Mauritania, your country, accepts the proposal. If Mauritania refuses, then no one gets the increase–it will be allocated to some other region of the world. Do you accept or reject the division of the increased quota proposed by Ruritania?

Scenario B (Territory-Ruritania) You are the foreign minister for Ruritania, a developing country in Southern Europe. Your country, and your neighbor, Mauritania, have an ongoing dispute over a small border area that is currently under the control of the United Nations. The UN has decided that it can no longer afford the cost of administering the disputed area and has called for the resolution of this squabble. Because Ruritania has paid its UN dues and contributed troops to a number of other peacekeeping missions, UN officials will accept any division of this 10,000 square kilometer territory that Ruritania proposes, so long as Mauritania, your neighbor, accepts the proposal. If Mauritania refuses, then no one gets the land–the UN will be forced to continue its trusteeship. What division of the disputed land will you propose to Mauritania?

Scenario B (Territory-Mauritania) You are the foreign minister for Mauritania, a developing country in Southern Europe. Your country, and your neighbor, Ruritania, have an ongoing dispute over a small border area that is currently under the control of the United Nations. The UN has decided that it can no longer afford the cost of administering the disputed area and has called for the resolution of this squabble. Because Ruritania has paid its UN dues and contributed troops to a number of other peacekeeping missions, UN officials will accept any division of this 10,000 square kilometer territory that Ruritania proposes, so long as Mauritania, your country, accepts the proposal. If Mauritania refuses, then no one gets the land–the UN will be forced to continue its trusteeship. Do you accept or reject the division of the territory proposed by Ruritania?

Appendix B
Losses Scenarios

Scenario A

You are the president of Algo, a developing country in Southeast Asia. Your country, and your neighbor, Utland, share a border that runs along a large river. The river then passes through a powerful neighboring country, Candur, before reaching the sea. Unfortunately numerous factories located in both Algo and Utland discharge pollution into this river, which has imposed significant costs on Candur. Candurian officials have given both countries an ultimatum: Algo and Utland *together* must pay clean-up costs of $10 million. However, because Algo has supplied diplomatic help on other issues, Candur will accept any division of this payment that you, Algo, propose, so long as Utland, your neighbor, also accepts the proposal. If Utland refuses, then Candur has informed you that it will imposes taxes on the important trade that passes up the river to each country. The taxes will cost *each* upstream country at least $10 million. What division of the clean-up costs will you propose to Utland?

Scenario B

You are the president of Algo, a developing country in Southeast Asia. Your country, and your neighbor, Utland, sell textiles in Candur, a third country that borders on each of you. These sales are made under a quota system in which both Algo and Utland each have the right to sell 200,000 pants every year. Unfortunately, as a result of domestic political pressure, Candur has decided to reduce the overall number of pants that it imports by 100,000 units, a reduction to be divided *between* both exporting countries. Because you, Algo, have supplied diplomatic help on other issues, Candur's trade officials will accept any division of this reduction that you propose, so long as Utland, your neighbor, also accepts the proposal. If Utland refuses, then the trade officials have informed you that *each* country will have to reduce its exports to Candur by 100,000 units. What division of the reduced quota will you propose to Utland?

Scenario C

You are the president of Algo, a developing country in Southeast Asia. Your country and a neighbor, Utland, have traditionally relied on a powerful regional ally, Candur, for security. Due to a decade long recession in Candur, its government has decided to reduce funding of the CAU (Candor-Algo-Utland) alliance. In order to maintain the alliance, the Candurian parliament has decided that Algo and Utland must *together* contribute an additional $20 million. However, because Algo has supplied diplomatic help on other issues, Candur will accept any division of this payment that you, Algo, propose, so long as Utland, your neighbor, also accepts the proposal. If Utland refuses, then Candur will withdraw from the CAU alliance. If this occurs, both Algo and Utland will need to spend $20 million *each* to provide their own security force. What division of the security burden will you propose to Utland?

Scenario D

You are the president of Algo, a developing country in Southeast Asia. Your country and your neighbors, Utland and Candur, share a border area that is populated by a nationalist ethnic minority. After years of conflict, your countries have decided to renounce your claim to this territory and allow a new state to form. Candur, the largest and most powerful of the three states has agreed to give up 5 million square kilometers. The Candurian government has demanded that Algo and Utland *together* give up an additional 2 million square kilometers. However, because Algo supplied diplomatic help on other issues, Candur will accept any division of this land redistribution that you, Algo, propose, so long as Utland, your neighbor, also accepts the proposal. If Utland refuses, then Candur will reduce its land concession and force Algo and Utland to *each* give up 2 million square kilometers. What division of this land redistribution will you propose to Utland?

Endnotes

1. An earlier version of this paper was presented at the annual meeting of the Midwest Political Science Association, Chicago, April, 2002. We gratefully acknowledge the comments of Susan Alberts, Peter Furia and Michael Cobb.

2. The formula was the same one proposed earlier by the so-called "contact group" made up of the U.S., Russia and several European countries. It had, therefore, the property of a prominent solution to the division game.

3. Of course each side was aware of variation in the land to be divided. Negotiations were especially fierce over specific cities, for example Sarajevo. However, territorial concessions had to be balanced. Formal analysis of the problem of dividing heterogenous goods suggests that efficient and fair division does not require a fifty-fifty split. Indeed, such a split may be neither efficient nor fair given variation in the intensity of preferences over different elements of the good to be divided (for applications to political science see Brams and Taylor, 1996).

4. This phrase may trouble the reader. However, biologists think in terms of design all the time. Organisms have attributes that are designed (by selection) to meet functional needs (imposed by the environment). Understanding the purpose of an attribute is accomplished by a process of "reverse engineering". For example, the observation of the presence of one-way valves in veins led to the discovery of the circulation of blood.

5. The genotype is an individual's total complement of genes, which can be thought of as the blueprint for a not-yet-existing organism. The phenotype is the actual individual expressed in nature based on a particular genotype. In other words, identical twins share one genotype, but are two different phenotypes. The differences between the phenotypes are due to slight variation from very early on, even *in utero,* in the environment encountered by each as their genetic endowment was transformed into a living being.

6. It is worth noting here that uncles have, roughly, as much genetic material in common with nieces and nephews as grandparents do with their grandchildren.

7. Altruism of this kind is not restricted to *homo sapiens*, or even primates. The practice has an evolutionary history of several million years or more.

8. Of course, extremely low offers will continue to be rejected as the difference between the loss from rejection and the loss from acceptance becomes less consequential. An eventual plateau is expected in the decline for both offers and accepted offers.

9. In the final play of the iterated losses game we may observe less stable behavior. Proposers may grow conservative in the wake of successful play or excessively risk acceptant as they gamble for resurrection. Responders may likewise become conservative if they have done well or vengeful if they

see little hope. This is suggested by research that has revealed the existence of survival/suicide levels in iterated risky decision making (March and Shapira 1987) .