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by

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Abstract

Many economically-oriented anthropologists assume, often implicitly, that humans are rational calculators who weigh the costs and benefits of each decision and select the behavior that best achieves their goals, given the constraints of their particular circumstances. Further, such researchers typically rely on an incomplete, often static, view of cultural factors which relegates culture to the explanation of last resort, only to be revived when all other explanations have failed. "Culture" is evoked to explain exotic practices or strange exogenous preferences that resist a rational or cost-benefit re-interpretation. In disputing this prevalent view of human decision-making, I marshal evidence from throughout the social science to show two things: 1) that humans cannot be effectively modeled as primarily rational decision-makers or cost-benefit analysts; and 2) instead of individual-level cost-benefit calculation, people acquire *most* of their behavior, ideas, beliefs and values from other people via social learning or cultural transmission. Building on this, I argue that various kinds of cultural transmission processes give rise to the subtle, often intricately-integrated, adaptive behavioral patterns that we observe ethnographically (as well as the maladaptive ones) without the unrealistic assumptions about human cognition and information processing, which are ingrained in the cost-benefit approach.

Keywords: Economic Anthropology, Cultural Transmission, Adaptation, Decision-making

By integrating evidence from diverse fields such as economics, cognitive psychology and anthropology, this paper challenges the rational-actor or individual-level cost-benefit models that, often implicitly, dominate much of economically-oriented anthropology, including approaches like political ecology, behavioral ecology and cultural materialism. I argue that researchers must reduce their reliance on the rational or cost-benefit models and incorporate a cognitively more-informed understanding of human learning, information processing and cultural transmission. Synthesizing this greater psychological detail with an understanding of the cultural evolutionary processes to which they give rise will assist us in illuminating the behavioral patterns at both the individual and group levels—including how such processes can generate the patterns of adaptation and maladaptation so frequently observed in anthropological literature.

The issue debated here is not whether individuals or groups are well-adapted to their environmental, socioeconomic and/or political circumstances. This question is one of *process*: how or why do individuals or groups alter their behaviors or behavioral strategies to adapt, and sometimes mal-adapt, to their circumstances. Numerous anthropological studies from many different societies have convincingly shown that individuals and groups possess behavioral practices that are well suited to their environments or quite 'sensible' given the socioeconomic situation. However, from a cognitive perspective, it remains unclear whether humans can and do perform the cost-benefit or rational analyses (hereafter termed 'CBA') that could lead to the kinds of adaptation (and maladaptation) that we observe.

In this paper I will try to convince you of the following five claims:

1) Many economically-oriented anthropologists often assume, implicitly or explicitly, that humans are rational calculators who weigh the costs and benefits of each decision and select the behavior that best achieves their goals (which could be to maximize self-interest, group-interest, individual fitness, inclusive fitness, or something even more fuzzy) given the constraints of their particular social, ecological and economic circumstances. Put simply: individuals assess their situations and do 'sensible things'.
2) Many economically-oriented anthropologists rely on an incomplete, often static, view of cultural

factors which relegates culture to the explanation of last resort, only revived when all other explanations have failed. "Culture" is evoked to explain exotic practices or strange exogenous preferences that resist a rational re-interpretation.

3) Humans are not primarily rational decision-makers or cost-benefit analysts. Substantial empirical evidence from economics, psychology and anthropology demonstrates that humans cannot be accurately modeled as rational actors or cost-benefit analysts.

4) Instead of individual rational calculation, we acquire most of our behavior, ideas, beliefs and values from other people via cultural transmission. Culturally acquired behaviors may be improved through individual learning (e.g. trial & error experimentation). These two processes, not rational calculation, account for most of human behavior—especially economic behavior.

5) Various kinds of cultural transmission processes can give rise to subtle, often intricately integrated, adaptive behavior and/or maladaptive traits at both the individual and group levels without anyone figuring out anything very complex. People can be doing quite 'sensible things' without anyone doing much cost-benefit calculation.

At the core of economically-oriented approaches in anthropology lies the assumption that individual actors cognitively evaluate (process) *payoff-relevant* information in order to assess the relative costs and benefits of alternative actions. By *payoff-relevant* information, I mean information from the environment (including the social world) that relates to the relative differences in costs and benefits of alternative behaviors or actions. In this approach, people process this information and then adopt behaviors that increase benefits and/or reduce costs—which is equivalent to maximizing the ratio of the benefits over costs. So, what many anthropologists mean, in economics terminology, is that individuals (or households) seek to maximize their utility—and utility in this case is defined as the benefits/costs ratio. Specifically what constitutes 'benefits' and 'costs' varies among anthropologists and often from ethnographic situation to ethnographic situation. Often benefits are protein, calories, security, resources, cash, children, wives, social status, etc., while costs are typically time, labor, social disharmony and risk. It often seems that anthropologists first describe what people are doing, then figure out what quantities people could be maximizing and minimizing that would produce this behavior.

We don't want to get stuck in the mire of definitions. For many anthropologists, 'cost-benefit maximization,' 'rational behavior' and doing 'sensible things' mean roughly the same thing. For economists, philosophers and some psychologists, these terms often mean quite different things. For example, many of the 'rational' predictions of positive game theory in bargaining situations seem absurd to us if we consider what seems 'sensible' or what maximizes typical anthropological benefit/costs ratios. However, for the purposes of this paper, what lies at the core of all of these approaches, implicitly or explicitly, is the cognitive processing and evaluation of payoff-relevant information—this is what I claim people don't do very much.

Claims 1 & 2: Economically-oriented anthropologists: (1) *assume* that individuals perform cost/benefit calculations, and (2) relegate culture to the explanation of last resort.

In this section I will detail some examples from recent work in economic anthropology to demonstrate how researchers model individuals as cost-benefit calculators, and how cultural explanations are only invoked when CBA fails. In each case, I first explain the situation, quote where appropriate, and then detail the types of information and calculations necessary for the for the claim. Finally, I point out how authors deploy culture and cultural explanations.

Netting's description of the approach he calls "practical reason" best captures the general framework used by many cultural ecologists, economic anthropologists and political ecologists. He writes that practical reason, "hypothesizes that individuals, acting together in households, make rational choices about the costs and benefits associated with various alternatives" (1993: 61). Netting further states his agreement with Wilk's conviction (1991 p.85):

> My working hypothesis is that agrarian social groups, including the household, are constituted partially as work groups that motivate and apply the proper combination of labor, knowledge, and leadership to each task in an efficient (if not the most efficient) fashion. Existing social form provides a template for acceptable change; innovations are selected and molded according to what is socially and technically practical.

So, according to Wilk and Netting, people are "practical" (i.e. 'rational' or 'sensible'). Households analyze costs and benefits that include social compatibility and social costs (Wilk's "template") in order to choose among alternative social forms and innovations. This CBA allows them to achieve "efficient" combinations of labor, knowledge and leadership. Culture is not mentioned, so presumably the social transmission of ideas, beliefs and behaviors does not substantially affect behavior, choice or the diffusion of innovations (also see Rocha 1996:16).

Stonich (1993: 109) uses a similar cost/benefit approach as she explains why farmers in the town of Oroquina (Honduras) rely on a system of intercropping of corn and sorghum:

> This farming system is a compromise between the clear cultural preference for corn, the staple of the peasant diet, and the need for the less desirable but climatically better adapted and more reliably yielding sorghum...The function of the more drought tolerant sorghum as a risk reduction crop is illustrated...

Here, in microeconomic terms, farmers are maximizing a benefit/cost function containing both a "cultural" preference for corn and a (rational?) preference for "better adapted and more reliably yielding" crops (sorghum in this case). To accomplish this farmers must calculate the proper amount of sorghum to cultivate, given the strength of their cultural preference, their desired degree of risk reduction, the average yields of corn and sorghum, and the variance in those yields (the variance is required to assess the risk involved). All this requires an accurate recall of crop production from previous years, the ability to calculate expected yields and variances, and some capacity to integrate and process all this information.

A further question arises from considering this information processing: How do Oroquinan farmers know *not* to plant crops that they don't routinely plant (and thus have no information on)? That is, why don't these farmers plant rice, millet or manioc? Do they somehow know the expected yields and yield variances for each of these, and can thus eliminate them?

Regarding culture, it seems that corn becomes a "cultural preference" when it doesn't make good rational sense. The implication is that farmers should plant all sorghum, but don't because a cultural preference gets in the way. When people behave irrationally, especially in the realm of economics, many researchers resort to "culture." As we'll see, an approach that incorporates an understanding of human cognition, including the psychological mechanisms of cultural transmission, eliminates the dichotomy between rational/sensible practices and irrational cultural practices. One might ask: why isn't the frequency of farmers with a corn preference or the strength of their corn preference diminishing through time? Why is the preference maintained?

Stonich also mentions risk reduction as a factor in this computation. How do farmers compute or acquire their degree of risk aversion? We know individuals and groups vary in their degree of risk aversion (Henrich & McElreath 1998). Thus, a more complete explanation should explain where this risk preference comes from—that is, why they want to reduce risk by this amount. Presumably, if they desired even less risk, they would plant even more sorghum. Why aren't they more risk averse? Is their risk aversion a cultural preference? Is it adaptive? Is it rational?

In another example, Eduardo Garland tries to explain why Andean colonists migrating into the Upper Huallaga region of the Peruvian Amazon employ extensive agricultural practices instead of more intensive agriculture methods:

> Their subsistence strategies are structured around very restrictive patterns of maximization (1995: 231). Colonists combine a strategy of reducing the requirements for labor [by cutting new land to avoid weeding] with that of minimizing risk [intensive agriculture is more productive, but requires risky expenditures]. Such an approach leads to a pattern of extensive land management and continuing deforestation... (1995: 224; brackets are my additions).

In this approach, individuals are maximizing a utility function containing a preference for little work, a preference for low risk, and a desire for greater production/profit (implicit). To arrive at this behavior, individual farmers must be able to calculate the difference in the average amount of labor required to cut a new garden vs. that necessary to continue weeding an older field, and the difference between the expected crop yields from each garden. This requires sufficient experience in both continuing to weed older gardens and cutting new gardens, as well as an accurate memory of the labor requirements and yields of each. Farmers must also be able to integrate the probability of catastrophic failure (the yield falling below a subsistence minimum) with the probability of generating greater income with higher crop yields, given environmental and market fluctuations.

Such calculations require the accurate assessment of expected yields, yield variances, environmental conditions and market prices, as well as the ability to weight and process this information. Given that these are new *immigrants,* who have little or no experience with local markets, regional price fluctuations or the effectiveness of modern inputs under local conditions, it is difficult to see how farmers could acquire the necessary information, let alone, process it.

Interestingly, Garland goes on to use this economic approach to analyze the differing rates of deforestation among five swidden agricultural groups in Peru: the Amarakaeris of the Madre de Dios, the Machiguenga of the Urubamba, the Ashaninka of Satipo, colonists of Satipo and colonists of the Upper Huallga (See Table 1). In standard fashion Garland attempts to explain these differences by first examining how factors such as land pressure, wage labor and resource availability affect individual economic decisions. However, these situational differences seem small relative to the large differences in deforestation rates between indigenous peoples and colonists (note, for example, the difference between the colonists of Satipo and the Ashaninka of Satipo). In response, his analysis moves to focus on group-level differences in such things as resource management strategies, resource diversification, and conservation ethics—things that vary, not as a consequence of individual maximizing decisions or CBA, but as a consequence of individuals having been reared in certain social groups. Once again "culture" is resurrected as a default explanation when benefit/cost maximizing fails. Unfortunately, due to the lack of any *theory of culture*, the analysis stops once something is designated as 'cultural'. The next question should be: why do beliefs and management practices differ between these groups, and how can such beliefs be maintained through time under changing economic and environmental circumstances, and in the face of opposing individual-level cost-benefit analysis?

Claim 3: Humans are not primarily rational decision-makers or cost-benefit analysts. Substantial empirical evidence from economics, psychology and anthropology demonstrate that humans cannot be accurately modeled as rational actors or cost-benefit analysts.

During the last thirty or more years anthropologists have repeatedly sought to show that peasants, smallholders, householders, foragers and horticulturalists, etc. are actually sensible, rational economic actors (e.g. Attwood 1997; Netting 1993, Barlett 1980, Harris 1979; Hames & Vickers 1983), while cognitive psychologists and experimental economists have demonstrated in hundreds of laboratory experiments and some field studies that university students, "experts," "consumers" and MBA's often behave irrationally (even in the simplest of games) and cannot perform the kinds of computations required by most economic models. The old debate in economic anthropology about whether the formal (rational) economic analysis used to understand Western industrial societies can be applied in non-western contexts seems particularly strange as an increasing number of economists abandon their standard neoclassical and game theoretical approaches in favor of new cognitive, evolutionary and adaptive-learning approaches (Weibull 1995, Young 1998; Schlag 1998; Bowles 1998; Camerer & Tek 1998; Fehr & Schmidt 1997). It seems that standard economic models don't even work in western-market contexts. In this section I review evidence from cognitive psychology, experimental economics and ethnographic research to show two things: 1) based on experimental research, humans cannot behave according to most benefit/cost models because they lack the computational abilities, and 2) in the real world, whether peasants or actuaries, humans do not behave according to cost-benefit models. As a theoretical alternative, I subsequently argue that certain kinds of cultural transmission processes can lead to the adaptive behavioral patterns we observe in the real world, and do not require the unrealistic assumptions of CBA that are entailed in the standard approaches of economic anthropology.

Humans perform poorly on lots of decision-making tasks—at least the formally-educated western subjects typically studied by psychologists and experimental economists. Our judgement is fraught with calibration misalignments, perception problems, memory biases, data processing errors, learning obstacles and subjective illusions. Consequently, any approach to understanding behavior which assumes that each individual possesses a generalized ability to evaluate information about the costs and benefits of alternative behavioral options should expect consistent, and often substantial deviations, from optimal behavior under a variety of conditions.

Anthropological proponents of this cost-benefit form of explanation might think this criticism misses the mark, as anthropological definitions of rationality are often looser than the quite precise definitions used by economists. When anthropologists say a behavior is, or set of behaviors are, 'rational' they often mean that they are "sensible" given the overall context of the individual and the individual's group. Contrastingly, these laboratory studies define "rationality" as producing behaviors consistent with the predictions of normative probability and statistics or positive game theory under standard preferences—which stand as benchmarks for comparison with actual individual decisions. Regardless of these definitional differences, however, the biases and heuristics suggested by this vast literature will surely handicap any individual's effort to evaluate costs and benefits and produce "sensible" behaviors. Instead, these biases and heuristics should generate behavioral patterns that are *predictably* suboptimal—assuming that human behavioral patterns rely primarily on the individual-level analysis of pay-off relevant information.

Because this experimental literature on decision-making has grown rapidly in both psychology and economics, many of these results are aimed at disputing or confirming specific theories within their respective disciplines. In this section however, I've tried to distill all this into a brief summary of the robust findings, and unfortunately have space only to detail a few studies as illustrative examples. Interested readers should begin with some of the excellent review papers: see Camerer (1995), Rabin (1998), Abelson & Levi (1985), and Thaler (1987).

Memory Bias

Experimental work suggests that human memories are biased by what psychologists call the *availability* (Tversky & Kahneman 1973). In accessing the probability of events or frequency of items, people search or sample from their memory. Events involving recent examples and personal experiences are more available and overweighed (judged more likely). For example, a comparison of married couples indicates that individuals overweight their responsibility and contribution toward household activities, including their contributions to negative items like starting arguments and making messes (Ross & Sicoly 1979). Similarly, in judging the likelihood of the next earthquake, individuals who have recently experienced an earthquake greatly overestimate the short-term chances of another (Camerer 1995).[1]

Some items are more "retrievable" or salient than others are in memory. For example, given a list of names of men and women, in which there are more men but more famous women, subjects remember the list as containing more women's names. Similarly, if asked which is more common, words that start with an "r" or words that have "r" as the third letter, most people reply that words which start with an "r", despite the clear predominance of words with "r" as the third letter (Tversky & Kahneman 1973).

When assessing the probability of a rare event or the risks involved in a novel task, people reveal an *imaginability bias.* When events or tasks have no precedents stored in memory, individuals judge the likelihood of risks associated with them according to the ease with which they can be imagined. In assessing the risks of a new practice or a dangerous journey, people disproportionately rely on imagining vivid potential contingencies without incorporating the probabilities of more difficult to imagine scenarios. Our capacity to evaluate such things depends on our ability to imagine different scenarios, but our ability to imagine different things does not seem to covary strongly with the occurrence of actual events (Tversky & Kahneman 1990).

If people cannot accurately store and retrieve the relevant information (see Kahneman et. al. 1982 for more biases), how can we expect them to properly compare crop yields from previous years, notice recurrent patterns in the environment, or accurately assess what past events tell them about the present? Now, from a cognitive/evolutionary perspective, memory should not be thought of as a monolithic information storage device, but rather a space differentially allocated and organized to meet the fitness challenges of life in our ancestral environment. Humans should be best at acquiring, storing and accurately recalling information that would best assist them in survival and reproduction.[2] For our purposes however, it does not matter if humans excel at remembering fitness enhancing items and forgetting other information. What matters is whether people possess sufficient memories of events and items, which were *never* encountered or selected for in the ancestral environment, in order to perform the computations required by most benefit/cost approaches. Can people, for example, remember a sufficient number of crops yields, rainfalls, labor allocations and market prices to make economic decisions in the way many economic anthropologists think that they do? This evidence strongly suggests that they cannot.

Data processing biases

In addition to biases in their recall of information, people have difficulty processing information. They often make systematic errors in processing information and making judgments. In this section, I review a small fraction of this data for six areas: sample sizes & the gambler's fallacy, regression to the mean, covariation detection and forecasting.

Sample Size and the Gambler's Fallacy

Humans often under weight or sometimes even ignore the effect of sample size when using data, depending on the type of problem. People reason as if they assume that samples of any size will be representative of the distribution or underlying process from which they arise (the '*representativeness heuristic*'). Small samples are often weighted as heavily as large samples. This means that individuals gather too little data and over generalize from these small samples to distributions, processes and decisions (Tversky & Kahneman 1971, 1993; Kahneman et. al. 1982).

For example, Kahneman and Tversky (from Nisbett & Ross 1980: 78) posed the following question to students at the University of Michigan:

> The average heights of adult males and females in the U.S. are, respectively, 5 ft. 10 in. and 5 ft. 4 in. Both distributions are approximately normal with a standard deviation of about 2.5 in. An investigator has selected one population by chance and has drawn from it a random sample. What do you think are the odds that he has selected the male population if:
>
> (i) The sample consists of a single person whose height is 5 ft. 10 in.?
> (ii) The sample consists of 6 persons whose average height is 5 ft. 8 in.?

As you might guess, a substantial majority of subjects estimated odds that favored the sample of one (choice *i*) over the sample of 6. The median odds estimated by the subjects favoring the male population for the 1-person sample were 8:1, while their odds favoring the male population for the 6-person sample were 2.5:1. The actual odds of 16:1 and 29:1, respectively, demonstrate that subjects misperceive the effect of sample size *in the opposite direction*—they favor the information provided by the small sample over a sample six times the size.

More recently, scholars have begun to refine the conditions under which humans (i.e. university students) properly weight, underweight and ignore sample size information. In a meta-analysis of this body of work, Sedlmeier & Gigerenzer (1997) have shown that people almost entirely ignore sample size when they are analyzing one kind of sample size problem (which they term "sample distributions" –a distribution of sample means), but that many people (70%) will use sample size information, in some fashion, to guide their judgments when analyzing problems involving standard frequency distributions (it still remains unclear how well they use the information). Although this distinction is an important refinement of the existing literature, and potentially related to the evolutionary origins of human brains, it does *not* help the cost-benefit maximizers that inhabit the minds and models of economic anthropologists. Lots of real economic problems, to which anthropological peoples have well-adapted solutions, would require cost-benefit analysts to compare samples of different sizes and means. Many people need to "choose" among different gathering patches, fishing spots, crops, cropping techniques, domesticated animals, and hunting techniques. This research indicates that if people and groups relied primarily on cognitive data-processing algorithms that evaluate pay-off relevant information (crop yields, hunting yields, etc.) then people would not possess very adaptive behavioral patterns.

This insensitivity to sample size may cause a phenomena termed the "gambler's fallacy" in which individuals perceive the events in the world as occurring in swings or streaks. Basketball players and fans, for example, possess an unshakeable belief that certain players get "the hothand"—meaning they're on a scoring streak (i.e. field goals are positively autocorrelated).[3] In reality, however, actual hits and misses by players are remarkably close to independent (Gilovich et. al. 1985). When presented with this information, basketball coaches refuse to accept it and don't alter their strategy. Instead, they continue trying to get the ball to the player with "the hothand." Similarly, a mistaken belief in winning streaks creates systematic errors in betting odds on professional basketball games (Camerer 1989). People also consistently see streaks and patterns in random data (Bar-Hillel & Wagenaar 1993)—such data does not 'look' random.[4]

Regression to the Mean

This insensitivity to sample size, or perhaps a tendency to assume any sample is representative of its underlying distribution or generative process, causes people to misperceive a statistical phenomena termed *regression to the mean.* I'll explain regression to the mean with an example. Pilot instructors, among many others, have learned from experience that negative reinforcement (scolding and criticism of trainees) after a poor landing performance works better than positive reinforcement after a better-than-average landing. Unfortunately for trainees, pilot instructors are mistaken. If student pilots have an average quality of landing, then some landings will be better than average and some landings will be worse than average. A particularly poor landing is likely to be followed by a better-than-average landing, and quite likely to be followed by at least some improvement. Good landings are likely (as a statistical fact) to be followed by worse landings, and often worse-than-average landings. Pilot instructors recognize this phenomena, but rather than seeing it as a statistical phenomena, they falsely assume their negative reinforcement on bad landings had a positive effect on their students and their positive reinforcement after good landings had a negative effect. Psychologists exploring the influence of both positive and negative reinforcement on performance have accounted for this statistical tendency and actually found that positive reinforcement improves average future performances and negative reinforcement retards improvement! So, in many situations, human teachers do exactly the wrong thing.

Covariation Detection and Illusory Correlation

In general, evidence from psychology shows that people are poor detectors of covariation and correlation, except under very specific conditions. For example, after reviewing the data, Nisbett and Ross (1980: 111) conclude the following:

> The evidence shows that people are poor at detecting many sorts of covariation...Perception of covariation in the social domain is largely a function of preexisting theories and only very secondarily a function of true covariation. In the absence of theories, people's covariation detection capacities are extremely limited...Though the conditioning literature shows that both animals and humans are extremely accurate covariation detectors under some circumstances, these circumstances are very limited and constrained.

People often miss subjectively important strong covariations when the interval between the stimuli and the reinforcement, or the interval between successive sets of stimuli and reinforcements, is too long. For example, few insomniacs understand how temperature, the presence of an odd smell, exercise before bed or mental concentration prior to retiring influences their ability to get to sleep. Freedman & Papsdorf (1976) demonstrated that insomniacs, whose sleep onset was delayed by a pre-bedtime exercise program, nevertheless reported that the program *reduced* their insomnia.

Besides missing strong covariations, people also frequently see correlations where none exist—a phenomenon termed *illusory correlation.* Chapman & Chapman (1967, 1969, and 1971) found that scientifically-sophisticated clinicians insist that projective tests like the Draw-a-person and Rorschach tests are important diagnostic tools, despite the *fact* that empirical validation tests consistently show that most of these associations have little or no real correlation. The Chapmans argue that clinicians have some pre-existing notions that connect specific test results to certain diagnoses, and that these notions cause them to observe correlations where none exist.

If people figure out rational solutions or perform CBA in the manner suggested by many economic approaches, then people need the ability to detect a wide variety of correlations in environmental and economic information. For example, calculating when to stop investing labor in some activity by analyzing the diminishing marginal rate of return to labor input (the point of 'diminishing returns') in a stochastic environment (every real environment) requires the cost-benefit analyst to observe correlations between labor input and productive returns. Unfortunately, humans are terrible at observing such correlations, at least in laboratory settings, so it seems unlikely that individual-level computation is responsible for the subtle and intricate ways that humans have adapted to various environments. [5]

Forecasting

In studies intended to explore our ability to incorporate multiple predictor variables in a forecast of another dependent variable, psychologists have shown that learning is very difficult in simple deterministic situations and extremely difficult in stochastic situations (Castellan 1977; Brehmer 1980). Even experts perform worse than simple linearly-weighted combinations of observable variables. In over 100 careful studies of repeated judgements about stochastic outcomes in natural settings by medical doctors, psychiatrists and other experts, researchers have consistently shown that a weighted linear combination of observable variables outperforms these "experts" under most circumstances (Dawes, Faust & Meehl 1989). For example, Dawes (1971,

1982) discovered that the success of doctoral students could be better predicted by an equally-weighted linear sum of three measures—GRE scores, undergraduate school ratings and undergraduate grades—than by the rating of the faculty admissions committee.

Effect of training, practice and expertise

Some might think that many of the biases and irrational decision-making patterns I have discussed result from a lack of training, practice or familiarity with these abstract tests. This is not the case. For example, the objection does not apply to evidence such as the basketball coaches' belief in the "hothand," the gambler's fallacy, or the systematic mistakes by odds makers, not to mention the repeated market games used by experimental economists. Outside the laboratory, actuaries and stockbrokers consistently reveal many of the same mistakes that freshmen do in the laboratory. Under some conditions, with well-structured feedback in repeated tasks, subjects can learn to avoid some of these mistakes, or at least diminish the strength of their biases, but extensive investigations demonstrate that these acquired abilities do not transfer well from task to task, across time or even when the parameters of the same task are altered (Camerer 1995). In short, there's no reason to believe that experience in the stochastic, poorly organized world of real life eliminates or even significantly reduces these errors and biases.[6]

Throughout the literature on judgment and data processing, humans place much greater weight on pre-existing theories, expectations and suspicions, than they do on data.[7] Most covariation remains quite invisible to human cognition without a pre-existing theory or expectation. The unfortunate consequence of this is that we often see correlations where none exist, just as we see patterns where only randomness exists. Perhaps researchers need to begin asking: from where do people get their pre-existing theories, expectations and suspicions. In the next section, I argue that individuals acquire them from other people via social learning.

Ethnographic Data

Ethnographic data from several anthropologists support the findings of experimental researchers, and further suggests that population-level behavioral patterns do not result from CBA. Instead, many anthropologists have found that individuals rely directly on culturally-transmitted behaviors, or on simple, tightly-defined (often culturally-transmitted) rules-of-thumb for specific decisions. Remember, I am *not* arguing that people do not have sensible or adaptive behaviors—many studies have shown that people possess adaptive behavioral repertoires. Rather, I am showing that CBA is not the primary process that generates most behavioral patterns.

During my fieldwork among Mapuche farmers in south-central Chile, I explicitly addressed the question of whether economic behavioral patterns can be explained by cost-benefit decision-making. This research, based on extensive observational, experimental and interview data from 63 farmers, clearly shows that many of the broad patterns of Mapuche economic behavior, although often quite "sensible" given their socioeconomic situation, do not result from CBA.

However, before digging into the details of particular economic behavior patterns, I will briefly sketch the ethnographic context. The description derives from my work in the rural communities of Carrarreñi, Cautinche and Huentelar around the town of Chol-Chol.[8] In this cool, wet Mediterranean climate (similar to San Francisco), the Mapuche live in widely scattered farming households that range in size from two to 38 hectares, with an average size of around 10 hectares. All practice a form of 3-field cereal agriculture using steel plows and 2-oxen teams. Most households subsist primarily on wheat (consumed in the form of bread), but many also produce oats—which are used only as animal feed. Households supplement their diets with vegetables, legumes and livestock, as well as some store-bought foods. Cash income to buy these foods and other goods such as cooking oil, chemical fertilizers and school supplies derives from a number of other sources, including (listed in decreasing degree of importance): livestock, lumber (fast-growing pines and eucalyptus trees), wage labor and cottage crafts.

My analysis examines broad patterns of economic behavior among three Mapuche communities. The goal is to find theories (cost-benefit or otherwise) that explain the general patterns found in these data. Often the particularistic or idiosyncratic explanations of informants may seem to explain the behavior of one or two farmers, but the essential question is: can these explanations elucidate the overall pattern? Often candidate models can be eliminated from competition if it's clear that individual farmers do not possess the requisite information or knowledge to make the required calculation. For example, if price is considered a key decision-making factor that individuals use, but nobody has even a vague idea of a product's market price, then models that incorporate price as a decision variable can be eliminated.

Here I analyze one of the most important decisions of farmers anywhere: which crop to plant. Among the 63 farmers, 100% always plant wheat, while 95% have never planted barley. Why not plant barley? How can we explain this strong pattern of 'barley aversion'? This aversion seems particularly strange, considering everything I have found, *including* the testimony of some Mapuche farmers, suggests that barley is a fine crop for the local conditions— perhaps better than wheat. Local agronomists, working in the region's agricultural extensions, believe barley is an excellent crop for the climate and soil, and claim that regional breweries will subsidize the purchase of seeds and fertilizers. They frequently recommend barley to Mapuche farmers, and are willing to supply some 'start-up' seeds. Similarly, crop ecologists have shown that barley sustains its yields in the face of drought much better than wheat (Loomis & Connor 1992: 374). Interestingly, the #1 farming concern of many Mapuche farmers is insufficient rainfall, and they often cite persistent droughts as the cause of their low wheat yields, yet most never plant barley.

As an economic anthropologist, my initial instincts were that the Mapuche's long experience with their land, climate, social structure, economic position and lifestyle must have revealed something to them that the agricultural extension agents and I were missing. This certainly would not have been an unusual occurrence in an anthropological inquiry. To address this, I asked 63 farmers why they (and their neighbors) do not plant barley. See Table 2.

To understand this data, first compare the behavioral pattern (95% of farmers have never planted barley) to the informants' 18 different reasons for their behavior. Notably, of the 5% (3 out of 63) who have planted barley, two have just recently experimented with it, and the other one remembers planting it over 30 years ago. Here we have a strong behavioral pattern (avoiding barley), yet farmers fail to articulate any clear reason that could explain the prevalence of this *pattern*. The most common response (1 in 5 informants) was, "nobody here plants that," as if the low frequency of this behavior justified avoiding any further consideration of the idea (suggesting the cultural transmission rule, "copy the majority;" see Henrich & Boyd 1998).

I wanted to know if this pattern of cropping behavior could result from some kind of cost-benefit cognitive processing. Almost any economically-oriented, cost-benefit, model of barley analysis would have to involve one or more of the following factors: barley yields (per unit of land), market price, labor requirements and processing difficulties/costs. I asked around, and none of my anthropological or economics colleagues could suggest a sensible model that did not incorporate at least two of these factors.

Factor 1: Can knowledge or beliefs about barley yields (as compared to wheat) account for the observed pattern? The second and third most popular responses to my inquiry about barley begin to illuminate this question. These two answers mostly arose from my secondary probes. After initially asking, "why don't you plant barley?" I would wait patiently and record any responses. After the informant had said all they wanted, I would probe a bit further by suggesting, "perhaps barley gives a poor yield." This leading question produced an interesting result: 10 farmers *disagreed* with my suggestion and claimed that barley probably produces just fine, while 9 agreed that perhaps its yields are a bit low (compared to wheat). This disagreement among farmers about the productivity of barley suggests that the *strong* pattern of barley aversion does *not* result from a pervasive belief about the productive potential of barley (accurate or otherwise). Farmers who think barley grows just fine (producing as much as wheat or more) don't generally plant barley. Similarly, those who think its yield might be low also don't generally plant barley. Further, ethnographic experience tells me that, if anything, the answers to my leading question may have biased the answers toward a "low yield" response, as some might have though it more diplomatic to simply agree with me, especially if they were uncertain about the real yields of barley. This suggests that, perhaps, more than 10 of 19 believe barley yields are equal to or better than wheat—which means beliefs about barley yields are even less likely to account for barley aversion.

Further, almost no one has any experience with barley (60 out of 63 have never planted it), or even knows anybody who does have experience with cropping barley (57 out of 63). When I asked people, "what's the yield of barley?" they would typically answer "*no tengo idea*" ("I have no idea"). In contrast, *everyone* knows the yield of wheat. Of the 10 who claim that barley has a good yield, eight have never planted it and don't plan to in the near future; one has recently experimented with it and plans to plant more; and one has not planted it, but plans to next year. Of the nine who think its yields are low, one has just recently experimented with it and plans to try it again, and eight have never planted it and don't plan to.

These data indicate that any cost-benefit models which requires knowledge about the yield of barley relative to alternative crops cannot explain the pattern of cropping among the Mapuche. There's no reason to believe that individual farmers possess experimental information or any accurate knowledge of barley's performance against other cereal crops. Further, there's no correlation between beliefs about barley yields (good or bad) and actual planting behavior. Most people admit they've no idea about barley yields, and those that do indicate a belief seem evenly divided on the issue. Meanwhile, the empirical pattern remains: almost no one plants barley or plans to plant it.

Factor 2: any cost-benefit model that includes the price of barley cannot explain the pattern of Mapuche behavior. I asked 63 farmers about the market price of barley and 57 of 61 had no knowledge of price—yet everyone knew the market price of wheat. Of those four who ventured a guess on the price, only three were anywhere in the ballpark, while one was way off (3 times the actual price). All four of these farmers believed the price of barley was equal to, or higher than, wheat. In case people were not able to give the price numerically, I also asked if they thought the price was higher, about equal, or lower than the price of wheat. Only one additional person felt they had some sense of this, and guessed correctly that barley had a somewhat high price per sack than wheat. So, not only do most people not know the price of barley, but those few who do, believe its price is higher than wheat. Consequently, cost-benefit models that include price as an important variable cannot explain the observed pattern of barley aversion.

Factor 3: it's possible that some aspect of the planting, harvesting or processing of barley makes it less desirable by increasing labor or processing costs relative to alternatives. To address this, I asked a sub-sample of 20 farmers about these aspects directly. I found that no one thought barley producing and processing would be any more difficult than wheat. Of course, only three of these 20 had ever grown barley before, and only two of that 20 had ever milled it—the other farmer sold his barley after threshing. Therefore, even if it is true that barley is more difficult to process than wheat, nobody knows that, so that cannot be the reason for the strong pattern.

This analysis indicates that any cost-benefit model of crop selection, which includes prices, yields or labor/processing costs cannot account for the pattern of Mapuche behavior. Other researchers have made similar observations. Ortiz (1980) has argued that Mexican farmers lack sufficient knowledge of weather and price dynamics to make rational decisions based on this information. Quinn (1978) has observed that the decisions Mfantse fish sellers, on going to market, do not integrate supply and demand information, and instead rely on shared heuristics.

Evidence from interviews with older farmers combined with past ethnographic work (Latcham 1909; Stuchlik 1976; Titiev 1951) among the Mapuche—and sometimes in the same communities—suggests the somewhere between 30 and 50 years ago these Mapuche farmers abandoned planting barley. Ten out of 63 interviewees mentioned that they (only one case), their fathers or their grandfathers cultivated barley. Four of these accounts note that there was a problem with *polvillo* (a symptom of a crop disease where the seeds crumple). This indicates that in the past Mapuche farmers did include barley in their planting strategy, but dropped the practice a generation or two ago as a crop disease spread. Nowadays, such crop diseases are not a serious problem as most farmers (over 90%) routinely disinfect their wheat seeds with commercially available chemicals (the same technique could be applied to barley). Thus, memories of a crop disease in barley are not the reason why so few people plant barley now. Plus, no one suggested that a fear of *polvillo* was the reason why they were not presently cultivating barley.

Finally, some preliminary evidence suggests that the practice of planting barley may be gradually re-entering the farmers' repertoire. The pattern of re-adoption suggests, not individual-level CBA, but biased cultural transmission. Two farmers have recently experimented with barley and another plans to plant it in the coming year. Of the two, Martín claims he got the idea while working a local *fundo* (a large-scale, managed farm). The other guy, Domingo, says he got the idea from a local agricultural extension agent who is also a friend. The one who intends to plant it, José, got the idea and all his information from his neighbor, Domingo. So, the practice was transmitted from one individual to another, and perhaps from higher status individuals to lower status people, or at least through social networks.[9]

Perhaps peasants acquire their behavioral strategies like MBA students (no offense to peasants). In a multi-round experiment, MBA students had to divide their allotted money among three different investment options (A, B & C). Each of these investment options had different mean returns and different amounts of variation on those returns. The returns between investments were sometimes correlated (e.g. a high yield in A probabilistically predicts a high yield in C), but these correlations changed as the game proceeded. Students were informed of all this and could also borrow money (at interest) to invest. Students were highly motivated because their overall performance strongly affected their grade in the class. After each round, the experimenters posted a ranking of each student's performance (including both their allocations and total performance). As part of their analysis, these economists regressed the decisions made in each round by each individual against those of the top-performer in the previous round and found strong evidence that students were "mimicking" the behavior of top-performers (Kroll & Levy 1992).

Further, when Kroll & Levy compared the overall results of this experiment against a previous experiment in which nothing was posted between rounds, they found that copying high performers allowed the whole group to move much closer to the optimal allocation behavior (as predicted by *Portfolio Theory*) compared to the no-copying control. Perhaps peasants, foragers and horticulturalists possess well-adapted behavioral repertoires, not because they are each powerful rational calculators, but because simple rules like 'copy the most successful individual' generate well-adapted behavior in cultural evolutionary time.

Claim 4: Instead of individual rational calculation (evaluating costs and benefits), or individual learning via trial and error or experimentation, humans acquire most of our behavior, ideas, beliefs and values from other people via social learning or cultural transmission.

In the last section I argued that individual-level, cost-benefit decision-making is insufficient to explain lots of economic behavior because: 1) individuals do *not* possess the cognitive machinery capable of making the kinds of cost-benefit analyses required by typical models, and 2) ethnographic work shows that, even if individuals do possess sufficient cognitive processing power, this cannot explain the broad-level patterns of observed behavior because individuals lack the relevant information to deploy such machinery. In this section, I argue that instead of being adept at CBA, we are actually incredibly good at, and strongly inclined towards, imitating others—unlike other animals.

Approaches to understanding how people arrive at their behaviors can be fruitfully divided into three categories: 1) individual rational calculation, 2) individual adaptive learning, and 3) cultural transmission. Using rational calculation, individuals evaluate problem-specific information related to costs and benefits aimed at achieving specifiable goals. In individual adaptive learning, people use trial and error learning, experimentation, and reinforcement stimuli to compare alternative behaviors and select among them. With cultural transmission, humans assemble their behavior repertoire through the observation and selective imitation of other individuals. Clearly, humans do *all* three of these to some degree. The interesting question is one of emphasis: What is the relative importance of each in explaining actual behavior?

Individual adaptive learning and rational calculation are both types of CBA, but still must be clearly distinguished. Individual adaptive learning requires *only* that individuals be able to make small variations in their behavior and select among those variants according to which produces the most desirable outcomes. In its most extreme form, rational calculation requires that individuals be able to project outcomes of every possible behavior (apriori, without experience or experimentation), and select the one that produces the best outcome.[10] This distinction becomes especially salient when problems are modeled as having 'complex topographies.' For a two-dimensional problem (with 2 variables), imagine a mountain range with many different peaks, plateaus, ridges and valleys. Your latitude and longitude represent the two variables that you are tinkering with, while your altitude is a measure of how good your current behavior is (your approach to the problem). Adaptive learning guides you up to a peak (a local optima), but not necessarily to the highest peak (the global optima). Once you are at the top of any one peak, there's nowhere else to go, but down to worse behaviors. In contrast, an extreme rational decision-maker can see the whole adaptive landscape and simply pick the highest peak. Consequently, under simple conditions, adaptive learning and rational decision-making yield the same equilibrium response (when there's only one peak), yet under complex conditions (i.e. realistic) adaptive learning and rational decision-making produce different behavioral responses most of the time (both different equilibria and dynamics).

Some have argued that, (2), individual learning via experimentation, allows economic actors to build adaptive behavioral repertoires (e.g. see Johnson 1971, 1972). Unquestionably, individuals do rely on trial and error learning, reinforcement learning and experimentation. However, because of the enormous variety of different behaviors that a culturally competent person must acquire, and the nearly infinite number of behavioral dimensions along which each competency could be varied, it seems unlikely that individual learning is our primary mode of behavioral acquisition—more empirical evidence is discussed later. In contrast, as the research summarized below demonstrates, social learning or imitative learning allows individuals to rapidly acquire vast repertoires of behaviors without the costs of experimentation. After cultural transmission provides a starting point, individual adaptive learning can then marginally modify and improve some components of culturally-acquired behavioral repertoires. Finally, more rational decision-making may also be applied once cultural transmission and individual adaptive learning have greatly simplified and reduced the decision-making task, and perhaps supplied the objective.

Ethnographers know that cultures are replete with patterns of subtle, often unconscious, behavioral patterns that vary from place to place. Even after months, sometimes years, of intensive study and participant observation, ethnographers only begin to acquire the basics of social interaction. Table manners, customary greetings, conversational distances, home remedies and conversational rhythms all vary substantially among groups. The vastness of a group's interactional norms, customs and beliefs cannot be accounted for by rational calculation or theories of social conditioning. If rational calculation were important, trained ethnographers would be able to figure out the proper behaviors more effectively than children. Often, the subtle, yet essential, nuances of behavior remain imperceptible to ethnographers and unconscious to informants, making them unavailable to individual calculation. Further, theories of social conditioning cannot explain these patterns because the amount of continuous punishment—the reinforcement schedule—necessary to inculcate the immense body of knowledge possessed by each individual within a culture is enormous. If reinforcement schedules were responsible for cultural repertoires, parents would have to constantly monitor each action by their children and repeatedly punish them for each little infraction until the child reaches cultural competency. In reality, parents often cannot get the desired behaviors even when punishments are severe (Bandura & Walters 1963).

In what follows I summarize evidence from throughout the social sciences which argues that humans rely heavily on cultural transmission to acquire much of their behavior, beliefs and ideas. Because I believe that most anthropologists generally accept that humans rely on cultural transmission in some domains (e.g. dialect acquisition, clothing styles, personal adornment, etc.), but that many remain skeptical about the relative importance of cultural transmission in understanding economically-essential, livelihood-related behavioral patterns, I will provide only a brief discussion of social learning theory, and will instead emphasize the cultural transmission of economic practices in real life and in experimental research in which subjects received performance-related compensation.

Social Learning Theory

In his book, *Social Learning Theory*, Albert Bandura (1977) argues forcefully that psychologists must abandon approaches that emphasize reinforcement or internal drives and replace them with a cognitively detailed understanding of social learning—an understanding of how people acquire their behaviors, ideas, beliefs and values from other people.[11] After more than two decades of research, Bandura concludes (p. 12):

> The capacity to learn by observation [learn socially] enables people to acquire large, integrated patterns of behavior without having to acquire them gradually by tedious trial and error...it is difficult to imagine a social transmission process in which the language, lifestyles, and institutional practices of a culture are taught to each new member by selective reinforcement of fortuitous behaviors, without the benefits of models who exemplify the cultural patterns (brackets are mine; 1977: 12).

Social learning research within psychology further shows that humans have the ability to infer abstract behavioral rules directly from observed behavior. Experiments demonstrated that:

> Modeling has been shown to be a highly effective means of establishing abstract or rule-governed behavior. On the basis of observationally derived rules, people learn, among other things, judgmental orientations, linguistic styles, conceptual schemes, information-processing strategies, cognitive operations, and standards of conduct (Bandura 1971; Rosenthal & Zimmerman 1977). Evidence that generalizable rules of thought and conduct can be induced through abstract modeling reveals the broad scope of observational learning (1977: 42).

Bandura's work and those of his fellow social learning theorists show that human cognition is strongly biased towards social learning. Humans will acquire behaviors and beliefs via social learning unconsciously, *without* positive reinforcement, and when they are unaware that a "correct" answer is sought or available. In experiments, individual display the same propensity for social learning regardless of incentives or whether they are informed that corrected imitation will be rewarded (Bandura et. al. 1966; Rosenthal & Zimmerman 1977). Bandura (1977: 38) writes, "one cannot keep people from learning what they have seen."

Social Influence and Conformity Research

Although much of the social influence and conformism literature is bedeviled with a failure to distinguish behavioral influences that result from individuals observing and copying the behavior of others (to acquire information) from that which results when individuals replicate the behavior of others in order to avoid appearing deviant, some recent experimental work does begin to differentiate these two.[12] For example, Baron et. al. (1996) used a lineup experiment to systematically vary both the *difficulty* and *importance* of a task. Control subjects observed slide projections of a "perpetrator" for some fixed period, and then had to pick him out of a lineup of four suspects. Test subjects faced the same task, except that they were in a room with two other 'subjects,' who were actually confederates of the experimenter. To obscure the actual structure of the experiment, seven "critical trials" were interspersed with a series of other trials. During these critical trials, both confederate subjects would give the same incorrect answer before the actual subject gave their answer. Conformity was then assessed by comparing the answers of the test subjects on these critical trials to those of the control subjects. *Difficulty* was varied by changing the amount of time a subject could view the perpetrator. Control subjects selected the correct person from the lineup 97% of the time in the easy version, but only 76% of the time on the harder version. Task importance was also varied. In the less important task, subjects performed for the "good of science," while in the more important task, subjects performed for the "good of science" *and* they received a lottery ticket for each correct answer in a $20 lottery.

In Figure 1, the y-axis plots the mean number of conforming trials (out of 7 possible), while the x-axis shows the 'less important' vs. 'more important' (i.e. unpaid vs. paid) versions. The dotted line connects the mean number of conforming trials for the treatments when the task was moderately difficult (control group got 76% correct), while the solid line connects them when the task was easy (97% correct). The key thing to note is that when *importance* increases, the social influence *decreases* as long as the problem remains *quite* easy. However, when the problem is moderately difficult, social influence *increases* when the problem becomes more *important.* This is the opposite of what would happen if subjects were concerned about appearing deviant. It seems that in costly economic situations people shift their reliance towards social learning as uncertainty rises and problem difficulty increases.

Anthropology and Child Development

In a recent paper that summarizes a great deal of research on cross-cultural studies of child development, Fiske (1998) argues that children learn most of what they need to know by observation and unconscious imitation, and not from active instruction—he doesn't even consider the possibility that children may acquire their behavior via rational calculation. Fiske finds the same patterns of imitation plus individual experimentation across time, space and anthropological subfields. Children imitate older siblings or adults; they often rehearse and perfect these imitations via play or practice; and, they receive only the most general kind of negative feedback (in most places, adequate performances are expected). As with many things, western society seems to be a strange aberration, where children may receive positive feedback and lots of active instruction (LeVine & LeVine 1977).

Children learn almost all of the their adult behavior, including their economic practices and practical knowledge, by imitation and practice. In reference to rice agriculture in Okinawa, Maretzki & Maretzki (1966: 144) write, "Children learn by observing and experimenting. Whatever adults are doing, children are present to watch their activities and overhear their conversations" (see Titiev 1951: 91 for a similar observation among the Mapuche). Block (1994:278, from Fiske 1998) gleans findings from a number of sources to make a similar point:

> In nonindustrialized societies most of what takes people's time and energy—including such practices as how to wash both the body and clothes, how to cook, how to cultivate, etc.—are learned very gradually through imitation and tentative participation...Knowledge transmission tends to occur in the context of everyday activities through observation and "hands-on" practices...

If this is true, how can economic behavior be a product of CBA? If people gradually acquire their economic practices, knowledge and values from other members of their social group, then this work suggests that economic practices result more from some form of cultural transmission, and less from individual-level evaluation.

The Diffusion of Innovations

This interdisciplinary body of literature focuses on understanding why certain ideas, technologies and practices spread, why some spread rapidly and others more slowly, and why some never spread. Rogers (1995, p.18) summarizes some of the lessons from 50 years of researc as follows:

> Diffusion investigations show that most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations are not entirely irrelevant...Instead, most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation. This dependence on the experience of near peers suggests that the heart of the diffusion process consists of the modeling and imitation by potential adopters of their network partners...

According to Rogers, thousands of studies indicate that the costs and benefits of alternative practices, no matter how clearly observed, cannot explain the behavioral change process recorded in many places. In contrast, what does consistently emerge as essential to the diffusion process ar the patterns of social interaction, modeling and imitation.

One robust finding of the diffusion of innovations literature, the "S" shaped adoption curve, argues strongly that the adoption of new ideas, practices and techniques results primarily from biased cultural transmission, and not individual adaptive learning (CBA). The "S-curve" labels the shape of the line that researchers repeatedly find when they plot the number of adoptees or frequency of adoptees vs. time (usually in years or months). These curves rise slowly, accelerate to a maximum rate near the middle, and then taper offer toward the end of the adoption cycle (forming an "S" like shape). Comparative analytical research indicates that adaptive learning models cannot produce this shape. In fact, mixed models, which include both individual adaptive learning and cultural transmission, do *not* consistently produce the "S-shape" unless biased transmission is the dominant force. Consequently, this evidence strongly suggests (over 3,000 studies) that biased cultural transmission must be a central feature in any theory about the adoption of new techniques, technologies and practices (Henrich 1999b).

If costs and benefits don't matter, then what does? Rogers (1995) argues that the diffusion of new ideas, technologies and practices is strongly influenced by "local opinion leaders." Compiling findings from many diffusion studies Rogers describes these individuals as: 1) locally high in social status (e.g. high status within the village), 2) well respected, 3) widely connected and 4) effective social models for others. This description corresponds remarkably well to what cultural transmission researchers call *prestige-biased cultural transmission* (Gil-White & Henrich 1999; Henrich et. al. 2000). This suggests that individuals will preferentially imitate ideas and behaviors (regardless of their costs and benefits) of certain other individuals according to the respect these models receive (their prestige). Prestigious individuals are more influential and more imitated than other individuals—even in domains or on topics that they know little about (e.g. people take advice about who to vote for from film actors).

Cross-cultural experimental economics

Mounting evidence from cross-cultural experimental economics strongly indicates that people from different places behave quite differently when faced with the identical economic circumstances. In these experiments, researchers use simple games, in which people receive real money, to examine how individuals behave under various kinds of economic circumstances—often involving risk, cooperation and bargaining.[13] In my own work, for example, I have used comparative data from the Machiguenga (horticulturalists in Peru), the Mapuche (subsistence farmers in Chile), the Sangu (Tanzania herders/farmers) and U.S. university students to demonstrate that behavioral choices vary enormously among groups—even when individuals confront simple (computationally tractable) situations that involve significant sums of money (Henrich 1999c; Henrich & Smith 1999; Henrich & McElreath 1998). More recently, other researchers have found substantial cultural differences in how people deal with these simple economic situations.[14]

In the most widely tested of these games, the Ultimatum Bargaining Game, two anonymous players receive a sum of money, say $160. The first player, called the 'proposer,' mus offer a portion of this sum to the second player (he can offer any amount from $0 to $160), who is called the 'responder'. Suppose the proposer offers $30. The responder, then, can either accept or reject the proposer's offer. If the responder accepts, he gets the amount of the offer (in this case, $30), while the proposer gets the remainder ($130). If he rejects, nobody get anything (both get zero).[15]

In industrial societies, Ultimatum Game proposers typically offer around 50% of the total, and responders usually accept such offers, although they will often reject offers below 20% of the total. These results are quite robust in industrial societies. In contrast, Machiguenga proposers from the Peruvian Amazon most frequently offer 15% of the total and have a mean offer of 26% of the total. And, unlike typical western subjects, Machiguenga responders would never consider rejecting a low offer.[16] Control experiments with university student confirm this substantial difference (Henrich 1999c).

This is important because it shows that even in simple economic situations (involving big money) in which everyone knows everything, and the 'rational' response could be calculated, individuals' behavior still varies substantially according to where they grew up—perhaps according to the behavioral norms, notions of fairness and expectations of punishments that they have acquired via cultural transmission from the other members of their group.

Theoretical evolutionary models predict a heavy reliance on social learning

Evolutionary anthropologists might wonder how imitative capacities can arise in a species if imitation sometimes causes individuals to do stupid, irrational, fitness-reducing things. In addressing this question, a number of theoretical evolutionary models have convincingly shown that natural selection will favor the evolution of imitative capacities under a wide range of conditions (Boyd & Richerson 1985, 1989). Imitation acts like a short-cut to a good answer (but maybe not the best answer), and evolves because it saves the cost of individual experimentation and information gathering. Cultural transmission will evolve as long as the savings created by the short-cut exceeds the costs of occasionally acquiring maladaptive or less-adaptive traits. For example, Henrich & Boyd (1998) constructed an evolutionary simulation model that allowed the degree of reliance on cultural transmission vs. individual learning (experimentation etc.) to evolve in multiple subpopulations with migration and temporally changing environments. The model robustly shows that a strong reliance on cultural transmission will emerge from a population that begins with almost a complete reliance on individual learning under a wide range of conditions. Only when environments change quite rapidly or problems are very easy, does individual learning predominate.

Appeals to intuition

To us humans, imitation seems so simple and obvious, yet it remains nearly impossible for most other primates. Even intelligent, tool-using primates like capuchin monkeys rarely, if ever, imitate in the wild—despite their intelligence, they lack the specialized capacity to copy the behaviors of fellow capuchins. Similarly, most apes cannot ape (Tomasello 1996). Why, then, is social learning or imitation so much easier for us than figuring things out for yourself? Why is plagiarism easier than writing it yourself? Why do we need rules to prevent school children from cheating? Capuchin monkeys, for example, would never cheat because it's infinitely easier for them to figure it out by-themselves. Perhaps, the reason is that human cognition was designed by natural selection to observe and imitate. As Bandura points out, people cannot help but copy what they've observed. Perhaps, humans are better classified as *Homo imitatus* than *Homo economicus.*

Individual-level adaptive learning and experimentation

Although cultural transmission is the focus of this section, I want to briefly point out how individual-level adaptive learning interacts with, and complements, cultural transmission as the primary processes that account for human behavioral patterns. Some economically-oriented anthropologists have argued that individual learning via experimentation (as opposed to rational calculation) allows economic actors to achieve adaptive ends. I agree that experimentation represents an important force of change in many places. However, in most cases experimentation tests or refines behavioral variants that have been acquired via cultural transmission. Only infrequently, do we find radical experimentation with previously unknown ways of doing things.

For example, Johnson (1971) describes how a Brazilian sharecropper, after observing a new method of planting bananas at a "technically advanced plantation," then performed a controlled experiment in which he planted alternating rows of bananas with the new and traditional methods—the traditionally-planted rows acted as a control group for comparison with the new method. Here, the farmer first acquires an idea from a 'prestigious cultural model,' and then experiments with the idea, before incorporating it into his behavioral repertoire. He did not arrive at a new method *de novo*, through rational calculation. He copied a prestigious model, and then experimented.

In my work with Mapuche farmers I've found similar cases of experimentation. Although generally the Mapuche seem less inclined towards experimentation than Johnson's sharecroppers, they too will sometimes acquire an idea from an experience working at a local *fundo,* or from someone they trust, and then experiment with the idea. The re-adoption of barley that I described earlier fits this pattern, and I've seen similar examples with the sowing of spring wheat (vice winter wheat) and the application of lime in soil management.

Claim 5: Cultural transmission processes can give rise to highly adaptive behavioral repertoires without anyone figuring out anything very complex. People can be doing quite "sensible" or adaptive behaviors without any individual doing much cost-benefit calculation or experimentation.

Anthropological research has provided us with a vast literature which shows that people behave in well-adapted ways—that people behave quite sensibly given their social, economic, political and ecological contexts. At the same time, enormous amounts of evidence have emerged from throughout the social sciences that strongly suggest that humans are neither very rational nor very adept at analyzing costs and benefits. If this is so, then how do individuals and groups end up with all these intricately-integrated, well-adapted, and often subtle behavioral patterns?

Here, I argue that certain kinds of cultural transmission processes generate highly adaptive behavioral patterns at both the individual and group-levels without individuals doing complex calculations or evaluating payoff-relevant information. These cultural evolutionary processes solve several problems: 1) they can account for the empirical observation that behavioral patterns may be adaptive at either the individual or the group level; 2) they explain common ethnographic situations in which individuals rely on well-adapted practices and behavioral rules, but seem to lack the knowledge, experience or information that would be necessary to arrive at these behaviors or rules via calculation; and 3) they have dynamic properties that may explain why groups are sometimes poorly adapted to their contexts—as well as why they are well adapted.[17] To illustrate these three points, I begin by presenting two ethnographic examples of adaptive economic practices in contexts where these behaviors clearly cannot be a product of cost-benefit analysis, and can best be explained by some form of biased cultural transmission.

Bird Augury among the Kantu of Kalimantan

Dove's analysis (1993) of how the Kantu of Kalimantan use bird augury to select swidden garden locations provides an excellent example of both the systematic errors in human judgement and how cultural evolution can provide unconscious adaptation without individual CBA. Dove first points out how some Kantus reasoned that, because destructive floods had not occurred for several years, they should locate all their gardens on high ground (because a flood seemed "due"). In contrast to this classic exposition of the 'gamblers fallacy,' Dove writes:

> Cyclical resonance is a key heuristic device in many ecological models, in industrial societies as well as tribal societies (Henderson 1987: 253 cf. Dove 1985: 76). But there is no evidence of cyclical patterns in rainfall or flooding in Kalimantan. Consequently, the nonoccurrence of a rice-destroying flood during a three-year period does not affect the statistical likelihood of such a flood during the following year: it is no more or less likely than in any other year (1993:147).

This means that interpreting floods as part of a cyclical process makes cultivators more likely to make mistakes. Cultural evolution, however, seems to have solved this problem: Kantu farmers rely on a system of cultural rules that effectively randomizes their interpretation of bird omens with respect to environmental and climatic factors, and thereby allows them to select garden sites without the negative influence of the gambler's fallacy (see Moore 1957 for similar system). Decisions depend not only on seeing a particular species of bird in a particular location, but also on what type of call the bird makes.

Dove also notes how augury rules inhibit the operation of another important learning bias—prestige-biased transmission—which could cause cultivators to copy the short-term successes of lucky neighbors (this also occurs in multi-round experiments; see Kroll & Levy 1992). He writes, "The Kantu are keen observers of one another's harvest successes and failures, and when one household enjoys conspicuous success, other households are tempted to copy its strategies" (1993: 147). Short-term strategies used by successful households in one particular year could be disastrous the following year. Cultural proscriptions, however, make the results of each household's bird augury a big secret, and the rules indicate that failure to heed one's own omens or the use any others' omens will result in bad luck and a poor harvest. Copying short-term success would also tend to homogenize the group and deplete essential, risk-managing variation. So, these rules also promote inter-household diversification, which acts as insurance against local failures of certain land types.

Interestingly, no rules prevent households from copying the bird augury *beliefs* themselves from successful neighbors. This system of bird augury seems to have evolved and spread throughout this region since the 17th century when rice cultivation was introduced—which makes good adaptive sense, as it's rice cultivation that is most positively influenced by randomizing garden locations. It's possible that, with the introduction of rice cultivation, a few farmers began to use bird sightings as an indication of favorable garden sites. On average, over a lifetime, these farmers would do better (be more successful) than farmers who relied on the gambler's fallacy. Using prestige-biased imitation, individuals would copy whole sets of traits from successful individuals, including their rules and beliefs about garden selection. Consequently, within 400 years, the bird augury system spread throughout the agricultural populations of the Borneo region, yet remains conspicuously missing or underdeveloped among local foraging groups and recent adopters of rice agriculture (illustrating a maladaptive temporal lag, as recent adopters of rice haven't yet acquired the bird augury beliefs), as well as among populations that rely on irrigation agriculture (e.g. the Rungus). Here, cultural evolutionary processes seem to have retrofited some rare beliefs about bird omens to deal the problem of garden site selection (and avoid the gambler's fallacy), and adorned this belief system with prohibitions that prevent the short-term cascade effect sometimes generated by biased imitation.

Machiguenga slash and burn agriculture

Many anthropologists and agronomists agree that swidden agriculture is adaptive in the infertile tropical soils of the Amazon (Moran 1993; Johnson 1983). Cutting and burning trees, bushes and other plants release a range of important nutrients into the soil and slows the invasion of weeds (although it also sublimates valuable nitrogen). This nutrient boost helps for a couple of years, but soil quality soon declines. When this occurs, swidden agriculturalists like the Machiguenga typically cut new gardens—sometimes every year or every other year (Johnson 1983; Baksh 1984; Henrich 1997). This practice creates an agro-ecological cycle in which farmers can always plant in richer soil, while avoiding the labor of weeding older gardens. Further, the small size of these gardens and their rapid turnover rate allows forest re-growth to fill in fairly rapidly; meanwhile these plots continue to supply supplemental foods to families.

The Machiguenga of Camisea live at the confluence of the Urubamba and Camisea rivers and farm on soils much more fertile than typical Amazonian soils. In fact, many of the soils around Camisea are even more fertile than interfuvial parts of the same region (ERM 1996). As a result, government agents have attempted to convince the Machiguenga to switch to an alternativ method of *slash and mulch* agriculture, but farmers have been entirely uninterested in this suggestion and continue to use fairly traditional swidden techniques. This led me to ask: Do swidden agriculturalists like the Machiguenga practice slash and burn agriculture because they understand the soil-enhancing and agro-ecological benefits of slash and burn agriculture, or is it part of a culturally-transmitted agricultural script (see Alcorn 1989)? As part of my investigation, asked Machiguenga farmers three questions: 1) Why do you burn after you cut a new garden? 2) Does burning or the ash affect the soil? and 3) If you had a machine to clear your garden, would you continue to burn? See Table 3.

This research indicates that the Machiguenga do not understand the adaptive connection between the burning of forest biomass in swidden agriculture and the temporary infusion of nutrients and organic matter into the soil. The Machiguenga clearly believe that, given their present agricultural system, not burning would make planting and moving about the garden too difficult (Table 3A). They recognize no general connection between burning and improving soil quality (Table 3B). And, if given the ability to clear the garden without burning, they would discontinue burning entirely (Table 3C). [18] Because no Machiguenga farmers in the region practice methods of slash & mulch agriculture, the Machiguenga of Camisea haven't had any exposure to alternative agricultural systems that deal with the difficulties of infertile Amazonian soils. Consequently, they have no way to comparatively *evaluate* the relative costs of systems that involve burning with those that do not. In this particular section of Machiguenga territory, slash & mulch *may* be superior (in terms of long-term yields per unit land), but the Machiguenga maintain an agro-ecological system adapted to more typical regional environments and lower population densities—only recently (in the last 30 years) did Machiguenga begin living in communities along major rivers near more fertile soil. Thus, the generally-adaptive pattern of tropical forest agriculture (averaged across environments and time) used by the Machiguenga cannot be a product of CBA related to ecological or productive advantages because they lack the necessary comparative information. Instead, it appears consistent with the patterns created by cultural transmission mechanisms adapting agricultural practice to more traditional Machiguenga environments—which were not along the fertile ground of the Lower Urubamba. This finding is similar to that of Alcorn (1989) for Bora and Huastec farmers, and of Wilken (1987) for Mexican farmers.

Prestige-biased cultural transmission and cultural group selection

A variety of cultural evolutionary processes can generate the accumulation and recombination of adaptive behaviors and rules, however here I will discuss only two classes of mechanisms: *prestige-biased cultural transmission* (PBT) and *cultural group selection* (CGS). Understanding PBT requires an exploration of the evolution of prestige as a novel type of status in humans—which a co-author and I have undertaken elsewhere (Gil-White & Henrich 1999). For now, this form of cultural transmission can be glossed as 'copy successful people.' But, because our complex world is full of uncertainty and noise, and it's often difficult to figure out why someone is so successful, individuals copy entire bundles of traits from successful individuals. For example, if a young hunter 'wants' to copy the best hunter in the community, how does he know what to copy? Should he imitate how the best hunter makes arrows, his tracking techniques, his carrot-rich diet, or the prayers he says after taking down a big prey? PBT allows individuals to acquire many or all of these behaviors, without paying the costs of analysis and experimentation.

PBT does *not* require a finely tuned ability to discriminate among models (according to their success) to generate locally optimal behavior in cultural evolutionary time. Formal models using replicator dynamics have show that *any* ability to distinguish 'better-than-average' models will drive the overall behavior of a population toward the locally, best-adapted, behavior (Boyd & Richerson 1985: Chap 8; Weibull 1995). This claim assumes some mechanism for introducing new behavioral variants, but as long as people sometimes make copying errors, or simply alter their behaviors idiosyncratically, this assumption poses no serious difficulties. Consequently, if al people have is some meager ability to distinguish well-adapted (successful) individuals from less-well-adapted individuals, and they posses the 'ability' to make occasional random errors in their learning, then we should expect the average behavioral repertoires of groups to approach optimal levels on cultural evolutionary time scales.

Because this adaptive process occurs in cultural evolutionary time, we should expect that populations currently living under recently changed conditions (after an environmental shift, migration, war, etc.) to display less adaptive behaviors than populations inhabiting more stable environments, because cultural evolutionary adaptation takes time to sort out the consequences of alternative behaviors (perhaps many generations). This hypothesis contrasts with both rational decision-making and individual adaptive learning. Rational decision-making should occur instantly as individuals' brains project the long-term outcomes of all possible behavioral alternatives in the new situation to produce nearly instantaneous adaptation. Individual adaptive learning would require more time than rational decision-making, but would have to achieve its most-adaptive level within the lifetime of a single individual. Under individual adaptive learning, groups do not accumulate adaptive knowledge and practices, as these approaches do not account for transmission between successive generations.

In cultural group selection, social groups or institutions compete with one another in a number of different ways. Social groups with more efficient institutions, more group-oriented beliefs, more stable political structures, or a greater ability to marshal and motivate warriors tend to proliferate in competition with other groups. Proliferation may involve political conquest, demographic swamping, economic incorporation or prestige-bias group selection (people in one group preferentially copy members of more prestigious groups). CGS allows more efficient and durable institutions that may arise only rarely through a fortuitous sequence of events, perhaps involving very specific environmental conditions or historically rare events, to spread even when high individual costs would otherwise stifle their diffusion (Soltis et. al. 1996; Boyd & Richerson 1990; Bowles 1998; Alchian 1950).19

CONCLUSION

In this paper, I have argued that economic models in which individuals make rational, cost-benefit decisions, cannot account for much of the behavior we observe, both in the laboratory and in the field. Laboratory evidence clearly demonstrates that people (i.e. university students) lack the cognitive abilities to perform the kinds of analyses required by most cost-benefit models. Similarly, field evidence shows that many behavioral patterns, despite being quite adaptive, cannot be products of CBA. Instead, I argue that in order to explain behavioral patterns and behavioral change, we must develop an understanding of how human psychology acquires ideas, beliefs and behaviors by observing others. Rather than rational-actor models, we need to develop psychologically-informed cultural evolutionary models.

Some researchers might be concerned that a focus on cultural transmission falls into the trap of 'cultural determinism,' which leaves no room for cultural change or individual variability. This concern is unfounded. Cultural transmission models are explicitly about the dynamics of cultural ideas and behavior; they make hypotheses about why some cultures change more slowly and others more rapidly; they seek to understand why some ideas spread through populations while other ideas do not. Cultural transmission dynamics also often produce 'mixed equilibria' in which different behaviors are maintained in relatively stable proportions within a population. That is, under some specified conditions, cultural transmission approaches *predict* a high degree of individual variation; under different conditions they may predict a high degree of individual conformity. Such models can also predict when previously stable equilibria will destabilize and evolve towards novel states. Recently, for example, simple cultural transmission models have been deployed to understand the evolutionary processes that generate political complexity (Bowles 1998), social stratification and 'marked' ethnic groups (McElreath & Boyd 1999). Unlike more typical approaches in which labeling a behavior as "cultural" halts further inquiry into why the behavior exists or is so prevalent, cultural transmission crashes through this imaginary dike to explore the cognitive mechanisms of social learning and the population-level patterns which they generate.

These ideas have substantial implications for some of the classic debates in anthropology. For example, the substantivist-formalist debate, which raged in economic anthropology during the late 1960's and early 1970's, dissolves when viewed through the lens of this cultural evolutionary approach. In this debate, the formalists, who were applying rational-actor models from economics to traditional anthropological populations, faced off against the substantivists, who maintained that economic actors behave according to culturally-prescribed rules, and thus could never be modeled as rational actors. Today, economic anthropologists usually admit that neither side won the debate (Plattner 1989; Wilk 1996). Rather, it seems to have been an indecisive stand-off.

The approach I've put forth above reconciles this unresolved debate by providing a theoretical framework in which both sides are correct, however incomplete. Cultural evolutionary theory holds that individuals do largely behave according to culturally-acquired beliefs, ideas, and values (á la the substantivists), but that psychological biases (like PBT) create adaptive processes on cultural evolutionary time scales that often approximate cost-benefit maximization, and thereby causes behavior to appear integrated and rational. Most formalists would agree that norms, beliefs, institutions and values influence economic actors, but they want to figure out why these norms, etc. exist in the configurations that they do. However, rather than being the product of individual rational actors reasoning things out, this approach proposes that cultural transmission mechanisms often generate well-adapted behavioral products (i.e. norms, beliefs, institutions, etc.) over time. Yet unlike CBA, this approach also predicts the kinds of maladaptation (Edgerton 1992) and technological devolution (Diamond 1978) we observe throughout the ethnographic record.

Anthropology's conflict of mentalist vs. materialist approaches also evaporates under the illumination of cultural transmission approaches. Materialists view behavior as resulting from the combination of things such as tools, technology and resources that are deployed to reduce labor, curb reproduction, increase production or maximize caloric intake rate. Mentalists see behavior as the product of ideas, symbols, moral convictions, worldviews, beliefs, etc. This division seems strange and artificial in the age of information and the Internet. Information is material, whether it involves polarized electrons on your hard disk, or excited neuronal patterns in your brain. The question is: How did the information—the particular instructions, mental models and decision algorithms—which lead individuals to particular behavioral patterns get into people's heads? Why did certain information get there instead of other information? What processes put it there?

The particular characteristics of physical environments, local soil types, regional labor markets, available game, land tenure systems, etc. certainly affect patterns of human behavior and behavioral change, but to understand how such forces shape behavior, economically-oriented anthropology must explore the psychological details of human learning, information processing and cultural transmission that give rise to cultural evolution.

Endnotes

[1] The chances of another earthquake, given that one has recently occurred, are lower than the base rate of earthquakes because the stress has been temporally relieved.
[2] For example, a general bias toward *availability* might even be adaptive if most events in the real world were autocorrelated. Under some circumstances, shorter memories that preferentially retain the most recent information actually outperform longer memories in accurately recognizing correlated patterns in the environment (Kareev 1995).
[3] Positive autocorrelation means that the occurrence of an event increases the likelihood of that same event in the next trial or time period. For example, if coin flips were positively autocorrelated instead of independent, the appearance of "heads" on the first flip would increase the chance of heads on the next flip from 50% to, say, 60%.
[4] This generates an important consideration for experimentalists: if you want your subjects to believe that a succession of examples or events are random, you should make them negatively autocorrelated, so they will appear random.
[5] Humans are also poor at searching for information. Economists have shown that people search too little, accept too soon and respond too slowly to changes in the distribution of wage and price offers (Braunstein & Schotter 1982).
[6] Non-human animals reason like humans. It seems that university students reason more like rats, starlings and bees, than rational actors or cost-benefit analysts. For example, while studying the economic decision-making of bees, Real (1994) showed that, like humans, bees underweight low probabilities and overweight high probabilities in making risky decisions. Like humans, these animals also show an *availability bias,* in which they remember only the most recent or salient events (Bees: Real 1994; starlings: Cuthill et. al. 1990; Brunner et. al. 1992, 1996). When researchers compare the human and non-human animal literatures they conclude that animals exhibit the same errors and biases that humans do (Camerer 1995; Davis & Holt 1993; Kacelnik 1997).
[7] Psychologists have shown that somewhat ambiguous data will actually drive people's opinions farther apart as individuals interpret new data in favor their existing view (Lord, Ross & Leper 1979).
[8] More generally, the Mapuche are a growing indigenous group of approximately 1 million people. In the last 50 years, this population has been expanding out of the rural regions of central Chile (Bengoa 1997: 11).
[9] This anecdotal finding is consistent with research from the 'diffusion of innovations' literature (Rogers 1995).
[10] In a less extreme form, "bounded rationality" proposes that individuals with limited memories make simple computations in order to generate 'satisfactory' results. Because this research program attempts to explore the actual learning algorithms and heuristics that individual use to make decisions, bounded rationality should often be classed with individual learning, not rationality approaches. Notably however, it's still a type CBA.
[11] Note, Bandura is arguing with psychologists, so he frames his argument for cultural transmission in opposition to the predominant approaches of the time in psychology—i.e. reinforcement learning and internal drives.
[12] Both of these psychologies may be part of human cognition, but it's important to distinguish them.
[13] Note that economists began to use these experimental games to test the predictions of game theory. Numerous experiments clearly show that human behavior substantially violates these predictions (see Kagel & Roth 1995).
[14] Gil-White, personal communication; Ensminger, 1998; Marlow, 1999; Henrich & Smith, 1999; Roth et. al. 1991.
[15] Positive game theory predicts that proposers should offer the smallest unit amount possible (e.g. $1 out of $160) and responders should always accept—responders face a choice between zero or something, and proposers know this.
[16] Common-pool resource experiments (Henrich & Smith 1999) and ethnographic research (Johnson 2000; Baksh 1984) further support this result.
[17] In contrast, because rational approaches don't produce 'evolutionary dynamics' (with temporal lags, multi-stable equilbria and runaway processes) researchers working in the rationality framework must either deny maladaption exists, or claim that a particular group is either less rational or worse at CBA than better adapted groups.
[18] If one wanted, one could use the machine to clear the garden (saving the cost of labor), and still leave some trees and branches behind to burn—thereby saving the labor and getting the nutrient fix. I suggested this during a few interviews, but the Machiguenga seemed to think it was a ridiculous suggestion. Why would one burn if one did not have to burn (i.e. it's both dangerous and extra work)? Of course we know that other groups use topical agricultural systems that do not involve burning (see Orejuela 1992).
[19] Unlike genetic group selection, *cultural group selection* does not suffer from the problem of maintaining variation between groups in the face of migration. Another cultural transmission mechanism, *conformist transmission,* causes individuals to preferentially imitate the most common traits within a group, and thereby tends to create behavioral similarities among individuals within groups, while maintaining differences between groups (Henrich & Boyd 1998).

Table 1. Estimated Deforestation Rates for five Peruvian Groups

Group	Estimated Deforestation
Amarakaeris of the Madre de	0.31
Machiguenga of the Urubamba	0.68
Ashaninka of Satipo	0.76 or 0.81*
Colonist of the Upper Huallga	1.47
Colonists of Satipo	2.13

*Depends on the assumptions about cropping cycle

Table 2. Why don't you plant barley?

Why don't you plant barley?	*# of Responses*	*Percentage*
Nobody here plants that	16	19.5
Good yield/good rotation w/wheat	10	12.2
Poor yield	9	11.0
Don't know why	8	9.8
No seeds	8	9.8
No enough land	6	7.3
Don't like it	6	7.3
Needs lots of care/fertilizer	5	6.1
Low market price	4	4.9
Tough to cut with sickle	2	2.4
It's not our custom	1	1.2
Birds eat it	1	1.2
No transport to market	1	1.2
No good land	1	1.2
Hills are good for barely	1	1.2
Good market price	1	1.2
Don't like to eat it	1	1.2
Type of seed is gone now	1	1.2
Total Number of Responses	82	100.0

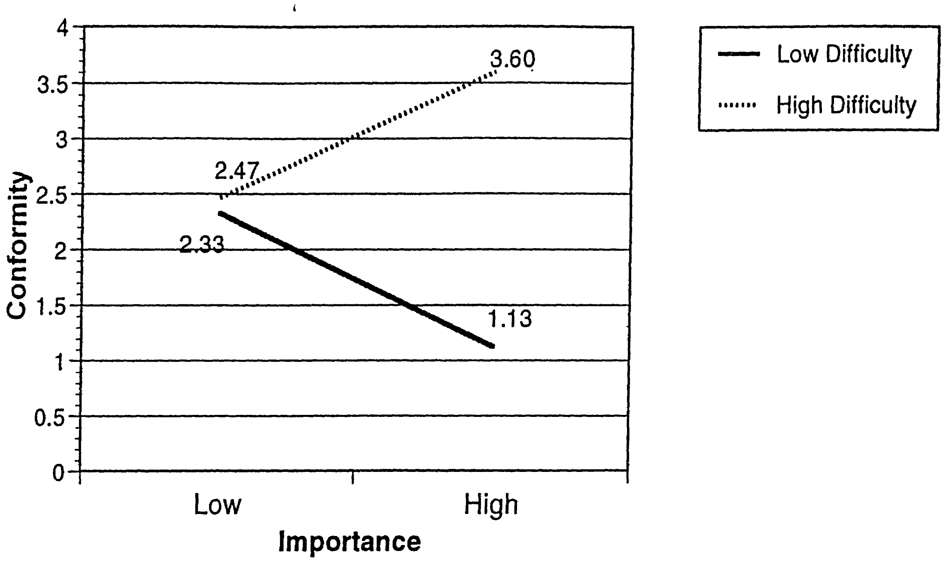

Figure 1. Mean number of conforming trials by condition on lineup task

Table 3. Machiguenga farmers in Camisea use of slash and burn agriculture

A. Why do you burn?

Responses	Number of responses	Percent of total
To clear thorns and	19	90.5
No response§	3	---
Clear out snakes	1	4.76
Custom	1*	4.76
Total	24	100.00

B. Does burning or the ash affect the soil?

Responses	Number of responses	Percent of total
No	12	85.7
No response§	2	---
Yes (improves it)	1*	7.1
Affects a little (damages it)	1	7.1
Total	16	100.00

C. If you had a machine to clear your garden, would you continue to burn?

Responses	Number of responses	Percent of total
No	10	100
No response§	6	----
Total	16	100.00

§ by this I mean that the farmers either did not respond or avoided the question—even after further explanation and questioning. Machiguenga are quite independent, and if they don't like a question or are confused, they often simply don't respond, or ignore the question. In this case, I inferred from facial expressions and ethology that some were confused by the question.
This "1" in A and B represents the same individual. He has spent a substantial amount of time in the metizo towns doing wage. This acculturative experience may explain his divergent responses.

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