# Chapter 16: Principles of Evolutionary Psychology

## Introduction

In the previous chapter, we posed a number of simple questions about human behavior and explained how evolutionary psychology might answers those questions. At the end, the reader was admonished to maintain an attitude somewhere between skepticism and open-mindedness towards the answers of both the evolutionary psychologist and his/her critics.

If that chapter gave you some interesting questions to think about, then it succeeded in its purpose. But it could also give the misleading impression that evolutionary psychologists are a breed of armchair speculators. This is definitely not the case. There are well-developed principles and theories within evolutionary psychology that have sparked considerable empirical research. In this chapter, four major theories are explored—(1) prepared learning, (2) inclusive fitness and kin selection, (3) reciprocity and cooperation, and (4) parental investment.

## Prepared Learning

Several decades ago, American psychology held several laws of learning as sacred. One law was *equipotentiality* and it stated that an organism could learn to associate any stimulus to any response with equal ease. The classic example is Pavlov's dog who, according to this law, could have learned to associate a bright light to the food as easily as it learned to associate the bell with food. The two stimuli, light and bell, are equipotent in the sense that given the same learning parameters, both could eventually lead the dog to salivate. A second law was *temporal contiguity*. This law stated that the presentation of a novel stimulus with a learned stimulus must occur quickly in time. In Pavlov's case, the food must be presented shortly after the bell was rung in order for learning to occur. The dog never would learn to salivate to the bell if the food were presented three days after the bell.

The third and final law was *practice*—it took many trials before the behavior was fully learned.

These laws begin to crumble after a series of fortuitous studies in the 1950s and 1960s by the psychologist John Garcia and his colleagues. Garcia's initial interest centered on the behavioral effects of low doses of radiation. In the experimental paradigm, rats were placed into a special chamber for a relatively long time while they were exposed to a constant amount of low level X-ray radiation. To keep the rats healthy, the chamber was equipped with water bottles containing saccharin-flavored water. Garcia and his colleagues noticed three important things: (1) as expected, the rats became sick from the doses of X-rays; (2) quite unexpectedly, the rats stopped drinking the sweetened water; and (3) the rats needed no practice to avoid the water—they learned after one and only one trial.

Garcia's genius consisted in asking one simple question, "Why should these rats avoid drinking the water when the learning situation violated the accepted laws of learning?" According to the Pavlovian tradition, the unconditioned response (sickness) occurred several hours after the conditioned stimulus (sweetened water)[1]. This clearly violated the law of temporal contiguity because the paring of sweetened water and sickness did not occur within a short time interval. Second, there was no need for practice. Most rats learned to avoid the water a single trial.

Garcia abandoned his initial interest in radiation poisoning to focus on this peculiar phenomenon of learning. His general results and conclusions are illustrated by the study of Garcia and Koelling (1966). Here, rats were assigned to one of four groups in a two by two-factorial design. The first factor was the sensory quality of water given to the rats—it could either be colored with a food dye and oxygenated with bubbles (colored, bubbly water) or mixed with saccharin (sweetened water). The second factor consisted of the consequences of drinking the water—half the rats in each group rats were be given an

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[1] It takes several hours before the effects of radiation produce sickness.

electrical shock upon drinking while the other half were make sick several hours later by lacing the water with lithium[2]. The results are tabulated in Table 16.1.

[Insert Table 16.1 about here].

The rats in the colored, bubbly water/shock group eventually learned to avoid drinking the water, albeit after a number of trials. This accords well with the established laws of learning at the time. Rats shocked after drinking sweetened water, however, failed to learn avoidance within the time limit of the study. This fact clearly violated the established law of equipotentiality under which sweetness should lead to just as much avoidance as the visually colored water.

Curiously, the effect of making the rats sick had showed the opposite pattern. Rats made sick by the colored water had a difficult time learning to avoid it while rats sickened by lithium learned to avoid the water after one trial. The colored-water/lithium group followed the established laws of learning because sickness did not occur in temporal contiguity with the water. The sweetened-water/lithium group, on the other hand, violated the laws just as much as those rats made sick by X-rays did.

The current explanation for this curious state of affairs is that the laws of learning depend importantly on the biological predisposition of a species. The rat has evolved into a highly olfactory creature that perceives the world in terms of smell and taste. Indeed, rat colonies develop a characteristic smell that is used to recognize colony mates and identify intruders[3]. Rats are also scavengers who dine on a surprisingly wide variety of organic material. Because they locate food though smell, they are especially attracted to rotting fruit, vegetable, and animal matter because of its pungent odor. Rotting food, however, poses a problem for digestion because it can create sickness when it is too far gone.

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[2] Lithium cannot be tasted, but when given in sufficient amounts, it is poisonous. Curiously, small doses of lithium help in stabilizing the marked mood swings of mani-depressives.

Rats react to their food in a peculiar way. When a rat locates a novel food source, he seldom gobbles it all up. Instead, he will nibble a little bit of it, go way for several hours, and then return. The rat may repeat this another time or two—a quick taste, a lengthy departure, and then a return—but soon he will return and gorge on the food. Interestingly, if an experimenter laces the original food source with enough poison to make the rat sick but not enough to kill him, the rat may return but will not eat the food any more. It is usually a quick, one trial learning experience.

Evolutionary psychologists speculate that rats evolved a biological predisposition and a behavioral repertoire to avoid rotting foods that may make them ill. At some point rats who nibbled at a novel food source outreproduced those who gobbled the whole thing down, presumably because the gobbling strategy had a high probability of incapacitation or even death through sickness. Similarly, rats who nibbled and learned quickly outreproduced those who nibbled but took a long time to learn. And what sensory cues would the rat use to bad food from good food? Most likely they would be olfactory cues.

In this way, rats in the Garcia and Koelling study would easily learn to associate an olfactory cue (water sweetness) with eventual sickness but would have a harder time associating a visual cue (colored, bubbly water) with sickness. Rats who learned to avoid sweetened water when they became sick were biologically predisposed to learn this and to learn it quickly. Were a rat drinking the bright, bubbly water able to cogitate about his situation, he might think, "Every time that guy puts me into this box I get sick but it can't be the water because it tastes perfectly ok." Rats are not biologically prepared to associate a visual cue with sickness.

Similarly, electric shock is a not a natural event in the ecology of the rat. The cogitating rodent given sweetened water would be quite perplexed—"The water tastes good

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[3]  If an adult male rat is taken from his colony and given a sufficient bath to remove the colony smell, he will be attacked and sometimes killed when he is reintroduced to the group. Even his littermates will attack him.

and did not make me sick. Nothing wrong with that stuff." Again, this is a biological constraint. Finally, the rats given two stimuli that are quite arbitrary from the perspective of their natural habitats—bright, bubbly water and shock—followed all the rules of avoidance learning that had been established early in the century, i.e., the paradigms using arbitrary stimuli and shock.

Proponents of this interpretation of the data are quick to point out the role reversal that happens in different species. Birds, who are highly visual like us humans, associate visual cues with sickness with the ease that rats learn about olfactory cues and illness. Birds will readily learn to avoid, say, blue food pellets (which make them sick) and eat red pellets. When presented with a novel pellet that is half blue and half red, the bird will peck at the middle, break the pellet in two, and then eat the red half.

The general phenomenon has now come to be called *prepared learning* (Seligman & Hager, 1972) or *biological constraints on learning*, a hypothesis that was initially proposed in 1911 by the famous learning theorist, E.L. Thorndike, but was ignored by later researchers[4]. The prepared or constrained part of the learning process is due to the biology that has been evolutionarily bequeathed to a species. We learned of this in the previous chapter. Preparedness consists of all those biological factors that make it easy for the members of a species to learn certain responses but make it difficult for them to acquire other responses. In terms of human behavior, the most often touted example is fear and phobia.

**Human fears and phobias[5]**

From the perspective of evolutionary psychology, fear and panic—like most of our emotions—should be viewed as adaptive responses (Nesse, 1990). They may be unpleasant

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[4] Thorndike (1911) proposed both primary and secondary laws of learning. His primary laws received consideration attention much to the deteriment of one of his secondary laws that stated that for learning to occur, the organism must be prepared to learn.

[5] See Isaac Marks (1987) for a thorough overview of this topic.

to experience, but they serve the useful function of prompting us to avoid dangerous situations and/or to energize our bodies for fight or flight. The relationship between fear and adaptiveness resembles the inverted U-shaped function of stabilizing selection (see Figure 13.2). In general, it is good to be in the middle of distribution. Too little fear could lead to maladaptive risk-taking while too much fear might incapacitate a person.

To understand biological and evolutionary factors in human fears and phobias we must first recognize three salient empirical findings about them—(1) the types of fears and phobias; (2) the age of onset of fears; and (3) precipitating events. The first salient aspect of these stimuli is that they are not a random sample of the stimuli that humans tend to have noxious experiences with. Surveys about the types of stimuli that humans fear have been very consistent. The majority of fears and phobias[6] involves spatial stimuli (heights, enclosed places), specific animals (snakes, bats, spiders, rats), and public speaking. Many of us have received a punishing electrical shock in trying to extract an obstreperous bagel from the toaster with a fork, but no clinician has ever reported treating a toaster phobia, a bagel phobia, or a fork phobia. Neither are clients complaining of electrical outlet or extension cord phobias overwhelming mental health professionals. People seriously injured in a car crash in a red Volkswagon may develop strong fears of driving or riding in a car, but hardly any of them panic at the sight of a red Volkswagon parked along a curb. Children sometimes develop strong fears and phobias of darkness, but few, if any, develop fears of all the other stimuli associated with going to sleep—pillows, pajamas, sheets, bedtime stories, or even the light bulb. How many of us know someone who panics at the sight of a bowl of chili even though the person may have had a quite noxious experience eating chili that was too hot for his taste? Most of us have been burned by touching a hot stove or cooking pan. Do you know anyone with a stove phobia, a double-boiler phobia, or

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[6] A phobia is an intense fear that the person cognitively realizes is too extreme for the situation but cannot avoid feeling. Phobias usually lead to avoidance of the object or situation. Phobias can lead to phobic disorder in which the person suffers from some personal or social incapacitation because of the phobia.

a frying pan phobia?  Why is it easy to acquire fears of a snake but hard to acquire one of toasters?

A second salient aspect of human fears and phobias is the age of onset.  Fears and phobias of specific animals usually have an onset in childhood.  Over 95% of them have develop before the age of 12.  Phobias of heights on the other hand increase with age.  It is not unusual for someone unafraid of heights in their teens and twenties to acquire a fear of heights in middle or late adulthood.  Agoraphobia—a serious multiphobic condition that involves fears of many spatial situations, crowds, and being alone—has an onset in the teens and early twenties.  It is unusual for it to appear in early childhood or after age 40.  Why should fears develop at different ages?

Finally, we must recognize that a large number of phobias develop in the absence of an adverse experience with the object or situation.  Most people phobic of specific animals report that they have had this fear as long as they can remember and can recall no specific event that initiated the fear.  Very few people develop fear of heights because they have fallen from a great height.  Why should someone develop a phobia in the absence of an adverse learning experience?

Evolutionary psychologists posit that we are biologically prepared to acquire certain types of fears at certain times in the life span.  Even before our own species evolved, hominid youngsters had to learn very quickly what types of animals to avoid.  Perhaps the nervous system of an ancient primate ancestor evolved a sensitive period for the acquisition of fear responses to dangerous animals, and we inherited that mechanism.  In addition, we may also be sensitized to acquire these fears through social learning.  Seeing someone shout and run away from a snake or being admonished by elders to avoid snakes might generate just as much fear as having a bad personal encounter with one.  Indeed, we humans may follow the pattern of rhesus monkeys who, when raised in a laboratory, show no congenital fear of snakes.  But in a single trial, they will develop an intense fear of snakes

when they are exposed to another monkey who exhibits fear in the presence of a snake (Mineka et al., 1984).

It should come as no surprise then that people placed in experimental situations develop fear responses and even cognitive appraisals of fear differently to biologically prepared stimuli than to biologically neutral stimuli. Ohman, Erixon, and Lofberg (1975) developed autonomic fear responses[7] in subjects to pictures of either a snake or a house. The fear rapidly extinguished to the picture of a house but was maintained at a high level for the picture of the snake. Tomarken, Mineka & Cook (1989) presented both pictures of prepared stimuli (snake or spider) and neutral stimuli (mushroom or flower) to subjects and randomly shocked then one-third of the time after a picture was shown. Despite the fact that the subjects were shocked just as much with the snake/spider pictures as with the mushroom/flower pictures, they reported that they were shocked more after the snake/spider pictures than after the pictures of the neutral stimuli. Somehow, prepared stimuli influence cognitive estimation of probabilities.

With the example of prepared learning, we can see how evolutionary psychology moves away from speculation and into the laboratory. The hypothesis of preparedness explains the learning studies on rats as well as the epidemiological data on human phobias (types of phobias, age of onset, etc.). It is also a good explanation for the considerable amount of laboratory experiments with humans (see Marks, 1987). Hence, it is a very useful construct that serves to put a number of different puzzle pieces together.

Prepared learning also illustrates the lemonade quality of human experience. Too often learning has been cast as a purely environmental phenomenon completely antithetical to genetics. Learning definitely involves the environment but it equally occurs within the context of a nervous system that experiences the environmental events. As we have seen in the first module to this course, all the enzymes, receptors, peptide hormones, etc. operating

in this system have their blueprints encoded in genes.  Learning is as much lemonade as the body's reaction to stress.

## Inclusive Fitness and Kin Selection

Sometimes, mothering ringneck pheasants perform a marvelous act of self-sacrifice. If a large animal trods too close to her nest, she will make a great deal of noise and run through the field flapping her wings.  The safest course of action for her is to be silent, run a few steps to build up the momentum for flight and then soar away.  Yet she makes herself deliberately conspicuous to a potential predator and is sometimes caught in the process. Prairie dogs also show similar behavior.  When a raptor soars overhead or a land based predator approaches the colony, the prairie dogs who initially spot the threat stand upright on their hind legs and issue a series of loud barks that act as alarm codes for their colony mates to run post haste to their boroughs.  This behavior assists the colony as a whole, but at the expense of making the signaler conspicuous to the predator.

These are examples of *altruism*, a behavior that can reduce the reproductive fitness of the altruist but increase the fitness of conspecifics.  Ever since Darwin's time, altruism posed a problem for natural selection.  Certainly any heritable behavior that reduced fitness should decrease over time.  Just consider a prairie dog colony that consists of 50% altruists and 50% cheats[8].  When a cheater spots a predator, he hightails it to the nearest borough. The odds that the predator eats an altruist are slightly increased because the cheater has just removed one of his own kind from the denominator of vulnerable prairie dogs.  When the altruist spies the threat, she announces her position to the predator and places herself in danger.  Both the other altruists and the cheaters benefit, but if anyone is to be devoured, it is once again more likely to be the altruist than the cheater.

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[7]  Autonomic responses are sweating, increased heart rate, and irregular respiration—the types of phenomena measued by polygraphs.
[8]  Most people would use the word "selfish" as the appropriate antonym for altruism.  In *The Selfish Gene*, however, Richard Dawkins (1989) points out that from a gene's perceptive, altruism is actually a selfish action to help the gene replicate itself.  Hence, most evolutionists prefer the word "cheat" to "selfish."

A solution for this had to wait until 1964, when W.D. Hamilton published a classic paper. Using mathematical models, Hamilton showed that altruism could evolve when altruistic genotypes preferentially benefit other altruistic genotypes over cheater genotypes. The clearest way for an altruistic genotype to do this is to have mechanisms that bias it to work altruistically for *close genetic relatives*. If I have an altruistic genotype, then the most likely individuals in the world to also share this genotype will be my parents, siblings, and children. When this concept was presented to the famous geneticist H.B.S. Haldane he quipped that he would he would never give his life for his brother, but he would for two brothers or eight first cousins[9].

Hamilton's work presented the twin ideas of *inclusive fitness* and *kin selection*. Inclusive fitness is defined as the *fitness of an individual along with the fitness of close relatives*[10]. Your inclusive fitness would be a weighted sum of your own reproductive fitness, that of your first-degree relatives, second degree relatives, etc. Kin selection refers to implication of inclusive fitness that *natural selection can work on the close genetic relatives of the organism actually performing the behavior*. In a loose sense, fitness can be expressed in terms of kinships just as we have seen it being expressed in terms of genotypes, phenotypes, and individuals.

Inclusive fitness and kin selection have been used to explain many different human behaviors. The very fact that we humans recognize and pay close attention to genealogy may reflect a cognitive mechanism developed through evolution that helps in kin recognition. The phrase "blood is thicker than water" has been interpreted as a realistic description of human emotions and behaviors that preferentially benefit kin over others. Several aspects of altruistic parental behavior may have evolved through kin selection.

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[9] I have found several different texts that quote Haldane, all differing slightly from one another. But the substance of his comment remains that given in this text.

[10] In terms of the concept of fitness given in the chapter on the five forces of evolution, inclusive fitness may be more broadly defined as *the fitness of an individual plus others with the same genotype*. In this case, it simply equals the fitness of genotypes irrespective of the individuals carrying those genotypes.

Continual themes in fiction portray noble parents shielding their young children from potential harm, but evil stepparents threatening their stepchildren.

Daly and Wilson (1988) have pointed out how familial homicide patterns agree quite well with kin selection. Although rare, parents do murder a child, but the perpetrator of such a heinous act is much more likely to be a stepparent than a biological parent. Despite the hyperbolic threat "do that again and I'll kill you" echoed by many a frustrated parent, very, very few parents ever even contemplate homicide when it comes to their offspring. The inhibition of homicide is not restricted to parents and their offspring. Ask yourself the following two questions: "In your whole lifetime, which person has shouted at you and hit you the most?" and "Which person have you yelled at and fought with the most?" If you respond like most people, then you will nominate a brother or sister. Yet fratricide (the killing of a sibling) is very rare. Humans are much more likely to kill a spouse than an offspring or sibling.

## Reciprocity and Cooperation

A close cousin to inclusive fitness is the concept of reciprocity and cooperation, sometimes called reciprocal altruism. Traditionally, inclusive fitness and kin selection have been used to refer to altruism towards genetic relatives. Reciprocity and cooperation deal with *behavior that requires some "sacrifice" but also has beneficial consequences between conspecifics who are not necessarily genetic relatives*. Hence, the target of the behavior—a genetic relative versus another conspecific—distinguishes inclusive fitness from reciprocity/cooperation. Robert Trivers (1971) developed the concept in a seminal paper.

To understand reciprocity and the problem it posed for evolutionists, we must once again consider cheaters. Lions and wolves hunt large prey cooperatively. Although it is mentioned infrequently on the nature shows, chasing, grabbing, and killing large prey is not a safe enterprise. Zebras kick and bite, wildebeest have horns, and caribou have antlers, so

predators can be hurt, sometimes even mortally so, in the hunt. Imagine a cheating lioness who approaches the prey only after it is dead. Would not her behavior be advantageous? She can participate in the feast but avoids the risk of injury. If cheating has a selective advantage, then would it not eventually result in the extinction of cooperative hunting? Another problem is how cooperative hunting ever got started in the first place. Most feline predators like the lynx, tiger, cheetah, leopard, and jaguar, make a perfectly fine living at solitary hunting. Why did lions ever develop cooperation?

According to Trivers (and others like John Mayard Smith and Axelrod who developed mathematical models of the evolution of reciprocity) cooperation cannot evolve alone. It must be accompanied with mechanisms that detect and reward mutual cooperators and detect and punish cheaters. Consider grooming in primates. It serves the very useful function of eliminating large parasites (fleas, lice, etc.) from a hairy monkey or ape. Imagine that you are a chimp and that a fellow chimp, Clyde, is continually presenting himself to you to be groomed. Being the nice chimp that you are, you groom Clyde every time that he requests it. After a while, however, you notice something peculiar. Whenever you present yourself to Clyde for grooming, he refuses. Ask yourself how you truly feel about this situation and how you are likely to respond to Clyde's future presentations. Again, if you are like most people, when Clyde presents to you, you would feel some form of negative emotion that could range from mild exasperation to downright contempt, depending on the type of chimp you are. At some point, you are also likely to refuse to groom Clyde. Evolutionary psychologists would say that this is your "cheat detection and punishment" mechanism in action.

Reciprocity evolves when reciprocity and cheating can be recognized or anticipated and then acted upon. If your roommate, Mary, is cramming for her physics exam, you are likely to bake some banana bread for her when you suspect that Mary will do something nice for you on the eve of your big chemistry exam next week. But if Mary were the type of roommate who clutters and trashes the place leaving you to do all the cleaning up, then

you are likely to feel irritated and aggravated at her. No banana bread tonight! We feel that it is right and just that everyone does their fair share, and as parents, we spend considerable time and effort inculcating this ethos into our children[11].

One of the strengths of the modern evolutionists is their ability to uncover subtle and non-obvious phenomenon that fit better with evolutionary theory than other theory. You were correct to express skepticism of the Mary example—after all, there is really no way to determine the relative influences of a biologically softwired "cheat detector" and your upbringing on the behavior. But consider the following example, taken from Pinker (1998, p. 336 ff)[12].

Figure 16.1 gives three sets of four cards. Consider for a moment the set in panel (a). Each of the four cards has a letter on one side and a number on the other side. Which cards would you turn over to test whether you could falsify the following statement: "If a card had a D, then it must have a 3 on the other side?"

[Insert Figure 16.1 about here]

Panel (b) has a similar problem. Suppose that you have a job checking on whether bars are obeying the state law and serving alcohol to people age 21 and over. You go into Jack's bar and there are four patrons represented by the cards below. The patron's age is on one side and their beverage is on the other. Which cards in panel (b) would you turn over to check if Jack's bar is following the law?

Finally, suppose that you are in Jill's deli chatting with one of the servers (panel c). The server says that everyone who eats hot chili peppers here always drinks a cold beer. Again, there are four patrons, their food being on one side and their beverage on the other side of the cards below. Which cards would you turn over to check out the server's statement?

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[11] Because biological tendencies and learning are not mutually exclusive, parental reminders and admonitions can serve to reinforce behavioral patterns to which we are already genetically predisposed.

All three of these problems have the *same* logical form. Pinker points out, however, that most people get the letter/number and the chili problem *wrong* but get the bar problem *correct*! If we humans were really using the formal rules of logic to solve these problems, we should solve each problem equally well.

Consider the bar problem. The correct solution is to turn over the "Drinking a beer" and the "Age 16 cards." If the "Drinking a beer" card has someone under age 21, then Jack's bar is not obeying the law. Similarly, if the "Age 16" card reveals that the person is drinking alcohol, then Jack's bar in not obeying the law. Turning over the "Drinking a Coke" and the "Age 25" cards do help to solve the problem. Someone drinking a coke can be any age, and a 25-year-old can drink anything.

In the letter/number problem, the correct solution is the D and the 7 card. Pinker states that most people pick either the D card or the D and the 3 card. If the proposition holds, then D card *must* have a 3 on the other side and the 7 card *must not* have a D on the other side. Turning over the 3 card does not help solve the problem because 3 could be paired with any letter. A similar logic holds for the chili problem where the correct solution is turning over the "Eating hot chilies" card (which, if the proposition holds, should have a "Drinking beer" on the other side) and the "Drinking Coke" card (which must *not* have "Eating hot chilies" on the other side).

This example is based on a number of studies summarized by Leda Cosmides and John Tooby (1992, 1994) who conclude that our cheater detector is elicited in the bar problem but not in the letter/number problem or the chili problem[13]. Jack's bar is disobeying the rules ("cheating") if alcohol is being served to someone under 21. There is no morality associated with a D card or with the beverage one drinks while eating chili peppers. These data to not agree with the idea that the mind is that learns formal rules and

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[12] Almost every introductory text n cognitive psychology will also have an example similar to this one.
[13] Technically, Cosmides and Gigerenzer conclude that the logical problem is easier to solve whenever it involves a social "contract."

then applies these rules to specific cases.  It does agree with the evolutionary theory of

reciprocity.  We humans are biologically sensitized to detect cheating, so a logical problem

with a content based on cheating is easier to solve than identical logical problems with

arbitrary content.

## Parental Investment

Robert Trivers, who first explicated reciprocity and cooperation, also gave us

parental investment theory (Trivers, 1972).  This theory states that *in any species the parent*

*(male or female) that invests the most time, energy, and resources on its offspring will be*

*the choosier mate*.  The theory begins by asking the fundamental question of why many

species act finicky in choosing mates.  Most evolutionists explain mate preferences as

mechanisms that genes have developed in organisms to assist in their own (i.e., the genes

own) replication.  If I am a gene in an organism of a sexual species, not only do I want

"my" organism to reproduce but I also want "my" organism to reproduce with a mate

who has good genes[14].  Hence, if mechanisms develop to recognize good mates, then

natural selection will

Triver's theory maintains that the fastidiousness of mate preferences will be

stronger in the sex that expends the most resources in producing offspring.  Ordinarily, this

will be the female because biologists define a female as the sex of a species that produces

the larger gamete. (Hence, human women are females because eggs are many, many times

the size of sperm).  The sex that produces the larger gamete produces fewer of those

gametes.  Hence, each gamete is more "precious" in a reproductive sense[15].

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[14]  Again, recognize the anthropomorphism here.  In reality, genes that developed mechanisms in their
organisms for recognizing and mating with others who possessed beneficial genes increased in frequency.
[15]  Even in insects, the female is almost always the choosier of the sexes.  In several insect species, the
males present "nuptial gifts" to the female by offering her another dead insect (usually killed by the male) to
consume.  When the gift is small, stale, or unpalatable, the female effectively says "Goodbye, Charlie" and
flitters away in search of a better offer.  Once she finds a satisfactory present, she begins consuming the
carcass.  The male moves behind her and copulates while she is munching away in gustatory delight.

In mammals, the female expends more resources on offspring than the male. Fertilization in mammals is internal to the female, offspring development takes place in the female's uterus, and the female must suckle the infant for a significant period of time. Hence, female mammals should be choosier mates than the males. Indeed, this is always the case. In species where one sex competes for mating, males compete with other males for the opportunity of having sex with females. Females do not butt heads with each other for the opportunity of mating with any random guy in the herd. Even in chimps and bonobos where mating is largely promiscuous, every male in a troop tries quite hard to have a go at any female in estrus. Whenever one sex shuns a mating attempt, it is the female shunning a male and not a male shunning a female[16].

Parental investment theory, along with the concept of certainty of parenthood, has been used to explain many different types of human mate preferences. Females must commit nine months to pregnancy and then, before the advent of manufactured baby formula, more than a year to feeding a single offspring. Even if a woman conceived after her first menstruation, she could bear one child per year until menopause, and the most likely number of offspring for a female during most of human evolution was probably no more than five (Nesse and Williams, 1994). A human male, on the other hand, has the potential of fathering a baby every single day after puberty. Female humans are biologically constrained to devote considerable resources to a single offspring; human males lack such constraints[17]. Hence, human females should have more discriminating mate preferences than males.

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[16] Advocates of parental investment theory are fond of pointing out discrepancies to the "female is choosier" rule, although to my knowledge, the rule has no contradiction among mammals. In the seahorse and the jacuna bird, the male invests more in offspring than the female. In the seahorse, the female deposits her eggs into a males pouch where they are fertilized, incubated, and cared for after hatching by their father. The female jacuna bird maintains a large territory containing several males. She is fertilized by one male, lays her eggs, and leaves the male to tend the nest and feed the chicks while she moves on to another male and conceives. In both case, the male is apparently more choosier than the female in mating.

[17] The constraints referred to here are the purely physical. Human males may have *behavioral* constraints that are also biologically influenced and may limit their reproductive potential.

A litany of empirical observations is used to support of this conclusion. Certainly in our Western cultures, anecdotal observations agree with it. Males are more ready than females to engage in anonymous sex, even to the point of paying for it. Women report more sexual advances made on them by men than men report sexual advances initiated by women. Personal ads written by women request males for relationships more often that those authored by men; men's personal ads stress sex (Deaux & Hanna, 1984). Consider the following questions—how long would you have to know someone before feeling comfortable going out on a date with that person, and how long would you have to know someone before getting married? Both males and females have similar time frames—a short time frame for dating and a longer one for matrimony. Now consider this question—how long would you have to know someone before having sex? The average woman picks a time frame somewhere between dating and marriage. Males pick a time frame *shorter* than dating (Buss & Schmitt, 1993).

This account of human parental investment, however, faces a real problem—why should men ever stick around at all? If sleeping around with as many women as possible maximizes the reproductive fitness of the genes in a male organism, why would these genes ever develop mechanisms that predispose a man to settle down with a woman? The evolutionists answer to this is that it effectively "takes two to tango." Just like the peacock's tail, men's behavior is influenced by women's mate preferences. If mutations arose that influenced women to prefer men who stuck around, and if there were men who actually did stick around, and if the pairing between this type of woman and this type of man had high reproductive fitness, then females who prefer stabile males would increase in frequency as will males who actually remain stabile.

# References

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| Table 16.1. Results of the Garcia and Koelling (1966) study on conditioned avoidance. | | | |
|---|---|---|---|
| | | **Aversive Stimulus**: | |
| | | Shock | Lithium |
| **Type of Water:** | Colored, bubbly | High Avoidance | Low Avoidance |
| | Sweetened | Low Avoidance | High Avoidance |

**(a)**

| D | E | 7 | 3 |

**(b)**

| Drinking a beer | Drinking a coke | Age 25 | Age 16 |

**(c)**

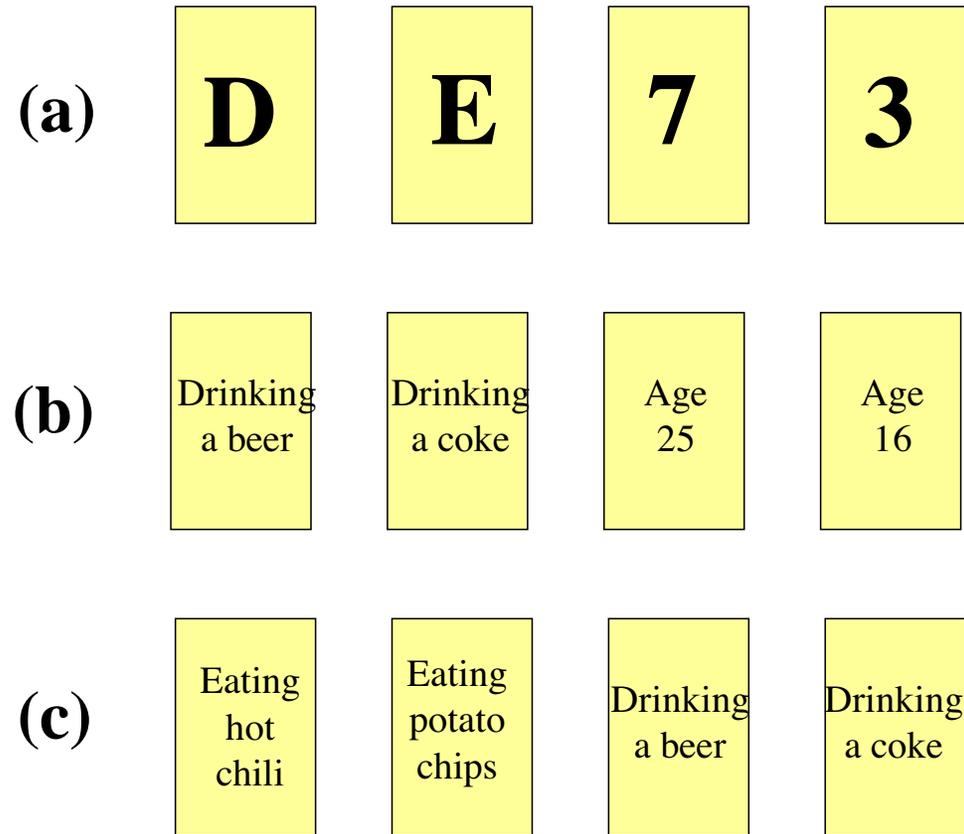| Eating hot chili | Eating potato chips | Drinking a beer | Drinking a coke |

Figure 16.1.  Three different problems with the same logical pattern (see text)