



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute  
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## **Evolution, Population, and Humans**

Curriculum Unit 98.07.07

by Richard R. MacMahon, Ph.D.

**OBJECTIVES:** This unit is designed to acquaint the student with both the origin of humans and how evolution has shaped human behavioral patterns; and to help the student to better understand how recent population changes have affected behaviors and customs in societies worldwide.

**GOALS:** The students will learn how humans evolved, how they established primitive social groups and how the influences of population growth have affected the relationships of humans to their environment and to each other.

**UNIT PLAN:**

OBJECTIVES

GOALS

UNIT PLAN

INTRODUCTION

MAMMALS

PRIMATES

HUMANS

HOMINID EVOLUTION

SOCIAL EVOLUTION

AGGRESSION / RECIPROCAL ALTRUISM

AGRICULTURE AND CIVILIZATION

SOCIAL RELATIONS

PARENTAL CARE AND EDUCATION

SHARING - CARING IN THE MODERN WORLD

READING AND THE DEVELOPMENT OF THE MIND

SHARING AND CARING: SOME FINAL WORDS

## INTRODUCTION

This unit grew out of a hand-out that I had written for my students for a course in genetics and evolution at High School in the Community. It seems to me that most high school students have not been exposed to, or thought about, what humans are all about. This unit is my attempt to stimulate thought and discussion among teachers and students. So feel free to agree or disagree with any or all of this unit. Some lesson plans to accompany this unit are included in the appendix.

I first want to spend some time discussing humans. This is important. It is vital that we begin to understand what it means to be a human being. And it is important that we all begin to develop a view of the world and of humanity that is a positive and realistic world view and outlook.

As a biologist, I am intrigued both with the nature of humanity and how we came to be this way. In order to understand this, we need to look at how we evolved as a species. To do this we start with a short summary of how we fit into the animal kingdom, more particularly why we are classed as mammals.

### **Mammals and Other Animals**

There are many more animal types than we usually think of, such things as fish, clams, beetles, starfish, various worms, lobsters, jellyfish, and ants are all animals. Even sponges are a type of animal. There is a vast variety of animal forms in nature. The body structures and organ systems of humans all have their origins in structures and systems found in these other animal groups.

Mammals are warm-blooded animals with fur. They produce milk for their young in mammary glands, and this structure has given us the name of the group. All mammals including humans possess the following: (Gould, 1995)

1. Mammary glands
2. A diaphragm
3. Four types of teeth
4. Hair/Fur
5. Intense parental care
6. Three specialized bones in the middle ear

There are three types of mammals, the most common being those called Placental Mammals. The other two types are Monotremes and Marsupials. Humans share the characteristic of placental mammals by possessing a placenta by which the fetus receives nourishment from the mother. The other two classes, the Monotremes and the Marsupials, are primarily Australian mammals, and we will not consider them here.

## The Primate Story

An Order is a category of classification. In the mammals, orders are groups of animals that are generally similar, including such orders as the Carnivores (cats and dogs) and Cetaceans (whales and dolphins). Humans belong to the mammalian order Primates. This order includes the prosimians (lemurs and tarsirs), old and new world monkeys, and the apes including humans. But where did the primates come from, and what are the basic characteristics of this order?

The primates evolved from the most primitive order of mammals, the Insectivores. These are an order of rodent-like animals that feed upon insects. Common examples are the shrew and mole. Some of the early insectivores were tree dwellers and thus were arboreal. Primitive arboreal primates soon diverged from the insectivores by evolving three features - eyes that were set in the head looking straight forward, an opposable thumb, and the ability to rotate the forearm. The combination of these three features allowed the primates to better judge distance (from the stereoscopic vision that comes with having cones of vision that overlap), and to grasp tree limbs more efficiently as they moved from one tree to another.

Finally, in order to read, interpret, and coordinate all of the complicated sensory messages that were coming into the central nervous system, the primates evolved a larger brain, with a proportionally larger cerebrum - that portion of the brain which processes incoming sensory messages and makes decisions. This enabled the primitive primates to move more efficiently through the trees by being better able to judge distance, to jump the correct distance from limb to limb and to grasp limbs more effectively with the hands using the opposable thumb and rotatable forearm.

For example, suppose you were a primitive primate up in a tree in the Tropical Rain Forest, peacefully feeding on flowers and fruit, when all of a sudden there appeared a large python snake sliding along the branch toward you. Your first instinct is to flee. But you are cut off except to run to the end of the branch and jump to another tree. Think about what is happening as you run. First of all, your brain must process what your eyes see in order to place each foot on the branch, and to grasp other limbs for balance as you pass. Secondly, you must judge the distance to the next tree and decide on the best spot in that tree to attempt a landing. Thirdly, as you near the end of the branch and gather your legs under you to jump, your brain must tell your leg muscles how hard to push off. You don't want to fall short, and you don't want to over-shoot. Either flight path could lead to a fatal fall. So your brain must signal your muscles how hard to push off and exactly in which direction. And as you are in the air, your brain must interpret the input from your eyes in order to rotate and line up your arms to best grasp the approaching limb of the next tree.

It takes more time to describe the above events than it does for them to actually happen. And in order to process all of the incoming sensory messages, interpret them, make decisions and signal the muscles what to do; a rather effective and sophisticated cerebrum is required. One resulting characteristic of the entire order of primates is what is called good hand-eye coordination.

Thus the Primates are characterized by having:

1. Stereoscopic vision
2. An opposable thumb
3. A rotatable forearm
4. A larger cerebrum

These characteristics led to the evolution of an order of mammals that was relatively smart and agile, was arboreal in habitat and ate a varied diet of vegetation and fruits and nuts, as well as what meat they could obtain.

### **Uniquely Human**

We all know that humans are different from any other primate. But in some ways we are still very similar to the large African apes, i.e. the gorilla and the chimpanzee. We possess the same basic body structure, with well defined legs and arms, and indeed our DNA is 99% identical with that of the chimpanzee (Bailey et al, 1992). What makes man unique? The answer lies in the environment in which man and the other apes evolved.

The large apes are all tailless and are basically ground dwellers. Gorillas and chimps are not arboreal. Neither was primitive man. The large apes evolved in a forest habitat. Man's ancestors about five million years ago began to evolve out on the open grassland of the savanna on the east side of the great rift valley in Africa. The apes seemed to have evolved on the west side of the Rift Valley in a forest habitat (Coppens, 1994; Stevens, 1993). Man was not a large, fierce predatory animal. He was basically a scavenger and opportunistic gatherer of whatever was at hand to eat (Blumenshine and Cavallo, 1992; Katz, 1998). Man's best weapon for avoiding predators was his ability to see. And for this reason, those individuals who could remain standing and walk upright for long periods of time, and at the same time visually search the surrounding grassland for danger, had a better chance of surviving. (See the review article by Dorfman, 1994).

You might also consult Johanson's books (1981, 1989, 1994), as well as Leakey (1981, 1994) and Leakey and Lewin (1997, 1978, 1992) for more complete details of this story. Lovejoy (1980) proposed that upright stance was a reproductive response. Gorilla's only have one child every four years. Orangutans have only one child every seven or eight years (Knott, 1998). This makes for a very slow increase in these populations. If hominid females were upright they could manage carrying an infant plus food when they were gathering. This permits more efficient feeding of the young, better childhood development and a shorter time between successive children. (Lovejoy, 1980)

Do the wider hips of hominids make walking upright more comfortable? They seem to. Also, the bipedal mode of walking is more efficient than the four-legged gait of the apes. The bipedal mode uses less energy and is much faster over long distances than the four-legged gait (Lovejoy, 1977).

### **Apes to Man: Hominid Evolution**

By the Miocene epoch primitive apes had evolved. From them came two separate groups of apes, differing mainly in their tooth structure. The Dryopithecoid group of apes had apelike teeth and probably were the ancestors of the gorilla, orangutan and chimpanzee. They seemed to live in forest, and left almost no fossils. Forest does not preserve fossils well. The Ramapithecoid group of Miocene apes had teeth that were not apelike. They had big molars, heavy enamel and small canines. The evolution of hominids probably came from this group. Primitive human-like ancestors are called hominids by anthropologists. Ramapithecoid group - "They foreshadow hominids. The dryopithecoids with apelike teeth, foreshadow modern apes." (Johanson, 1981).

But understanding hominid evolution is even harder. Four things seemed to be evolving at the same time.

1. Increased brain size
2. Bipedalism (more efficient than ape walking)

3. Loss of extreme gender size difference.
4. Pair-bonding of mating pairs

The evolution of hominids took place on the east side of the rift valley in a drier climate than the forest on the west side. Evolution was initially at the edge of the forest in open glades, meadows and woods. Later, after the establishment of bipedalism, hominids emerged more onto the open savanna. The oldest hominid fossils we know of are *Australopithecus afarensis* (Lucy) at 3.75 million years ago plus her ancestors dating back to approximately 4.2 million years ago (Gore, 1997). The second important human ancestor, *Homo habilis*, appeared about 2.5 million years ago (Coppens, 1994; Stevens, 1993). *Homo erectus* appeared about 1.75 million years ago, while *Homo sapiens* is known only as far back as 750 thousand years (Gore, 1998).

Thus by about 4 million years ago hominids evolved an upright posture which enabled them to keep watch on their surroundings. Since they were out in the open more often, did not spend as much time in trees, and did not walk using their arms as chimps and gorillas do, but rather walked upright; they had no need of the extra long limbs that the other large apes inherited from their simian ancestors. Humans evolved as we see them today, with an erect posture and relatively short forelimbs. As one of my students so intriguingly put it , humans "needed not long arms for tree climbing". Man is the only truly bipedal placental mammal who walks constantly upright on his hind legs.

Well, what about the hands and arms? If you walk upright on your hind legs, this leaves the arms swinging free at the sides for balance, and the hands empty. Man might gather food with his hands and carry the food in his arms. Humans might also carry a stick or a large stone to use as a digging tool or a type of hammer, as chimpanzees have been observed to use (Goodall, 1986, 1990). But unlike chimps, humans walked upright and thus could carry tools around with them. And these tools very quickly became weapons. At this point, man could become more of a hunter and less a scavenger. More important probably was woman's ability to carry an infant and also a digging stick.

At the same time, extreme gender size difference as is seen in modern baboons for example, was rapidly diminishing in early hominids. We know from observation of living apes, especially gibbons, that lack of gender size difference indicated monogamous pair bonding (Johanson, 1994).

### **More Than Anatomy**

But even more important than the physical features that humans evolved was the social make-up of the primitive groups of scavengers/hunter-gatherers that were early humans. These individuals were not large and were fearful of predators. Primitive human-like ancestors (called hominids by anthropologists) were a smaller animal than we are now, probably about five feet tall for the males and three and one half to four feet tall for the females (Wilford, 1994; Gore, 1997; Johanson, 1981). They had no particularly potent weapons, especially at first. Their best defensive weapon was avoidance.

On the west side of the rift valley, our ape cousins were evolving in a lush tropical forest environment. Apes basically feed alone, and are not normally dependent upon each other for food. There is such an abundance of food that they can almost always find a meal. The only exception seems to be when hunting for meat. At

these times there is cooperation and some begging for food, but this is not a common occurrence (Goodall, 1971, 1986, 1990; Fossey, 1983). In primitive hominids, however, the situation was very different.

On the east side of the rift valley, our hominid ancestors were evolving in a semi-open and rather dry environment. Early hominids lived in small groups of up to about twenty five people. They might gather food on the savanna. When they had quickly and thoroughly gathered whatever they could carry, they retreated to a safe place in the rocks or to a cave, where predators would have a difficult time attacking. Here in their safe place, food would be shared and later might even be cooked under some circumstances. Without this retreating to a safe place and sharing, chances for survival from predators were not very good. Thus humans evolved the instinct to share within the family group. Along with sharing evolved caring. If you constantly share with others, you place some of your trust in them. You never know when you may be dependent upon them to help you when you are sick or injured or simply didn't find anything to eat. And they put some of their trust in you. And mutual trust is one large element of caring. The human line slowly evolved as hunter-gatherers over a period of four million years (Gore, 1997). I believe that the traits of sharing and caring were well imprinted in our genes by the process of evolution.

This seems to me to be a basic difference between apes and man. There was no particular selection for sharing and caring in apes. They evolved in an environment where food was easy to obtain and predators were at a minimum. The leopard is the only large predator of apes I can recall. Man, in contrast, was forced by the environment to learn to share and care. There was no other way to be successful on the open savanna. The savanna provides food but not in abundance. There are also a large number of predators; including the lion, cheetah, leopard, hyena and wild dog. And man was, at least in the beginning, essentially a scavenger (Blumenshine and Cavallo, 1992; Katz, 1998).

At the same time, pair bonding was encouraging men to return to a particular woman with meat that he might have obtained in either scavenging or hunting. This helped supply added protein for fetal and early childhood development and probably was instrumental in the evolution of the very large brain of humans.

Females will more readily mate with males who will invest heavily in their offspring. It is the female who is in a position to choose a male who will make a greater investment. As a consequence, the infant mortality rate in part is a reflection of parental investment in the young, which in turn is a reflection of female choice of a mate. For example, in the United States males who marry in any given year earn nearly 50% more than males of the same age who do not marry (Trivers, 1985). In our society, the ability to earn money is a direct indication of the ability to support offspring.

Human females are unlike any other mammal in that the female is normally receptive to the male at all times in her cycle. This is thought by many to be an evolutionary adaptation to partly assure that a male will return to his mate. A male cannot know when his mate is ovulating. If he stays away this creates opportunities for other males to inseminate the female in question. In other mammals females are only receptive to males during estrus. Trivers states that human females enjoy sex most and engage in it most frequently during the time that they are ovulating (Trivers, 1985).

Human males are attracted to females in specific ways. The male interest in female breasts and hips may be due in part to male interest in female reproductive ability. Human females are likewise attracted to males. The attraction here seems somewhat less physical, with more concern being given to the ability of the male to provide for the family, which includes optimum development of the offspring (Trivers, 1985).

## **Aggression / Reciprocal Altruism**

A number of years ago, there were books by both Ardrey (1961) and Morris (1967) on the nature of man. They took the view that man was descended from some rather fierce predatory apes, carnivores, who were very aggressive and ruthless. This ancestry is supposed to account for situations in which man will exhibit aggressive behavior. Later works by deWaal (1989) and Wrangham (1996) leave no doubt as to the periodic violent nature of modern day male chimpanzees. Another point of view is that man evolved as an opportunistic scavenger and gatherer (Blumenshine and Cavallo, 1992; Katz, 1998), and sharing and caring were important features of the social group. This idea was proposed by Robert Trivers (1971) and is called Reciprocal Altruism which may be defined as a benefit given to another individual at a cost to the giver in expectation (and probability) that the benefit will be returned.

But evolution works by selecting those individuals who are then able to produce the most offspring. Thus selfish traits in obtaining territory, shelter and mates are selected for. At times we see the apparent opposite. This would seem to go against evolutionary theory. Reciprocal altruism is a kind of "I'll scratch your back if you'll scratch mine." and seems to be very much like the Sharing/Caring discussed by Leakey and Lewin (1978). After reading chapter eight of their book *People of the Lake*, one has a much better appreciation for the concept of reciprocal altruism. Wilson (1996) seems also to endorse this view and has a good essay on the subject of altruism and aggression. This view is further endorsed in Wallace's (1992) book when he discusses animal behavior in Ch. 24 and formally discusses reciprocal altruism. The claim here is that reciprocal altruism was primarily responsible for human evolution. Those humans that did not share and care or plan ahead were destined to become extinct, as was the case with Neanderthal man (Fischman, 1992).

Human populations were so sparse and far enough apart that they seldom infringed upon each others territories. Groups moved around a great deal, following seasonal changes, the ripening of different plant foods and migrations of game herds. This made the infrequent contact with a stranger or strange group a novel event and cause for celebration. Perhaps somewhat cautious at first, people were not normally openly hostile, and meeting another group could lead to exchanges of knowledge, goods and people (Auel, 1982).

The point is this. For at least 4 million years other hominids and humans lived as scavenger/hunter-gatherers in fairly small groups. Everyone in a group was mutually dependent upon the other members of that group. Sharing and caring became well established as instinctive genetic traits. It is only in the last 10,000 years that humans have taken to living in urban communities. As soon as you begin to live in a permanent village, relationships change. You are no longer living as one large group. Instead, each biological family lives more or less by itself and people who are less closely related become more distant in their relationship. (Do you remember your cousin who moved to Denver? She really wasn't quite the same person when she came back to visit, was she?) With this type of living comes crowding. When human populations become dense you begin to observe abnormal behavior - crime, aggressiveness, etc. The more crowded the situation, the more abnormal the behavior.

Another trait that we share with other mammals is the tendency to establish dominance and act aggressively - especially within our own species. This is the natural and normal mechanism for establishing the "pecking order" in all animal societies. There is nothing wrong with this. In large part this is a natural result of our evolutionary history. After all, we talk about survival of the fittest in evolution. Who are the fittest humans at this present time? How do these people show their social dominance? Those who are considered the socially dominant individuals in our modern society are those individuals who are either rich, famous or both. The Rockefeller and Vanderbilt names are synonymous with rich, while many people are famous (Bill Clinton, Al Gore, Ted Danson, Meryl Streep, Larry Bird, Mike Tyson, etc.).



What has evolved in our modern society is a confusion about the relative value of various people to society. When you lived in a cave it wasn't very hard to select the leader of the group. It was that male who was the best hunter and demonstrated leadership in both hunting and solving group problems. The female leader was that woman who was most competent in gathering, preserving, making clothes and other techniques of home-making. She also had to arbitrate group problems. She was often, but not always, the wife of the male leader (Auel; 1980, 1982, 1985, 1990).

But in today's complicated society, how do we choose leaders? It is often those individuals who can project the most positive image on television, and may have very little to do with competence. We also have to deal with the experts. Being an expert in one field does not make somebody an expert in all fields. But all too often they think they're infallible about anything and everything, and people believe them. We seem to be all too willing to listen to experts give opinions about matters completely outside of their field. We have this terrible habit of mentally transferring ability. How many sports commentators are as good at commenting as they were at their sport?

Because of the confusion in roles and competence, we often see people in our society in positions for which they are not really suited. And these people usually know that they are not suited. But they maintain the position by being very aggressive and nasty (in a polite way) with those with whom they have to deal. Most such people, when pressured from above, lash out at those who are under them. This is not at all unusual. It happens in schools, companies and factories. It also happens in social situations. And this is where you are likely to see it as a teenager. Someone will give a party. And certain kids will not be invited. It is often a message of one kind or another ("Bathe more often!!" or "I don't like you!") or it may be an attempt to change the pecking order in the peer group. If Sally isn't invited to Mary's party, is she reduced in rank in the peer group?

## **Agriculture and Civilization**

Well, we certainly see around us that modern humans can be aggressive. But is this a result of our evolution and genes? or a result of our culture? About 10,000 years ago humans began to settle down and become sedentary. This was the start of the age of agriculture. Man no longer followed the herds of wild game, gathering grains and other plant materials. Settlements were formed, land was plowed and villages and towns emerged. More crops could be raised by one family than were needed. Surplus food allowed the development of non-farming occupations. Specialization had started! There was the village cobbler, the potter, the butcher, etc. This all started at least 9,500 years ago (Molleson, 1994). As time went on large city-states emerged and we had the beginnings of "civilization". And with civilization came the realization that we were dependent upon the weather and climate for the continued production of crops. A priest class emerged, to intercede with the gods, because the gods obviously controlled the weather! Large temples were built, and stone masons, architects, carvers, gilders and painters were all employed to build these structures. We can see all of this in the remains of the ancient Egyptian and Chinese societies, which date back at least 5500 years ago.

But another thing we see emerging in the very earliest civilizations are police forces, armies, prostitutes, thieves and politicians. There are examples of this from all ancient civilizations. You can see the armies on the monuments to war that dot the ancient landscapes of Egypt, Babylon and the Hittites. The oldest Chinese graves of kings were guarded by large armies of clay pottery soldiers. Egyptian tomb paintings show thieves, and they are mentioned in other ancient civilizations. The tombs themselves were subjected to robbery, and elaborate measures were resorted to in order to make the tombs as safe as possible. Early politicians were also obvious on the tomb paintings. You have to wonder if these bureaucratic advisers to kings were as devious as many of our present day politicians are supposed to be.



Consider this. Dishonest behavior is practically impossible in a small, close-knit scavenger/hunter-gatherer society. If you steal someone's spear or favorite digging stick, where do you hide it? You might get away with stealing some food, because you could immediately eat it. But how do you hide and then later use something? I suppose murder occurred occasionally, maybe over a woman or position of leadership within the group. You could push somebody off a cliff if you were alone. But these events were rare, because everyone lived together in a group for mutual protection and support. It would be very unnatural to kill off part of your protection. And difficult to do so when there were normally other members of the group around.

As an aside here, you need to think about this - were these primitive people smart enough to commit crimes or do other sophisticated mental activities? Despite the fact that they are often portrayed in the movies and cartoons as stupid people who could only grunt, fossil evidence tells us that early man, scavenger/hunter-gatherer or cave-man types, had about as large a brain case as we have. They had the potential to be just as smart, and probably showed the same variation in intelligence that we find today in modern man. What they did not have was a high-technology society. But they were just as intelligent in their world as we are in ours. Probably more so! They left their world for us. Are we going to leave our world for our descendants?

When you stop to consider the whole picture, you find that scavenger/ hunter-gatherers lived in more primitive conditions than we do, but probably were just as intelligent. Social order within the group was probably much as it is in those few primitive groups that still exist on our planet today. Each group was led by a small group of males, of which one was the leader who was responsible for directing the group to new hunting territory as the need arose. There was a parallel line of leadership on the female side of the group.

### **Social Relationships With Others**

There is one outstanding attribute of humans that has absolutely nothing to do with structure or function. This is the fact that humans are a social animal. We spend a vast amount of time in social intercourse. Part of this is an inherited parental concern for our offspring. All mammals show this concern (to a greater or lesser degree). It is one of the characteristics that is a feature of mammals. But in humans, parental concern is of greater significance. The other part is our genetic inheritance of the sharing-caring mode.

There are many things that relate us to other mammals. One notable feature of the class Mammalia that has made its members so successful is the intense care that is lavished on the young by the parents. I know this may be a difficult statement to accept if you are in the ninth or tenth grade. You are just at the stage where you are trying to get out from under the care of your parents, and you probably do not agree that everything that they do is caring. Probably feels more like smothering or interfering, right?

But consider the alternatives. How much parental care is shown by a trout? a clam? a starfish? a turtle? a lizard? All statements are relative. So, in relation to other animals, mammals do lavish much care on their young. Think about it. Here you are at fourteen, still being supported by your parents. Even the most protective birds, like the osprey, only care for their offspring for the first year. Other large mammals, such as the elephant, only look after their offspring for a few years. Humans, in our society, often care for offspring for over twenty years!!

### **Parental Care and Education**

If you look at the mammals as a group, there is one outstanding characteristic that is present in almost all of the species. And that is intense parental care. Virtually all mammals lavish much care and affection on their young. This includes a great deal of teaching on the part of parents. The adult bison has to teach its calf how

to forage and which plants to avoid and which to eat. The mother mountain lion has to teach its young how to hunt and how to avoid man and other dangers.

In man's closest relatives, the apes, there is a great deal of teaching that takes place, including the use of primitive tools. When the offspring is an infant, the teaching is done mostly by the mother, with some help from older female siblings. If the offspring is a female, instruction continues within the female structure of the group. If the offspring is a male, later teaching is by older males, both adults and juveniles, and is separated from the maternal influence.

The same thing holds true in man. We all learn a tremendous amount of material at our mother's side as infants and toddlers. And as children become older they can learn from grandparents, other siblings and other adults and children. There seems to be no limit as to what a very young child can learn. And if you think about it, this is perfectly natural. The young of any mammalian species, especially the larger primates, depend upon learning to supplement their instinctive knowledge. Those young that learn quickly and easily have a definite adaptive advantage. They are more likely to survive to reproduce. Thus we may look at the ability to learn quickly and easily as an adaptive genetic trait, passed on and intensified by the evolutionary process.

At the same time, those adults that are the most effective teachers are the ones whose offspring have the best chance to survive and reproduce. The quicker and easier an offspring learns from a teacher of dangers and resources in the environment, the better the chance for survival. Thus the ability to be a good teacher is also an adaptation for survival of the family unit. The ability to teach is also built into our genome, and has likewise been passed on and intensified by the evolutionary process. And these traits have been selected for in man for at least four million years.

If we look at the few remaining primitive peoples on earth, such as the hunter-gatherers of the Kalihari desert, or some of the native tribes of the Amazon River basin, we see exactly what I have discussed above. Parents spend a good deal of time teaching their children. As the child gets older, the entire tribe takes over the education of the youngster. Remember, the survival of the entire tribe depends in part upon how well and how quickly they teach the young. This process culminates in the more explicit education of the young by the tribal elders, at which point they are formally installed as adults in the tribal structure (Fagan, 1974). There is an old African saying - "It takes an entire village to raise a child."

Primitive children, indeed all children, learn a great deal about their environment from play. They learn where to find food, what plants and animals are safe to eat and other dangers in their environment. More importantly they learn about each other and how to get along in their group. The more complex society becomes, the longer it takes to educate a young person to be a functional adult in that society (Leakey and Lewin, 1978)

How does this compare with our complex and highly technological society? In modern times, education in anticipation of becoming a functioning adult in society requires a much longer time and the accumulation of an incredible amount of information. In order to condense and streamline the educational process, we have evolved a system of formal schooling. This has varied a great deal in time. The teachings of Socrates and others in the classical past were done in small groups, with a circle of students sitting around the master teacher. In medieval times there were great universities that were part of the Catholic Church. Later there were private universities and schools.

In the new democratic society of the United States, there was evolving a public school system; followed by public, land-grant universities. The concept of universal free education emerged from Europe. And as society became more complex, the schools were called upon to teach the various subjects in greater depth; and also

to assume a great deal of teaching that had been done at home as part of normal family life. Thus we find the introduction of home economics classes, various shop courses, music, sex education, etc. Formal education in schools has become extremely complex (Webb et al , 1992)

There seems to be a lot of concern now about how we learn. And yet it dawned on me from remarks that have been made, by my sons and daughter in particular, that really the easiest way that kids learn is by sitting there asking questions or talking with you. Therefore, when they talk about learning at your mother's knee, they're probably right, and that's probably the simplest way to learn. I think this is important to comment on because of all the talk at this time about how we are going to change the way students learn. We're going to give them experiential learning and hands-on and all this kind of stuff, and I'm not sure that's really a correct approach. Maybe we ought to concentrate on polishing up the way we talk to students, so that students can simply sit there and listen and learn.

Some of the things that my kids have told me that they've learned from me I wasn't even aware that I was teaching. I was just talking to them when they were younger. And I'm amazed at what they've retained. My son recently built a ten foot wooden gate for his driveway, held together with carriage bolts and an intricate wooden latch. And when I asked him where he had learned that, he said "From watching you build the gates to the pasture." And when I had thought about it for a while, I realized that I, in turn, had learned that gate-building technique from my uncle, on our farm in Ohio. So I suspect that most of us still retain the inherited ability to teach, and I am very sure that virtually all children retain the inherited ability to learn quickly and easily. So what accounts for our inability to teach and learn in our present society? Probably the complexity and the resultant mental stress that all of us are subjected to, to a greater or lesser degree, in our modern high-tech society.

If you lived in some of the primitive societies on earth, life would be simpler. For example, suppose you were a native Amerind living in the tropical rain forest in Brazil. You become sexually mature somewhat earlier in the tropics than in the temperate climate. So at about twelve a male passes puberty and is married at about fourteen. He probably marries a young woman twelve or thirteen years in age. Why so young?

What adult skills do you have to learn in order to succeed in this lifestyle? The young man needs to know how to construct a thatched-roof house, hunt in the Tropical Rain Forest and be able to clear a small plot of land and grow crops. The young woman must know how to maintain the house and garden, cook and make simple clothes. She probably also knows something about medicine. But these are all skills that these young people learn by observing and listening to adults as they grow up. And by the time they are sexually mature they are just about ready for marriage. In our society, in contrast, by the time you're sexually mature about all you're ready for is seventh grade. And you all know how far away seventh grade is from being an adult!

Our society is extremely technological and education of necessity has become formalized into a system of schools and colleges. But we still retain that inherited ability to teach and learn, at least partially. Have we lost some of the adaptations to learn and teach? Yes, probably, in part because there is no longer the critical need for this trait. There is little or, at least, less selection for teaching and learning in our present-day society, as there was in our primitive past. This may be one reason there are a number of students now who find it very hard to learn.

One of the reasons that teachers find it so hard to gain the respect of the adult community is that, at least on an instinctive level, why respect someone who has a job as easy as teaching? It comes naturally, right? But what the public does not seem to be aware of, is how complex the job of teaching has become, above and beyond the genetic traits involved, because our society has become so complicated. Many of the people who

complain about the teaching profession have absolutely no idea what it is to expend the mental effort and concentration that is required. So that while teaching and learning may be very natural, they are so overlain by societal structure that they are sometimes very hard to identify.

To summarize. Humans share with the other primates, and indeed all of the mammalian groups, the genetic traits of learning and teaching. There is a great adaptive advantage to the early education of the young. How the young learn best is determined by age, subject and the complexity of the society. In humans this trait evolved over a period of at least three million years. The complex social structure that has evolved in the past one thousand years has made the more natural method of teaching and learning too slow to teach all that is needed in today's technological age. We now learn in more formal systems of schools. It has become difficult for many people to recognize what is involved in teaching today, because society is so complex.

### **Sharing-Caring in the Modern World**

The sharing-caring part of our nature and society seems to have been partly lost under a blanket of technology and civilization. The problem is, how do young adults grow up being able to share and care when so much of what they see and hear as children is so negative, aggressive and self-centered? Look at some of the statistics for children. Many children watch an average of three hours of television a day. Children watching TV are extremely passive and show a lower metabolic rate than those children at rest. Even the best of the "quality children's programs" are essentially passive. Thus the children soak up what is presented, and never question what they see (Healy,1990). Nor do they interact with anyone or learn how to use their minds or develop social skills. We see children entering kindergarten who have all the social skills of a three year old, and who are selfish and self-centered because they have not learned how to cooperate with others and be polite.

In 1950 the average vocabulary of a child entering first grade was 4000 words. By 1990 this figure had dropped to 1000 words. Why? Because children are not read to and do not have very much quality interaction with their parents. Plus they do not pick up new words at play with their peers. And it is hard for two tired, working parents or a single parent to do much with their children at the end of the day. Many kids are simply placed in front of the TV while mom and/or dad get supper ready. What are these kids watching?

In our area late afternoon and evening seem to be primarily talk shows, news and reruns of sitcoms. Only PBS has anything vaguely suitable for children. Since most families don't seem to pay any attention to this network, and since most kids don't like or understand the talk shows, they end up watching old sitcoms. But the sitcoms currently playing 4-6 PM in our neighborhood are definitely adult shows. Nothing wrong with them, but they are definitely not for children.

Children who watch adult shows get some very strange impressions and messages. Many adult sitcoms use a great deal of double entendre and allude to all manner of things sexual. It is no wonder children are often confused and sometimes even anxious over what they have seen on TV. But no matter what kind of shows children watch, adult or those made especially for children, the result is the same - passivity and the lack of stimulation of the mind.

### **Reading and the Development of the Mind**

Suppose a child reads the following passage in a book. "Mary walked down the path to the river. She sat in the shade of the big sycamore tree. Mary felt the wind gently blowing on her face. She watched the patterns on the water that the sun made shining through the moving leaves." The child when reading this has to imagine

the setting. Each and every thing and event has to be constructed in the mind - Mary, the path, the tree and the river; plus the feel of the wind and the action of the light on the water. This uses the mind. But what about showing this same scene on TV? Here there is no reason to construct anything in the mind. It is what is called in modern slang WYSIWYG (what you see is what you get). There is Mary already represented on the screen. She walks down the path in a studio set. She sits under a tree that is already there. The sun on the water is probably a computer-generated effect. It leaves nothing for the mind to do except absorb what is presented. This is not at all stimulating and does not help to develop the mind (Healy, 1990).

One other aspect of television and the development of young minds is the amount of violence and death, usually related to drugs, that is presented daily on the TV screen. It seems that hardly a day goes by when there is not shown a body lying in the street in a pool of blood. If a child sees three violent deaths per week on TV, by the time he or she is twelve they have probably seen over 1000 violent deaths! But when you constantly show something like this on television, you are in one sense saying that this is normal societal behavior. After all, it can't be an unusual and aberrant act if it happens every week year in and year out. So it is very easy for a child to get the impression that killing and violence are normal and OK events. And then we wonder why there continues to be an increase in crime and violence among the young. (U.S. News, 1994a). We see this especially in economically depressed communities. The way it is reported, there is a great deal of violence in the black communities. And this was not always the way things were (Gates).

Now I am not placing the blame on television alone. But it is probably no coincidence that as the tone of TV news reporting has become bloodier in the past ten years, the incidence of violent crimes among young people has increased greatly. And yet there are many other factors involved.

We continue to have an increase in homes with a single parent (U.S. News, 1994). This results in a lack of supervision and also a lack of a proper role model, especially for boys since single parents are more often women. Thus we have a large number of young men growing up with no idea of how to act like a man or interact with people, especially with women. As a result, sexual harassment, rape and assault on women have all increased.

Probably out of despair and frustration the incidence of drug use continues to rise. Drug-related crime seems to be by far the largest portion of current criminal cases. (What %? I heard recently on TV one police chief estimate that - 90% of all reported incidents were drug-related!)) And what is most alarming is the increase in violence connected with these crimes. A boy was shot and killed recently for a pair of sneakers! It seems every week there is another child killed by accident in a drug-related drive-by shooting. This has many parents and children just plain scared! And this has affected the most important part of children's lives, education. What child wants to go to school if there's a chance of being shot on the way or coming home? And how can she/he concentrate on their school work if they are worried about getting home alive!?

This has also lead to demands that we stop supporting the people that need it the most. Do away with welfare! No more free lunch programs at school! And this is a perfectly understandable reaction to a part of society that seems to be getting out of control. We even have a book that links all of this social behavior to IQ and recommends many changes in our social welfare laws (Herrnstein and Murray, 1994).

But in a general way, how do we account for the actions of so many of our young people? They act in a self-centered and selfish manner and seem to care little for the feelings of others. Why? Perhaps because deep down inside they don't see any kind of very positive future. Why should they care about and participate in a society that has let them down? For the past ten years the environmental news has been bad when we expected it to get better. Since the breakdown of the communist states we have learned that Eastern Europe

is an environmental disaster area. The ozone layer will continue to decline far into the future even with the shift away from CFC's. And the incidence of skin cancer continues to climb. We are overfishing the oceans. We are over-cutting our forests. The incidence of AIDS continues to rise, especially in young adults. It is now the leading cause of death of young women. We are over-using our drinkable water. And although we have a vice-president who has written a book on global environmental problems (see bibliography - you should know who this is!), currently we seem to hear less about the environment in the news. The one big global environmental problem that we now face is that of population. There are simply too many people in the world!! This fact is becoming increasingly evident and yet at the same time birth rates continue to rise in many countries.

### **Sharing and Caring: Some Final Words**

What does all this have to do with the nature of man and sharing and caring? Simply this. Man's essential nature seems to be submerged under layer upon layer of cultural conditioning. We get most of our information and take many of our attitudes from what we see and hear in the news media. And the medium of television seems to be particularly effective in implanting opinions in the minds of viewers. One example.

When President Clinton was elected I, along with many people, assumed that the U.S. would intervene to stop the genocide in Bosnia. But very quickly there were reporters questioning "whether this is in the best interests of this country?" "Do we want to see American blood shed in this kind of a war?" "We couldn't pull out of here easily." etc. Almost overnight it seemed, there were polls that showed that an overwhelming number of people did not favor saving Bosnia! And the President reacted to the polls and we let Bosnia die. Too bad Bosnia didn't have any oil! As I write this there is about one half of the country left and the politicians have carved Bosnia up into "ethnic enclaves". This was a great disappointment to me, for after World War II I had heard and believed the rhetoric and promises that genocide would never be allowed to happen again, and that this type of armed aggression would not be tolerated by the civilized world. But both the U.S. and the U.N. have done very little except to make empty threats. There are a half dozen similar situations in the world today including Somalia, Haiti, and China.

You young adults as you read this must understand that the one effective way for you to assert your humanity is to use your mind. Question everything you see and hear, especially what comes to you as "news" from the television set. Even the best of the written articles in newspapers and journals may be in error, but not nearly as often as television news.

If you are able to sort through the "spin" placed on the news, if you can come to terms with just how effective we are dealing with our planet and if you can understand that most people act the way they do out of need or fear and not from choice; then you will be able to deal positively with your world and let the sharing/caring side of your nature come to the surface and be a real human.

"Fac et Spera"

## **Appendix**

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### **Lesson Plans**

#### *Introduction*



There are a large number of projects that might be attempted by students in order to better understand human evolution and population. I have included two which I think will excite student interest and lead to understanding.

### **1. Scavenging Bones on the Savanna**

We cannot easily get to the savanna of Africa, and yet this is where scientists say we originated. There is a good bit of fossil evidence that indicates that primitive humans were scavengers first and only later became hunters. (Blumenschine and Cavallo, 1992; Katz, 1998). This evidence is primarily the gouges, scrapes and scratches that appear on fossil animal bones found associated with flint tools and other early human remains. Scientists who have studied modern-day bones left by predators and scavengers have been able to observe and categorize the marks left by each type of animal. Each type of scavenger leaves their own particular marks on bones that they have gnawed. Marks left by hyenas, vultures and other animals are all distinctive. Likewise, the marks left by humans using flint knives or stone hammers are also characteristic.

Humans have an incredible urge to consume fats (Eaton and Shostak, 1986). The best source of fat in the lean herbivores of the savanna is the yellow bone marrow. In order to get at this tissue, the bones must be cracked open, either with teeth (as in the case of the hyena and lion) or with a rock (as has been found in the case of an early hominid). Students may attempt this procedure and get a feel for how easy it really is to get at bone marrow. Bones used for this exercise should not be too large. Veal shanks are about the right size.

### **2. Population Density and Behavior**

Another exercise may show the students how societal behavior is affected by population density. There are many statistical sources for this exercise, both state and national. The hardest part of this exercise may be in finding the statistics needed, which include murder, rape, assault, armed robbery, breaking and entering, drug arrests and teen-aged pregnancies. An almanac is probably the best place to start. This exercise will also give the students practice in extracting raw data, manipulating the data and graphing the results. The results may show a correlation between population density and societal behavior. The results may not always be conclusive, it depends in part upon the populations selected.

The following exercises are to be xeroxed and passed out to the students.

#### **Scavenging Bones on the Savanna**

We cannot easily get to the savanna of Africa, and yet this is where scientists say we originated. There is a good bit of fossil evidence that indicates that primitive humans were scavengers first and only later became hunters. (Blumenschine and Cavallo, 1992; Katz, 1998). This evidence is primarily the gouges, scrapes and scratches that appear on fossil animal bones found associated with flint tools and other early human remains. Scientists who have studied modern-day bones left by predators and scavengers have been able to observe and categorize the marks left by each type of animal. Each type of scavenger leaves their own particular marks on bones that they have gnawed. Marks left by hyenas, vultures and other animals are all distinctive. Likewise, the marks left by humans using flint knives or stone hammers are also characteristic.

1. Students should work in pairs. Your first assignment for this exercise is to find and bring to class two stones. One of these stones should be about fist size, and should fit comfortably in your hand. You will use this stone as a hammer, so make sure it is large enough to extend beyond your fingers. The second stone should be somewhat larger, and will be used for an anvil. A somewhat flat top and bottom will make a more stable and efficient base. Make sure the stones you select are hard and solid. They should not disintegrate or chip excessively when struck together.



2. The next period, your teacher will pass out to each pair of students a bone with some meat on it. Using a scalpel, cut off as much meat as you can and weigh it. Then examine the bone under a stereomicroscope (or with a magnifying glass) for marks that you made in removing the meat. Sketch the bone and marks. Are there any other marks present? Where might these marks have come from? If some students have dogs, try taking the bone home and letting your dog play with it for a few hours. Again, examine the bone under a stereoscope. Did the dog leave any marks on the bone? Where these marks different from the marks that you left? Sketch the bone and marks.

3. Review the structure of a bone in your biology text. Where in the bone is the fatty marrow? Finally, place the bone on your anvil stone (on the floor, under some newspaper) and strike it with the hammer stone. Be careful! Mashed finger tips are very painful! Wear protective lab eye ware when doing this part of the exercise. A stone or bone chip in the eye is not much fun! Crack the bone open, twist the two parts of the bone and remove the fatty marrow from the center of the bone. Weigh the marrow. The calories found in fatty tissue such as the marrow = 9.2 C/gram, while the calories found in muscle = 5.1 C/gram. Was it worth it to crack the bone open and extract the marrow? How many calories did you get from the marrow tissue? How many from the muscle?

4. Dispose of all materials properly in the wastebasket or where directed.

### **Population density and behavior**

This exercise may show you how societal behavior is affected by population density. There are many statistical sources for this exercise, both state and national. This exercise will give you practice in extracting raw data, manipulating the data and graphing the results. The results may show a correlation between population density and societal behavior. The results may not always be conclusive, it depends in part upon the populations selected and the accuracy of your work.

1. Obtain from the teacher an almanac or handout that shows population figures for cities and towns in your state. Select four cities and towns of different sizes and socio-economic conditions. Enter the population values in the table below.

TABLE I. Population Values for Four Cities and Towns

City/Town	Population	Area	Density
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2. Plot on a graph the values for population density (x axis) versus the number of murders per thousand people in one year (y axis). Is there a correlation between population density and violence? Plot separately population density against the number per thousand of rapes, assaults, armed robberies, breaking and enterings, drug arrests, teen-aged pregnancies and other statistics available. Using different symbols, you should be able to plot all of your data on one graph. The resulting graph is called a scattergram. This scattergram should show a correlation between population density and some societal behavior.

3. What is your conclusion? Is there any correlation between population density and behavior? Do you think we are more stressed and under greater pressure when we live closer to one another? For homework, write an essay on our human living arrangements. What could we do to alleviate stress in the population? Can most crimes be reduced by living further apart? What are your ideas?

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