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EFFECTS OF WILDLIFE CARTOONS ON CHILDREN'S PERCEPTIONS OF WILDLIFE AND THEIR USE OF CONSERVATION EDUCATION MATERIAL

By

Cynthia Jill Wong-Leonard

A DISSERTATION

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ABSTRACT

EFFECTS OF WILDLIFE CARTOONS ON CHILDREN'S PERCEPTIONS OF WILDLIFE AND THEIR USE OF CONSERVATION EDUCATION MATERIAL

By

Cynthia Jill Wong-Leonard

Conservation education organizations often incorporate wildlife cartoons to present ecological ideas and make messages more interesting. This study examined whether an anthropomorphic wildlife cartoon experience modified the physical, anthropomorphic and moral attributes ascribed to real animals by Michigan school children in 2 age groups (1-3rd and 6-8th grades). Subject age, past direct contact with wildlife, and gender were analyzed to discern whether they affected a child's susceptibility to the effects of anthropomorphic cartoons.

Subjects (N=2200) in each age group were randomly placed into 6 experimental groups involving various combinations of viewing a natural history video (NH) and a cartoon video. The NH video presented habitat requirements of 3 unfamiliar species (marten, kingfisher and shrew). Animals were portrayed using actual photographs. The cartoon video presented a message promoting environmental respect; however, the caricatures of the 3 species had purposeful distortions in some of their natural characteristics. For example, shrews were depicted as being slow creatures, martens were afraid of heights, and kingfishers were vegetarians. Pre- and post-test items measured changes in subject perception. Also, 210 of the subjects were personally interviewed to explore youngsters' cognitive processes related to their perceptions of cartoons.

Results showed that for both age groups, the wildlife cartoon experience modified the children's ascription of physical and anthropomorphic attributes to real animals. Subjects were willing to accept the distorted characteristics of the cartoons as reality, even after they viewed the NH video containing accurate information. Test and order effects also occurred. In general, the NH video had a stronger influence and was able to "correct" some of the misconceptions

fostered by the cartoon. The cartoon did not affect either age group's ascription of moral attributes (concern for right and wrong treatment of animals). Neither gender nor past direct contact with wildlife influenced subject susceptibility to the effects of the anthropomorphic wildlife cartoon.

The interviewing process revealed that for both age groups, the wildlife cartoon was a symbol of the real animal, not simply a character in the story. Both groups displayed strong anthropomorphic orientations, and expected to learn from cartoons--ones viewed at home and at school.

To -- Him "Who is able to do immeasurably more

than all we ask or imagine"

and

Mom and Dad

who have faithfully lived out Proverbs 22:6

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INTRODUCTION

Cartoons are an integral part of American culture. Comic material enjoys a higher readership than any other print-oriented medium except the daily newspaper (Ball 1983), and cartoon shows are young children's favorite television programs (Lyle and Hoffman 1972, Liebert and Schwartzberg 1977, Forge and Phemister 1987, Huston et al. 1987). Conservation organizations have even created wildlife cartoons (Ranger Rick, Smokey Bear, Woodsy Owl) to present ecological ideas and make messages more interesting. Using unrealistic human-like creatures, however, raises the question of whether learners develop humanistic and moralistic values of wildlife at the expense of ecological and/or utilitarian perspectives. The complexity of present and future resource management requires participation by citizens who have developed a balanced attitude toward resources. Thus, humanistic and moralistic concerns for wildlife are important but need to be balanced by an appreciation of ecological and utilitarian values of these resources. This study examined the effects of anthropomorphic wildlife cartoons on children's perceptions of wildlife and use of conservation education material. Through written surveys and oral interviews children's responses to 2 video presentations (photographs versus cartoons) were measured, and differences due to age, sex, wildlife knowledge, and contact with wildlife were compared.

Findings apply strictly to children ages 7-9 and 12-14 years living in Michigan. However, because childhood experiences strongly influence adult attitudes and activities, as More (1977) and Pomerantz (1977) proposed, study implications may be applicable to other ages.

A need exists for this type of research examining any causal links between wildlife cartoons and children's perceptions of the resource.

More (1977), Pomerantz (1977), Pomerantz and Hair (1988), Kellert (1980), and Kellert and Westervelt (1983) found that young people's most important contact with wildlife is the media: television, newspaper, movies, and children's literature. Children will depend even more on these communication vehicles for their wildlife contact as our population becomes more urban, and as more and more information is presented in animated and graphic forms with society's increasing use of and dependency on computer technology (Wright and Huston 1983). Further, people who view the greatest amounts of television perceive the presented information as a construction of reality (Potter 1988). Thus, as children's contact with wildlife through television and other media increases, their understanding of wildlife reality will hinge on whatever these media offer. Cartoons may intensify this effect since cartoon characters can create an aura of trust among children (Van Auken and Lonial 1985).

Few studies have closely examined the consequences of this vicarious contact with wildlife. Only one study specifically considered the influence of the cartoon medium on children's perceptions of wildlife, and it suggested that "cartoonizing" wildlife distorted 5th graders' perceptions of the resource (Wong 1985). Ramsey's (1989) study on children's preferences for certain art styles provided additional evidence for the negative effects of wildlife cartoons. It showed that children who preferred cartoons of animals over realistic, representational and expressionistic styles gave some degree of anthropomorphism to the creatures. In response, Ramsey warned against current practices of using the cartoon style indiscriminately in illustrating print and non-print materials.

The social science literature also lacks research on the effects of cartoons on children's attitudes and/or learning (Hapkiewicz 1979). Past research primarily focused on the physical reaction of children to cartoon violence, and mixed results were reported. Further, these studies were restricted to children under 10 years of age. Information

on the effects of cartoons on older children is needed because the middle years offer the greatest opportunities for acquiring knowledge and an understanding of the environment (More 1977, Pomerantz 1977). In addition, past research analyzed either interpersonal aggression or aggression toward inanimate objects; none studied how cartoons affect children's response toward animals or the environment. Simonson et al. (1979) felt that the cartoons and attitudes stimulus-response phenomenon offered the "most fertile ground" for future research efforts in audiovisual communication.

The study has strong implications for wildlife management. Public perceptions of management practices may be altered by wildlife cartoons. In his article describing the history of controversial forest fires in America (e.g., the 1988 Yellowstone National Park fire) and U.S. fire management, Williams (1989) explained one famous blaze in 1942 that changed public opinion of forest fires:

> "In 1942 there came a truly tragic forest fire--by far the worst that mankind has ever witnessed. Crazed, screaming animals flew, galloped, ran, and crawled from hideous tongues of flame, stopping only long enough to warn their friends. Some were burned. Many wept. They lost their families and their beautiful, happy homes."

This "worst" U.S. fire in history was the one in Walt Disney's animated motion picture *Bambi*. Williams cited Roderick Nash, a professor of history and environmental studies at the University of California at Santa Barbara, who believed that this one blaze in *Bambi* was the "most important document in American cultural history bearing on the subject [of fire-management policy]." Williams also mentioned another cartoon character that has swayed public perception of forest fires--Smokey Bear. Pomerantz (1977) agreed, offering that Smokey and its message have been oversold to the point of creating false impressions in young people.

Lutts (in press) did an extensive review on the effects of *Bambi* on American culture. He argued that this one film has been one of the greatest influences on public perception of wildlife preservation; it has affected American ideas about the environment and hunting, and "Bambi" has become almost a synonym for deer and/or opposition to hunting. Lutts explained that in 1943, the year after *Bambi*'s release, Aldo Leopold pressed for an antlerless deer season to manage an overpopulated Wisconsin herd. Public opposition defeated the proposal, and Lutts cited Flader and Meine's suggestion that *Bambi* played a role in shaping public opinion on this issue. Public attitudes toward hunting is an extremely important issue in wildlife management. Misconceptions must be corrected as soon as possible if wildlife populations and sport hunting are to survive (Pomerantz 1977, Armstrong and Odom 1982).

Lutts summarized his warnings about *Bambi* as follows:

> "It may well be that more people have, consciously or unconsciously, based their understanding of deer and woodland life on Walt Disney's *Bambi* than on any other single source. Its images and concept of nature have been impressed on the American psyche and reinforced through decades of exposure to the film and its multitude of spin-offs. Bambi has become one of our most widespread and emotionally powerful national symbols of nature; one that motivates deep concern and, sometimes, dedicated action to protect wildlife. However, Disney's Bambi is an empty symbol, because the concept of nature that his fawn represents is impoverished. The film motivates, but does not educate. It may stimulate action, but not understanding. Rather than affirming nature, it represents a flight from the natural world into a comfortable nature

fantasy that, ironically, offers no hope for Man or the rest of us poor humans.

Nature, symbolized by Disney's infant Bambi, an infant with endearing human qualities, becomes something fragile and vulnerable. It becomes something that we must nurture and protect. This can be a useful metaphor, given our enormous technological abilities to destroy our environment. However, grave problems lie ahead if we confuse a fetching metaphor with the living reality of deer, other wildlife, or our environment. After all, the challenge we face is to protect real wildlife in a real environment--not the Disney version."

Findings from the present study may provide insight on why and how wildlife cartoons like Bambi and Smokey Bear can influence public perceptions of wildlife and resource management.

Results may also suggest ways to draw wildlife which foster accurate perspectives of the resource in children. Then as adults, they should make better decisions concerning wildlife management since childhood experiences strongly influence adult attitudes and activities, as suggested by More (1977) and Pomerantz (1977). Wildlife cartoons portrayed accurately could also diminish the strong preferences the public has toward animals, seeing some as "good" and others as "bad" (Badaracco 1973, Collins 1976, Kellert and Berry 1980, Kellert and Westervelt 1983, Tangley 1984). Without polarizations, people would be more aware and concerned about all species, not just attractive "higher" ones (Kellert and Berry 1980). The public would also better understand food webs and complex interactions between animals and their environment (Gallant 1981). More (1977) believed that the public's strong animal preferences was the source of wildlife management problems.

Because children develop attitudes toward and knowledge of wildlife (Pomerantz 1977, 1984; Rejeski 1982, Kellert and Westervelt

1983), comparing the effects of cartoons on different age levels can provide insight on children's receptivity to this educational strategy, and optimal ages to use it. Females differ both in their orientations to wildlife (Badaracco 1973, Collins 1976, Westervelt and Llewellyn 1985) and in their picture processing (Bogue 1982). Thus, assessing gender differences is also important to wildlife management and education. Findings will enable producers of conservation education programs to better tailor their curricula for specific needs and audiences.

With increasing urbanization, analyzing any urban-rural differences is critical. Although studies suggest that the amount of direct contact with wildlife influences attitudes toward and knowledge of wildlife (Bryan and Jansson 1973, Dahlgren et al. 1977, Westervelt and Llewellyn 1985), few studies have examined the effects of this variable on responsiveness to wildlife education programs, especially those incorporating anthropomorphic cartoons.

A study of the positive and negative impacts of this educational strategy would provide insights for general education as well as for wildlife education. Although people prefer to learn by cartoons over printed text (Baker and Popham 1965, Popham 1969, Sewell and Moore 1980) and realistic photographs (Kauffman and Dwyer 1974), some cartoons may hinder understanding of new concepts (Caldwell 1973). Children may associate cartoons exclusively with fantasy, distortions of reality and entertainment (Wilson and Shaffer 1965, Snow 1974, Dorr 1983, Ramsey 1989). Further, abstract media may also poorly facilitate attitude changes (Simonson 1980). In general, cartoons are a "mystery" to researchers, educators and artists because no one understands how or why they "work" or how individuals process them (Perkins 1976) . Cartoonist and researcher Harrison (1981) described the advantages and dangers of this mystery medium as follows:

"The seemingly simple cartoon turns out to be a surprisingly

> complex intellectual problem. At a very basic level, it is not easy for us to explain how the human organism processes a caricature. Yes, the cartoon is 'communication to the quick' and it has all the advantages of speed and all the dangers of haste. It simplifies and exaggerates, so it has all the advantages of clarity, and all the disadvantages of distortion. It is humorous, with all the advantages of amusement, and all the dangers of diversion."

This study examined the effects of cartoons on children's perceptions of wildlife and use of conservation education material by addressing the following research question:

> Does exposure to an anthropomorphic wildlife cartoon experience modify the physical, anthropomorphic and moral attributes ascribed to real animals by receivers?

Wildlife cartoons range from realistic (e.g., Mark Trail) to extremely anthropomorphic where the animal is actually a human "in fur" (e.g., Mickey Mouse). This study evaluated the effects of an anthropomorphic wildlife cartoon intermediate between these extremes. While not animated, the characters were similar to those in *Bambi* where the animals behaved like real wildlife (walked on all fours, lived in a forest, etc.), yet spoke and showed emotions plus other human traits (ethics, gestures, etc.).

An anthropomorphic wildlife cartoon experience referred here to a particular combination of visual and verbal information--i.e., an anthropomorphic cartoon with character dialogue. Another possible cartoon experience is a realistic wildlife cartoon accompanied by narration. Thus, the study analyzed the effects of the entire cartoon experience; it did not compare the impacts of the pictorial versus verbal components nor individual differences in verbal and visual

learning which must be addressed when comparing these 2 effects (Bogue 1982).

The physical attributes referred to the morphology, physiology, behavior, and habitat needs of wild animals. For example, some physical attributes of a porcupine (*Erithizon dorsatum*) are its nocturnal and arboreal nature, slow speed, spiny coat, and diet of buds, small twigs and the inner bark of trees (Burt and Grossenheider 1976).

Anthropomorphism is the attribution of human characteristics to nonhuman organisms (Blanchard 1982). Thus, anthropomorphic attributes referred to any human characteristic given to animals--e.g., worrying, loneliness, long-term planning, hatred, etc. Moral attributes reflected the subject's perception of right and wrong treatment of an animal. Measures of moral attributes did not differentiate between animal rights and animal welfare perspectives.

The study tested a model (Figure 1) to answer the research question. Age, past direct contact with wildlife, and gender were selected as exogenous or independent variables because research shows that these factors affect children's knowledge of and attitudes toward wildlife. Studies of children's reaction to television stimuli revealed that perceived reality is an important variable, though not completely understood or estimated (Hawkins 1977, Potter 1988). Thus it was included in the model and labeled "Perceive Educational Experience as Real Wildlife".

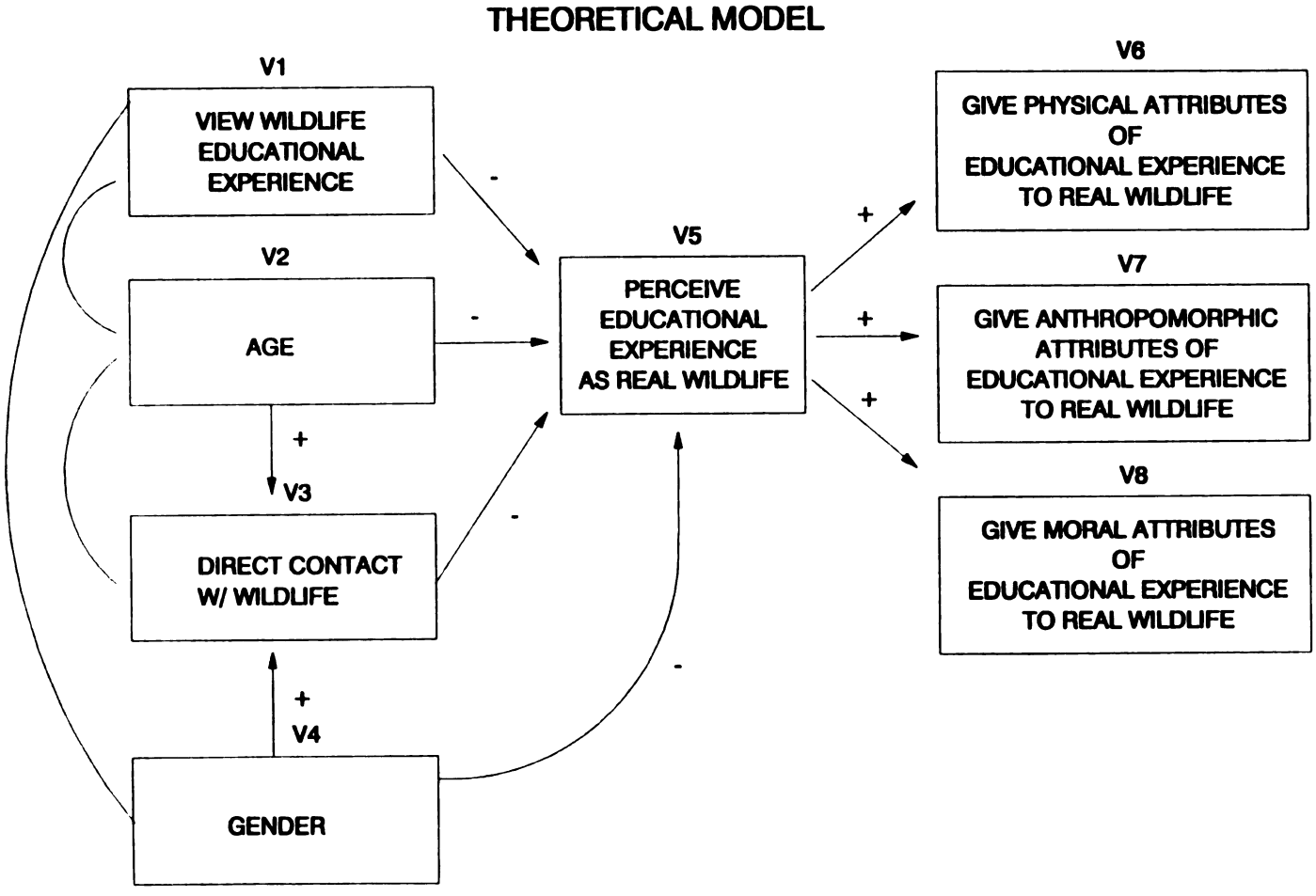


Figure 1. Original theoretical model.

The model tested 2 levels of each exogenous variable:

View Wildlife Education Experience:

1. natural history--photographs accompanied by narration
2. fantasy--anthropomorphic cartoons with character dialogue

Age:

1. 1-3rd grade
2. 6-8th grade

Past Direct Contact with Wildlife:

1. low
2. high

Gender:

1. female
2. male

Perceive Education Experience as Real Wildlife:

1. yes
2. no

The educational experiences were presented in a video format using still photographs or cartoons. Time and budget limitations prevented the use of motion or animation; plus a simple still cartoon presentation would provide basic information on the impacts of anthropomorphism without the confounding effects of animation. Two age ranges were studied to assess whether developmental changes influence youngsters' responses to an anthropomorphic wildlife cartoon. Further, children between the ages of 7-9 years are exposed to more animated cartoons than any other age group (Lyle and Hoffman 1972, Liebert and Schwartzberg 1977), and youngsters 12-14 years of age are the greatest consumers of comic books (Wright 1983a,b). These 2 age groups should also show responsiveness to the new concepts and attitudes presented in the treatments, because children tend not to permanently form their

attitudes toward the environment until the late middle school years (Horvat 1974, Miller 1975, LaHart 1978, Pomerantz 1984).

The following hypotheses verbally state the predictions of the causal model represented by the "+" and "-" signs.

1. H_o: Regardless of which wildlife educational experience an individual views, he or she will perceive it as depicting real wildlife. That is, there is no difference between the effects of an educational experience containing realistic photographs and one using anthropomorphic cartoons on an individual's perception of whether that experience portrays real wildlife.

   H_A: As the educational experience becomes more abstract or fantastic, an individual will less likely perceive it as depicting real wildlife.

   Rationale for H_A:

   Children may associate cartoons exclusively with fantasy, distortions of reality, and caprice (Wilson and Shaffer 1965, Snow 1974, Dorr 1983, Ramsey 1989).

2. H_o: There is no difference between the 2 age groups' perception of a wildlife educational experience. Both perceive it as depicting real wildlife.

   H_A: Children in the older age group are less likely to perceive a wildlife educational experience as depicting real wildlife.

   Rationale for H_A:

   Older children have more knowledge about wildlife (Dahlgren et al. 1977, Kellert and Berry 1980, Kellert and Westervelt 1983, Westervelt and Llewellyn 1985) and more experience

with it; thus they can better discern whether a wildlife educational experience is accurately depicting real animals.

3. H_0: Regardless of how much past direct contact with wildlife an individual has experienced, he or she will perceive a wildlife educational experience as depicting real wildlife. That is, there is no difference between the perception of an individual having high past direct contact with wildlife and an individual experiencing low past direct contact.

H_A: An individual with more past direct contact with wildlife is less likely to perceive a wildlife educational experience as depicting real wildlife.

Rationale for H_A:

Studies on the perception of television reality suggest that people who have had more real-life contact with people and events similar to those presented on TV are better able to recognize unrealistic information (Potter 1988). Thus, children with more past direct contact with wildlife can better discern whether an educational experience about wildlife is accurate or not. They have had more first-hand contact with species; the experiences have not been interpreted by editors, artists or writers--a process inherent in vicarious wildlife contacts. Further, children with more direct contact with wildlife may be more knowledgeable about animals (Kellert and Westervelt 1983, Westervelt and Llewellyn 1985). Indirect contacts may carry inaccuracies and misconceptions about wildlife (Bryan and Jansson 1973, More 1978).

4. H_0: There is no difference between males and females in their perception of the educational experience. Both sexes will perceive it as depicting real wildlife.

   H_A: Males will be less likely to perceive a wildlife educational experience as depicting real wildlife.

   Rationale for H_A:

   Males are more knowledgeable about wildlife (Dahlgren et al. 1977, Kellert and Berry 1980), and thus better able to discern whether an educational experience about wildlife is accurate or not.

5. H_0: There is no difference between the 2 age groups (1-3rd and 6-8th) in the amount of their past direct contact with wildlife.

   H_A: The older individuals have more past direct contact with wildlife than the younger children do.

   Rationale for H_A:

   As individuals age, they have more opportunities to experience direct contact with wildlife.

6. H_0: There is no difference between the sexes in the amount of their past direct contact with wildlife.

   H_A: Males have more past direct contact with wildlife than do females.

   Rationale for H_A:

   Studies show that males experience more direct wildlife contact than females (Richmond and Morgan 1977, Kellert and Berry 1980, Kellert and Westervelt 1983, Kellert and Berry

1984, Westervelt and Llewellyn 1985).

7. H_0: There is no difference between an individual who perceives the educational experience as depicting real wildlife and one who does not in their ascription of the physical attributes presented in the educational experience to real wildlife.

H_A: An individual who perceives the educational experience as depicting real wildlife will more likely ascribe the physical attributes presented in the educational experience to real wildlife.

Rationale for H_A:

Children often perceive television as representing reality, and believe that characters and events exemplify people and situations in the real world (Lyle and Hoffman 1972, Hawkins 1977). This study's educational experiences are similar to television; thus if an individual accepts them as reality, it seems likely that he or she will ascribe the physical attributes presented in them to real wildlife.

8. H_0: There is no difference between an individual who perceives the educational experience as depicting real wildlife and one who does not in their ascription of any anthropomorphic attributes in the educational experience to real wildlife.

H_A: An individual who perceives the educational experience as depicting real wildlife will more likely ascribe any anthropomorphic attributes in that experience to real wildlife.

Rationale for H_A:

Children often perceive television as representing reality, and believe that characters depict people in the real world--including their attitudes, emotions and other human traits (Lyle and Hoffman 1972, Hawkins 1977). This study's educational experiences are similar to television; thus if an individual accepts them as reality, it seems likely that he or she will ascribe any anthropomorphic attributes presented in them to real wildlife.

9. H_0: There is no difference between an individual who perceives the educational experience as depicting real wildlife and one who does not in their ascription of moral attributes to real wildlife.

H_A: An individual who perceives the educational experience as depicting real wildlife will be more concerned about the right and wrong treatment of wildlife.

Rationale for H_A:

Children often perceive television as representing reality, and believe that characters and events exemplify people and situations in the real world (Lyle and Hoffman 1972, Hawkins 1977). If an individual accepts the educational experiences as reality, it seems likely that he or she will ascribe any perceived moral attributes presented in them to real wildlife.

LITERATURE REVIEW

Several areas of research were pertinent to this study: children's attitudes toward, and knowledge and perceptions of wildlife; animism; anthropomorphism; visual versus verbal learning; the use of pictures in learning; the definitions, history and trends of cartoons; the effects of cartoons on learning, attitudes and behavior; and cartoon production. A literature review for each section follows.

Children's Attitudes Toward, and Knowledge and Perceptions of Wildlife

Individuals encounter and learn about wildlife in 3 ways (More 1978): 1) direct natural experiences (encounter in natural habitat), 2) direct artificial experiences (zoos, museums, circuses, nature study at school), and 3) vicarious experiences. Research shows that the public's primary contact with wildlife is through the media, a vicarious encounter (Kellert 1980, Gilbert 1982, Kellert and Westervelt 1983, Pomerantz 1986b, Pomerantz and Hair 1988).

The Effect of Media on Children's Perception of Wildlife

Media includes pictures, reading, watching movies (especially in school), videos, and television. Television may be the greatest influence on children's attitudes toward wildlife (Pomerantz 1977, Richmond and Morgan 1977, Gilbert 1982). However, literary sources of information are also important. Powell and Powell (1982) found that children's literature, general books on animals, magazines, and pictures were the most important resources for kindergarten and 1st-grade teachers to learn about (and teach from) unfamiliar wildlife. Natural resource magazines were 5th graders' primary source of information on

wildlife and the environment in Pomerantz and Hair's (1988) study.

More (1978) gave reasons why the children's wildlife story may be the most significant factor determining wildlife perceptions in an individual. It is the first contact that he or she has with many species, appearing at a time when perceptions of many species are not well formed. Thus, the children's story may create the basis for their perceptions of wildlife. In a later study More (1979) found that books on wildlife comprise one of the largest, most popular categories of children's literature. Peterson (in O'Donnell 80) found that the specific subject most frequently selected by 2nd graders in Iowa were fantasy stories about animals.

Children's stories and other vicarious wildlife experiences can generate inaccuracies and misconceptions (Bryan and Jansson 1973, More 1978). One reason is the editorial process. A story may initially contain factual information about wildlife, but as it passes through several editors whose definitions of objectivity and reality concerning wildlife may differ from those of a biologist, the final product may be inaccurate (More 1978).

Secondly, some animal stories are completely unscientific (More 1977). Creatures are actually people "in fur"--e.g., *The Jungle Book*. Other animal narratives have characters that closely resemble real animals, neither talking or thinking, but show human characteristics of joy, sadness, loneliness, etc. Thus, fact and fantasy may be inseparable to the child. It is this element of uncertainty that may make these stories convincing and exciting (More 1977).

Powell and Powell (1982) found interesting trends regarding predator stories for children. Books for kindergartners to 3rd graders had predators with human characteristics; in fact, humans could have been substituted for the predators in many of the stories. In books for 3rd to 8th graders, predators had straight animal roles.

Some animals are used more frequently than others in children's books. Mammals appear most often, followed by birds, then reptiles,

amphibians, fish, and insects. Thus, a child learns about the animal kingdom through only a few species--usually hippopotami, rabbits, porcupines, squirrels, and bears (More 1978). Liebert and Schwartzberg (1977) reported that male animal stories outnumber female stories two to one. More (1978) believed that because the number of books about a species may reflect current socio-cultural trends, it may be possible to monitor trends in wildlife preferences by examining the frequency by which specific animals appear in children's books.

Studies seem to support the proposal that vicarious experiences generate misconceptions about wildlife. Persons who contact wildlife directly (hunters, birdwatchers and animal club members) generally exhibit higher knowledge, and more concern and appreciation for wildlife than those who experience animals primarily through vicarious means (Kellert and Westervelt 1983, Westervelt and Llewellyn 1985). Individuals do learn factual information from the media, however. Richmond and Morgan (1977), LaHart (1978), Westervelt and Llewellyn (1985) found wildlife television show watchers scoring higher on wildlife knowledge questions than non-watchers. Pomerantz and Hair (1988) discovered that readers of *Ranger Rick*, a conservation education magazine for children, knew more about wildlife and ecological concepts than non-readers.

Children's Knowledge and Perceptions of Wildlife

Subject Areas

The general public is not balanced in their knowledge about wildlife. They know more about concepts regarding the environment than facts (Richmond and Morgan 1977). In general, the public is least knowledgeable about endangered species, superstition and myth, invertebrates, taxonomic characteristics, wildlife management, wildlife history, and wildlife issues such as pesticide effects on birds, baby seal killings, and steel leg-hold traps (Kellert 1979, Kellert and Berry 1980). They do not understand the importance of vegetative diversity in

producing a diversity of wildlife species, the potential of different habitats to support wildlife (Gilbert 1982), or wildlife behavior patterns (Bryan and Jansson 1973). Hooper's (1988) sample of California teachers knew the least about the "edge effect", wildlife stocking programs, exotic species introductions, and the relationship between wildlife abundance and soil fertility.

In her study of 7-12th graders in Michigan, Pomerantz (1977) found that these youths hold misconceptions regarding biological processes--especially succession, effects of forest fires on wildlife, and wildlife as a renewable resource. She warned that if the public does not understand the concept of wildlife renewability, hunting for reasons other than subsistence may be viewed as an action that depletes a resource and threatens species viability. Surveying children nation-wide, Llewellyn and Westervelt (1985) found that 5-6th graders had only a "moderate" understanding of wildlife. Although factual knowledge may increase the most between 5th and 8th grade, most children do not seem to understand ecological processes like predation and nutrient cycling. They interpret them in anthropomorphic and negative terms, failing to identify the ecological value of these activities (Kellert and Westervelt 1983).

Armstrong and Odom (1982), in their study of gifted students in Georgia (4-12th graders), reported that many had a distorted concept of wildlife conservation, and a lack of understanding of the importance of habitat. About 44% of their solutions to the problem of endangered wildlife were unrealistic, with the largest percentage coming from high school students. Further, most had a poor understanding of the impact of hunting on endangered species.

The public does not understand the role of hunting and habitat on wildlife populations. The 1969 Gallup Poll (Hooper 1988) showed that people thought that the best ways to perpetuate wildlife populations were to provide stricter law enforcement and curtail or eliminate hunting. Little mention was made of wildlife habitat maintenance and

improvement. Hooper's (1988) teachers incorrectly thought that the main causes of population declines were predators and hunting. Most of Armstrong and Odom's (1982) gifted students felt that hunting was a major reason for population declines while habitat destruction and pollution were less important factors. Armstrong and Odom observed that most of their students visualized direct harm to each animal (e.g., trapping) as being more detrimental to wildlife than indirect factors (e.g., pollution) which may destroy entire populations.

The subject areas that the public has the most knowledge about include highly familiar species, human injuries inflicted by species, common historical practices, domestic animals, emotional issues involving specific attractive large and phylogenetically higher animals, and ecosystem interdependence (Kellert and Berry 1980). Gilbert (1982) found that the Canadian public had a wider definition of wildlife than wildlife professionals. To the public, wildlife was more than just mammals. It included insects, fish, amphibians, and reptiles.

Factors Affecting Wildlife Knowledge

How knowledgeable a person is about wildlife seems to depend on familiarity or contact with wildlife either through residential location or recreational occupation (Bryan and Jansson 1973, Dahlgren et al. 1977). Individuals with more direct contact with wildlife exhibit a broader knowledge base and fewer misconceptions. Demographically, the most knowledgeable groups are males, college graduates, Alaska or Rocky Mountain states residents, and/or those not frequenting religious services (Kellert and Berry 1980). In their study of 1,060 Iowans, Dahlgren et al. (1977) found the highest scorers on knowledge questions were married males >49 years of age who grew up in a rural or small town setting and had an education up to 2 years of college. Farmers and trappers showed the highest knowledge levels.

The least knowledgeable groups in the U.S. include blacks, those with <11th-grade education, large city residents, individuals older than

76 years of age or younger than 25 years, and persons living in the northeastern United States (Kellert and Berry 1980).

Dahlgren et al. (1977) found that as people aged, they scored higher on wildlife knowledge questions. However, children know more about invertebrates and basic biological characteristics of animals than do adults (Kellert and Westervelt 1983). Adults are more knowledgeable about domestic animals and situations with strong practical significance, e.g., human injuries inflicted by animals.

The most knowledgeable children's groups include those with high naturalistic interests, and low fear of animals (Westervelt and Llewellyn 1985). Other groups with high knowledge scores are bird identifiers (Westervelt and Llewellyn 1985), wildlife television show watchers (Richmond and Morgan 1977, LaHart 1978, Westervelt and Llewellyn 1985), hunters (Dahlgren et al. 1977, Kellert and Westervelt 1983) rural town residents, frequent zoo visitors, (Kellert and Westervelt 1983), and animal club group members (Kellert and Westervelt 1983). LaHart (1978) suggested that an association exists among animal-related activities, knowledge level and attitudes. Greater involvement in animal-related activities encouraged greater knowledge about wildlife. Increased knowledge positively correlated with a positive attitude toward wildlife. Westervelt and Llewellyn (1985) believed that this relationship between animal-related activities and knowledge was stronger and more consistent than that between attitudes and knowledge; for although many of their subjects were quite knowledgeable about wildlife, they showed strong humanistic attitudes, emphasizing individual animals and attractive species.

Rejeski (1982) proposed a 3-stage model of cognitive development in children as they acquire environmental knowledge and understand ecological concepts:

1) Literalism (6-7 years): The child is interested in the immediate environment only, and has little ability to see himself/herself removed from physical surroundings. An

important symbol of nature during this stage is a tree with its inhabitants, their homes and behaviors.

2) Organization (9-10 years): Child classifies and systematically reduces the complexity of the world through natural laws. Nature is seen as an enclosed space (pond, forest, mountain). He or she becomes aware that human intervention may produce deleterious effects in the environment. A land ethic could be effectively introduced at this stage.

3) Moralism (13-14 years): The child begins to understand basic ecosystem concepts and the link between humans and the natural environment. A sense of moralism is established here.

Despite their knowledge level of wildlife, children have strong anthropomorphic or personification tendencies (LaHart 1978, Westervelt and Llewellyn 1985). Pomerantz (1977) found that most 7-12th graders attributed the sense of pain to animals. Further, half believed that animals think about their actions. Bowd (1982) found that although kindergartners' beliefs toward animals are primarily egocentric and subjective, these youngsters are beginning to have a more de-centered and generalized view of wildlife. They can differentiate animal capabilities from humans, seeing animals as having weaker sensation of pain and maternal affection, an absence of moral responsibility, and limited linguistic capacity. However, in a study of 5th graders Bowd (1984) reported that 65% believed that animals could linguistically communicate, and 61% perceived them as capable of moral responsibility.

Children and adults attribute a gender to an animal depending on its species. Lash and Polyson (1987) found that subjects viewing animal images perceived most of them as a particular gender, especially male (58% male, 14% female). Animals considered male included ape, bear,

bat, beaver, buffalo, chipmunk, cockroach, crow, dog, donkey, eagle, frog, lion, monkey, owl, penguin, rat, shark, tiger, turkey, turtle, walrus, wolf, and worm. Animals perceived as female were bird, butterfly, cat, chicken, cow, deer, kangaroo, lamb, seal, and sheep. Findings were consistent across sex; no cases occurred where an animal perceived as male by subjects of one sex was perceived as female by subjects of the other sex. One problem with this study was that no neutral category was provided on the scale. Further, whether or not subjects were responding to the word or picture was unclear.

Lash and Polyson suggested that animal figures in dreams, artwork, fairy tales, and projective test responses may be a metaphoric representation of the significant people in one's life. The notion that animal images are psychologically meaningful for all age groups is supported by the frequent occurrence of such responses in projective testing. For example, 48% of all Rorschach ink blot responses by adolescents are animals.

Children's Attitudes toward Wildlife

Knowledge alone does not guarantee intelligent environmental policy making. It also rests on public attitudes (Ramsey and Rickson 1976). An attitude may be defined as "a general and enduring positive or negative feeling about some person, object or issue (Petty and Cacioppo 1981). Children's attitudes toward wildlife are extremely important to wildlife management because childhood experiences strongly influence adult recreation activities and attitudes toward wildlife as proposed by Kellert (1976) and Pomerantz (1977).

Kellert (1976) proposed a typology of 9 attitudes the public has toward wildlife: ecologistic, naturalistic, moralistic, humanistic, utilitarian, negativistic, scientistic, aesthetic, and dominionistic (Table 1). Although the validity of Kellert's theoretical model and original instrument are suspect (Peyton and Langenau 1985, Eberhardt and Wong, Mich. State Univ., unpubl. data), Kellert and Berry (1980)

reported that humanistic, moralistic, utilitarian, and negativistic attitudes dominate in the public. Children's primary attitude specifically toward wildlife may be humanistic (Kellert and Westervelt 1983, Westervelt and Llewellyn 1985), and these feelings are stronger toward mammals than fish (Pomerantz 1977). Children may also have strong naturalistic, negativistic and moralistic attitudes. Both their humanistic and naturalistic attitudes are greater than that found in adults (Kellert and Westervelt 1983, Westervelt and Llewellyn 1985).

Table 1. Kellert's (1976) attitude typology.

Naturalistic:	Primary interest and affection for wildlife and the outdoors
Ecologistic:	Primary concern for the environment as a system, for interrelationships between wildlife species and natural habitats
Humanistic:	Primary interest and strong affection for individual animals, principally pets
Moralistic:	Primary concern for the right and wrong treatment of animals, with strong opposition to exploitation or cruelty towards animals
Scientistic:	Primary interest in the physical attributes and biological functioning of animals
Aesthetic:	Primary interest in the artistic and symbolic characteristics of animals
Utilitarian:	Primary concern for the practical and material value of animals or the animal's habitat
Dominionistic:	Primary interest in the mastery and control of animals typically in sporting situations
Negativistic:	Primary orientation an active avoidance of animals due to indifference, dislike or fear.

Factors Affecting Children's Attitudes towards Wildlife

Direct Contact

Bryan and Jansson's (1973) hypothesis that increased direct contact with wildlife increases public knowledge of animals may also apply to attitudes--greater contact leading to more positive attitudes. This is supported by research on "mere exposure". ("Mere" is defined as a condition which makes the stimulus just accessible to the individual's perception.) Studies suggest that repeated exposure to a stimulus object enhances an individual's attitude toward it (Zajonc 1968).

Whether or not the object of concern impinges directly on one's life or requires personal sacrifice appears to affect children's general attitude toward the environment, with greater sacrifice leading to a less positive orientation (Richmond and Morgan 1977, Pomerantz 1986a, Pomerantz and Hair 1988). Benjamin et al. (1977) found that elementary environmental education may help change some of their attitudes, e.g., toward man as a contributor to environmental problems. He reported that attitudes most difficult to transfer through environmental education programs were those concerning natural ecological processes such as life-death cycles.

Age

Kellert and Berry (1980) proposed that as people age they have less affection for pets and wildlife, or show more negativism. Persons older than 76 years of age tended to be more utilitarian and less concerned about wildlife and animal protection. Children may value wildlife because they want to learn more about it (Pomerantz 1977). Kellert and Westervelt (1983) proposed a 3-stage model for early development of attitudes toward wildlife.

> Stage 1 (2-5th grade): A child's emotional concern and general affection for animals increases. Environmental education efforts should focus on instilling this feeling. Prior to this stage, the child had less contact with animals. He or she was more detached,

fearful and pragmatically-oriented toward them, stressing the needs and benefits of people. The child expressed minimal interest and concern for species' rights or natural habitats.

Stage 2 (5-8th grade): Intellectual and cognitive understandings of animals increases. The child has a broader and finer grasp of biological characteristics of animals and some physical parameters associated with natural habitats. Environmental education programs should emphasize factual learning.

Stage 3 (8-11th grade): An increase in ethical concern, welfare and kind treatment of animals occurs. An understanding of abstract concepts like ecosystems, biological diversity, wildlife protection, and wildlife management issues also develops. The child tends to be more ecologistic, moralistic and naturalistic, with a greater interest in outdoor recreation involving wildlife. Environmental education should emphasize ethical relationships and an appreciation for ecology and wildlife management.

Morris and Morris (1966) proposed another model of attitude development, focusing on "animal reactivity" in children 4-14 years old:

Younger group (4-8 years): These children react most strongly to big animals, because they see them as parent figures. These youngsters have not yet "rebelled", so they prefer animals that fit the role of the omnipotent parent.

Older group (9-14 years): These youngsters respond to smaller creatures, perceiving them as infant figures. They are beginning to compete with their parents and express it by imitating them.

Pomerantz (1986a) compared several development theories on children's perceptions of the environment with Piaget's cognitive stages (Figure 2). She noted that as a child progresses from the egocentric stage through the concrete to the formal operational, a parallel

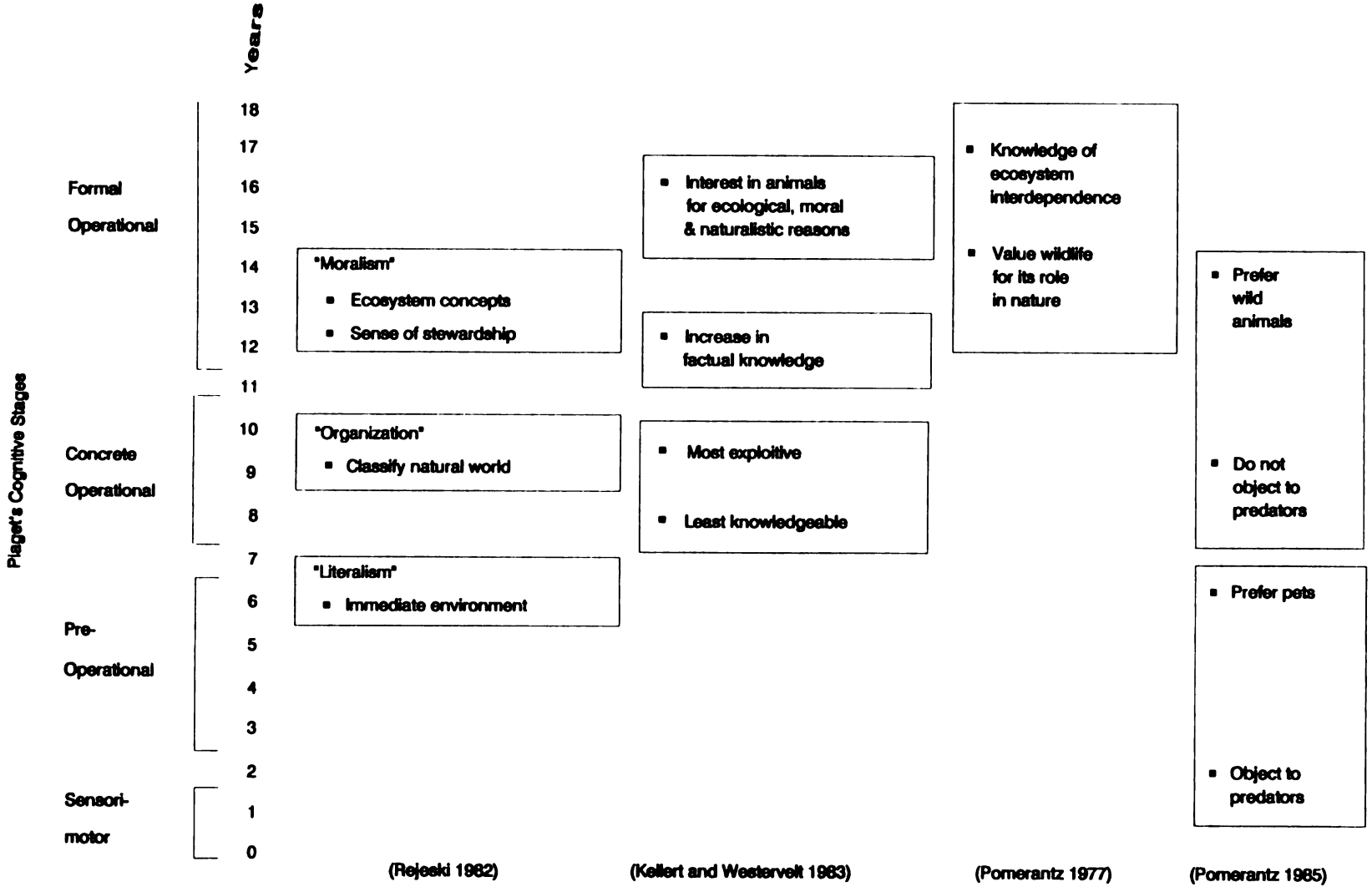


Figure 2. Comparison of children's perceptions of the natural world with cognitive stages of development (Pomerantz 1986).

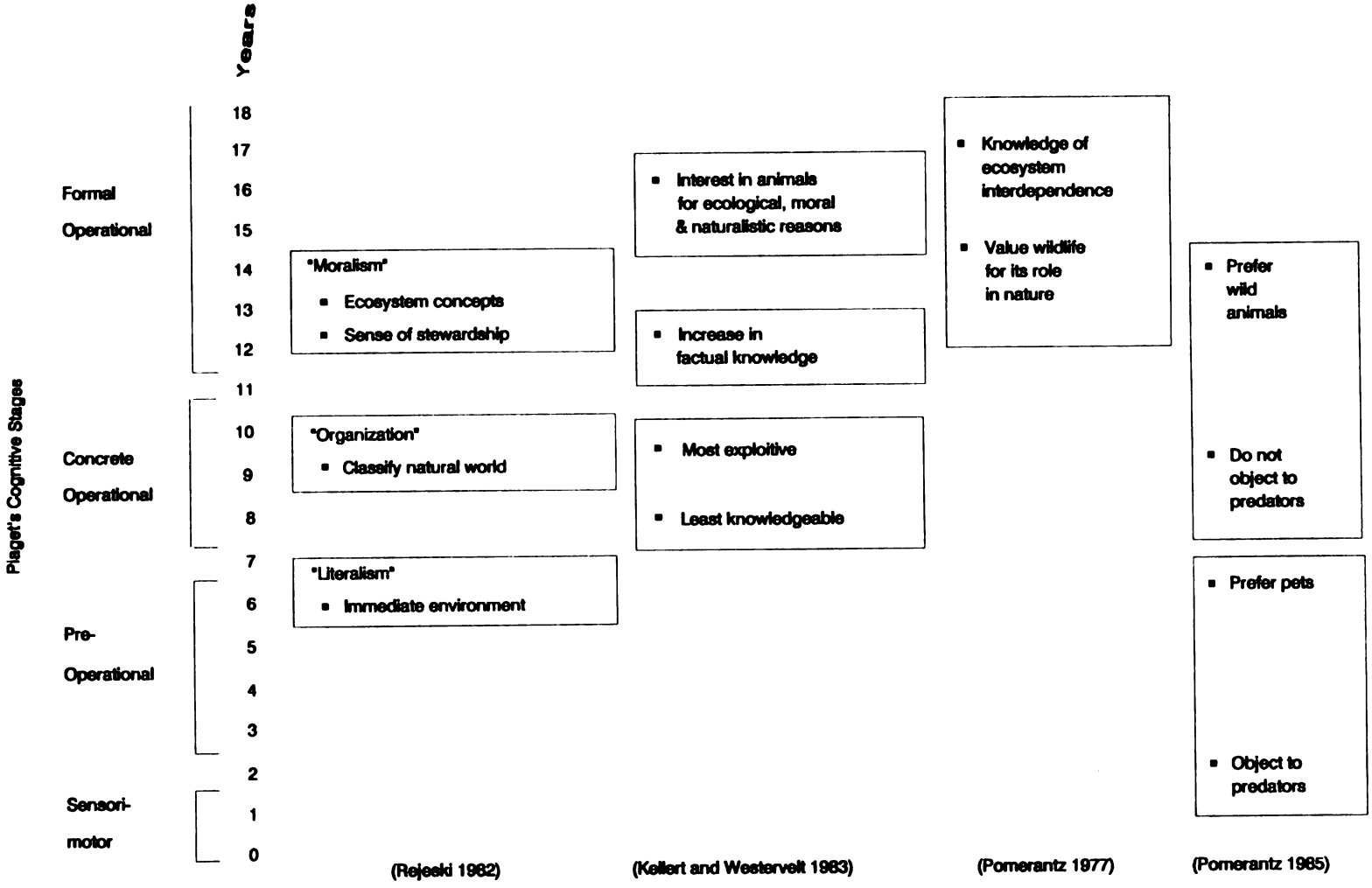


Figure 2. Comparison of children's perceptions of the natural world with cognitive stages of development (Pomerantz 1986).

evolution in attitudes toward animals and nature occurs.

Fifth and eighth grades seem to be transition ages with unique characteristics. Westervelt and Llewellyn (1985) proposed 5th grade as a pivotal phase for an individual's attitudes toward hunting. Horvat (1974) found children in this grade more optimistic toward the future than older students, but less environmentally responsible. They saw environmental problems primarily as how they affected themselves or their families. Horvat also noted that 5th graders showed much concern for aesthetic values in nature and saving animals' homes. Kellert and Westervelt's model (1983) supported this, proposing that 5th graders still have a great deal of emotional attachment for wildlife. Rejeski's model (1982) recommended that a land ethic be instilled at this age.

Compared to 5th graders, 8th-grade students have more internally consistent and stable "environmental orientations" (Horvat 1974). They show feelings of either optimism or pessimism toward future and present aspects of environment and pollution, and toward environmental problems and the capability to solve them. Further evidence on attitude stability shows that attitudes toward ecology and pollution stabilize for most students about this time or when they reach high school (Giles 1959, Miller 1975, LaHart 1978).

Gender

Males and females differ in their attitudes toward wildlife (Badaracco 1973, Collins 1976, Kellert and Berry 1980, Kellert and Westervelt 1983, Westervelt and Llewellyn 1985). Adult males tend to have a greater interest in wildlife and are more knowledgeable of wildlife and natural habitats. They show less negativistic attitudes, but more naturalistic, utilitarian and dominionistic orientations (Kellert and Berry 1980, 1984; Westervelt and Llewellyn 1985). In contrast, females are more humanistic, protectionistic, moralistic, and anthropomorphic toward wildlife (Kellert and Berry 1980, 1984; Westervelt and Llewellyn 1985).

For children, boys show greater factual knowledge, awareness and concern for wildlife than girls do (Richmond and Morgan 1977, Kellert and Westervelt 1983). They like a wider range of animals (Badaracco 1973, Collins 1976, Kellert and Westervelt 1983), and have a more positive attitude toward carnivores (Collins 1976).

Girls are less pragmatic and material-oriented toward wildlife, and less willing to support activities resulting in the subordination and dominance of them (Kellert and Westervelt 1983). They show more anti-hunting sentiment and concern about animal welfare problems. Girls' stronger moralistic and humanistic attitudes express themselves through greater anthropomorphic, aesthetic and emotional affection for large, attractive, and primarily domestic animals (Pomerantz 1977, Kellert and Westervelt 1983). Girls tend to be more negative than boys toward certain species (Kellert and Westervelt 1983). They dislike predators, reptiles, invertebrates, and amphibians (Badaracco 1973).

Education, IQ, Geography, and Race

Education, particularly the college experience, appears to be the most sensitive indicator of appreciation, concern, affection, knowledge, and respect for animals. They increase with more education, while emotional attachment to individual animals, especially pets decreases (Kellert and Berry 1980). Children with higher IQ scores show a greater concern for and awareness of environmental problems than those with low marks. Horvat (1974) found that IQ and grade level were the 2 most significant predictors of children's attitudes toward environmental problems.

Persons living in Alaska, Pacific Coast states and the Rocky Mountain Regions have the highest wildlife interest and participation scores, and the strongest naturalistic attitude (Kellert and Berry 1980). Pacific Coast residents like a broader number of animals (Westervelt and Llewellyn 1985). In contrast, individuals living in the South score the lowest in naturalistic attitudes and highest in

negativistic and utilitarian orientations (Kellert and Berry 1980, Westervelt and Llewellyn 1985).

Whether a person comes from a rural or urban background affects his or her attitudes. Rural residents (from populations <500) show higher naturalistic and ecologistic orientations and participation in wildlife activities. They also exhibit low humanistic, negativistic and moralistic attitudes (Kellert and Berry 1980), plus less animal preference (Kellert and Westervelt 1983). Horvat (1974) found rural children more optimistic toward the present world. Urban residents (from population >50,000) are more humanistic, moralistic and fearful toward wildlife, and less utilitarian (Kellert and Berry 1980, Westervelt and Llewellyn 1985).

Race may predict attitudes. Blacks express less interest and concern for wildlife and natural habitats than do whites (Kellert and Berry 1980). Less knowledgeable and naturalistic, they show high negativistic scores. Black children perceive wildlife as dangerous. They have low humanistic scores and are more willing than white youngsters to support practical needs of humans over wildlife (Kellert and Westervelt 1983). White children are less willing to subordinate animals, showing more affection toward wildlife.

Animal-Related Activities

Another important variable estimating individual affection and concern for wildlife is involvement in animal-related activities (Kellert and Berry 1980, Westervelt and Llewellyn 1985). Children and adults appear to show interest in the same kind of activities, but children like a broader range (Kellert and Westervelt 1983). Youngsters not participating in wildlife-oriented activities exhibit higher humanistic and moralistic scores, with birdwatchers being an exception. They show strong humanistic and moralistic attitudes (Westervelt and Llewellyn 1985).

Westervelt and Llewellyn (1985) did a nation-wide survey on

children's participation in wildlife-activities and discovered that fishing was the most popular activity--especially for boys, rural residents and those living in the north central U.S. or the Rocky Mountain states. Other popular endeavors included watching wildlife television shows and going to the zoo. Many children also had a father who hunted. Kellert and Westervelt (1983) found zoo visitation the most frequent animal-related activity. Children who did not frequent the zoo had high negativistic attitudes. Further, children who did not watch wildlife television shows expressed the most fear toward animals.

Westervelt and Llewellyn (1985) reported moderate participation in school lessons involving animals, birdwatching and hunting. The least popular activities all required more commitment to learning: belonging to an animal club and identifying numerous species of birds. Birdwatchers (different from bird identifiers) and pet owners expressed high protectionistic, humanistic, moralistic and naturalistic attitudes (Kellert and Westervelt 1983, Westervelt and Llewellyn 1985). They have low dominionistic orientations, but high negativistic ones.

Anglers, hunters and bird identifiers have characteristic attitudes toward wildlife (Kellert and Westervelt 1983, Westervelt and Llewellyn 1985). All are very knowledgeable and show an appreciation of and concern for the resource. They have lower sentimental affection for individual animals with less fear of certain species. They, along with wildlife television watchers, show strong naturalistic attitudes. The groups are less opposed to hunting and have high utilitarian, dominionistic and ecological orientations.

Attitudes toward Hunting

Public attitudes toward hunting is an extremely important issue in wildlife management. Pomerantz (1977) and Armstrong and Odom (1982) believed that misconceptions must be corrected as soon as possible if wildlife populations and sport hunting are to survive. Attitudes toward this sport appear to correlate with knowledge level, with increasing

knowledge leading to a more positive attitude toward hunting (Dahlgren et al. 1977, LaHart 1978).

Adults approve of hunting more than children do (Westervelt and Llewellyn 1985). Children who support hunting are either hunters themselves or have fathers who hunt (Westervelt and Llewellyn 1985). In their Iowa study, Dahlgren et al. (1977) discovered that males have a more favorable attitude toward hunting than do females. The same trend was seen with those reared on a farm versus those from a large city.

Youngsters' attitudes toward hunting may be formed before the teen years (LaHart 1978, Westervelt and Llewellyn 1985). In general, most support food hunting more than sport hunting--a preference that seems to increase with age (Pomerantz 1977, LaHart 1978, Kellert and Westervelt 1983, Westervelt and Llewellyn 1985). Westervelt and Llewellyn (1985) proposed a model to explain this shift. They defined 2 critical periods between ages 8 and 13 for the development of attitudes toward sport and food hunting. The first stage occurs between ages 8-10 years when children can become negative toward sport hunting and remain so into young adulthood. During the second period, 11-13 years of age, their attitudes about food hunting may become more positive and persist through adulthood. Unfortunately, the authors provided no mechanism or factors for the attitude shift or persistence.

Attitudes toward the Use of Animals in Biology Teaching

Children's attitudes toward the use of animals in biology teaching may also influence their views toward wildlife management. Tamir and Sever (1980) found that 2/3 of their subjects approved invertebrate use in experiments that caused irreversible damage. Only half of them condoned the sacrifice of reptiles, amphibians and mice. The use of birds and mammals was condemned by almost all of the students.

Preferences for Certain Wildlife Species

The public, including children, has definite preferences toward certain wildlife species. The best-liked animals are those that are domestic, aesthetically attractive and game species (Kellert and Berry 1980, Kellert and Westervelt 1983). The least-like species include biting and stinging invertebrates, unattractive animals, and those capable of inflicting injury (Badaracco 1973, Kellert and Berry 1980, Kellert and Westervelt 1983). Thus, the order of public preference for wildlife species is birds and mammals, fish, amphibians and reptiles, and invertebrates (Badaracco 1973, Kellert and Berry 1980).

The public does not value all endangered and threatened species equally. Kellert (1979) reported that people strongly supported the protection of the eagle, mountain lion, trout, crocodile, butterfly, and grizzly bear. They expressed less concern for plant species, the snake, spider and unspecified fish species. LaHart (1978) found that while young people want to preserve endangered species, they apparently viewed no management as the best management.

Preferences toward animal species change with age (Westervelt and Llewellyn 1985, Pomerantz 1986a). In general, younger children prefer pets and domestic animals while older ones like wild animals (Pomerantz 1986a). Westervelt and Llewellyn (1985) found children in the 5th and 6th grade (10-11 years old) favoring pets to wild animals. Pomerantz (1985), however, reported that the decline in pet preference occurred as early as 7 years of age. She found that 6-year olds disliked predators, but their attitude improved with the decline in pet preference from 7-14 years of age. That same study revealed that 7- to 14-year-old boys liked animals that were "different and strange". Girls preferred wildlife babies. Positive attitudes for reptiles and amphibians may decrease in 7-12th grade (Badaracco 1973). In Westervelt and Llewellyn's (1985) study, subjects' favorite species were the rabbit, eagle and robin; their least-liked animals were the mouse, skunk and rat.

Interestingly enough, some least-liked species may be the ones children like to read about the most. Pomerantz and Hair (1988) found in their study of *Ranger Rick* readers that the 2 most popular animals children liked to read about were deer and snakes, followed by birds and rabbits. The snake is not popular with both children and adults. However, their subjects enjoyed reading about animals that were strange and different, and liked seeing photos of scary or strange animals.

Westervelt and Llewellyn (1985) found that children were more positive toward predators than were adults. Powell and Powell (1982) reported kindergartners and 1st graders as positive or neutral about a new, unknown predator--weasel (*Mustela, spp*). They indicated no initial prejudices toward it. Although the teachers in the study were also basically positive regarding predators, some showed reservations in how their students would react. They were surprised when children seemed to accept predation sooner than they and children's book authors presumed.

Kress (1975) explained that the stereotypes and negative attitudes toward kinds of animals are not unlike the prejudices and stereotypes expressed toward minority races and religions. Both depend on overgeneralized beliefs based on too limited a set of real experiences. Other researchers have proposed species characteristics influencing public preferences (Morris and Morris 1966, Collins 1976, More 1979, Kellert and Berry 1980, Kellert and Westervelt 1983): species size, aesthetics, perceived intelligence, phylogenetic relatedness, economic value, perceived dangerousness, likelihood of inflicting property damage, cultural and historical performance, predatory tendencies, skin texture and morphological structure, mode of locomotion, domesticity, softness, cold-bloodedness versus warm-bloodedness, ease of name, human-like features (flat face, large eyes, sits up vertically, etc.), and how often the animal appears in children's literature. Tangley (1984) suggested that "cuteness" is not necessarily an inherent quality of any animal, but only a product of Western cultures. Westerners tend to portray animals as juvenile--big heads, big eyes, short snouts, round

faces, and round bodies. Those in other societies do not show this bias.

Summary

Media may be the greatest influence on children's attitudes toward wildlife. However, such vicarious experiences can generate inaccuracies and misconceptions because of the editorial process and unscientific information often contained in children's literature.

The general public is not balanced in its knowledge about wildlife. People have many misconceptions about hunting, wildlife management techniques, the importance of habitat and vegetative diversity, wildlife renewability, and ecological processes such as succession, fire, and predation. An individual's knowledge level appears to depend on his or her contact with wildlife through residential location or recreational occupation. Persons with more direct contact with wildlife exhibit a broader knowledge base and fewer misconceptions. However, despite their knowledge level of wildlife, children show strong anthropomorphic tendencies.

Children's general attitude toward the environment is less positive when the object of concern impinges directly on their lives or requires personal sacrifice. Males and females differ in their orientations toward wildlife; males show greater factual knowledge, awareness and concern for wildlife. Female children are less pragmatic and material-oriented toward wildlife. They also show more anti-hunting sentiment and concern about animal welfare problems.

Many factors besides gender influence children's attitudes toward wildlife: education, IQ, geographic place of residence, urban versus rural background, and race. Different wildlife-related activities correlate with certain attitudes toward wildlife. Anglers, hunters and bird identifiers show a greater appreciation for the resource, with lower sentimental affection for individual animals. They are also less

opposed to hunting and have stronger utilitarian and ecological orientations.

Children show consistent attitudes toward hunting and other controversial wildlife issues. Most support food hunting more than sport hunting--a preference that seems to increase with age. The majority do not approve of the use of birds and mammals in biological experiments causing irreversible damage.

Youngsters prefer birds and mammals over fish, amphibians, reptiles, and invertebrates. The best-liked animals are domestic and aesthetically attractive. However, species preferences change with age, with younger children favoring pets and domestic animals, and older kids preferring wild species.

Animism

Animism is the "attribution of conscious life to nature or natural objects" (Webster's New Collegiate Dictionary 1977). Piaget began the first systematic research of animism while investigating the development of the concept of life (Looft and Bartz 1969). He defined animism as the tendency among children to consider things as living and conscious. As a child ages, this tendency decreases until the child eventually reaches a mature cognitive state in which he or she attributes life only to what educated adults consider alive--animals and plants. A review of animism research is important to this study because it will help guide methodology, and provide insight into how children perceive cartoons--e.g., Do they attribute life to wildlife cartoons, and if so, does this association affect how they perceive real wildlife?

Piaget identified 4 developmental stages of animism:

Stage 1 (4-6 years old): The child characterizes life as usefulness or activity. For example, the sun is alive because it gives light. A gun is alive because it shoots.

Stage 2 (6-7 years old): The child attributes life solely to things which move--e.g., a stone lives because it moves (by rolling). A table does not live because it cannot move.

Stage 3 (8-10 years old): A child restricts life to things which move spontaneously or by themselves. A fly is alive because it flies by itself. A bike, however, is not alive, for someone must make it move. A stream lives because its water flows continuously.

Stage 4 (11 years old and over): An individual confines life to plants and animals.

Studies have both refuted and supported Piaget's theory (Looft and Bartz 1969, Beveridge and Davies 1983, Richards and Siegler 1984). Although evidence exists that animism is age-related, with decreasing

animistic tendencies with increasing age (Looft and Bartz 1969, Hapkiewicz et al. 1983, Berzonsky 1988), several studies showed that animism does not "disappear" at early adolescence, as Piaget surmised. In fact, different stages of animism appear across all ages (Looft and Bartz 1969, Smeets 1974, Sheehan et al. 1980, Dolgin and Behrend 1984). Dennis (1953) and Crowell and Dole (1957) found college students giving animistic answers, calling a lighted match, the sun and the ocean "living". Fifty to seventy-five percent of some adult samples have been identified as "animistic" (Looft and Bartz 1969, Jones-Molfese and Wilcox 1977). Both collegians and adults used movement and self-movement to justify their answers even though these are criteria of stages 2 and 3 (6- to 10-year olds) in Piaget's theory.

Jahoda (1958) suggested that investigators often take Piaget's 4-stage theory too literally, expecting an absolute age-by-age correlation. He proposed that pervasive animistic thought declines with age, but animism may emerge at any age when the child is confused. Some agreed with Jahoda (e.g., Richards and Siegler 1984); others believed that animism is an all-or-nothing phenomenon (Berzonsky 1988, Berzonsky et al. 1988).

Although studies generally do not support Piaget's theory, several problems with animism research have made some results disputable and comparisons between studies difficult. Many studies suffered from small sample sizes using 50 subjects or less. Semantics threatens internal validity in most, if not all, animism research (Voeks 1954, Nass 1956, Looft and Bartz 1969). The words "living", "life" and "real" all evoke very different responses from individuals. Subjects often define "living" as movement, release of energy, or usefulness (Mikulak 1970)--characteristics not necessarily associated with the word "life". Thus, the question "Is it living?" elicits more animistic responses than "Has it life?". This "living"/"life" problem may have caused the high occurrence of animism reported in collegians and adults (Voeks 1954, Looft and Bartz 1969). Other possible reasons for animism in adults

include a misunderstanding of the criteria for life, whimsy, or a tendency to use anthropomorphic terms, and a developed attachment to certain physical objects (Looft and Bartz 1969, Sheehan et al. 1980).

The words "why" and "how", and "dead" and "not living" also draw different animistic responses. "Why do you think it is alive?" encourages animism more than "How do you know it is alive?" (Looft and Bartz 1969). "Dead" implies that an object once had life; "Not living" does not (Dolgin and Behrend 1984).

Methodology affects subject response (Looft and Bartz 1969, Papalia-Finlay 1978, Morison and Gardner 1978, Manaster 1980, Beveridge and Davies 1983, Richards and Siegler 1984, Berzonsky et al. 1988, Prawat et al. 1989). Williamson (1981) found a difference in animistic responses depending on whether children responded with verbal justifications or with sorting exercises. Berzonsky et al. (1988) suggested that sentence-judgment tasks may reveal less animism than direct questions. Increased specificity of questions may increase a child's accuracy regarding the nature of objects, and/or the researcher's understanding of it. In a study examining children's judgments of television characters, Quarfoth (1979) found that a multiple choice test on whether or not Tony the Tiger was make-believe evoked appropriate answers from 60% of kindergartners while open-ended questions elicited correct responses from only 40% of the sample. Verbal probing may be the best method to ascertain children's conceptualization of life, for it gains more insight into the child's thought process (Williamson 1981, Berzonsky et al. 1988).

Because of these semantics and methodological concerns and other factors unique to individual experiments, scientists encourage an analysis of the child's overall animistic thought pattern. Both the errors of omission (denying life to animate objects) and commission (giving life to inanimates) should be included for a complete evaluation (Berzonsky 1975). The number of correct answers alone is inadequate for testing a child's understanding of the criteria for life (Looft and

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Bartz 1969, Smeets 1974, Morison and Gardner 1978).

In spite of the difficulties plaguing animism research, studies have generated some consistent trends. Animism appears very early in an individual's life (Berzonsky 1973, McNew 1973, Williamson et al. 1982, Bullock 1985). However, Gelman and Spelke (1981) reported that a child as young as 4 years old appreciates that only animate objects have certain kinds of parts (e.g., organs), substances or knowledge. Although Gelman and Spelke need empirical evidence, they proposed that at least for purposes of communication, children fully understand the difference between animate and inanimate objects. When a child talks to people, he or she expects an exchange of information. Children do not show such expectation with inanimate objects. Whether or not children equate 2-way communication with life, however, needs to be tested.

Inagaki and Hatano (1987), working with Japanese kindergartners, reached a similar conclusion. They believed that animistic responses were not prevalent even among children. Youngsters have some of the knowledge needed to differentiate between objects that are humans and non-human, animate and inanimate. Berzonsky et al. (1988) showed that development of animistic judgment parallels that of sentiency judgment--i.e., individuals realize that humans are capable of having intentions, beliefs, and wants whereas inanimate objects and plants are not.

Animism does not depend on gender (Mikulak 1970, Fu and Billingham 1980, Wolfinger 1982) or mental age and the ability to give explanations to physical phenomenon (Berzonsky 1973, Smeets 1974, Williamson 1981, Wolfinger 1982). Thus the concept of a "stage" in animistic thought differs from that for general cognition. Smeets (1974) proposed that an individual's mental age interacts with his or her chronological age, and this relationship determines animistic thought.

Evidence exists that an individual's locus of control may modify animistic tendencies (Fu and Billingham 1980). Externals may be more animistic than internals since they focus more on concrete environmental cues and external events like self-movement. Berzonsky (1974) reported

contradictory evidence, finding animistic thinking related not to locus of control, but to the degree of reflectivity or impulsivity in an individual. Because they are more apt to consider, analyze and detect inconsistencies in reasoning, reflectives may be less animistic than impulsives.

The effects of social factors on animism have been addressed. Berzonsky (1973) reported that children's reasoning regarding various interpersonal situations or social concepts (morality, justice and psychological causality) does not influence their animistic responses. However, Sharp et al. (1985) found cultural and social differences (geographic location and religious experience) affecting animistic thought. Jahoda (1958) proposed several social factors that encourage and modify animism in individuals: 1) feelings of participation which originate in early family situations and transfer to objects; 2) feelings of moral obligation produced by education which then extend to the entire physical universe; and 3) language, which fosters and channels animism, but does not create it. Mikulak (1970) believed that the English language with its many masculine and feminine pronouns and nouns does stimulate animistic thinking. For example, boats are referred to as "she", the earth is seen as "mother", and a flame is said to "die".

A mother may have a greater influence over a child's cognitive functioning and animistic thinking than the child's father during middle childhood years, 10-13 years old (Billingham and Fu 1980). This may be due to the greater amount and quality of interaction that mothers share with their children at this time.

Familiarity with an object affects a child's animistic response to it (Looft and Bartz 1969, Sharp et al. 1985, Beveridge and Davies 1983, Dolgin and Behrend 1984, Richards and Siegler 1984, 1986; Berzonsky 1988, Bullock 1985, Sharp et al. 1985, Inagaki and Hatano 1987, Berzonsky et al. 1988). The more familiar a child is with an object, the more accurate is his or her perception of its nature. Because

children learn to differentiate between living and non-living by operating directly on objects (Wolfinger 1982), children have less animistic thought for objects they frequently see and handle (e.g., favorite toy), or those that are prototypical animates and inanimates (Looft and Bartz 1969, Beveridge and Davies 1983, Dolgin and Behrend 1984, Sharp et al. 1985). Thus, when children err in classification of objects, misattributions arise not from a general "animistic" attitude toward all things, but from an uncertainty about the precise properties of certain objects.

Animate or inanimate, some objects are more difficult for children to categorize than others. Embryos (seeds and eggs) and dead objects seem to cause the most confusion (Tamir et al. 1981, Dolgin and Behrend 1984). Children also frequently misjudge non-mammalian, self-moving or animate-appearing objects (fish, insects and dolls) and some birds and plants (Dolgin and Behrend 1984, Berzonsky 1988, Berzonsky et al. 1988). Berzonsky et al. (1988) thought that children misjudge the life status of plants because plants share characteristics with both humans and inanimate objects. Although plants exhibit life, growth and reproduction, they are not sentient.

Children and adults use movement as a criterion for life more frequently than any other characteristic (Dennis 1953, Looft and Bartz 1969, Crowell and Dole 1957, Jones-Molfese and Wilcox 1977, Sharp et all. 1985, Beveridge and Davies 1983, Richards and Siegler 1986). Perhaps children use movement as the main criterion because they tend to focus on only one attribute of an object (Margand 1977, Stepans 1985). The external action may also be sufficient for the child to call the object alive or to assume that other animistic characteristics also exist (Dolgin and Behrends 1984, Bullock 1985). Richards and Siegler (1984) proposed that children identify life with motion only when it is emphasized in the interview question. In a later study (1986), Richards and Siegler discovered that children also differentiate among different types of motion which influences their judgments concerning life status.

Objects that moved via leglike appendages were cited as alive more often than were objects that moved by wheels.

When movement does not encourage individuals to call an object "alive", biological criteria--absence of organs (heart, brain), arms or legs, or certain functions (eating, breathing, growing)--are used (Sharp et al. 1985, Tamir et al. 1981, Stepans 1985). Some children, although identified as "nonanimistic" for certain objects, may still possess an incomplete understanding of biological processes and criteria for life (Looft 1974, Wolfinger 1982). They do believe, however, that the life of man and animals differs from that of plants, embryos or inanimates, even though they cannot explain why or how (Tamir et al. 1981).

Education or training influences animistic responses, (Jones-Molfese and Wilcox 1977). Looft and Bartz (1969) reported that children with religious training exhibited more animistic responses than those lacking such experiences. Wolfinger (1982) found that elementary science experiences eliminated students' use of animism as a causal relation. Carey (1985) supported this, arguing that lack of biological knowledge--not immature causal reasoning--is primarily responsible for young children's over attribution of life to inanimates. However, Stepans (1985) emphasized that simply reading a biology textbook does not guarantee an understanding of the differences because children learn to differentiate between living and non-living by operating directly on objects.

Beveridge and Davies (1983) summarized the factors which may potentially determine animistic or non-animistic responses: 1) the child's understanding of the term "alive" (If his/her definition includes "in good condition", "working order", "having a use", "real", or "lively", inanimate objects may be considered alive); 2) the level of the child's thinking--e.g., pre-operational, concrete operational, etc.; 3) how much the child has assimilated knowledge about the world; and 4) familiarity with the object.

Children's Animistic Responses to Cartoon Characters

When evaluating individuals' judgments of cartoon characters, researchers unfortunately used the word "real" instead of "alive" or "living" in their interviews. Thus, whether or not subjects equated "real" with life is unknown. A study by Hapkiewicz et al. (1983) examining individual's judgments of cartoons demonstrates this semantics problem. Without a clear presented definition of "real", subjects may have used different meanings of the word. Nevertheless, preschoolers stated that cartoons were real, basing judgments on direct perceptual experiences ("They're real because I watch them"). Second graders did not label cartoons as real because "They are just drawings." Fifth graders seemed to be a transition age. When asked specific questions, they reacted like 2nd graders. When asked open-ended questions, 5th graders responded like adult subjects, basing "realness" on physical existence or perceptual, interactional knowledge. To adults, cartoons, feelings, thoughts, attitudes, and other abstract items are real.

Dorr (1983) offered 3 criteria used by individuals to determine whether or not something on television is real:

1. Concrete: The object is real because it exists exactly as is even without TV. For example, a chair is always a chair. Drawings which make up an animated program are real drawings.

2. Deemed possible: Although the object or event is made-up, it is possible; therefore, it is real.

3. Deemed probable or representative: An object or event is real because it happened to the viewer or his or her acquaintances.

Dorr found that not until the 6th grade (11-12 years old) could children explain why something on TV was real. This ability increased with age, as did the number of children using "possible" as a

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justification for reality. Equating reality with "possible" then decreased with age, while use of probability as a reason increased. Most adolescents and adults, therefore, defined "real" on TV as something probable or representative. Hapkiewicz et al. (1983) supported this conclusion. In their study adult subjects also used first-hand experience to make reality judgments.

In his review of research on perceived reality, Potter (1988) concluded that perceived reality with television may not be a unidimensional construct. He found 3 facets of it, but admitted that they may not be exhaustive:

1. "Magic Window" component: The central dimension of perceived reality, it is defined as a belief in the literal reality of TV messages. It consists of 2 subcomponents--syntax and semantics. Syntax is a belief in the reality conveyed by the style of the message (language, costumes, set, etc.). Semantics is believing in the reality of the message's meaning--e.g., the manner in which characters treat one another, or the broad themes of every day life. A situation comedy may appear realistic on the syntactic level, but unrealistic or fantasy on the semantic level.

2. Social expectation or perceived utility: This is a belief in how applicable television lessons are to a viewer's own life.

3. Identity: This is a belief that a TV character is active in a viewer's real life. A feeling of closeness exists. For example, people who closely follow a television character might feel as close to him or her as they would a good friend.

Potter described 3 sources of a person's perception of reality of media, its programs and characters: 1) a person's experience with the media, 2) a person's ability to make sense out of the media stimuli, and 3) the types of cues in the stimulus material. Dorr (1983) supported Potter's third source, reporting that children sometimes use form or contextual cues to judge reality.

Potter (1988) also reviewed the effects of real-life experiences, television exposure, television viewing motives, IQ, age, and other demographic factors. He found that viewers who have had real-life contact with people and events similar to those presented on television were more able to recognize the unrealistic information. However, Potter cited a few studies reporting that people's perceptions of televised reality depend more on an indirect source of information--what interpersonal contacts tell them--than personal direct experience.

People who view the greatest amounts of television exhibit the highest levels of perceived reality. Certain television viewing motives seem to consistently correspond to higher perceptions of reality: to learn about things or information, and to become aroused.

Studies of the effects of IQ, gender and socioeconomic status showed mixed results. However, analyses of age effects suggested a curvilinear relationship with perceptions of reality decreasing from preschool to young adulthood, and then increasing again. Potter believed that future perception of reality studies need to address locus of control, authoritarianism, anomie, and degree of contact with others.

Quarfoth (1979) reported that the ability to distinguish between different forms of TV characters (human, animated and puppet) increases with age. By 3rd-4th grade, children realize that being alive and having the ability to move autonomously characterizes only human characters, not animated or puppet characters. However, they still make incorrect judgments, erring primarily with cartoons. Children this age or older fall back upon animistic explanations because they cannot discern how else to account for the existence of cartoons.

Although children may take animation as a cue that the program content is fantasy (Snow 1974, Dorr 1983), evidence exists that children may perceive still cartoons as reality. Wong (1985) found that 80-90% of a sample of fifth graders agreed to a Likert scale that "This figure will die someday." Whether their perceived reality of the cartoon was syntactical or semantic is unknown.

Summary

Animism is the attribution of life to non-living things. It appears very early in life and seems to decrease with increasing age. However, different stages of animistic thinking appear across all ages. Further, evidence exists that even young children (e.g., kindergartners) have some of the knowledge needed to differentiate between objects that are human and non-human, animate and inanimate.

Methodological problems or inconsistencies have plagued animism research, making comparisons between studies difficult. Verbal probing may be the best approach to ascertain children's conceptualization of life.

Animism does not depend on gender, mental age or the ability to give explanations to physical phenomenon. The factors which may potentially determine animistic or non-animistic responses are 1) the child's understanding of the term "alive"; 2) the level of the child's thinking--e.g., pre-operational, concrete operational, etc.; 3) how much the child has assimilated knowledge about the world; and 4) familiarity with the object. The more familiar a child is with an object, the more accurate his or her perception of its nature.

Movement is used as a criterion for life more frequently by children and adults than any other characteristic. Biological attributes are the next most regularly used criteria for life.

Different definitions for the various types of perceived reality of TV exist. Dorr's (1983) criteria for reality are 1) concrete (object exists exactly as is even without TV); 2) deemed possible; and 3) deemed

probable. Most adolescents and adults define "real" on TV as something probable or representative. Potter's (1988) facets of perceived reality are 1) the belief in the literal reality of TV messages; 2) how applicable TV lessons are to a viewer's own life; and 3) the belief that a TV character is active in a viewer's real life. Three sources affect a person's perception of the reality of media, its programs and characters: a person's experience with the media, an individual's ability to make sense out of the media stimuli, and the types of cues in the stimulus media.

Children may sometimes use the third source (form or contextual cues) to judge reality. However, cartoons seem to be a "problem" medium for them. Youngsters have difficulties explaining their existence, and may perceive them as reality (type unknown).

Anthropomorphism

Anthropomorphism is the attribution of human characteristics to nonhuman organisms (Blanchard 1982). People usually apply it to animals, but sometimes they project human traits (including subjective states and feelings) to inanimate objects (Morton et al. 1990). The Greeks (500 BC) are credited with the first recorded academic discussion on anthropomorphism in the Western World (Blanchard 1982). Both their discussions and those of today are based on the notion that if thoughts and actions of the unknown are to be understood, expressed or made bearable, they must be similar to the known, or life as humans know it. Children use anthropomorphism to deal with a largely unknown world (Blanchard 1982), and sometimes as a means to generate an educated guess about unfamiliar objects (Inagaki and Hatano 1987). Adults incorporate it for situations truly unknown to society, e.g., in movies, aliens are usually characterized as resembling humans (Blanchard 1982).

Although discussions of anthropomorphism began early, scientific inquiry did not begin until the late 1920's and early 1930's. Two schools of thought resulted--one group believing that anthropomorphism is universally present in children, the other viewing it as accidentally present (Blanchard 1982).

Inagaki (1989) divided human characteristics into 2 categories: anatomical/physiological properties (bones, heart, etc.), and mental properties (e.g., thinking and feeling). Through several experiments he found that people of all ages will give both types of human characteristics to non-humans depending on their use of 2 inference processes proposed by Carey (1985). An individual employing "similarity-based attribution" will apply his or her knowledge about humans to animates or inanimates depending on how similar they are to human beings. For example, the person would show decreasing anthropomorphism when presented with a person, rabbit, pigeon, fish, grasshopper, tulip, tree, and then stone.

The second inference process is called "category-based attribution". It is a deductive procedure relying on category membership. For example, an individual using category-based attribution would answer "No" to the question "Does a grasshopper have bones?" by inferring that the grasshopper is an insect, insects belong to the class of invertebrates, and invertebrates have no bones. Therefore, the grasshopper must not have any bones.

Individuals use the similarity-based attribution process initially and then shift to category-based attribution (Carey 1985, Inagaki 1989). Animism studies support this. For example, Richards and Siegler (1986) found that children shift from simply judging an object using characteristics of humans or animals (e.g., movement) toward using defining categories of living things (i.e., animals and plants). Inagaki (1989) believed that the process shift for anatomical/physiological properties occurs during the elementary school years, while the switch for mental properties (thinking, feeling happy, feeling pain) happens much later. More than 50% of Inagaki's (1989) college students showed the similarity-based process for mental properties of non-humans. Hogan (1980) reported similar results with undergraduates in Tennessee. Of 36 non-humans to receive mental human traits by subjects, the group given the most human attributions (humor, emotions, feelings, etc.) were mammals (chimpanzee, dog, horse), then birds, fish and insects, and finally a mixture of insects, reptiles, and worms. The 4 species receiving the least amount of human characteristics were snake, wasp, roach, and earthworm. Hogan also found that women projected more human emotions onto non-humans than did men.

Inagaki (1989) proposed that 2 types of information learned from school biology courses causes the process shift for both kinds of human characteristics. Through biology classes, individuals gradually accumulate categorical knowledge, and knowledge about the usefulness of higher-order categories--i.e., they realize that higher-order categories

are more dependable than similarity to correctly predict the nature of things. According to Inagaki, the delay in the shift for mental properties occurs because these characteristics are not directly addressed in biology. Persons will shift for the same 2 reasons above, but especially as they learn about the brain--the source of mental properties.

A person's anthropomorphic tendencies may depend on how strongly he or she associates a mental property with the brain (Inagaki 1989). Johnson and Wellman (1982) discovered that young children tend to think that the brain directs cognitive activities such as thinking, but not those like feelings or sensations. Citing their work, Inagaki (1989) predicted that mental properties weakly associated with the brain (e.g., feelings) will elicit more anthropomorphic responses than mental properties strongly associated with the brain (e.g., thinking). He also hypothesized that anthropomorphic attributions of mental properties will decrease as subjects realize that properties of feeling and sensation are closely associated with the brain.

Researchers have suggested other sources of anthropomorphism. More (1977) proposed that paired-association learning between wildlife and certain adjectives in children's literature promotes it (sly fox, big bad wolf, slow turtle, friendly bunny, etc.). Literary reference to the animal kingdom is universal and omnipresent. Newman (1987) believed that people use creatures in literature, mythology, magical powers, totem poles, etc. to help see themselves more clearly. Animals represent a side of humans that people must confront to be "whole"; animals complement the rational, thinking side of human nature.

Writers who "anthropomorphize" animals can be divided into 3 categories (Blount 1975): 1) those who cannot help writing about animals (e.g., C.S. Lewis); 2) those who dislike or criticize the human race and find animals a more innocent, congenial alternative (e.g., Beatrix Potter); and 3) those who are concerned, either consciously or unconsciously, with teaching readers something about the human race, or

transmitting values (Jules in Jungwirth 1979). Most writers of animal stories fall into this category.

There are several reasons why writers use anthropomorphic animals in children's books. Markowsky (1975) listed 4 of them:

1. It enables young readers to identify with the animals that have human attributes. Perhaps children identify more closely with animals than with adults (Bettelheim in O'Donnell 1980).

2. For fantasy--talking animals let children in another world which they may not be able to see without the creatures' help.

3. For variety--an author can develop many different characters in a short book with few words if an animal is used to express attributes commonly assumed to represent the creature; there is no need for elaborate description or character build up.

4. For humor--animals who spoof certain types of people are funny. The humor is often based on the animal's picture and conversation, not on a verbal description or account of its actions. Anthropomorphic animal books may be a child's introduction to humor in literature (Vogl 1982).

Four types of anthropomorphic characters occur in reading materials: mammals, other living creatures, machines, and monsters (Blanchard 1982). Authors create these characters with varying degrees of anthropomorphism:

Pattern 1: characters in human setting with few human attributes and no speech;

Pattern 2: characters in natural setting with few human attributes except for speech;

Pattern 3: characters in natural setting with many human attributes such as clothing and with speech; and

Pattern 4: characters in human setting with many human attributes such as clothing and with speech.

Within the last decade, publishers of children's books have introduced more anthropomorphic stories and characters than before (Blanchard 1982, Vogl 1982). This is a conscious attempt to meet the demands of special interest or censorship groups who want publishers to exclude or include certain portrayals of humans in their stories (Blanchard 1982). In response, publishers have switched to animals or nonhuman characters as replacements.

In her review of essays and books on animals in children's literature, O'Donnell (1980) found that as children mature, they become more interested in stories that depict animals more objectively--i.e., animals that act like animals. Children 3 to 7 years of age are interested in stories where animals behave like human beings, or animals that act like animals but talk. They may like the latter category because children at this young age are self-centered, expecting animals to talk about things important to them. Children from 7 or 8 to maturity are mostly interested in stories where animals act like animals. This may not be true for cartoons, however. Sebastian and Borton (1982) discovered that their elementary school subjects (grades not mentioned) preferred cartoon animal characters that acted like humans over cartoon human characters. Perhaps the preference shift from animals to humans occurs much later, if at all, for cartoons than for children book characters.

The pros and cons of using anthropomorphism in children's literature and science texts have been intensely debated. Proponents Sharefkin and Ruchlis (1974) stressed that it is irrelevant and, perhaps counterproductive, to require children below a certain conceptual level to express themselves in non-anthropomorphic terms. Anthropomorphic

formulations are not only natural for children at the preoperational or concrete operational stage, but actually help them comprehend the world. Teachers should avoid too rigid, exact scientific formulations for such young children. Anthropomorphism may motivate them toward a later study of animals and their behavior. Inagaki and Hatano (1987) suggested that personification allows children to give an educated guess about less familiar non-human objects. Youngsters are using their "richest domains of knowledge, namely that about humans".

Vogl (1982) argued that the problem of anthropomorphism in children's animal stories is less important than it has been made to appear. It has literary and practical virtues of gaining children's attention, serving as a vehicle for teaching about social relationships, and introducing youngsters to fantasy and humor in books. Moreover, because there are so many animal stories available, as children become older they will inevitably be exposed to realistic animal stories--some deliberately designed to correct misrepresentations of animals, others designed to provide biologically accurate accounts of wild and domestic animals.

Sharefkin and Ruchlis (1974) also asked the anti-anthropomorphic community to provide alternatives to anthropomorphism when teachers and writers try to communicate ideas. Vogl (1982) and DeRosa (1984) believed that it is virtually impossible to eliminate all anthropomorphic references from human vocabulary and children's literature. Sharefkin and Ruchlis (1974) encouraged opponents to concentrate their efforts on identifying the circumstances where anthropomorphic formulations are desirable, tolerated or prohibited.

More (1977) believed that the common wildlife-adjective combinations in children's books (big bad wolf, slow turtle, sly fox) encourage preferences for and aversions to different animal species--leading to wildlife management problems. Hughes (1973) agreed, calling anthropomorphism "deceiving and dangerous" because the literal application of resulting attitudes would be active attempts to

exterminate certain species whose appearance is unappealing to humans. He felt that there was no substitute for a description of an animal's behavior pattern in explicit, non-human terms. Morton et al. (1990) believed that associating such metaphors with animals could lead to uncritical thinking and invalid interpretations. Anthropomorphism may also be misleading in predicting mental events (e.g., feeling and sensation) of non-humans, and lead children to overestimate the abilities of these objects (Inagaki and Hatano 1987). Further, attributing human emotions to non-humans and/or labeling certain animals as "good" or "bad" can guarantee misunderstanding of factual animal behavior and complex ecological processes, e.g., food webs (Hughes 1973, Gallant 1981). Luchins (1961) warned against the use of anthropomorphism in learning because children have to know something about the subject matter to appreciate the point of anthropomorphism. They also have to understand where the subject matter ends and the anthropomorphism begins.

Investigators have tried to empirically analyze the effects of anthropomorphism on children's learning and attitudes. On the positive side, Blanchard and McNinch (1984) found that when children are trying to learn to read an unknown word, anthropomorphic cues (cartoon characters with at least 5 human attributes) enhanced learning rates more than illustrated and no-picture cues. The subjects also retained these anthropomorphic words longer. The authors hypothesized that the increased learning and retention occurred because the anthropomorphic cues acted as attentional cues, focusing the readers on the word to be learned.

Negative effects of anthropomorphism have also been reported. In Bowd's (1984) analysis of 5th graders, he reported that 65% of them believed that animals could linguistically communicate, while 61% felt that they were capable of moral responsibility. Jungwirth (1979) reported a high percentage of high school students using anthropomorphic and teleologic (attributing purpose to a non-human's act) explanations

for biological processes. The students equated these formulations with scientific explanations and factual or causal statements, and considered them appropriate for school biology texts. When presented with a series of statements labelled "unscientific", they could not identify teleology/anthropomorphism as their common denominator. Intelligence was not a significant factor in this study. These high schoolers accepted anthropomorphism of animals more than of plants and humans. Jungwirth called this the "Fairy Tale Syndrome". Bartov (1981) provided similar results with a sample of 60 10th graders in Israel. They also could not distinguish between teleological or anthropomorphic formulations and factual explanations. However, he found that this ability could be improved by appropriate instruction.

Only 2 studies have empirically reviewed the impact of anthropomorphism on attitudes. Pomerantz and Hair (1988) noted that readers of *Ranger Rick*, a magazine with a humanized raccoon as its main character and narrator, did not seem to have higher anthropomorphic attitudes toward wildlife than non-readers. In contrast, Wong (1985) found evidence that anthropomorphism did negatively affect 5th graders' attitudes toward hunting and perceptions of wildlife renewability. Lutts (in press) concurred. His extensive review on the effects of the *Bambi* cartoon suggested that its anthropomorphism greatly shaped public perspectives toward the environment and hunting, encouraging preservationist and anti-hunting attitudes.

Although no one truly knows the effects of either text-oriented or psychologically-oriented anthropomorphism on young readers (Blanchard 1982), familiarity with the "real world" functions of the "anthropomorphized" character seems to reduce its impact (Blanchard 1982, Blanchard and McNinch 1984).

Summary

Anthropomorphism is the attribution of human characteristics to nonhuman organisms. Human characteristics may be divided into 2

categories, anatomical/physiological and mental. Individuals may give both types to nonhumans depending on the individual's use of 2 inference processes: similarity- and category-based attribution. Persons use the first process and then shift to the second, possibly as a result of biology classes where individuals gradually accumulate knowledge about human properties. The shift from similarity-based to category-based may occur later for mental properties because they are not directly addressed in biology.

A person's anthropomorphic tendencies may depend on how strongly he or she associates a mental property with the brain. Other sources of anthropomorphism include paired-associate learning between wildlife and certain adjectives (e.g., sly fox, wise owl), and familiarity with the "anthropomorphized" object. Familiarity seems to reduce the impact of anthropomorphism.

Reasons why writers use anthropomorphism have been proposed. Some of the possible benefits of using anthropomorphism are: 1) children below a certain conceptual level have difficulty expressing themselves in non-anthropomorphic terms, and requiring them to do so would be counterproductive; 2) anthropomorphism helps children comprehend the world; 3) it teaches them about social relationships; 4) it gains children's attention; and 5) anthropomorphism introduces children to fantasy and humor in literature. Positive effects of anthropomorphism have been reported by studies on children and their learning to read.

The arguments against anthropomorphism include: 1) it encourages preferences for certain animals which may lead to wildlife management problems; and 2) anthropomorphism may mislead and generate misunderstandings of factual animal behaviors and complex ecological processes. Evidence exists that anthropomorphism may indeed negatively affect children's attitudes toward wildlife, hunting, biological processes, and the environment.

Visual versus Verbal Learning

From his research on verbal versus pictorial learning, Bogue (1982) concluded that how an individual learns from a medium depends on the interaction of 3 variables: (1) the nature of the presentation or stimuli, (2) the nature of the learner, and (3) the nature of the learning task.

Nature of the Stimuli

A "sign" is something that directs behavior in approximately the same manner as would the real thing it represents (Knowlton 1966). Thus, a sign is a substitute stimulus for its "referent". A "sign vehicle", or the physically embodied sign, is either iconic or digital. An iconic sign vehicle resembles its referent (drawings, paintings, photographs, statues), while a digital sign vehicle bears no resemblance to its referent; it is arbitrary (words, numbers, flag signals, sign language). The pictorial (iconic) and written (digital) versions of "man", for example, involve a single sign, but simultaneously involve 2 distinct sign vehicles.

Visual Literacy

Researchers studying iconic sign vehicles use the term "visual literacy" to describe the ability to "read" pictures or extract the information that the artist intended to communicate. Van Ert Casey and Wolf (1989) define it as follows:

> "Visual literacy involves the ability to understand and to communicate using visual images--to 'read and write' with these visual images rather than with words and letters. Visual literacy includes the development of spatial relationships, visual perception, and the enhancement of aesthetic awareness in the visual arts."

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This ability is learned (Fuglesang 1973, Miller 1973, Mangan 1978, Rosinha 1978, Mills 1980, Parlato et al. 1980, Van Ert Casey and Wolf 1989), and depends on the individual's culture (Miller 1973, Mangan 1978, Cochran et al. 1980, Nodelman 1984). Because of its dependency on culture, Cochran et al. (1980) proposed that visual literacy must be studied with techniques appropriate for cultural processes. Approaches used for examining a stimulus-response phenomenon will prove unfruitful and misleading. They suggested a cognitive approach for pictorial research: analyzing the formative processes that shape both intelligence or internal order, and adaptations to external order. Whether fellow researchers heed their proposal has yet to be determined.

The first step in visual literacy or processing pictorial material is actively attending to the visual event rather than concentrating on other stimuli available (Rolandelli 1989). The individual must then realize that the picture actually represents some object. In his study of several different cultures in the developing world, Miller (1973) found that if an individual had never learned that a picture may represent some object, he or she could not perceive any object when first presented with a picture. An individual's culture must have pictorial material or place an emphasis on acquiring the ability to perceive what pictures depict in order for a member to recognize that a picture represents an object (Mangan 1978). For example, when presented with a photograph, unacculturated people will not see the "picture" because they attend to the photo's most striking aspects--the paper's rectangular edges and sharp contours. Because they are focusing on the white border, they cannot see the weak and fuzzy contours of black and gray contrasts within, the "real" picture.

Once an individual understands that a picture can represent an object, the next step in processing a picture is to identify the depicted object (Hochberg 1962, Miller 1973, Parlato et al. 1980). This recognition ability depends, again, on culture, past experience and knowledge, for an individual can only recognize what he or she knows

(Knowlton 1966, Gombrich 1972, Cridge 1977, Rosinha 1978, Mills 1980). Age, education and intelligence also effect this ability (Hengen 1970, Rosinha 1978), but these correlations may simply be reflecting one's experience with pictures.

The ability to recognize objects requires learning a set of cues (Fuglesang 1973, Miller 1973, Mills 1980, Parlato et al. 1980, Nodelman 1984) for depth, movement, identity, familiarity, color, orientation, context, edges, and detail. Some of the cues for object recognition require more skill to learn than others (Miller 1973, Levie 1978). For example, the ability to interpret depth using linear perspective and overlap codes is more difficult to acquire than the ability to separate figure from ground.

Visual versus Verbal Processing and Learning

Another approach to understanding the processing of pictures is to compare how pictorial material differs from verbal information. The biggest difference between the 2 sign vehicles is that pictorial presentations are holistic, while verbal presentations are linear (Bogue 1982). Thus, individuals derive meaning from pictures by processing both the whole and the interrelations of parts to that whole. Individuals extract meaning from words by processing component parts to the whole.

A second difference is that pictures are more memorable than words. People have phenomenal recognition memory for pictorial material, as high as 90% or greater (Fleming 1979, Bogue 1982). Several reasons for this picture superiority exist. Pictures may provide more cues than words, making them more memorable (Fleming 1979, Bogue 1982, Childers and Houston 1984). Or, pictures may yield qualitatively superior sensory codes, for the lines and curves comprising the pictorial vocabulary are more distinct than those creating the typical set of words.

Pictorial material may evoke the use of mental imagery or the

ability to "think in pictures" (Childers and Houston 1984). Because imagery may be a more reliable and organized coding process than verbal encoding, greater retention and learning occurs. A final explanation for picture superiority is that pictures are encountered less frequently than words, making them more memorable (Fleming 1977, 1979).

This "picture superiority effect" may apply to children and television, i.e., the visual modality of television is more salient and memorable to them than the auditory (Rolandelli 1989). Some believe that this actually reflects children's response to comprehensible material (Lorch et al. 1979, Wright and Huston 1983, Rolandelli 1989). Thus, regardless of whether the information comes visually or verbally, youngsters will attend to that which is comprehensible and meaningful to process program content. Because typical language on television is usually linguistically difficult for young children, they rely on the visual presentation to understand plot information. The "visual superiority effect" may also reflect an "action superiority effect", because actions are remembered better than dialogue when presented either visually and verbally (Rolandelli 1989).

Although pictures may be more memorable than words, they have their limitations (Mills 1980). Alone, they cannot communicate concepts nor conditional situations. They cannot describe a state of affairs in the past, present or future. Thus, they may be worth a thousand words, but without some constraining context, one cannot know exactly which ones. Pictures are unable to limit the infinite number of meanings available from them--a task language does easily.

Nature of the Learner

The second factor influencing how much an individual learns from a medium is the nature of the individual himself or herself. According to Bogue (1982), there are 3 dimensions to an individual's aptitude in pictorial and verbal processing: verbal ability, level of imagery and cognitive style. Differential combinations of these 3 elements could

account for the varying performances seen among individuals when they are presented with a medium.

The first dimension, one's verbal ability, is specialized for abstract sequential processing like language and other serial memory tasks. Imagery, the second component and discussed in the previous section, is used when a situation involves processing more concrete information. The final dimension, cognitive style is the preferred manner an individual consistently uses when processing information (Bogue 1982). For example, some individuals exhibit a processing preference for pictorial representations. When given verbal material, they will process it more effectively when they translate it into pictorial form via mental imagery. An individual's cognitive style mediates between the stimulus (picture) and performance, predetermining his or her success with a particular task. Success occurs when a task is consistent with an individual's cognitive style, even though the task is inconsistent with the nature of the medium (Bogue 1982).

For example, layout artists are often accused of being bad spellers (Bogue 1982). Their misspellings may be an example of their preference for processing headlines and paragraphs holistically rather than linearly--not an example of their spelling ability. These artists' primary concern is for the spacing, alignment and shape that the letters and words create in the composition. They overlook spelling because they prefer to focus on the whole rather than on the sequence of letters. Their cognitive style determines how they process the medium.

Several components comprise an individual's cognitive style. Bogue (1982) described 10 of them in his review: field dependent vs field independent, visual type vs haptic type, right-hemisphere vs left-hemisphere specialization, scanning vs focusing, breadth of categorizing (broad inclusiveness vs narrow exclusiveness), cognitive complexity vs cognitive simplicity, reflectivity vs impulsivity, leveling vs sharpening, constricted control vs flexible control, and tolerance for incongruous or unrealistic experiences. In addition to these 10

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dimensions of cognitive styles, age and cognitive development affect individuals' responses to stimuli (Caldwell 1973). All of these factors produce huge variations in learners' preference toward processing pictorial material. Unfortunately, most of the past research has ignored this. In his review of the literature on visual and verbal learning, Bogue (1982) explained the 2 major problems of research on pictorial and verbal presentations. First, treatments do not separate pictorial and verbal components. Second, treatments fail to reflect the aptitude or ability being considered. Bogue found only 1 study which clearly separated and analyzed the visual and verbal components of a learning task (Gagne and Gropper 1965).

Nature of the Learning Task

The last variable involved in the processing of a media is the nature of the learning task. Bogue (1982) listed 2 different types of tasks individuals may experience: global and linear. A global or holistic task involves deriving contextual relationships between objects. Linear or analytic tasks require the individual to distinguish one item from another by noting detail differences. Whether the task is global or linear will determine the individual learner's strategy and performance.

Another way to describe the nature of a learning task is to use Bloom's (1956) taxonomy of educational objectives: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Summary

Individuals learn differently from pictures than they do from words. How one learns from a medium depends on the interaction of 3 variables: (1) the nature of the presentation or stimuli, (2) the nature of the learner, and (3) the nature of the learning task.

Individuals must learn how to be visually literate--understand pictures or the information the artist intended to communicate. Visual

literacy involves realizing the picture represents some object and identifying the depicted object.

Pictures are more memorable than words, a phenomenon that may apply to TV. However, the visual superiority effect of TV may actually reflect an "action superiority effect", or children's attention and response to comprehensible material signaled by the visual messages.

People learn differently from pictures and words; thus experimental treatments should separate and analyze the effects of the 2 components, and account for the visual and verbal aptitudes of their subjects.

Use of Pictures in Learning

The use of visuals to complement oral or verbal instruction does not automatically improve student achievement (Dwyer 1970, Levie and Lentz 1982). Whether a visual assists learning depends on many factors. Research traditionally focused only on color, realism and other physical/perceptual elements (Brody 1984a), but picture content, function or purpose, relationship with the elements in the larger system, and the system itself (type of learner, teacher behavior, time available to the learner, failure to tell a learner when to look at a picture in a text, student attitudes toward and previous experience with the lesson content, etc.) must also be examined to evaluate the effectiveness of visuals (Dwyer 1967, 1970; Duchastel 1980, Levie and Lentz 1982, Alesandrini 1984, Brody 1984a). The method of cuing (use of questions, motion, or orally telling students the type of information should obtain from the instruction), also significantly affects a visual's impact on learning (Dwyer 1967). Therefore, instructional visuals differ in their effectiveness (Dwyer 1970), and no single format (realistic, cartoon, simple line, etc.) is best for all occasions (Brody 1984b).

The function of a picture (what it is supposed to do) may be the most important criteria for effectiveness. Several classifications of the functional role of pictures exist. Duchastel (1978) gave 3 broad classifications: 1) attentional function (picture motivates reader and maintains his or her attention to the task of reading; 2) explicative (aids understanding); and 3) retentional (facilitates later information retrieval). Brody (1984a) and Hurt (1987) believed that the functions of pictures must be specific, describing their contribution to instructional processes and procedures. Table 2 lists Brody's (1984a) instructional functions.

Table 2. Instructional functions of pictures (Brody 1984a).

present new information	change of pace
concretize abstract information	isolate
compare	simplify
emphasize point	organize
provide examples	present redundant information
motivate	summarize
advance organizer	gain attention
control learner behavior	direct attention
common referent	novel stimulus
model cognitive process	provide analogy

Another possible function of pictures is "mathemagenic behavior", or any behavior that increases learning. Brody and Legenza (1980) studied whether the pictorial aspects of a presentation might serve a mathemagenic function similar to inserted questions. They found that pictures placed after a reading passage seemed to be more beneficial than those placed before the passage. Like inserted questions, they acted as a "general backward or review process", encouraging the reader to mentally review materials related to the picture.

Hurt (1987) emphasized that the attributes of an illustration must match the illustration's function. His study showed that an illustration using an analogical representation helped students understand abstract or conceptual information, while an illustration with a literal representation helped them comprehend phenomenal (tangible) information. Analysts must consider this attribute-function interaction when deciding the effectiveness of text illustrations.

Research on the effects of pictures should consider 3 separate domains of learning (Duchastel 1980): comprehension (Duchastel 1980, Brody 1984b), recall (Duchastel 1980, Levin and Berry 1980. Levie and Lentz 1982) and motivation (Duchastel 1980). Pictures can help comprehension of text by providing a context for interpreting text material, increasing the depth of semantic analysis, and providing clarifying examples (Levie and Lentz 1982). However, they do not facilitate understanding of all text information. Illustrations usually

increase only comprehension of verbal information that the learner is already familiar with, and/or central information depicted in both the illustrations and text (Levin et al. 1979, Levie and Lentz 1982). This may be due to the fact that people are not in the habit of learning new or additional information from pictures (Levie and Lentz 1982). They usually do not "study" an illustration unless prompted to do so. Further, individuals normally notice only global aspects of a picture, or attend to those elements mentioned in the text.

Peeck (1974) reported seemingly contradictory evidence. His 4th graders answered according to the pictorial content more frequently when it refuted information in the text. The type of illustration in this study, however, may have affected their responses. The format was like a picture book. Thus, the readers may have depended more on the visuals than they would have in other situations.

Combining words and pictures may interfere with comprehension of the words, pictures, or both (Franzwa 1973). Several studies showed that pictures distracted young children learning to read (Samuels 1970, Levie and Lentz 1982, Brody 1984b). The picture, not the word, elicited the desired response, and the shift in attention from picture to word failed to occur in some pupils (Samuels 1970). Overall, illustrations improve the reading skills of poor readers more than those of good readers (Levie and Lentz 1982).

The effect of pictures on the second learning domain, long-term retention, has not been rigorously studied (Peng and Levin 1979, Duchastel 1980). Investigators defined "long-term" as longer than only 3 days; most analyzed only immediate recall, which usually interacted with comprehension.

Pictures may increase retention or recall in several ways (Levie and Lentz 1982). First, they may enhance retention by providing a second learning opportunity if it induces the learner to process the material at a different semantic or sensory level. Second, pictures may facilitate recall by stimulating imagery or the ability to think in

pictures. Finally, pictures may encourage retention through dual coding of information. Pictures do not appear to effectively aid in the recall of highly abstract and complex material (Alesandrini 1984).

Most researchers assume that pictures increase the third learning domain--motivation to learn. However, no empirical evidence for this exists in educational research thus far (Duchastel 1980). The relationship is based on intuition only. Wright and Huston (1983) provide evidence that visual attention does not guarantee comprehension.

Although many factors determine a picture's effectiveness, certain variables have been of special interest to researchers. Gender may not affect picture effectiveness. Dwyer (1967), Katzman and Nyenhuis (1972) and Hurt (1987) reported no sex difference in their learning tasks. In contrast, Peeck's study (1974) of incongruent text and pictorial information, noted that girls tended to choose answers corresponding to the pictorial content more often than boys. Females may have better recall under conditions emphasizing visual imagery processes (Sewell and Moore 1980).

For students of different ages, the same visuals are not equally effective in increasing student achievement of identical objectives (Dwyer 1970). Fleming (1979) found a developmental change from 1-5th grade. As a child ages, he or she can better detect changes in inventory information (addition of one object for another), and in spatial location information (exchanging the location of two objects).

Studies disagree on the effect of color on learning (Rosinha 1978). Most evidence shows that color may influence retention more than the immediate acquisition of information. For example, Kauffman and Dwyer (1974) found that on a delayed retention test, college students who viewed the colored presentation retained more information than those who viewed the black and white version. Color may increase recall of peripheral material (information not relevant to the basic information, message, plot or theme being presented) but not central information (Katzman and Nyenhuis 1972). Color also seems to be most effective when

it relates to a specific instructional function (Rosinha 1978, Brody 1984b).

Although people appear to prefer realistically colored illustrations over unnatural ones (Travers and Alvarado 1970, Rosinha 1978), stylized or unrealistic coloring may increase learning for students with higher intelligence (Berry and Dwyer 1982). Unrealistic coloring confuses lesser intelligent groups. Neither the color realism or individual differences in mental ability facilitates the retention of material after 6 weeks, however. The use of black and white may also reduce individual differences associated with learner ability (Parlato et al. 1980).

Much research has been devoted to the role of realism in picture effectiveness. Rosinha (1978) reviewed 2 theories behind realism-abstract studies. "Realism theories" propose that pictures should be used to obtain the same response occurring in the presence of the original object(s). A realism continuum exists that extends from the object itself to a very simplified line representation. Therefore, learning improves as the number of cues or details in the learning situation or picture increases.

The "information theory" rests on the concept of a single-channel data utilization system. The intelligent use of information by human receivers is a highly selective process, passing only one message at a time. Because the presentation of realistic and irrelevant detail may impede this process, one function of the perceptual machinery is to reduce redundant stimulation so that only the essentials travel through the central nervous system to the brain. This "compression" of information is natural and permits a nervous system with limited capacity to handle a very complex environment. Without such compression, the nervous system would be overwhelmed. Thus, this theory argues that less detailed pictures increase learning. Because one cannot know the receiver's ability to compress information, the safest procedure would be to compress the material before it is transmitted.

Dwyer (1967) suggested other reasons why realistic visuals may be less effective than simple line drawings. Subjects may perceive them as possessing too many irrelevant, time-consuming learning cues. Further, students have not been taught how to learn from more realistic types of illustrations.

Most studies support the information theory approach--pictorials limited to essential information will facilitate learning better than ones presenting more complex material (Dwyer 1967, Cridge 1977, Rosinha 1978, Borg and Schuller 1979, Mills 1980, Berry and Dwyer 1982, Alesandrini 1984). However, there must be enough background detail to give readers useful clues about the setting (Rosinha 1978). A "good" background utilizes clearly defined simple lines rather than gradations of tones and indistinct boundaries.

Realistic pictures can be effective in certain situations. In fact, Joseph (1989) found that realism contributed to both immediate and long-term test performance for all levels of ability, pacing and types of test objectives. In general, realism facilitates learning if the objective involves drawing of elements, identifying location or interrelations among parts, specific patterns, or functional relationships (Alesandrini 1984). It is also important in student-paced environments. The student has enough time to process and study the details (Dwyer 1970, Joseph 1989). In contrast, illustrations with small amounts of detail are more effective in group-learning situations with externally-paced instruction. Mills (1980) found that people expected photographs, a more realistic medium, to be more informative than line drawings. However, their performance did not match their expectations.

Learners prefer viewing visuals with more detail, realism and complexity (Travers and Alvarado 1970, Katzman and Nyenhuis 1972, Smerdon 1976, Myatt and Carter 1979, Alesandrini 1984, Brody 1984b, Ramsey 1989). However, if the picture is too complex, interest and examination time decreases (Travers and Alvarado 1970, Brody 1984b).

Further, the viewer must be familiar with the content, or adept at interpreting visual information to extract a realistic drawing's intended message (Alesandrini 1984). People may prefer to view more complex illustrations, but they may not choose to learn by them. Kauffman and Dwyer (1974) found that their subjects preferred to learn by cartoons over realistic photos.

The preference for complexity increases with age because younger children prefer simple illustrations (Travers and Alvarado 1970, Myatt and Carter 1979, Ramsey 1989). The shift in preference from simple to complex may occur somewhere between age 8 and 11 (Machotka in Ramsey 1989). In addition to age, children's preference for different artistic styles depends on the type of accompanying literary text. Ramsey (1989) found that her subjects (1-3rd graders) preferred photographs and realistic art with informational passages, while they chose stylistic art for narratives. In Myatt and Carter's (1979) study of K-11th graders, boys preferred photos while girls favored simple line drawings. This sex difference lessened as maturation occurred.

Studies show that people enjoy a combination of text and visuals more than a presentation composed of just text (Levie and Lentz 1982). Adults prefer cartoon-embellished presentations over unembellished formats (Baker and Popham 1965, Popham 1969, Sewell and Moore 1980), but no evidence exists on the belief that children attend more to materials with pictures than non-illustrated information (Levie and Lentz 1982).

People living in low literacy countries appear to learn better from realistic pictures than simpler line drawings (Fussel and Hagland 1976, Rosinha 1978, Parlato et al. 1980), probably because of their lack of education and experience with media. Illiterates need absolute detail and near-perfect representation of an object to recognize it (Miller 1973, Rosinha 1978).

Because of the variations in defining "realistic" and "simple line drawings" in research, Fleming (1979) suggested that pictures be interpreted in terms of "relevant" and "irrelevant" cues. He defined

relevant information as follows:

1. Inventory information - what objects a picture contains
2. Spatial location information - where objects are located
3. Descriptive information - the figurative detail of objects
4. Spatial composition information - specifies the areas of filled or empty spaces--roughly equivalent to the figure-ground relationships which distinguishes objects from their background.

Smerdon (1976) warned against making generalized inferences from data obtained in an artificial testing situation. He stressed the need for more studies which treat the stimulus material in its real life context, with subjects in their natural setting.

Summary

Use of pictures does not automatically improve student achievement. Whether a visual assists learning depends on many factors, primarily the specific function of the picture. Further, the attributes of the illustration must match its function.

Research on the effects of pictures on learning can be divided into 3 categories: comprehension, recall and motivation. Illustrations usually increase comprehension of verbal information that the learner is already familiar with, and/or central information depicted in both media. People are not accustomed to learning new or additional information from pictures.

Effects of picture on recall and motivation have not been rigorously studied. Illustrations may increase retention by providing a second learning opportunity, by stimulating imagery, and/or through dual coding of information. No empirical evidence exists for pictures' effects on motivation to learn. Most researchers assume that pictures--including cartoons--increase people's motivation to learn.

The same visuals are not equally effective for students of different ages. Color seems most effective when its use in a picture relates to a specific instructional function. Picture usefulness does not appear to depend on gender.

The debate over the effectiveness of realistic versus abstract pictures rests on 2 theories: realism theory (learning improves as the number of cues or details in the learning situation or picture increases) and information theory (less detailed pictures increase learning because only the essential information travels through the central nervous system to the brain). Most studies support the latter. However, realistic pictures can be effective in certain situations--e.g., identifying location or interrelations among parts, drawing of elements, and student-paced environments.

People prefer to view complex visuals, yet like to learn by less complex ones. The preference to view complex drawings increases with age.

Definitions, History and Trends of Cartoons

A cartoon is a drawing which simplifies and exaggerates (Harrison 1981). It simplifies because it takes a 3-dimensional world and makes it 2-dimensional by emphasizing the outline of objects. A cartoon exaggerates as it accentuates events and actions. Harrison (1981) defined 5 types of cartoons:

1. Cartoon illustration - a drawing that is subordinate to the surrounding verbal text;
2. Single-panel cartoon - a drawing with a caption (usually a quotation) below;
3. Narrative art cartoon - (e.g., comic strip) drawings in a sequence telling a story with words in speech balloons;
4. Animated cartoon - a combination of words from a soundtrack and cartoons appearing to move; and
5. Cartoon product - drawings on greeting cards, T-shirts, etc.

Cartoons (probably type 1) were first published in Germany in 1880, and colored cartoons appeared in that country in 1887 (Rosinha 1978). In the United States, the first cartoon surfaced in the *New York World Sunday Supplement* on November 18, 1894. Originally, the comic strip was designed to carry visual messages to non-reading immigrants entering the United States. Their messages were often indoctrinating, as authors attempted to persuade newcomers to accept a particular issue, honor a specific event, or support certain ideologies. Cartoons became an effective medium for perpetuating the values and mores considered important for the growth of the country. Not until the middle 1920's did they fully expand into an entertainment medium (Ball 1983).

In 1896, the *New York World* presented the first story cartoon, *The Yellow Kid* by Richard Outcault, which used both words and cartoons (Ball 1983, Trede 1990). Other U.S. newspapers began to feature regular comic strips with the publication of *Mutt and Jeff* in 1907. The first color

cartoons appeared in Sunday papers some time later (Rosinha 1978). In 1911, the first comic book was introduced as a collection of newspaper comic strips. Presently, human characters dominate comic strips, taking over 90% of the published media (Harrison 1981). However, since 1959 animal personalities have increased. Comics were called the "funnies" because they originally dealt solely with humor; now they include adventure, mystery and science fiction (Trede 1990).

Comic materials enjoy a higher readership than any other print-oriented medium except the daily newspaper, which contains cartoons (Ball 1983). More than 130 million Americans read the comics every week (Rapaport 1987), making this medium a $120 million-a-year business (Trede 1990). Japanese peruse through 1.5 billion copies of comic books a year (Rapaport 1987). These "manga" have become a $1.8 billion dollar industry, their sales growing at a faster rate than book sales. The most popular Japanese comic book sells 4 million copies per week, more than *Newsweek* magazine sells worldwide (Rapaport 1987).

Research on cartoons covers 3 areas (Harrison 1982): cartoon creation (how to do it); cartoon criticism (assessment and appreciation of it as an aesthetic form); and cartoon communication (analysis of the cartoon as a social, political or educational force). Harrison (1981) stated that "Any medium that has the continued attention of hundreds of millions of people deserves serious attention and study."

Beginning at age 1 1/2 to 2 years of age, children may prefer cartoons to all other formats of televised programming (Forge and Phemister 1987). Viewing seems to level off between 5 and 7 years of age (Huston et al. 1987). Popularity of the comic book increases throughout the elementary school years and peaks among 12-14 year olds (Wright 1983a). Their major consumers seem to be children between 9-13 years of age. Wright (1983b) reported that most 4-9th graders preferred comic strip and comic book reading over all kinds of reading activities. Subjects in grades 10-12 ranked comic strip reading third, behind magazine articles and short stories. Lyle and Hoffman (1972) found that

comic book reading was negatively correlated with high social economic status.

Boys tend to have a higher frequency of comic book reading than girls (Lyle and Hoffman 1972). This trend fades as children age. Boys also like television cartoons more than girls do (Huston et al. 1987). Huston et al. (1987) suggested that boys' greater attentiveness to this medium was due to the cartoons' masculine appeal. Cartoons usually the contain a preponderance of male characters and masculine stereotypic themes. Further, the formal features in cartoons (e.g., high action, fast music, sound effects, rapid changes) carry masculine connotations for young children.

Researchers have analyzed the characteristics of cartoons--e.g., their reasons for appeal and popularity, attention-getting qualities, etc. Cartoons usually depend on easy stereotypes for quick identification of characters (Harrison 1981). They use simple and familiar words with readability of strips ranging from a 1.8 to 7th-grade reading level (Koenke 1981, Wright 1983b). Cartoons also tell a story in a limited number of independent but sequential stages (Rosinha 1978). There is an interdependence of words and pictures which may be the cartoon's most unique and distinguishing characteristic (Harvey 1979, Elliott 1985). Elliott (1985) believed that this unique word-picture interdependence and cartoons' popularity called for teaching comic book literacy in schools. Learning this "methods of comics" would enhance understanding of other similar media (movies, television and advertisements).

In their research on children and television cartoons, Wright and Huston (1983) and Huston et al. (1987) argued that the formal features (high action, rapid pace, children's voices, etc.) of television cartoons is what facilitates learning in children, not the stylistic presentation. They reported that children attend to, understand, and recall information better when these formal features are used rather than more "adult-like" features. Children may attend because they have

learned that these formal features mean appealing and comprehensible content (Huston et al. 1987).

Because of their flexibility, adaptability and ability to abstract, the comic book is suitable for reaching more literate audiences with a certain amount of media sophistication (Parlato et al. 1980). Further, comic books are often treated as objects of value in illiterate countries, and are frequently saved for at least a year after distribution. Parlato et al. (1980) discovered that 52% of their subjects still had the comic booklets, while 31% had either given or loaned them to friends.

Parlato et al. (1980) provided several reasons for the popularity of cartoons. First, they are as close to film or television as a print medium can become. Children enjoy them because most children play, think and ultimately live in the language of direct speech found in cartoons. This medium captures their language and carries all action visually. Further, because this medium is less confined to spatial and temporal constraints, it can present diverse information or information diversely. Cartoons allow for more regional depiction of characters. Their portrayal of fantasy and adventure make it a highly popular vehicle for both entertainment and education. Parlato et al. (1980) argued that there is an incomplete appreciation of the traditional conventions and generic structure which give the comic book its inherent appeal. They believed that with few exceptions, the medium has been underused as an effective tool for education.

Summary

A cartoon is a drawing which both simplifies and exaggerates. It simplifies by making a 3-dimensional world 2-dimensional through emphasis of object outlines. A cartoon exaggerates as it accentuates events and actions.

Comic materials enjoy a higher readership than any other print-oriented medium except the daily newspaper, which contains cartoons.

Children between the ages of 1.5 and 7 years may prefer cartoons to all other formats of televised programming. Popularity of the comic book increases throughout the elementary school years, peaking among 12-14 year olds. Comic strip and comic book reading may be the most preferred reading activities for 4-9th graders. Boys have a higher frequency of comic book reading and TV cartoon watching than girls.

Many reasons for the popularity and appeal of cartoons have been proposed: their dependence on easy stereotypes for a quick identification of characters, their use of simple and familiar words, their telling a story in a limited number of stages, their independence of words and pictures, and their formal features (e.g., high action, rapid pace, etc.).

The Effects of Cartoons on Learning

According to Information Theory, cartoons should be very effective conveyers of information because they contain only the essential information to be transmitted. Ryan and Schwartz (1956) found that, indeed, adults recognized cartoons more quickly than line drawings and/or more detailed representations. Their study, however, was preliminary with a very small sample size (N = 16). In her review on animated cartoons, Caldwell (1973) noted that children learned more from animated cartoons than a verbal lecture with chalkboard or other illustrations. Kauffman and Dwyer (1974) added support. On both immediate and delayed retention tests they found that a cartoon presentation was slightly more effective in facilitating subject achievement than a realistic photograph version. Parlato et al. (1980) reported that cartoons were very effective in presenting new information and concepts to less developed countries. Singh (1981) studied the experience of reading comics, and found that they improved subjects' skills to effectively work with pictorial material--especially their interpretation and sequential perception abilities.

Two recent studies have shown contradicting evidence to Information Theory. Tversky and Baratz (1985) and Rhodes and Wooding (1989) reported that subject recall and recognition were better for photographs than caricatures. These investigators proposed that the combination of greater detail and representativeness accounted for the difference.

Scientists have proposed different theories for the seemingly greater effectiveness of cartoons. Mills (1980) suggested that cartoons' external forms come closer to mirroring the internal structure of our mental schemas than do realistic photos or drawings. Hochberg (in Mills 1980) gave a physiologically explanation. The eye registers fine detail only within the very small foveal region at the center of the visual field, while the eye's periphery registers gross and

generalized form. The success of simplified outline drawings (e.g., cartoons) may occur because they are recognizable further out in the field of peripheral vision where the eye does less work. Therefore, humans may be "prewired" to process generalized, non-detailed forms more efficiently. The brain may store familiar faces in long-term memory as cartoons or caricatures (Rhodes and Wooding 1989). The distinctive information for each face is exaggerated, thus facilitating recall and recognition.

Cartoons may "work" via 3 processes available to the artist (Harrison 1982): preleveling (dropping details); presharpening (remaining details become clearer and more significant); and preassimilating (filling in missing details, inferring and extrapolating, and inventing and distorting to one's own experience). Although these affect the viewers' perceptual experience somehow, scientists do not fully understand how people process cartoons. Perkins (1976) commented on the "mystery" of this medium:

> "What sort of picture is this? It is deliberately inaccurate, yet the subject is often quite recognizable--perhaps more recognizable than in an accurate portrait or photograph. It lies about its subject's shape, but in doing so, often comments delightfully on that shape. What exactly is going on?"

Cartoons often use humor which may facilitate learning. Comedy arises from the upset and recovery of equilibrium, a process also found in education when students move from the cognitive homeostasis of one level to a new intellectual equilibrium at a higher level. Cartoons may exploit this unique characteristic of intellectual restructuring (Langer in Harrison 1982).

Although effective, cartoon material may have some negative side effects. Many comic illustrations often depend on stereotypes (Koenke

1981). Children might associate them exclusively with fantasy, distortions of reality and caprice (Wilson and Shaffer 1965). Ramsey's (1989) results suggested that children may associate some degree of anthropomorphism with cartoon animals. Twenty percent of her subjects who preferred cartoon pictures justified their selection with statements like "He looks happy." or "He looks sad." She believed that 1-3rd graders equate cartoon style art with make-believe stories, whereas they view photographs as representing real-life situations.

Wright and Huston (1983) warned that cumulative exposure to the formal features characteristic of animated cartoons (high action, sound effects, etc.) may lead children to become increasingly dependent on them to maintain their attention to programs.

Cartoons in comic book form may hinder reading improvement for some students (Guthrie 1978, Wright 1983a). If provided the opportunity to use them, poorer readers will usually just skim comic books or only look at the pictures. Good readers will process both the text and illustrations. Elliott (1985) cited Arlin and Ruth's study where students spent 64% of their time reading words when books were presented, and only 41% when comics were used. They hypothesized that the pictures interfere with learning to read.

Cartoons may be less effective with people in low literacy countries because they appear to learn better from realistic pictures (Fussel and Hagland 1976, Rosinha 1978, Parlato et al. 1980).

Cartoons' Effects on Attitudes

Simonson (1980) synthesized 211 studies performed between 1933 and 1978 on the effects of media on attitudes and made the following general conclusions. First, media-attitude experimentation is not currently a high priority for researchers in media or related areas. Second, mediated instruction does contribute to desired attitudinal outcomes in learners, especially when the instruction is specifically designed to produce certain attitudes or attitude changes. However, no specific guidelines for producing attitudinal outcomes exist. There is no theory of "media-produced attitude change."

Third, procedures most likely to encourage desired attitudinal outcomes toward content include: a) providing follow-up activities (e.g., discussions) and open-ended questions after the mediated instruction; b) use of as many realistic types of media as possible (e.g., the story film); and c) creating an aroused state in the learner through direct participation, intermittent distractions to divert the learner from previously held attitudinal positions, or dramatic presentations that involve the viewer emotionally and intellectually.

Finally, procedures least likely to produce desired attitudinal outcomes toward content include: a) varying only the channel of delivery (e.g., a videotape of a live lecture probably would not generate more favorable attitudes toward the topic than the live lecture itself); b) distractions such as extraneous information or cues; c) providing unrealistic, highly symbolic information in visual media (e.g., a slide show containing written information); and d) presenting problem/conflict situations with no mechanism for conflict alleviation or problem solving in the media or follow-up discussion.

A few studies have analyzed the effects of cartoons on attitudes. However, these used one of only 2 types of pictorial modifications to test media impacts: realistic or highly stylized. No research has incorporated several degrees of "cartoonism", or a realistic-cartoon

continuum in its analysis.

Litcher and Johnson (1969) found a positive attitude change toward blacks in children after exposure to multiethnic readers. However, these children lived in an area with a low black population resulting in little contact with blacks. They already had neutral or positive perceptions of them. Further, in a second study these authors could not repeat the attitude change (Litcher et al. 1973). They concluded that this lack of a significant difference was due to shorter exposure length to the readers, a different population (metropolis town with much more exposure to blacks and racial prejudice), and fewer pictures in the book.

Davidson et al. (1979) compared 3 animated cartoons and the effect of their sex-role stereotyping content on young girls attitudes toward women's roles. Results showed that girls (5-6 years) who viewed the low-stereotyped program received significantly lower sex-role stereotype scores than did the girls in the high and neutral conditions. The subjects' scores in the latter 2 groups did not differ from each other.

Brinkman (1968) discovered that the combination of editorials and cartoons changed public opinion more effectively than either one alone. However, Carl (1968) showed that many editorial cartoons are misinterpreted by their readers. Bedient and Moore (1985) lent support when they found that 5th, 8th and 11th graders did not always correctly interpret abstract messages of cartoons. These researchers concluded that cartoons are a medium that may not be easily understood.

Although Margolin and Misch (1974) found a positive, lasting attitude change toward family planning among Colombian women who read their comic booklets, the subjects already had a general appreciation of the program. The general climate in Colombia at the time of the study favored family planning. External validity of this study is, therefore, questionable. Sheppard's (1981) study on current attitudes toward aging showed that a subject's attitude toward personal aging did not influence how he or she responded to or rated cartoons on aging.

Baker and Popham (1965) noted no difference in subjects' attitudes toward the content of a presentation when viewers watched either a text or cartoon-embellished version. The subjects did, however, prefer to learn by the cartoon version.

A study on the effectiveness of the Smokey Bear cartoon used by the U.S.D.A. Forest Service showed that this caricature may facilitate a positive attitude toward cooperative forest fire prevention. Ninety-eight percent of those interviewed recognized the bear and associated it with forest fire prevention. The majority could complete the sentence "Only you ___ _____ _____ _____" (AHF Marketing Research 1976). Lutts (in press) also found evidence that a cartoon influenced public attitudes towards the environment. He argued that *Bambi* fostered a deep concern for wildlife--almost to the point of preservation. Lutts further provided examples of anti-hunting attitudes possibly encouraged by this cartoon.

In contrast, Pomerantz and Hair (1988) found that an anthropomorphic raccoon did not increase humanistic attitudes toward wildlife in young children.

The Effect of Cartoons on Behavior

In his review of the literature on the effects of cartoons on behavior, Hapkiewicz (1979) found only 10 published studies, and findings were inconsistent with each other. Much of the discrepancy seemed to reflect methodological differences. First, more than one type of cartoon was used across studies; some used realistic characters while others presented comical ones (e.g., Batman vs Woody Woodpecker). Differences in cartoon type may influence children's perceptions of programs. Haynes (1978) found that 5th and 6th graders perceived a comic cartoon (Pink Panther) as more violent (e.g., slapstick) and less acceptable than one containing "real-life" violence (Dick Tracy). He proposed that the difference was due to the fact that violence was the main purpose of the comic cartoon and used to evoke laughter.

Second, some research conditions tested children who were chronically aggressive or preangered, while others analyzed youngsters in an environment that seemed to condone violent behavior. Finally, some of the experiments were done in the unnatural setting of a laboratory, threatening external validity. All studies involved children less than 10 years old; thus, no evidence exists on the effect of cartoons on children older than 10 years of age.

Despite these problems across the 10 studies, several generalizations emerged. Experiments finding an increase in aggressive behavior always involved children interacting with inanimate objects--e.g., a Bobo Doll. Studies examining interpersonal (children-to-children) behavior reported post-cartoon viewing aggression expressed as impatience. "Aggressive" children were less willing to wait for materials or adult attention.

Similarities between the film setting and the viewer's actual surroundings helped predict cartoons' effects on individual behavior. Relatedness between the model's behavior and the observer's new task was another important factor (Hapkiewicz and Stone 1974). In addition to a

model's outward actions, its inward qualities (warmth, power, status, etc.) may affect viewer behavior (Hapkiewicz 1979).

A subject's gender appears to have no strong influence on his or her perception of cartoon violence (Dobkins et al. 1987, Haynes 1978). Perception may be a function of age (Collins et al. 1974). Younger children (grades K and 2) tend to remember only the aggressive act(s), or the act(s) plus its consequences. Older children (grades 5 and 8) recalled the act(s), consequences and motives.

Some data suggest that it is not the cartoon/style that increases aggression, but the formal features of these shows (Wright and Huston 1983). Cartoons and commercials containing high rates of action, pace, and visual and auditory special effects can increase interpersonal aggression among young children under some circumstances. What types of circumstances and the strength and generality of this effect are still in question.

Children's perceptions of television violence may not be congruent with those of adults (Haynes 1978, Dobkins et al. 1987). Snow (1974) analyzed children's interpretation of violent behavior in animated cartoons. He found that children 4-8 and 9-12 years of age did not always interpret violent behaviors as violence. Snow suggested that they may be play-oriented, seeing aggressive behavior as funny or enjoyable; for although the youngsters saw the isolated act as violent, they called it funny and make-believe because the context involved play behavior. When asked if they would engage in similar behavior, most children said that they would not. Dobkins et al. (1987) discovered that their own perceptions of female cartoon characters' personalities (e.g., Miss Piggy, Wilma Flintstone) differed from those of 4th and 5th graders. The children's perceptions seemed to be more "balanced and flexible". Results showed no gender difference in the children's perceptions.

Studies have examined the influence of other types of cartoons on youngsters' behavior. Viewing prosocial cartoons may improve

preschoolers' social interaction and may be as effective as a live-model under certain conditions (Forge and Phemister 1987). However, the cartoon characters' actions must support their prosocial words. If they show aggression, children will imitate these actions instead of heeding the prosocial message (Liss et al. 1983). Bryan and Schwartz (1971) supported this with their research on non-cartoon film material on children's behavior. They found that a model's actions had greater influence than his words on observers' behavior.

Research on still cartoons' effect on behavior suggested that reading comic books do not lead to greater aggression among children (Tan and Scruggs 1980). Perhaps the depicted behaviors are not sufficiently involving and motivating for observational learning to occur--or effects of comic book reading may be long-term and cumulative, requiring more than one exposure.

Cartoon Design and Production

Caldwell (1973) gave several guidelines for producing animated instructional cartoons for children 4-11 years old. Because animation is actually a series of single cartoons, several of her principles apply to this research.

1. Children can better distinguish an object as a figure when shading and corners are used to emphasize only the relevant objects. Irrelevant background should be less obvious.

2. Children 4-8 years of age can more readily perceive objects depicted in cartoons if the figures are outlined with obvious, unbroken boundaries (as opposed to broken or indistinct edges).

3. When several objects are portrayed at the same time in a visual, children will discriminate the most familiar one first.

4. The presence of cues not relevant to the learning task (e.g., inherent cues like exaggeration) detracts from the learning task.

5. Humor facilitates learning when used as a relevant cue.

6. When initial instructional visuals contain irrelevant "anthropomorphized" versions of objects so that distinctive features can be discriminated or categorized, abstract concept and rule learning will decrease because of interference.

7. A child (4-8 years of age) attends more readily to an animated illustration of a familiar object than to an abstract or unfamiliar one. Sebastian and Borton (1982) supported this conclusion in their study of elementary school children. Familiar objects and situations were more appealing to children than ones remote from their experience.

Other researchers have offered guidelines for the production of instructional cartoons:

Layout: After reviewing cross-cultural comic books and photonovels, Parlato et al. (1980) suggested that artists should use a variety of perspectives when designing layouts. This combination of close-ups and far shots will create a more interesting composition. However, different shots and viewing angles communicate different messages (Barbatsis 1986)--e.g., close-ups express intimacy. Thus, artists must ensure that the visual composition of each picture or panel projects the intended mood and supports the verbal message. Barbatsis (1986) described the "vocabulary" and "grammar" of pictorial language.

Salomon (1979) found that preschoolers did not comprehend a "cut-to-closeup". That is, they did not understand that the close shot was actually a part of the preceding long shot. When a long zoom was used to make the wide-to-tight transition, however, the youngsters were able to understand the context. Older children (>2nd grade) seemed to make the connection without the assistance of the long zoom. Thus, whether a zoom or cut should be used to move from a far to close shot depends upon audience age.

Because the viewer prefers the central portion of a layout to portions in either side, and his or her eyes tend to remain in the upper left portion of an illustration, Spaulding (1955) suggested that the most significant objects and actions should be placed in these areas. However, Harvey (1979), a cartoonist himself, explained that the arrangement of elements of most compositions automatically force the viewer's attention to an area called the "center of focus", which is not necessarily the geometric center of the medium. Harvey calls the center of focus in a comic strip, the "graphic center of narrative focus". "Graphic center" emphasizes the visual nature of the medium, and "narrative focus" stresses the story-telling function of comic strip art. Thus, the comic book's composition should force the viewer's attention to whatever element in the comic panel contributes most to the telling of the story.

Speech: The first character to speak must be on the left, and speech balloons should be on the same side of the panel as the character (Sebastian and Borton 1982). Only one word balloon per character per panel should be allowed, and balloons should never straddle panels.

Visual attention is positively correlated with comprehension (Lorch et al. 1979). Thus, children will attend to a program only until the content becomes either incomprehensible, redundant, or visually or auditorily unattractive.

Colors: Gnagey (1982) found that colors have certain meanings depending on the situation, plot, characters, and other factors. For example, green may communicate souls regenerated, wisdom, life, spring, rebirth, death, decay, slime, greed, envy, or madness. Red may signify pressure, danger, retribution, hysteria, violence, revolution, warm attractiveness, and passion. Blue may denote heaven, freedom, depression, or the supernatural. Purity, sterility, and devoid of emotion may be communicated by white. Black may suggest mourning, sadness, evil, fear, and ignorance.

Characters: Parlato et al. (1980) suggested that a comic book story should be complex and involved, and contain many characters. In their study of elementary school children's preferences for cartoons, Sebastian and Borton (1982) found that children preferred animal characters that acted like humans over human characters. The animal characters must be visually exciting with exaggerated facial expressions, showing many obvious basic emotions.

Baggaley (1985) studied preschoolers' (3-6 years of age) preferences for cartoon characters. He found that the characters most favored and best recalled by these children satisfied their desires for friendship and amusement. They disliked characters who teased, were deceitful, and dressed up like inanimate objects or authority figures. Baggaley also discovered that children preferred animal characters

having a comical distinguishing feature (e.g., large teeth or ears).

Action: In addition to preferring clear emotional expressions, children like obvious physical actions and humor (Parlato et al. 1980, Sebastian and Borton 1982). Dramatic movement ("Bang!", "Pop!") is preferred over word play. The cartoonist must avoid physical positions of the characters may be easily misread as something obscene or suggestive; this would detract from the instructional intent of the strip.

Peel et al. (1979) warned producers and designers of 2 potential problems with any instructional media. First, the segment might fail in its primary purpose as an educational vehicle. Second, the segment might have an unintended negative effect--e.g., negative stereotypes involving physically handicapped, sex roles, elderly, culture, children being dependent on adults for everything, etc.

METHODOLOGY

Children between the ages of 6-8 and 12-14 years of age were exposed to various combinations of a Natural History (NH) and a Fantasy (F) educational experience or video. The NH experience contained photographs of actual species while the F video had cartooned versions of the animals. Pre- and post-tests assessed changes in subject perception--i.e., whether exposure to anthropomorphic wildlife cartoons modified the attributes children ascribe to real animals. A proportion of the subjects were also personally interviewed to further explore youngsters' cognitive processes related to their perceptions of cartoons and real animals. The Michigan State University Committee on Research Involving Human Subjects approved all methodology (Appendix A).

Experimental Design

Six experimental groups were created for each age group to answer the research question and test the theoretical model and hypotheses. The design (Figures 3 and 4) included a pretest (O_4) and tests for order and test effects (O_2 vs O_3 and O_3 vs O_7) and treatment effects. The period between viewing the 2 educational experiences was set at 6 days. It was assumed that this interim would allow enough time for the realism/fantasy attributes of a species to enter into a child's frame of reference.

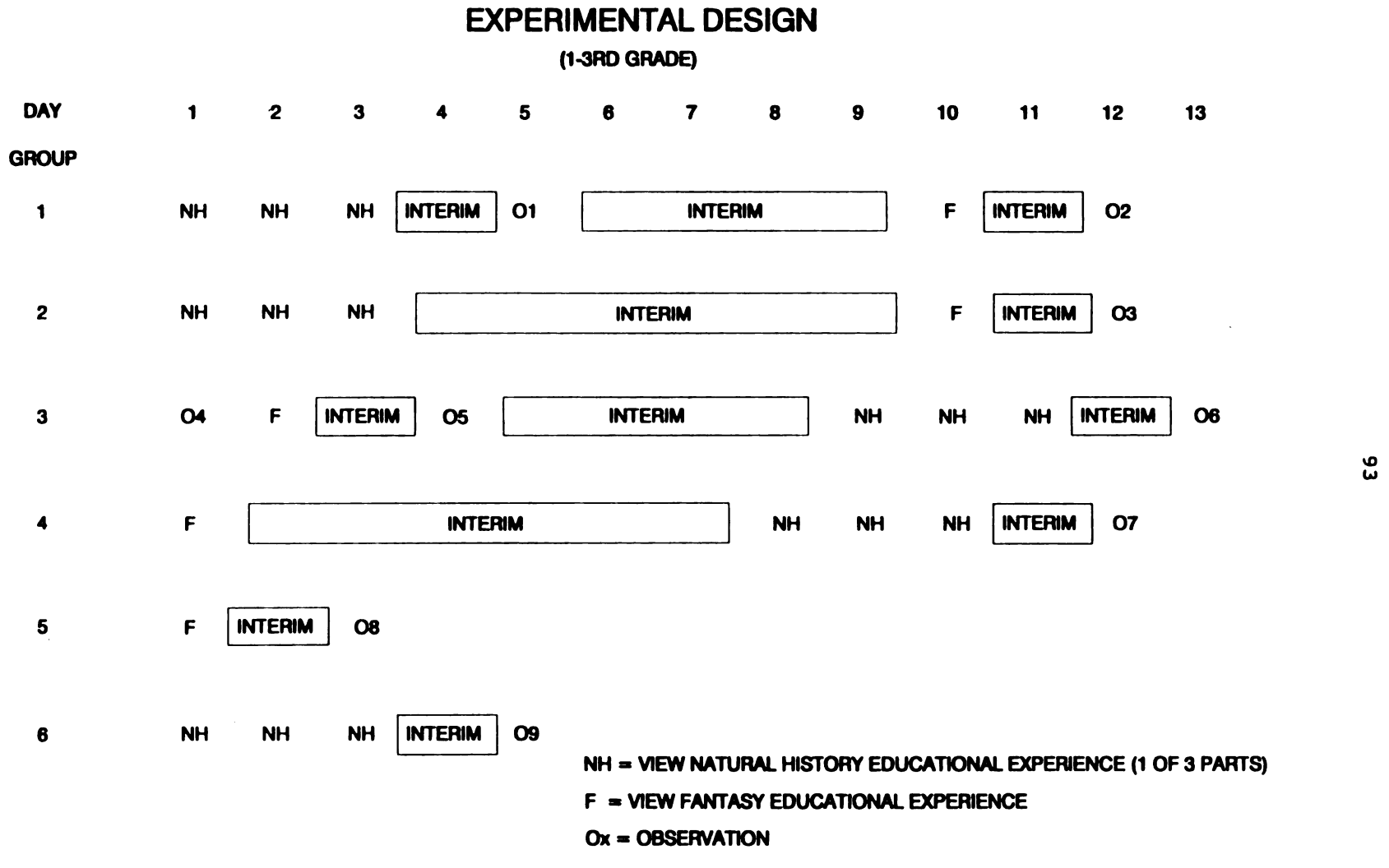


Figure 3. Experimental design for 1-3rd grade subjects.

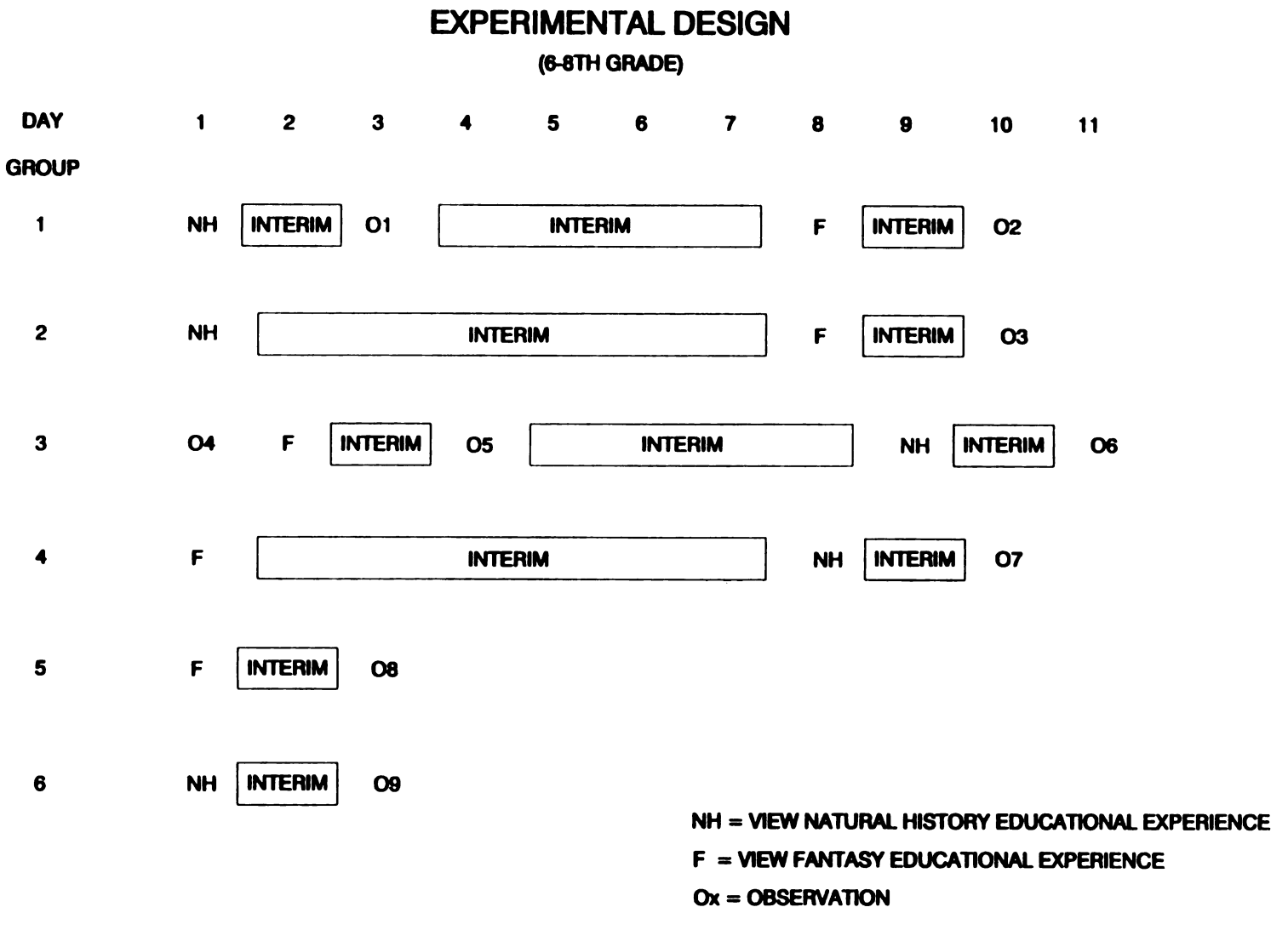


Figure 4. Experimental design for 6-8th grade subjects.

Natural History Educational Experience

Verbal/Linguistic Message

A linguistic message on the natural history of 3 unfamiliar Michigan wildlife species was created for each age group. The 6-8th grade version presented the information in 1 undivided presentation. The 1-3rd grade message was divided into 3 parts, one portion for each species, to account for these youngsters' shorter attention span. Each part reviewed material in the previous section.

Michigan species were chosen to increase the material's relevancy to the teachers and students. Unfamiliar species were selected based on the assumption that as familiarity with an object increases (Blanchard 1982), the impact of anthropomorphism decreases, animistic tendencies decrease, and accuracy concerning the nature of the object improves (Looft and Bartz 1969, Beveridge and Davies 1983, Dolgin and Behrend 1984, Richards and Siegler 1984, 1986; Bullock 1985, Sharp et al. 1985, Inagaki and Hatano 1987, Berzonsky 1988, Berzonsky et al. 1988). Therefore, using unknown species improved evaluation of the effects of anthropomorphic cartoons.

Children show equal preference to mammals and birds (Badarraco 1973, Kellert and Berry 1980); thus both groups were included in the presentation for variety. Fish, reptiles, amphibians, and insects were not selected because people have different attitudes (generally more negative) toward these creatures. The 3 species used in the educational experience were the pine marten (*Martes americana*), belted kingfisher (*Ceryle alcyon*) and shrew (*Sorex sp.*). The marten was chosen as an "unfamiliar" species to Michigan children because of its limited distribution and abundance, and solitary, nocturnal behavior. The shrew is also nocturnal and, although abundant, often difficult to see because of its small size, speed, and cryptic coloring. The kingfisher was considered a more obscure species for children because it is not a common backyard bird, and has very specific habitat needs: dirt banks

for nesting, and clean, clear bodies of water containing small fish.

The marten, kingfisher and shrew were also selected because each had distinct behaviors that could be specially addressed in the Fantasy video. Although the NH message described several habitat needs and behaviors of the 3 animals, these particular characteristics were emphasized in the NH presentation. They were: The pine marten is arboreal and solitary, the kingfisher is piscivorous and has a loud "rattling" call, and the shrew has a voracious appetite, always eating and moving quickly.

Three methods evaluated the readability of the preliminary scripts. Readability is "the measure of the ease with which a given passage of text can be read and understood" (Minnesota Educational Computing Consortium 1982). Local 1-3rd and 6-8th grade teachers reviewed the scripts, a Michigan State University Ph.D. Education graduate student doing research in readability edited the scripts, and both scripts were analyzed by a computer software package for readability (Minnesota Educational Computing Consortium 1982). All 3 approaches judged the scripts as appropriate for the 2 age levels.

The software used the Fry and Spache tests to evaluate the 1-3rd grade script. These tests predicted that the average readability grade level for the script was 5.25 (Fry) and 3.4 (Spache). This seemed high for 1-3rd graders, but these tests estimate only written readability, i.e., silently reading a given passage of text. Children's "listening" or oral comprehension of text is approximately 2 years higher than their understanding of written material (Sticht and James 1984). Hence, the 1-3rd grade script was appropriate for its age group. The software measured the readability of the 6-8th grade script with the Fry, Dale-Chall, and Raygor Tests. The average readability grade levels of this script were 6.8 (Fry), 7-8 (Dale-Chall), and 6 (Raygor)--suitable for the older subjects. Ecologists also reviewed the preliminary scripts to validate technical information. Their suggestions were incorporated into the final script (Appendix B).

Visual Message

Slides of the 3 species and their habitats were collected to accompany the Natural History verbal message. These animals were presented in a video format. When slides were unavailable, photographs from natural resource magazines, books or posters were made into slides using a copy stand and Kodak Ektachrome Tungsten 160 35mm film shot at 1/125 seconds and F-stops of 8.0-11.0. The computer software *Freelance* generated species' range maps. These graphics were photographed off a VGA monitor screen using Kodak Ektachrome 200 Daylight 35mm film at 1/2 second and F-stops 5.6-8.0.

Fantasy Educational Experience

Verbal/Linguistic Message

A story containing a conservation message was developed for each age group. The 1-3rd grade script, "Select Respect", focused on respect--respecting others, their possessions and time, and the environment. The 6-8th grade script, "Living Lightly", emphasized the impact human activities have on the environment through all their activities. Caricatures of the 3 species covered in the NH video dialogued these messages. Max and Mindy represented martens, Kurt and Kerry symbolized kingfishers, and Stu and Sandy characterized shrews. These characters were associated with the 3 wildlife species at the beginning of the video--i.e., introduced as Max Marten, Kerry Kingfisher, Stu Shrew, etc.--but referred to only by their proper nouns throughout the rest of the verbal message, e.g., Max, Kerry, Stu, etc. This initial name-species relationship was made so that experimental groups seeing only the fantasy presentation would have some frame of reference when answering questions about the actual wildlife species in the surveys. It was assumed that for the other experimental groups, most of the cartoon-species association would come through visually linking the cartoon character and photographs.

Although the fantasy presentation relayed conservation principals, it distorted the habitat and behavioral characteristics of the 3 species emphasized in the Natural History experience. For example, Max and Mindy Marten were acrophobic (afraid of heights) and desirous of friendships. They were not solitary creatures, but actively sought out others to engage in group activities because of loneliness. Kurt and Kerry Kingfisher were not fish-eating, but vegetarians. They were also very shy and soft-spoken, not loud and noisy. Finally, Stu and Sandy Shrew were not voracious eaters darting at a fast pace. These characters moved very slowly and were quite picky about their weight and eating habits. Although these distortions were obvious, they were not a major focus of the environmental message or plot. The faulty information was relayed through description and development of the characters only.

Local 1-3rd and 6-8th grade teachers and the Education graduate student reviewed the fantasy preliminary scripts for readability. They believed that the verbal messages were appropriate for the 2 age levels. Their vocabulary suggestions were incorporated into the final scripts along with camera directions (Appendix B). Both the 1-3rd and 6-8th grade messages were presented as 1 undivided segment.

Visual Message

The cartoons corresponded to Pattern #2 of Blanchard's (1982) categories for anthropomorphism--characters in a natural setting with few human attributes except for speech--but the characters had more human characteristics in addition to speech, e.g., emotion, ethics, gestures. The author first drew the cartoons accompanying the verbal message on white bond paper using an HB or Number 2 pencil lead. The rough drafts were then pencil-traced onto bristol board (21.7 x 35.5 cm) through a light table. Next, the pencil was inked using Higgins Black Magic Waterproof Ink and 2 pen points: Gillott's 290 Lithographic Pen and Speedball A-5 Lettering Point. The characters and other details

were colored with Berol Primsmacolor and Eberhard Faber Design Art Markers. Large areas were filled in with a watercolor wash of Liquitex Professional Artists' Watercolor and water. The cartoons were pressed or flattened under heavy books before mounted onto poster board (36 x 55.5 cm) with rubber cement. Each graphic was tagged with the number corresponding to its position in the Fantasy script. Examples of the cartoons are in Appendix C. The cartoon presentation incorporated these still characters into a video format. Time and budget limitations prevented the use of animation; plus a simple still presentation would provide basic information on the impacts of anthropomorphism without the confounding effects of animation (i.e., movement).

Bogue (1982) proposed that 3 components are involved when an individual processes a medium: the nature of the presentation, the nature of the learner, and the nature of the learning task. These components were taken into account when designing the cartoon visuals and all verbal messages. Work by Caldwell (1973) and others guided development of the first component, nature of the presentation. Many of their principles for the production and utilization of cartoons and animation in educational settings for young children were integrated into the cartoon presentations:

1. Color was consistent with those found in the real world (i.e., trees were green, water was blue, etc.);
2. Edges were solid and obvious, not unbroken;
3. Background was kept simple, especially for the younger children (a large solid green bush with a few background trees). The older students' cartoon story contained more complicated backgrounds--e.g., a far shot of a stream containing many characters performing several different tasks;
4. Orientation of characters was kept parallel with the frame of the picture. Caldwell (1973) showed that presentations

not following this rule result in children seeing the objects tipped at an angle; thus, they may have difficulty identifying the object and understanding the message;

5. Action was exaggerated and used as much as possible;
6. No negative stereotypes were used. Both female and male characters showed fear, shyness, intelligence, etc.;
7. A video instead of a slide show was used to allow movement through zooms and pans. Caldwell (1973) explained that animation and its movement "grab" children's attention. Some learning theories propose that attention is the first step in learning from a medium--followed by comprehension, yielding, etc. (Rolandelli 1989);
8. Language was simple and appropriate for each age group; and
9. What was communicated by the types of shots (close-ups, pans, far shots, etc.) was considered in design (Barbatsis 1986). When context was desired, a wide-angle cartoon was used. Times where important concepts were taught or intimacy was needed, close-ups were drawn.

The second component needed to process a medium, nature of the learner, involves 3 aspects of the learner (Bogue 1982): verbal ability, level of imagery and cognitive structure. Verbal language was tailored to the age group to account for differences in verbal abilities. Level of imagery and cognitive structures were considered by assuming that the subjects were visually literate. That is, both age groups recognized that a picture depicted some object; they could identify the object (would know that an object was an animal, tree, etc. even though specific species were unknown); and had learned enough cues (depth, color, context, movement, etc.) to interpret the picture. Since studies show that visual literacy is developmental (e.g., Van Ert Casey and Wolf 1989), the cartoons for the younger children were made less complex than those designed for the 6-8th graders.

The nature of the learning task, the final component, can be defined as global or linear. A global or holistic task involves deriving contextual relationships between objects. Linear or analytic tasks require the individual to distinguish one item from another by noting detail differences. It was assumed that the F and NH experiences contained both types of learning tasks because they required processing a picture (a global task) and words (linear task). Further, these activities were similar to environmental education materials commonly produced by natural resource agencies. Their curricula usually involve pictures, reading stories, and doing activities like crossword puzzles--all global or linear tasks--to meet the various learning styles of their consumers.

Production of Educational Experiences

Production of the NH and F educational experiences involved combining the verbal and visual messages into a video. The video medium was used because it is popular with children, and provides a media experience similar to television--the mode by which youngsters usually encounter wildlife cartoons. Also, all of the participating teachers had access to a videocassette player for the experiment.

Six Michigan State University students majoring in Theater were hired for the cartoon characters' voices. Each student was matched to a cartoon character according to his or her voice traits and the cartoon character's personality (e.g., high-voiced students were casted as shrews). Two of these students narrated the NH experience scripts.

The visual and audio portions of the videos were recorded in a Michigan State University recording studio. The visuals were filmed first, using a draft recording of the written script as a guide. Narration, cartoon voices and background music were then recorded and mixed with the visual segments. A chyron machine generated the credits and NH titles.

Measurement Models

Definitions

Hunter and Gerbing (1982) provided a good explanation of measurement models. A measurement model specifies the causal relations between the theoretically defined constructs and the responses to the observed variables (questions or items on the survey instrument) determined by the theoretical variables. Measurement theories are needed because an imperfect relationship between theoretical and observed variables exists, i.e., no indicator or item is a perfect measure of the underlying factor; measurement error exists. Thus, one must specify the relationships between the factor and items and between items through a measurement model. A Likert scale is an example of a measurement model for linear variables.

The usual method for finding the common factor underlying several responses involves adding or averaging the questions. If the items satisfy the empirical procedures of construct validation, the composite score is potentially a more reliable and valid estimate of the underlying factor than any of the single item responses. Further, the cluster of alternate items must be unidimensional for interpretation of the composite score. A measurement model that specifies a set of unidimensional scales is called a multiple groups model.

The most basic parameters of a measurement model are the "factor pattern coefficients" and the "factor-factor correlations". The factor pattern coefficients are the regression weights of the observed variables on the corresponding factors as specified by the measurement model. Because in a multiple groups model each observed variable is generated by only a single factor, there is only one number in the factor pattern of each item--the correlation between the item and the factor it measures. A second parameter associated with each item is its "communality". The communality is the hypothetical correlation of an item with another item of the same reliability--i.e., the variance of an

item attributable to only the underlying factor (no error variance). If the multiple group model fits the data, then the communality is the square of the factor pattern coefficient. Other parameters of the model are the "factor loadings": a matrix of the correlations of each observed variable with all the factors. The factor loadings are used primarily in the analysis of the measurement model or in testing the fit of the measurement model to the data.

The complete analysis of a measurement model--an example of construct validation--involves (1) model construction, (2) parameter estimation, and (3) model estimation, followed by (4) an analysis of the reliability of the cluster scores for the multiple groups models. The statistical evaluation of a multiple groups measurement model is confirmatory factor analysis (CFA).

Natural History and Cartoon Surveys

Three surveys containing the measurement models were constructed for this study: Activities and Knowledge (A&K), Natural History (NH), and Cartoon (C) Surveys. The NH and C Surveys contained items for the factors Perceive Educational Experience as Real Wildlife, Give Physical Attributes of Educational Experience to Real Wildlife, Give Anthropomorphic Attributes of Educational Experience to Real Wildlife, and Give Moral Attributes of Educational Experience to Real Wildlife. These 2 surveys were identical except for a few questions related to the accompanying video. For example, the NH Survey had items concerning the definition of habitat or the ranges of the 3 species. The C Survey asked questions about the meaning of respect or how different activities impacted the environment. None of these placebo items were coded or analyzed.

Items measuring the Give Physical Attributes of Educational Experience to Real Wildlife (subsequently referred to as Physical items) asked about behavioral characteristics of the 3 species: If you saw a wild marten, would it be alone? What kind of call does a kingfisher

make? Do shrews move slow? The questions for the Anthropomorphic Attributes factor (Anthropomorphic items) referred to human-like characteristics in the animals, e.g., Do you think a marten knows the difference between right and wrong? Do you think a shrew cares about how pretty it looks? Do you think a kingfisher makes plans for what it will be doing 3 weeks from now? Variables measuring the Moral Attributes factor (Moral items) addressed the right and wrong treatment of the animals: Someone keeps a shrew in a cage at home as a pet; Someone catches a marten in a trap and uses its fur for warm gloves; Someone kills a kingfisher to have it stuffed to show in a museum.

The factor Perceive Educational Experience as Real Wildlife was measured differently in the 2 age groups. Several items were included in the 6-8th grade NH and C Surveys to evaluate whether the subjects perceived the cartoon characters or the animals in the photographs as real wildlife. For example, the NH item asked whether kingfishers will die someday. The corresponding C Survey question inquired whether Kurt in the video will die someday. The 1-3rd grade surveys did not contain such questions. With this younger group, the interviewing process attempted to measure the Perceive Educational Experience as Real Wildlife factor.

A sticker system was created for the 1-3rd graders to simplify their task of responding to a written survey. Young children enjoy stickers and can easily place one on a survey even if they do not have the motor skills to circle or write an answer. Using stickers also lessened the chances of measuring these youngsters' test-taking abilities instead of their actual responses to the questions.

Five different stickers of various colors and shapes represented specific answers: A green circle meant "Yes", a red square signified "No", a "blue moon" (half of a blue circle) indicated "Not Sure", a white box meant an action was "Right", and a yellow triangle indicated that the action was "Wrong".

The NH and C Surveys for both age groups contained 3 different

measurement models, one for each of the Attributes factors. A scale using multiple-choice questions measured the Physical Attributes construct for the 6-8th graders; the 1-3rd graders simply responded "Yes", "No", or "Not Sure" to their Physical questions. Responses for both age groups were coded as either correct or incorrect. A Likert scale was used with the Anthropomorphic items, and a semantic differential scale evaluated the Moral Attributes factor for both groups. The 6-8th grade scales had 5 anchor points, with higher numbers implying greater anthropomorphic tendencies or concern for the right and wrong treatment of animals. The Likert scale ranged from "Strongly Agree" (5) to "Strongly Disagree" (1). Their original Moral semantic differential scale contained 3 adjective pairs: good and bad, fair and unfair, and right and wrong. The 1-3rd grade sticker system corresponded to a 3-point Likert scale and semantic differential scale. "Yes" or "Wrong" were scored as 3, "Not Sure" received a score of 2, and "No" and "Right" were coded as 1. All of these measurement models had at least 4 items each to ensure over-identification for model testing (Pedhazur 1982).

Activities and Knowledge Survey

This measurement model assessed an individual's age, gender and past direct contact with wildlife. For both age groups, a blank line was provided for the subject's age. The older students were asked to circle their correct gender, and the younger children answered "Yes" or "No" to direct questions (e.g., Are you a boy?). The rest of the Activities & Knowledge Survey contained Yes/No items about the students' participation in different activities where direct wildlife contact would most likely occur--e.g., Does someone in your family go hunting with a gun or bow and arrow?, Does your family put out food for birds, squirrels, deer or other wild animals?, Have you gone to a zoo in the past year? Several knowledge questions about whether certain wildlife species are found wild in Michigan were also included to measure past

direct contact with wildlife. Use of these items assumed that children more knowledgeable in this area have had more direct contact with wildlife, as suggested by Bryan and Jansson (1973), Dahlgren et al. (1977) and Kellert and Westervelt (1983).

The shorter attention span of 1-3rd graders required a shorter Activities & Knowledge Survey. Several knowledge items and the questions on trapping and wildlife-related clubs were omitted.

Sample

Sample size was determined by comparing the confidence intervals for various levels of Pearson's correlation coefficient ($r = 0.15, 0.30, 0.50, 0.85$) at a significance level of 0.05 (Figure 5). A sample size of 200 subjects per treatment appeared sufficient because correlation of at least 0.50 was expected for the paths in the proposed theoretical model. Further, the confidence intervals did not markedly decrease with additional participants.

Teachers participating in the 1987 or 1988 Higgins Lake, Michigan Environmental School were contacted to see if they or their colleagues were interested in participating in the study. Contact letters strongly emphasized the importance of recruiting subjects from all types of backgrounds. No gifted, learning disabled or special education students were included in the research. The disproportionate number of teachers having an interest in environmental education was accounted for by random assignment of teachers to experimental and control groups. This procedure will be described subsequently.

Approximately 90 teachers agreed to participate in the study. These educators taught grades 1-3 or 6-8 in public or private schools located in all regions of Michigan (north, south, east, west, and central). Southern Michigan contains more urban population centers than northern portions of the state. To improve representation of urban and rural youth in each experimental group, the teachers were first

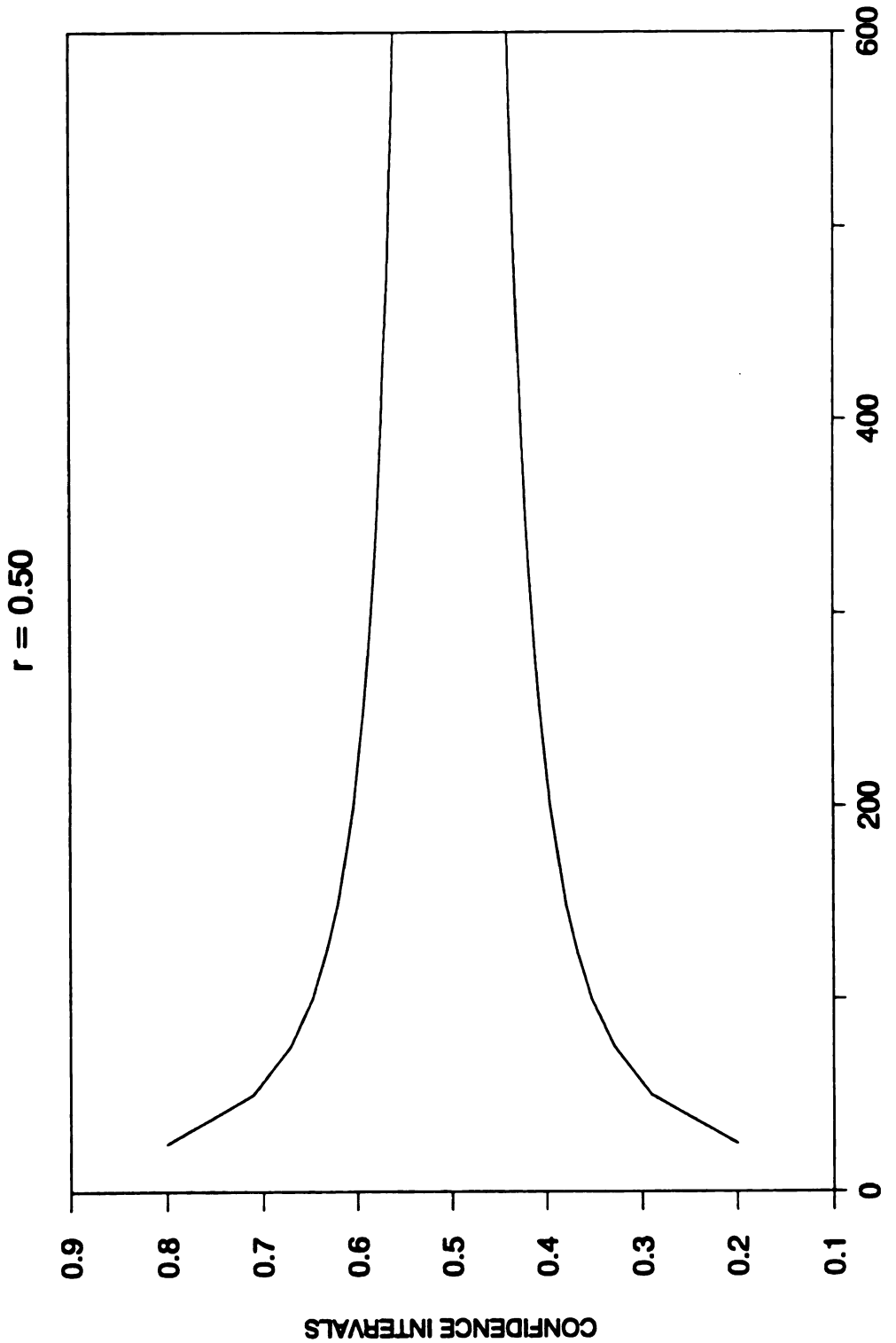


Figure 5. Confidence intervals ($P \leq 0.05$) of various sample sizes for $r = 0.50$.

categorized by their north-south and east-west orientations (northwest, northeast, southwest, southeast) and then randomly placed into 1 of the 6 experimental groups from these categories. The city of Claire was the dividing line for north and south; State Highway 27 determined east-west orientation.

Each experimental group had a specific teaching schedule. A copy of a teacher's assigned experimental teaching schedule was sent to him or her along with a description of the experiment and its material to confirm full participation in the study. Many teachers were unable to fit the specific schedule into their own program, and could not participate. The sample for the pilot and final experiment contained 68 teachers and approximately 3400 students.

Pilot Study

Natural History and Fantasy Educational Experiences

The 4 video presentations were taken to several 1-3rd and 6-8th grade classrooms for review. Eight teachers who had agreed to participate in the final experiment provided the students for the pilot study: 1-3rd grade = 128, 6-8th grade = 260. The purpose of this portion of the pilot study was to evaluate the children's comprehension and enjoyment of the videos, their attentiveness, and whether they could identify the species represented by the cartoon characters. This evaluation was accomplished through several means. First, as the children watched the videos, their attentiveness, questions, fidgeting behavior, and comments were noted. Second, the author discussed the videos' contents with the students after they completed the surveys. Students who saw the NH video were asked to identify and describe the 3 wildlife species and their behavior--e.g., red-orange neck patch on the marten, blue feathers of kingfisher, arboreal nature of the marten, speed of the shrew). Subjects viewing the F presentation responded to questions about the cartoon characters' names and the distorted

characteristics of the 3 species (kingfishers' vegetarian diet, martens' acrophobia, etc.). The discussion revealed that the children of both age groups easily comprehended the messages of the visual presentations. Thus, the assumption of their being visually literate was apparently valid, i.e., they recognized that the pictures represented an object and were able to identify all the objects. Some of the children viewing the F video did not know the proper species names for the cartoon characters, but they still correctly identified them as animals.

The third evaluation approach involved a general discussion with the subjects about the style and production qualities of the 2 educational experiences. The students commented on whether they liked/disliked the videos and why. The majority of both age groups liked the 2 videos. Their major criticisms were the lack of animation in the F version, and some long pauses between narration and/or dialogue. Finally, the videos were discussed with the teachers, and they provided some suggestions and opinions about the length and content of the educational experiences.

Revisions for the final versions of the videos incorporated all the evaluation results. For example, unwanted background noises and the long pauses were removed. The final NH and F educational experiences for the 1-3rd graders were approximately 12 minutes apiece. Each 6-8th grade presentation ran about 15 minutes. All videocassette tapes were mass duplicated by a local media production company. Brightly-colored labels were placed on videos for the experimental groups seeing only 1 of the educational experiences (NH or F). These labels reminded the teachers to refrain from showing the other presentation until after completion of the experiment and all surveys were returned to the investigators.

Measurement Models

The surveys containing the measurement models were pilot tested with the same 388 students who critiqued the videos. Of the 128 1-3rd

graders, 69 completed the NH Survey, and 59 answered the C Survey. For the 6-8th graders, 124 completed the NH Survey, and 136 answered the C Survey. The pilot test consisted of several assessments. First, the items and survey format were discussed with each of the pilot study teachers. They gave suggestions on the instruments relating to their students' ability to answer them. The majority of the students were able to understand the visual presentations and answer the questions. Hence, the assumption that the experimental process contained both global and linear learning tasks was apparently met since learning performance is successful when a task matches a learner's cognitive style (Bogue 1982).

Second, the director of the Michigan State University childhood development research center reviewed the 1-3rd grade surveys. All of these reviewers' comments were incorporated into the final surveys.

Finally, the Physical, Anthropomorphic and Moral Attributes measurement models were subjected to different statistical tests to estimate construct validity and reliability. The linear factors (Anthropomorphic and Moral Attributes) underwent confirmatory factor analysis. The non-linear construct, Physical Attributes, was tested for a Guttman simplex--"step-wise" progression (Guttman 1944)--and subjected to the non-parametric Mann-Whitney U Test. The Guttman simplex test evaluated whether the Physical Attributes questions showed a Guttman scale-like progression. (The test involves correlating the mean discrepancy between 2 items on a factor and their correlation. A large negative correlation suggests a Guttman simplex.) The Mann-Whitney U Test judged whether a significant difference existed between student responses on the NH Survey versus answers on the C Survey. A difference would imply that the 2 educational experiences communicated different information.

No Guttman simplex appeared in the 1-3rd or 6-8th grade surveys (1-3rd: $r_{NH} = 0.14$, $r_C = 0.17$; 6-8th: $r_{NH} = 0.12$, $r_C = 0.054$). Thus, the Physical Attributes factor was not characterized by a "step-wise"

progression of knowledge. Another non-linear relationship may describe the factor, but identifying it was beyond the scope of this study. The Mann-Whitney U Tests revealed a significant difference between student responses for the 2 videos (P = 0.0000). This suggested that the students were learning the intended opposing information about the species' physical attributes from the 2 presentations and responding on the measurement model accordingly.

Several modifications were made on all the measurement models as a result of these pilot tests. Seven Physical items were omitted from the 1-3rd grade instruments to shorten them. CFA suggested the deletion of 1 Anthropomorphic item on the 1-3rd grade survey. Four questions were removed from the 6-8th grade Anthropomorphic Attributes measurement model. CFA also revealed that the Fair/Unfair and Good/Bad items should be deleted from the 6-8th grade survey, because item-item correlations, factor loadings, communalities, internal consistency, and/or parallelism were poor. This deletion left a Right/Wrong semantic differential scale; these items showed acceptable levels of construct validity. Only 2 questions out of 6 measuring the construct Perceive Educational Experience as Real Wildlife in the 6-8th graders were retained to help shorten the survey.

Other modifications on the measurement models included altering the wording of several items for clarification or emphasis, replacing the single blank line for the 1-3rd graders' sticker answer with a large box, and adding more space between the 1-3rd grade items so that the younger children could easily "track" or follow the questions. Pilot test results also suggested that the subjects needed more interaction with the cartoon characters in order to develop a frame of reference about the 3 wildlife species. Interaction time was increased by instructing the teachers to show a picture of each cartoon character and clearly state its name before showing the F video.

Pilot study reliabilities were accepted if ≥ 0.50. Standard Score Coefficient Alpha assessed the reliabilities for the Anthropomorphic and

Moral Attributes measurement models. Reliability Coefficient Alpha (Split-Half Method) was used on all other models. All reliabilities met the $\geq$0.50 criteria (Table 3) except for the reliability of the 1-3rd grade Physical Attributes model at 0.33. The alterations were made in both age groups' surveys in an attempt to improve reliability and validity of this and the other factors' final measurement models.

Table 3. Reliabilities of 1-3rd and 6-8th grade measurement models for Physical, Anthropomorphic and Moral Attributes factors, and Past Direct Contact with Wildlife factor using pilot study results.

	Physical	Anthropomorphic	Moral	Direct Contact
1-3rd	0.33	0.62	0.63	0.57
6-8th	0.53	0.62	0.90	0.62

Reliability of the measurement model for the factor Perceive Educational Experience as Real Wildlife could be calculated only for the older age group (Reliability Coefficient Alpha = 0.55) because the oral interviews would measure this factor for the 1-3rd graders.

The final measurement model for the 1-3rd grade NH Survey consisted of 30 questions; the C Survey contained 31 items. The Activities and Knowledge (A&K) Survey for the younger age level had 16 items. The final NH measurement model for the 6-8th graders had 36 questions. The C Survey contained 46 items, and the A&K Survey had 23 questions. After their composition on a word processor, the instruments were printed out on a laserjet printer and duplicated by a local photocopy shop. Each survey was labeled and printed on different colored paper to avoid confusion. The final instruments and underlying factors measured by each item appear in Appendix D.

Final Testing Procedure

Each participating teacher was mailed a packet containing the following:

- Copies of NH, C and A&K Surveys (which surveys were mailed depended on the teacher's assigned experimental group),
- A videocassette containing both NH and F presentations,
- Instructions for the experiment,
- Teaching schedule according to the teacher's experimental group,
- 5 types of stickers (1-3rd grade teachers only),
- Copies of the 6 cartoon characters (if required by experimental group),
- Environmental education activities,
- Discussion questions,
- Comments sheet, and
- Return mailing envelope with correct postage.

Examples of the instructions, schedule, discussion questions, and comments sheet are found in Appendix E.

Instructions were very explicit and complete. They emphasized avoiding the following:

- Referring to the surveys as tests because most items do not have a right or wrong answer;
- Referring to the cartoon characters as animals, or associating the F presentation with animals;
- Discussing the discrepancies between the NH and F presentations until after completion of the experiment; and
- Discussing any of the material presented in the videos during the interim periods.

The Comments Sheet was provided for teacher input on the experimental process, any problems encountered, modifications of the instructions, etc. Discussion questions for the NH and F presentations were created to review the information and allow a sense of closure on the topics. The questions following the NH video asked about the 3

species' habitat requirements and appearance, and whether or not any students had seen the animals. The F video discussion questions focused on different aspects of the environmental message presented--e.g., definition and examples of respect.

Environmental education activities were developed to expand the educational experience for the students, and provide a complete educational unit for the teachers. They were optional activities given either before the experiment began or after it terminated. A Michigan State University undergraduate interested in environmental education designed the lessons. Some of them related to the environmental messages of the F presentation (e.g., "My Respect Booklet" was a coloring book for 1-3rd graders, featuring the 6 cartoon characters performing "respectful" deeds), but most addressed the ranges, habitat requirements, behavior, and life stages of Michigan wildlife species other than the marten, kingfisher shrew. None of the environmental education activities were a part of the experimental treatment, nor did any contain information about the 3 wildlife species presented in the NH or F educational experiences.

The teacher's packet also contained prepaid return envelopes for the completed surveys. When a teacher's completed surveys were received, a letter acknowledging the reception was mailed. The letter also explained the purpose of the experiment in more detail since it had not yet been disclosed to any participants (Appendix E). This delay helped reduce possible teacher bias and influence during the experiment.

Interviewing Process

A sample of students from the 12 experimental groups were personally interviewed to further investigate the mental processes related to children's perceptions of cartoon and real animals. Also, animism research suggests that verbal probing may be the best method to ascertain children's animistic thinking and conceptualization of life

(Williamson 1981, Berzonsky et al. 1988). Three types of students from each age group were interviewed: 1) those seeing only the NH presentation (NH); 2) those seeing only the F video (C-); and 3) those experiencing both the NH and F videos (C+). These students' survey forms were marked NH, C- and C+ to identify which group they were in. The graphics (cartoons) accompanying the interviews were prepared in the same manner as those for the F educational experience and converted to slides.

The interview questions assessed several processes. First, they measured whether the subjects understood and retained the information presented in the videos. Questions such as "A few days ago you saw a video called 'Living Lightly'. Tell me everything you can remember about what you saw and heard in the video." helped provide this information. Such a question also helped subjects review the video in their minds, and refreshed their memory for subsequent questions.

Second, the interview examined whether the subjects saw the cartoon characters as symbols of the real animals, or simply characters in a story. The following question would evaluate this: "If some people were camping in Michigan, could they see Max in the woods if they looked hard enough?"

Third, interview questions asked the subjects about their television cartoon-watching patterns (e.g., types of syndicated TV cartoons they watched and favored) and their perceptions of cartoon programs. These items were added to the interview form after interviewing the first group of subjects because such information would provide insight on children's exposure to TV cartoons and their perceptions of lessons or morals often presented in these programs. Finally, interview items evaluated their perceptions of the educational value of TV cartoons. The students were asked if people were supposed to learn things when they watched cartoons at home and at school.

In their review of animism research, Looft and Bartz (1969) found that questions beginning with "Why" (e.g., "Why do you think it is

alive?") drew more animistic responses from subjects than items starting with "How do you know...?". Thus, interview questions in the present that asked for a justification began with "How do you know..." to avoid encouraging animism unintentionally.

The interview questions were pilot tested with 12 1-3rd grade students. Descriptive analysis of the data suggested deletion or refinement of some questions and the addition of others. The final interview forms appear in Appendix F.

The author performed all the interviewing. Participating students were called one-by-one into a room separate from their classroom, or to an undisturbed corner of the classroom. The interviewer sat across from the student and first engaged in "small talk" to gain rapport and ease the participant's fears about being interviewed. The interviewer then stated that she was going to ask the student a few questions about the video he or she saw a few days ago. When the interviewer was sure that the student had seen the NH or F presentation or both, she proceeded with the interview questions. As the subject responded, the interviewer recorded the answers on an interview form. A small portable tape recorder hidden from view also recorded the conversation. This recording was taken for further reference and/or clarification of student responses.

When the questions referred to one of the cartoon characters, the interviewer turned on a slide projector (Singer Caramate 3300) which projected the image onto a small television-like screen below the slide tray. This machine was selected because its screen resembled a television, the same medium environment provided by the original NH and F educational experiences. Following the last interview question, the interviewer excused the student and asked him or her to send in another subject.

Data Analysis

Measurement Models

Final survey items were coded in the same manner as those in the pilot study. The author entered all data into a computer by hand using *Lotus 1-2-3* software. Surveys were separated by experimental group, and each survey received a unique 6-digit number identifying the subject's age level (1-3rd or 6-8th), experimental group (1-6), teacher, and the subject's number within the experimental group. Survey coding was checked after entering each survey to decrease data entry error. *Lotus 1-2-3* files were converted to ASCII files for use by statistical packages. *Statistical Package for the Social Sciences* (SPSS) was used to analyze the data for parametric and non-parametric statistics. *Path* (Hunter and Hamilton 1986) was used for path analyses, while *Package* (Hunter et al. 1987) performed confirmatory factor analysis (reliability and construct validity) on the final Anthropomorphic and Moral Attributes measurement models. Observations O_1, O_3, O_4, O_8, and O_9 were used for CFA. All missing values were handled by pairwise deletion, and then casewise if pairwise was not an option in the software.

Path Analysis

Definition

Path analysis is a procedure for systematically combining the use of partial and multiple correlations to study causal relations among a set of variables. The process involves (1) constructing the model, (2) estimating the path coefficients from the data, and (3) testing the path model (Hunter and Gerbing 1982). Path or causal modeling "provides an analytic logic of immense flexibility and power" by combining the general linear model, measurement theory, and the mode of thought characteristic of mathematical modeling (McPhee and Babrow 1987). This combination allows a researcher to redescribe, in a mathematical form, a limitless variety of causal systems. Causal modeling also provides the

researcher with 2 main types of powerful deductions available with mathematic models to determine the implications of theory and data: strong implications of weak data, and specific implications of complex data. Both types of implications are often unavailable to common-sense intuitions or straightforward data-analytic procedures, but readily accessible in causal modeling (McPhee and Babrow 1987).

Any variable within a path analysis may be an independent and/or dependent variable. Two kinds of diagrams explain the relationships among the variables: qualitative and quantitative causal diagrams. The qualitative diagram uses arrows pointing from one variable to another to indicate causal influence. The quantitative diagram has numbers on each link representing the strength of the causal impact. Two variables can be linked in 3 different ways: by a direct causal relation, by indirect causal linkages, or by a "spurious" relationship to a common causal antecedent variable (Hunter and Gerbing 1982).

The parameters of the causal system are estimated from the factor correlation matrix derived from the confirmatory factor analysis. If a model is recursive (unidirectional, no circular causal chains) and complete, the parameters can be estimated using simple correlations or multiple regression; path coefficients are equivalent to regression weights. Links between exogenous variables (variables whose causal antecedents are outside the scope of the given system) are numerically translated into path coefficients by inserting the corresponding correlation coefficient. Path coefficients for all other links are generated by considering the endogenous variables one at a time. The set of predicted correlations can be compared to the obtained correlations to generate a test of the path model. One of the major contributions of path analysis is its decomposition of the correlation coefficient into numerical components, measuring the net effect of each type of relationship separately (Hunter and Gerbing 1982). Pedhauzer (1982) or Hunter and Gerbing (1982) provide a more complete description and review of path analysis.

Modifications and Procedure

The original path model (Figure 1) was modified before the last 2 steps of path analysis, estimation and testing, commenced. Age in the original theoretical model was removed because several measurement differences between the 2 age levels existed. Unaccounted for, these discrepancies would threaten validity of the path analysis. The first difference was the length of the 2 age groups' A&K measurement models: the 1-3rd grade instrument consisted of fewer items than the 6-8th grade survey. Combining and summing both age groups' data would not have been legitimate without standardization. Standardization was not considered acceptable because the A&K instrument was not sensitive enough to discern age-related differences for or perceptions of past direct contact with wildlife. For example, a 1st grader's perception of his or her past direct contact with wildlife may not be equivalent to an 8th grader's.

Second, the factor Perceive Educational Experience as Real Wildlife was measured differently for each of the age levels (written survey vs oral interview). This difference generated very different sample sizes, which would affect the path analysis and interpretation. To minimize all these validity problems the original path model was tested separately for each age group (Figure 6).

Mentioned earlier, 2 Manipulation Check items on the 6-8th grade F and NH surveys were used to measure the Perceive Educational Experience as Real Wildlife factor: Kurt in the video/kingfishers will die someday, and Max/a marten will always be the same age. A repeated measures t-test was performed on these questions using surveys O_1 vs O_2, O_4 vs O_5, and O_5 vs O_6 to test the validity of using these items for this variable in the path analysis. This testing strategy assumed that if a student believed a kingfisher would die someday (item KFdies), and then answered that Kurt would also die (item Kurtdies), he/she perceived Kurt in the educational experience as real wildlife. An alternate explanation would be that the students' responses reflected what they

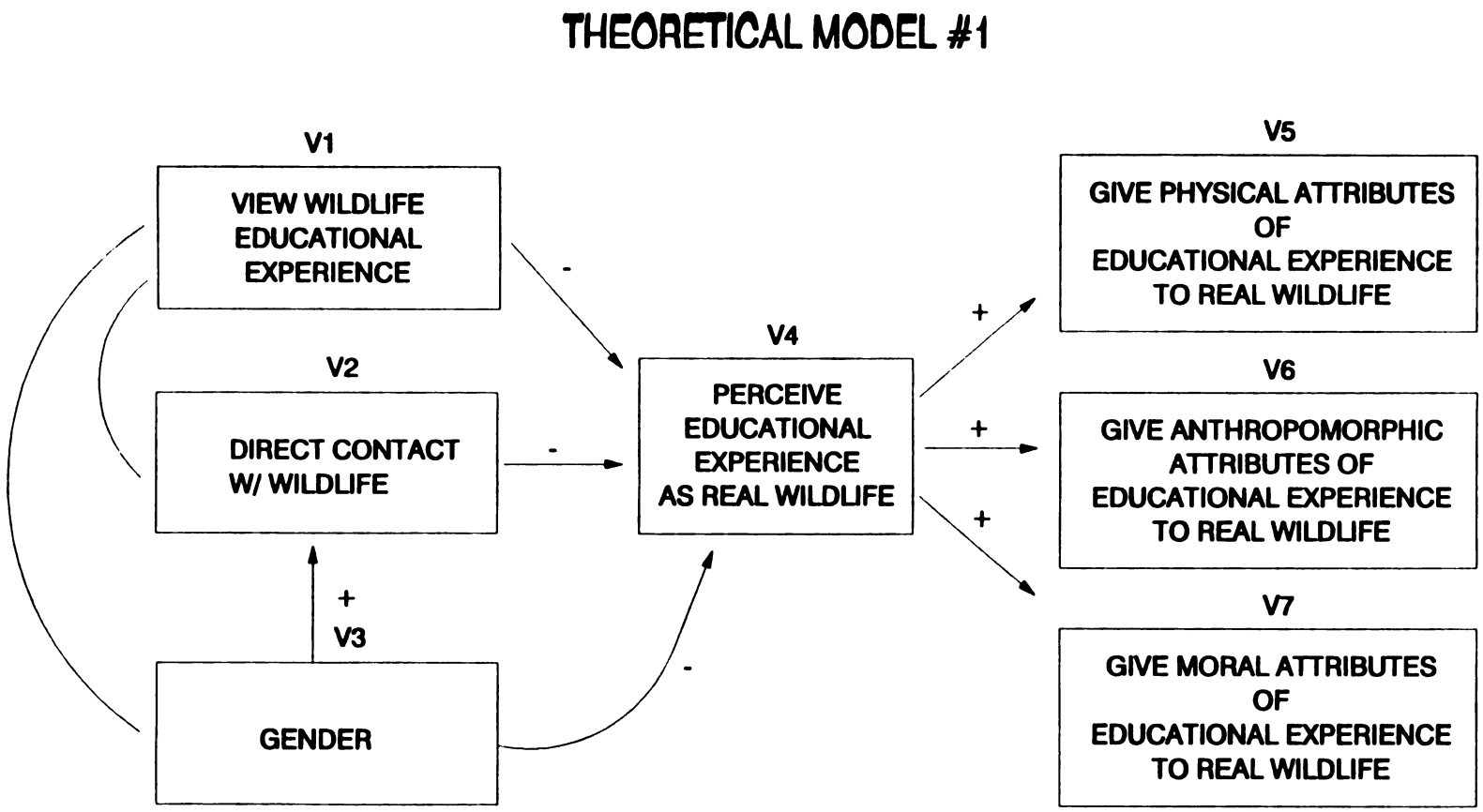


Figure 6. Modified theoretical model (Theoretical Model #1).

perceived the investigator was asking for--i.e., they thought that the investigator meant a real live kingfisher for the question "Kurt in the video will die someday".

There was no difference between the items KFdies & Kurtdies for the 3 t-tests (P = 0.30, 0.31, 0.40). However, there was a difference between how students answered whether martens and Max age (P = 0.001, 0.000, 0.000) with students responding that Max does stay the same age. Because there was no difference between the manipulation check items KFdies & Kurtdies, they were used for the variable Perceived Educational Experience as Real Wildlife.

Reliabilities of 1.00 were assumed for the variables Gender, Age level, and View Wildlife Experience (which Educational Experience video they saw) for the final data set. Reliabilities of the factors Past Direct Contact with Wildlife and Perceive Educational Experience as Real Wildlife were calculated using the reliability program (LIMPACK) within the *Limstat* reliability and validity statistical software package (Lim 1987). LIMPACK estimates the reliability coefficient using the split-half procedure. The reliabilities for Physical Attributes were calculated using the Kuder-Richardson 20 reliability equation for dichotomous variables. Reliabilities for the remaining variables--Anthropomorphic Attributes, and Moral Attributes--were estimated using standard coefficient alpha generated by the validity program within *Package*. Table 4 contains the reliabilities of each variable for both age groups.

Data from Experimental Groups 1, 5 and 6 (O_1, O_8 and O_9 respectively) from both age groups were used in the path analysis because these students saw either the F or NH educational experience. Using these subjects avoided confounding variables such as test and order effects not included in the original model.

Correlations between all variables were calculated for estimation of the path coefficients and testing of the theoretical model. The correlation matrix was corrected for attenuation (measurement error),

and both the uncorrected and corrected matrices were tested.

Table 4. Reliabilities of the variables used in path analysis for both age groups.

Variable	1-3rd	6-8th
View Wildlife Educational Experience	1.00	1.00
Past Direct Contact with Wildlife	0.52	0.72
Gender	1.00	1.00
Perceive Educational Experience as Real Wildlife	1.00	0.74
Physical Attributes	0.79	0.87
Anthropomorphic Attributes	0.46	0.76
Moral Attributes	0.54	0.70

RESULTS

Sample

The final sample consisted of 62 teachers and 2200 students--838 1-3rd graders and 1362 6-8th graders. The distribution of subjects among the experimental groups appears in Table 5. Out of the 838 1-3rd graders, 53% were male (N = 444), and 47% were female (N = 394). For the 1362 6-8th grade subjects, 50.1% were male (N = 683), and 49.8% were female (N = 679).

Table 5. Number of subjects within the 6 experimental groups

	Experimental Groups					
	1	2	3	4	5	6
1-3rd	163	137	137	138	128	135
6-8th	176	274	206	193	256	257

Confirmatory Factor Analysis of Final Measurement Models

1-3rd Grade

The range of the factor loadings for the Anthropomorphic items was 0.05-0.84. The mean was 0.34. Some of the items had a negative factor loading, suggesting poor items for that factor. The mean of the communalities for the Anthropomorphic items was 0.16. They ranged from 0 to 0.66. Items which had low factor loadings and communalities across all observation groups were whether a kingfisher would be shy if it met a squirrel in the woods, and whether a marten would feel happy if alone.

The factor loadings and communalities for the Moral items were

slightly higher. Factor loadings ranged from 0.19 to 0.61, and the mean was 0.45. The range of communalities was 0.07-0.50, with a mean of 0.22. No one Moral item seemed particularly problematic.

6-8th Grade

The factor loadings for the Anthropomorphic items ranged from 0.04 to 0.64 with a mean of 0.44. Only 1 item had a negative factor loading in one of the observation groups (item KFshy). The range of communalities was 0-0.41. The mean was approximately 0.21.

As with the 1-3rd graders, the Moral items showed higher correlations. The factor loading range and mean were 0.25-0.80 and 0.51. The range and mean for communalities were 0.06-0.63 and 0.28. The item about whether someone should kill a shrew that was damaging garden flowers was the only item that had low correlations across all observation groups.

Comparisons of Observation (O_x) Means

Observation (O_x) means for the Physical, Anthropomorphic and Moral Attributes factors were compared using a repeated measures t-test, t-test for independent groups, 1-way analysis of variance across 6 groups, and Tukey's test.

1-3rd Grade

Figures 7-9 provide the means and confidence intervals (CI) for every observation within the experimental groups for the 3 Attributes factors. An asterisk denotes whether 2 means were significantly different ($P \leq 0.05$). Standard deviations for observations, and results for mean comparisons not presented in the figures are found in Appendix G. Results of a repeated measures t-test on the means within Experimental Group 3 (O_4 vs O_5 vs O_6) are presented in Tables 6-8 for each of the 3 factors. A set of orthogonal contrasts was matched to the means to help explain the treatment effects.

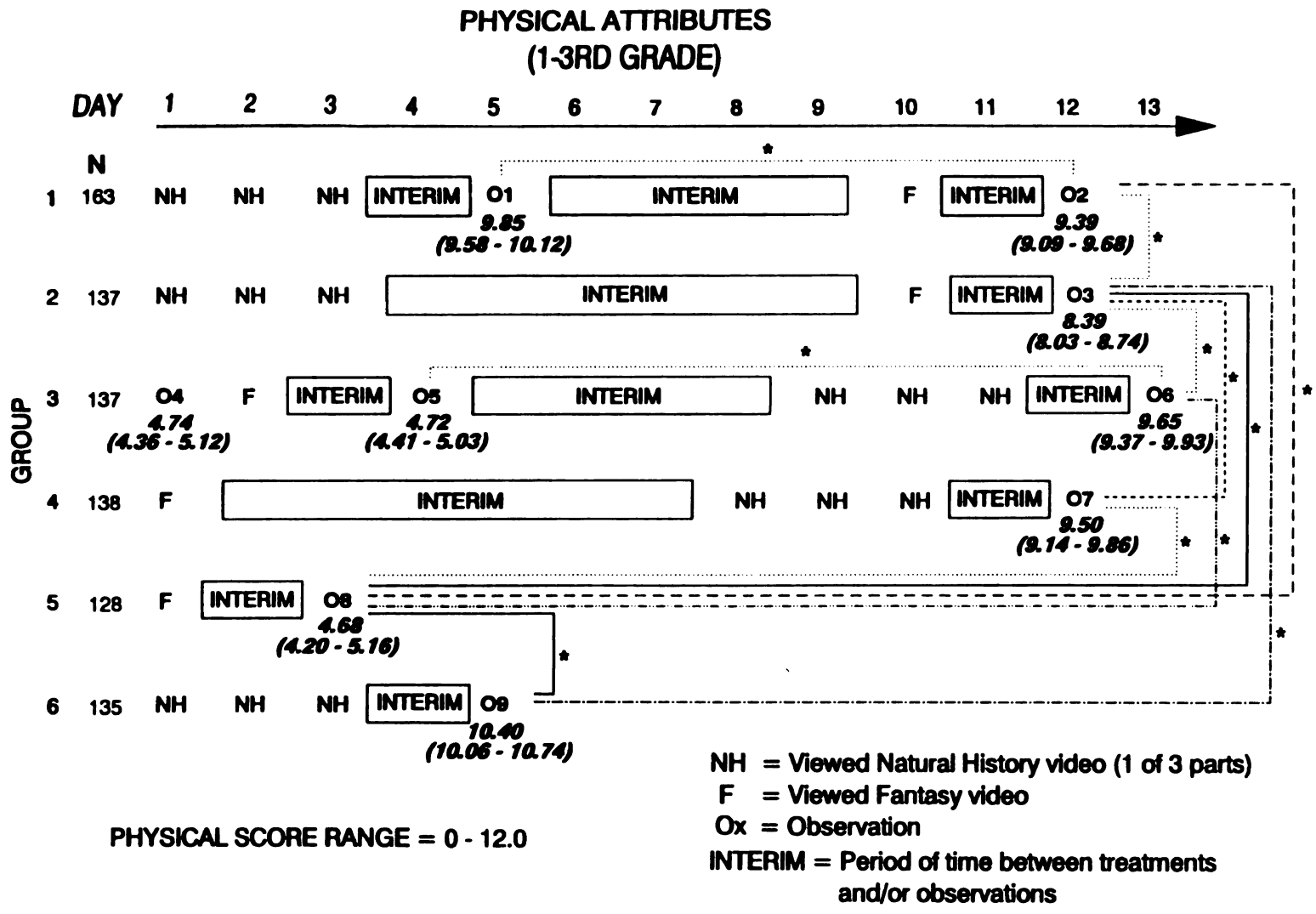


Figure 7. Physical Attributes Score means and confidence intervals (italicized) for the six 1-3rd grade experimental groups. Higher mean score indicates greater number of correct responses. Line and asterisk between 2 means denote a significant difference ($P \leq 0.05$).

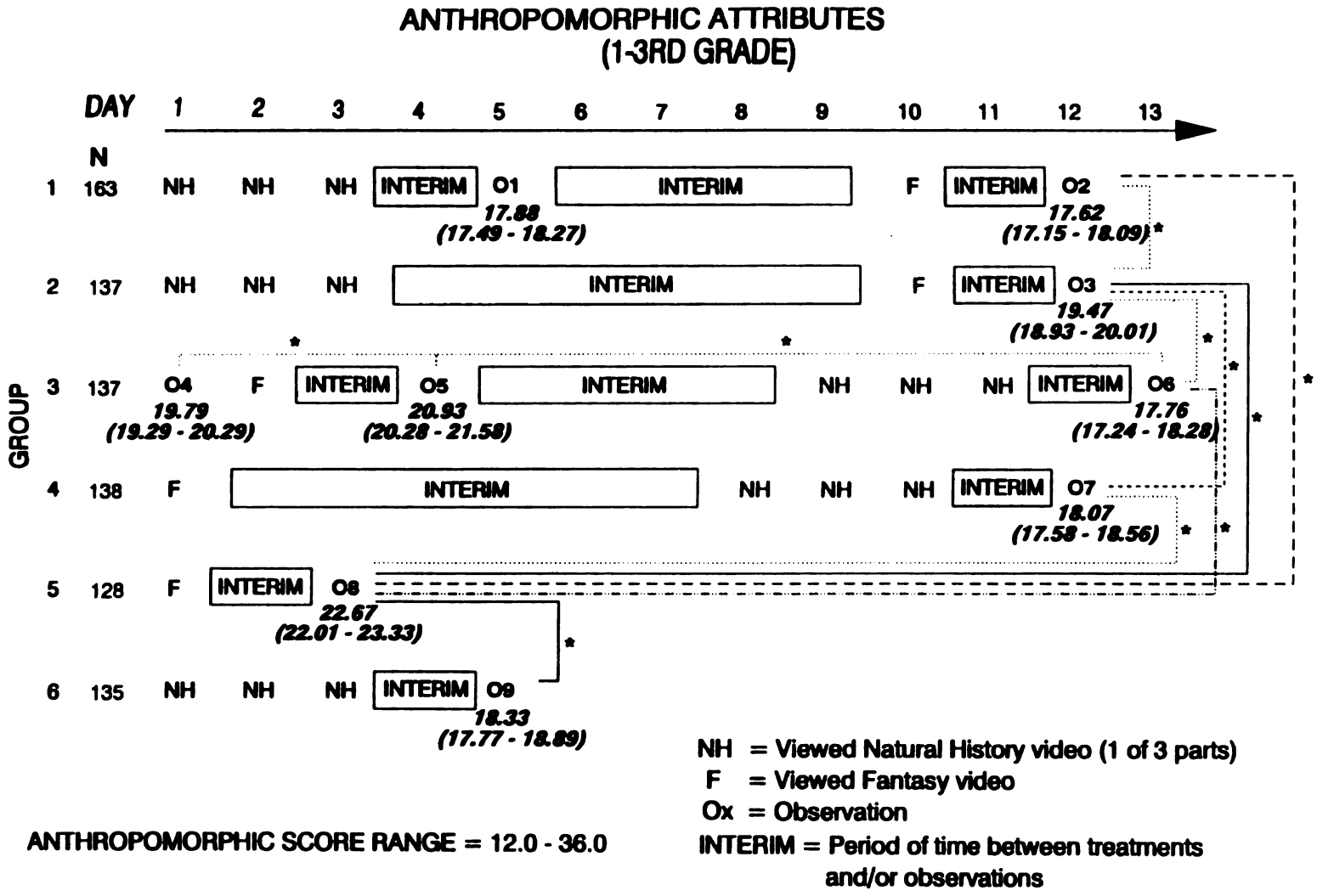


Figure 8. Anthropomorphic Attributes Score means and confidence intervals (italicized) for the six 1-3rd grade experimental groups. Higher mean score indicates greater anthropomorphism. Line and asterisk between 2 means denote a significant difference ($P \leq 0.05$).

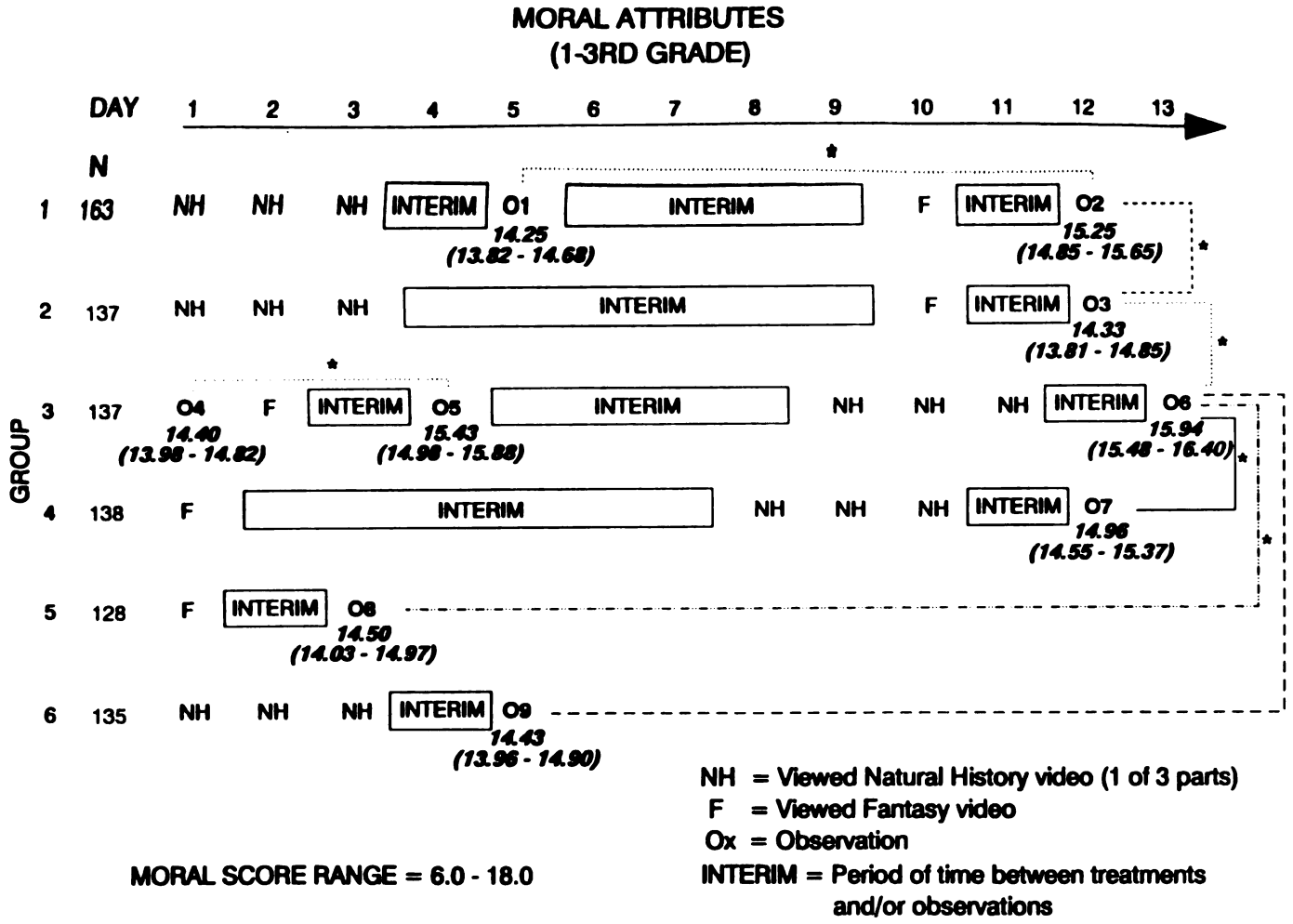


Figure 9. Moral Attributes Score means and confidence intervals (italicized) for the six 1-3rd grade experimental groups. Higher mean score indicates greater concern for the right and wrong treatment of animals. Line and asterisk between 2 means denote a significant difference ($P \leq 0.05$).

Table 6. Repeated measures t-test and orthogonal contrasts for the Physical Attributes factor in Experimental Group 3 (O_4 vs O_5 vs O_6) for 1-3rd graders (N = 130).

	SS	df	MS	F	P
Time	2061.37	2	1030.69	308.26	0.000
Within Cells	862.63	258	3.34		
Total	2924.00	260			
Contrasts	1996.80			597.84	0.000

Table 7. Repeated measures t-test and orthogonal contrasts for the Anthropomorphic Attributes factor in Experimental Group 3 (O_4 vs O_5 vs O_6) for 1-3rd graders (N = 129).

	SS	df	MS	F	P
Time	712.85	2	356.43	53.95	0.000
Within Cells	1691.15	256	6.61		
Total	2404.00	258			
Contrasts	706.70			106.91	0.000

Table 8. Repeated measures t-test and orthogonal contrasts for the Moral Attributes factor in Experimental Group 3 (O_4 vs O_5 vs O_6) for 1-3rd graders (N = 129).

	SS	df	MS	F	P
Time	173.43	2	86.72	30.87	0.000
Within Cells	719.24	256	2.81		
Total	892.67	258			
Contrasts	170.90			60.82	0.000

Physical Attributes

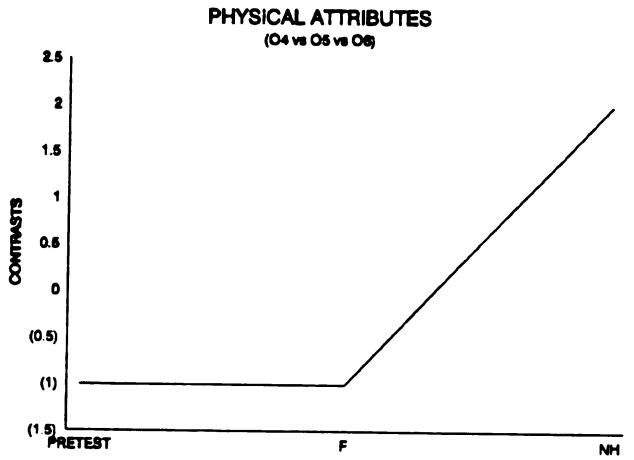
Comparing the different observation (O_x) means for the Physical Attributes score suggested the following. First, the children were willing to accept the distorted physical characteristics of the cartooned wildlife as reality. This is supported by the comparisons O_8 vs O_9, O_1 vs O_2, O_3 vs O_9. Thus, subjects accepted that shrews move slowly, kingfishers ate berries, and martens spend much time on the ground. The youngsters were also willing to accept the NH video information as reality (O_4 vs O_9).

Second, viewing the NH presentation containing accurate information failed to totally prevent or reverse the influence of the F experience (O_1 vs O_2, O_3 vs O_9). Thus, although the children were exposed to correct material presented by narration and actual photographs, their responses reflected the false information communicated by the cartoon and fantasy experience.

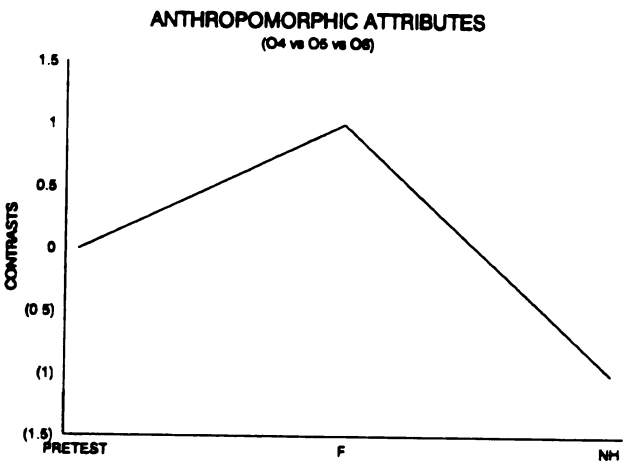
Third, a "test effect" occurred--i.e., taking the survey after watching the NH video reinforced its content, and perceptions of the physical attributes of the animals were less affected by the subsequent cartoon experience (O_2 vs O_3). Taking a pretest, however, did not appear to influence the children's responses (O_5 vs O_8). In addition to the test effect, an "order effect" emerged. The last video presented had the greater effect on subject response (O_3 vs O_7).

The contrasts -1, -1, +2 best explained the effect of the Physical Attributes information in the 2 educational experiences (O_4 vs O_5 vs O_6). These contrasts imply the trend shown in Figure 10a. The contrasts and trends suggested that the physical attributes information in the NH video had a stronger impact on the children than the opposing material in the F presentation. Other comparisons supported this: O_7 vs O_8, O_3 vs O_8, and change score of O_1 and O_2 vs change score of O_5 and O_6.

A



B



C

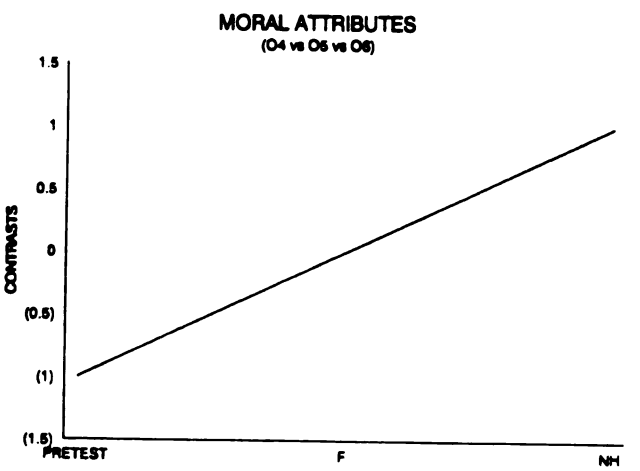


Figure 10. Implied trends for the orthogonal contrasts fitting the 1-3rd grade Physical, Anthropomorphic and Moral Attributes mean scores for O_4 vs O_5 vs O_6.

Eta^2 estimates the strength of effect (ranges from 0-1), and it was 0.68 for the effects of the Physical Attributes information in the 2 videos (Eta^2 = Treatment Sum of Squares / Total Sum of Squares). Thus, the effect of the physical attributes information in both videos was strong.

The difference between O_1 and O_9 was significant--an unexpected result since these observations were "theoretically" identical. However, the confidence intervals around each mean overlapped; thus, sampling error could have caused the difference.

Anthropomorphic Attributes

Findings for the effects of the F video on students' ascription of anthropomorphic attributes were similar to those for the Physical Attributes. The children gave more anthropomorphic attributes to the real animals after viewing the F educational experience (O_4 vs O_5, O_4 vs O_8, and O_8 vs O_9). However, eta^2 for the Anthropomorphic Attributes information in the 2 educational experiences was 0.29 (O_4 vs O_5 vs O_6), suggesting that neither experience had a very strong influence on children's ascription of anthropomorphic attributes to real animals. Although weak, the NH videos had a stronger effect for the anthropomorphic attributes information than did the F educational experiences, as suggested by the orthogonal contrasts best explaining the patterns of the O_4, O_5 and O_6 means (0, +1, -1) and their implied trend (Figure 10b). Other comparisons supported this (O_7 vs O_8, O_3 vs O_8, change score of O_1 and O_2 vs change score of O_5 and O_6).

Pretest (O_4) results showed high Anthropomorphic scores for subjects before they saw either video. Anthropomorphic tendencies for all subjects were suggested by the non-significant differences between O_1 vs O_2 and O_3 vs O_9.

As with the Physical Attributes score, a test effect appeared (O_2 vs O_3, O_5 vs O_8). Subjects taking a test after the NH video had lower anthropomorphic scores than students seeing both videos with no

intermediate survey. Finally, comparisons between O_3 and O_7 revealed an order effect. The last video viewed had the greater impact on the children's Anthropomorphic scores.

Moral Attributes

There was no treatment effect for the 1-3rd graders, i.e., this cartoon experience did not affect their concern for the right and wrong treatment of animals. This was inferred from most of the tests--e.g., the non-significant difference of O_8 vs O_9. No order effect appeared either (O_3 vs O_7). However, a test effect occurred (O_2 vs O_3, O_2 vs O_6, O_4 vs O_5): Subjects taking the survey more than once had higher Moral scores (expressed more concern for humane or moral treatment of an animal).

The contrasts -1, 0, +1 best described the effect of the Moral Attributes influence in the videos. Figure 10c presents the implied trend. The contrasts and trends suggested that the impact of the moral rights/welfare influence in both educational experiences was about equal. Eta^2 for the Moral Attributes was 0.19, implying a weak effect.

6-8th Grade

Figures 11-13 provide the means and confidence intervals (CI) for every observation within the experimental groups for the 3 Attributes factors. An asterisk denotes whether 2 means were significantly different ($P \leq 0.05$). Standard deviations for observations, and results for mean comparisons not presented in the figures are found in Appendix G. Results from a repeated measures t-test on the means within Experimental Group 3 (O_4 vs O_5 vs O_6) are given in Tables 9-11 for each of the 3 factors.

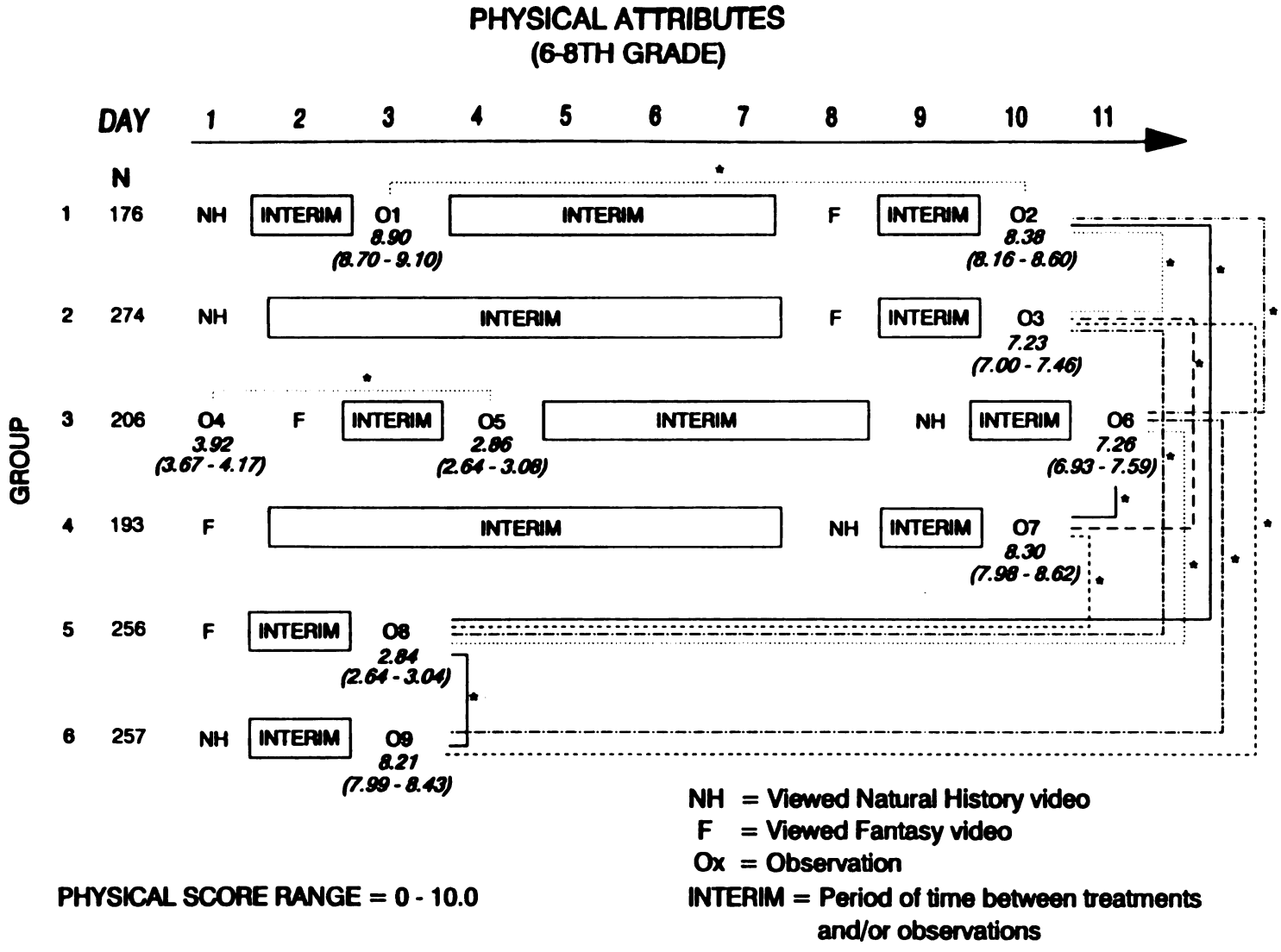


Figure 11. Physical Attributes Score means and confidence intervals (italicized) for the six 6-8th grade experimental groups. Higher mean score indicates greater number of correct responses. Line and asterisk between 2 means denote a significant difference ($P \leq 0.05$).

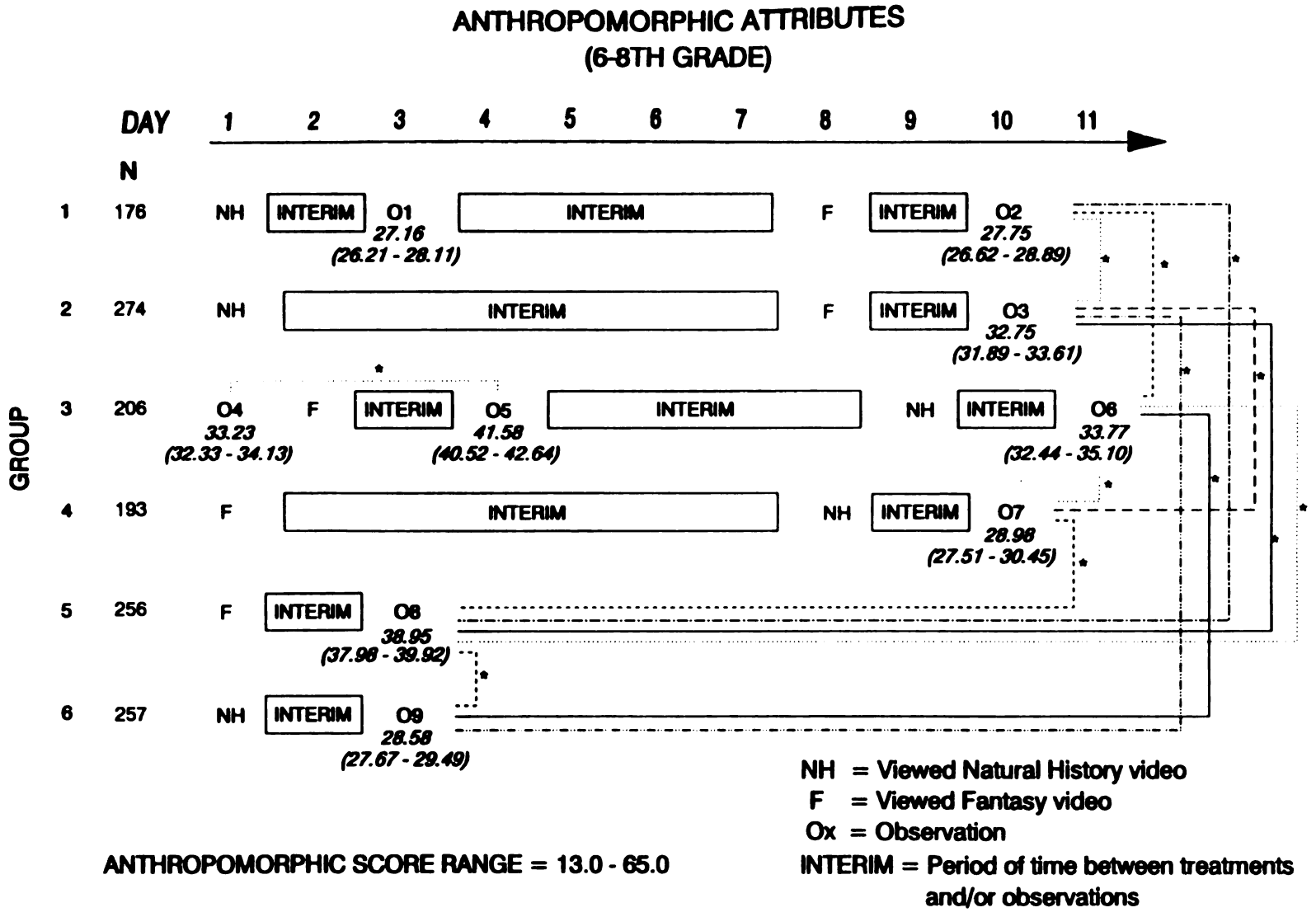


Figure 12. Anthropomorphic Attributes Score means and confidence intervals (italicized) for the six 6-8th grade experimental groups. Higher mean score indicates greater anthropomorphism. Line and asterisk between 2 means denote a significant difference ($P \leq 0.05$).

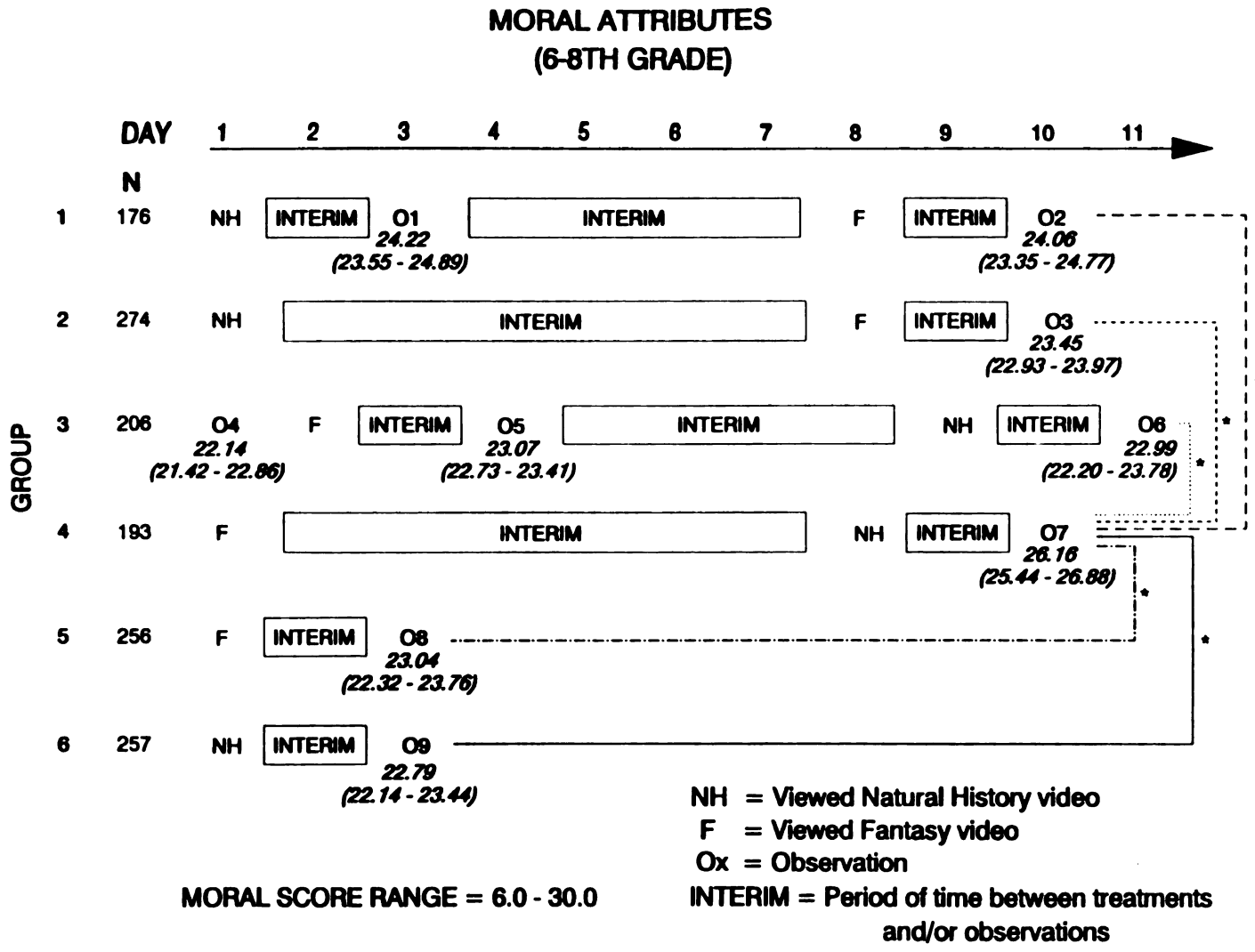


Figure 13. Moral Attributes Score means and confidence intervals (italicized) for the six 6-8th grade experimental groups. Higher mean score indicates greater concern for the right and wrong treatment of animals. Line and asterisk between 2 means denote a significant difference ($P \leq 0.05$).

Table 9. Repeated measures t-test and orthogonal contrasts for the Physical Attributes factor in Experimental Group 3 (O_4 vs O_5 vs O_6) for 6-8th graders (N = 155).

	SS	df	MS	F	P
Time	1646.78	2	823.39	286.92	0.000
Within Cells	883.89	308	2.87		
Total	2530.67	310			
Contrasts	1620.97			564.79	0.000

Table 10. Repeated measures t-test and orthogonal contrasts for the Anthropomorphic Attributes factor in Experimental Group 3 (O_4 vs O_5 vs O_6) for 6-8th graders (N = 172).

	SS	df	MS	F	P
Time	5633.52	2	2861.76	31.93	0.000
Within Cells	30165.82	342	88.20		
Total	35799.34	344			
Contrasts	5538.70			62.80	0.000

Table 11. Repeated measures t-test and orthogonal contrasts for the Moral Attributes factor in Experimental Group 3 (O_4 vs O_5 vs O_6) for 1-3rd graders (N = 172).

	SS	df	MS	F	P
Time	86.39	2	43.19	2.08	0.13
Within Cells	7105.61	342	20.78		
Total	7192.00	344			

Physical Attributes

Results were similar to those for the 1-3rd graders. Comparisons of the different observation (O_x) means suggested that the 6-8th graders were willing to accept the distorted physical characteristics of the cartooned wildlife as reality (O_8 vs O_9, O_1 vs O_2, O_3 vs O_9, O_4 vs O_5, O_4 vs O_8), and viewing the NH presentation containing accurate information failed to totally prevent or reverse the influence of the F experience

(O_1 vs O_2, O_3 vs O_9). Subjects were also willing to accept the NH video information as reality (O_4 vs O_9). As with the younger age group, a "test effect" occurred--i.e., taking the survey after watching the NH video reinforced its content, and perceptions of the physical attributes of the animals were less affected by the subsequent cartoon experience (O_2 vs O_3, O_6 vs O_7). Taking a pretest did not appear to influence the children's responses (O_5 vs O_8). In addition to the test effect, an "order effect" emerged. The last video presented had the greater effect on subject response (O_3 vs O_7).

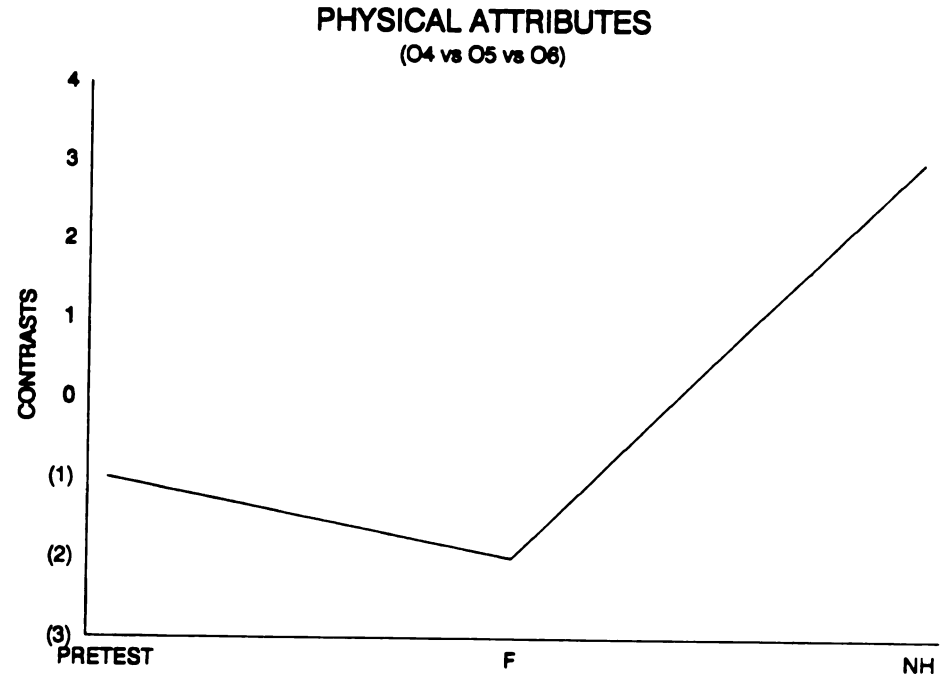
The contrasts -1, -2, +3 best explained the effect of the Physical Attributes information in the 2 educational experiences. These contrasts imply the trend shown in Figure 14a. Like the 1-3rd grade results, the contrasts and trends suggested that the physical attributes information in the NH video had a stronger impact on the 6-8th graders than the opposing material in the F educational experience. Other comparisons supported this: O_7 vs O_8, O_3 vs O_8, and change score of O_1 and O_2 vs change score of O_5 and O_6. Eta^2 was 0.64 for the effects of the physical attributes information in the 2 videos, suggesting that effects were strong.

The difference between O_1 and O_9 was unexpectedly significant. It is unknown why these 2 observations were significantly different for the Physical Attributes factor. The difference did not appear to influence the general impacts of the F educational experience.

Anthropomorphic Attributes

Findings for the effects of the F video on the older students' ascriptions of anthropomorphic attributes were similar to those for the younger subjects. The 6-8th graders gave more anthropomorphic attributes to the real animals after viewing the F educational experience (O_4 vs O_5, O_4 vs O_8, and O_8 vs O_9); however, eta^2 was 0.15, suggesting that neither experience's anthropomorphic influence was very strong. Although the effects were weak, the NH videos had a stronger

A



B

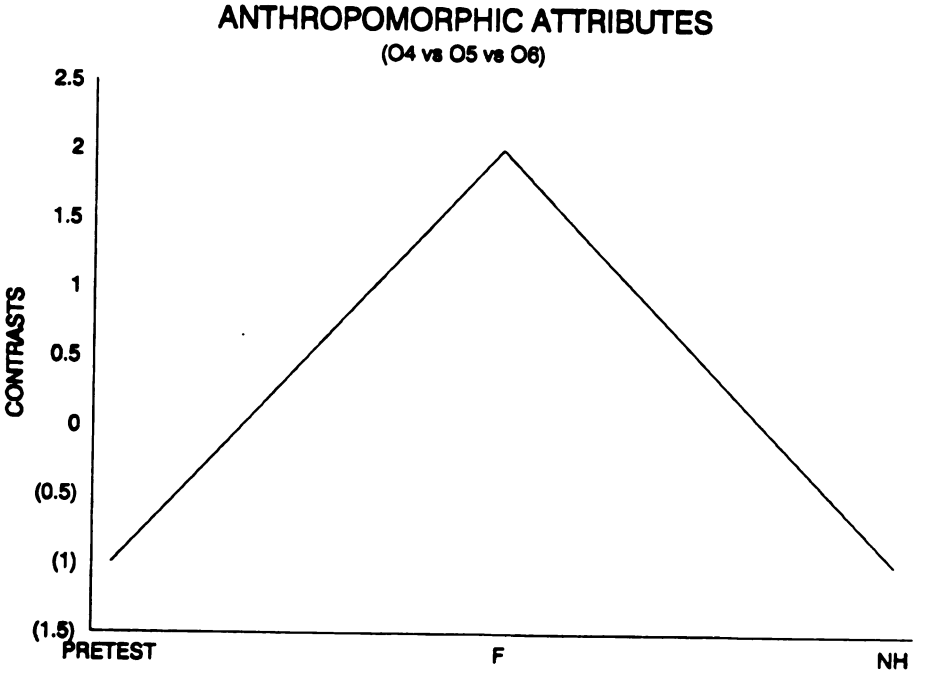


Figure 14. Implied trends for the orthogonal contrasts fitting the 6-8th grade Physical and Anthropomorphic Attributes mean scores for O_4 vs O_5 vs O_6.

effect for the anthropomorphic attributes information than did the F educational experiences. This was implied by the orthogonal contrasts best explaining the patterns of the means (O_4 vs O_5 vs O_6) for the Anthropomorphic Attributes factor (-1, +2, -1), and their implied trend (Figure 14b). Other comparisons supported this (O_7 vs O_8, O_3 vs O_8, change score of O_1 and O_2 vs change score of O_5 and O_6). Pretest (O_4) results showed high Anthropomorphic scores for subjects seeing neither video.

As with the younger age group, a test effect appeared (O_2 vs O_3, O_5 vs O_8, O_6 vs O_7). Subjects taking a test after the NH video had lower anthropomorphic scores than students seeing both videos with no intermediate survey. Finally, comparisons between O_3 and O_7 revealed an order effect. The last video viewed had the greater impact on the children's Anthropomorphic scores. Although the difference between O_1 and O_9 was significant for this factor, the confidence intervals around the means overlapped. Thus, sampling error could have caused the difference.

Moral Attributes

The Moral score mean for almost every observation was significantly different from the mean for O_7. All were lower, and this was not expected. The composition of the O_7 group was thus examined for biases. The examination revealed that the sample size for this group was much lower than the other observations (N = 94), and that most of the students in O_7 were from urban schools--which may have contributed to their higher Moral Attributes scores. The low sample size resulted when some Group 4 teachers altered the experimental procedure, and their surveys could not be included in the analyses.

Exclusion of the O_7 results revealed no treatment, test or order effects for the Moral Attributes factor. However, these 6-8th graders appeared to be highly concerned about the right and wrong treatment of animals as seen by the pretest (O_4).

Comparing O_4, O_5 and O_6 suggested no significant difference, relationship, or trend for the Moral Attributes factor--i.e., no orthogonal contrasts fit the means. Eta^2 for the Moral Attributes was 0.01; thus, strength of effect was slight, if existent.

Natural History and Cartoon Survey Items

Subjects consistently answered certain items in a manner inconsistent with the other items on that factor, regardless of the observation. An item was considered "inconsistent" if at least 25% of the subjects made the unexpected response.

1-3rd Grade

Subjects in the pretest observation (O_4) had not seen any educational experience when they took their first survey. The majority missed all the Physical items except for a few where at least 1/3 of the students answered them correctly: description of the kingfisher call, what a kingfisher eats, how fast a shrew moves, and what a shrew eats. Two Anthropomorphic items received high anthropomorphic scores--whether a marten feels lonely when it is by itself, and whether a shrew sometimes hates other shrews.

Both O_1 and O_9 subjects viewed only the NH video, yet many of these youngsters incorrectly answered the item regarding whether shrews eat fruit or not. Their responses to the Anthropomorphic items showed a few questions receiving high anthropomorphic scores even though the subjects had not seen the F educational experience: does a marten feels happy when it is by itself, and does a shrew sometimes hates other shrews.

The O_8 students saw only the F educational experience. The majority answered most of the Physical items incorrectly except for a few items--description of the kingfisher call, what kingfishers eat, and when shrews eat. Several Anthropomorphic items received low

anthropomorphic scores: does a shrew care about its looks, does a kingfisher make future plans, does a shrew think about getting old, and does a shrew know right from wrong. Most subjects answered the rest of the items anthropomorphically.

6-8th Grade

The pretest observation (O_4) showed that the majority of the subjects missed the Physical items except for 2 questions: what kingfishers eat, and what a kingfisher needs to live (a body of clean water). The Anthropomorphic items receiving high scores were: Does a marten feels lonely when it is alone, does a shrew sometimes hate other shrews, whether a kingfisher would be shy toward a squirrel, and whether shrews are picky eaters.

O_1 and O_9 subjects saw only the NH educational experience. They missed the Physical items concerning what a shrew eats and where a kingfisher nests. The Anthropomorphic items receiving high marks were whether a kingfisher would be shy towards a squirrel, and does a shrew sometimes hate other shrews.

Subjects in O_8 saw only the F presentation. The majority of these students answered the Physical items wrong except for the description of a kingfisher's call, what they eat, what kingfishers need to live, where they nest, and the amount of time a shrew spends eating. Only 2 Anthropomorphic items received low scores--a shrew worries about how nice it looks, and most shrews worry about getting fat.

Moral Items

1-3rd Grade

Consistent trends with the Moral items appeared in both age groups (Table 12). The majority of the younger subjects felt that 2 actions were wrong: Keeping a shrew as a pet, and killing a kingfisher to have it stuffed to put in a museum. The act perceived by most as being

"right" was capturing a marten to put it in a zoo.

Table 12. Percentages in each 1-3rd observation group answering "wrong" to the moral attributes items (N = 838).

	O_1	O_2	O_3	O_4	O_5	O_6	O_7	O_8	O_9
Trapfur	60.1	65.6	46.0	54.0	75.2	73.8	66.7	61.7	60.0
Digyard	59.5	71.8	59.9	54.0	65.0	76.9	63.0	60.2	66.7
Transfer	64.4	66.9	54.0	54.7	64.2	76.2	68.1	51.6	52.6
PutinZoo	39.3	55.8	53.3	47.4	62.0	68.5	49.3	55.5	45.9
Museum	60.1	77.3	62.8	70.8	77.4	83.1	81.9	74.2	72.6
Pet	68.7	71.2	67.9	65.0	81.8	90.0	72.5	64.8	57.0

6-8th Grade

The activities scored most often as "wrong" for the older children were keeping a shrew as a pet, capturing a marten to use its fur for warm gloves, and killing a kingfisher to have it stuffed to show in a museum (Table 13). The items receiving the lowest Moral scores (or seen as "right" more often) were killing a shrew digging up someone's garden flowers, trapping and transferring kingfishers to another state, and capturing a marten to put it in a zoo. As with the 1-3rd graders, the 6-8th graders showed the least amount of opposition to putting a marten in a zoo.

Table 13. Percentages in each 6-8th observation group answering "wrong" to the moral attributes items (N = 1362).

	O_1	O_2	O_3	O_4	O_5	O_6	O_7	O_8	O_9
Trapfur	76.1	80.6	73.7	63.1	75.7	74.5	91.0	70.7	66.1
Digyard	56.2	57.4	48.9	51.4	54.4	58.7	74.1	52.4	51.7
Transfer	63.1	63.1	55.9	41.8	42.2	40.2	69.6	51.5	49.8
PutinZoo	55.1	56.2	53.0	37.9	48.1	47.1	64.3	49.2	40.8
Museum	81.8	79.6	78.5	68.5	74.3	73.8	88.4	71.5	70.0
Pet	86.9	83.0	84.0	69.9	74.8	76.1	89.3	71.1	76.7

Past Direct Contact with Wildlife

The analysis of this data began with the question of whether all the Activities & Knowledge (A&K) items could be legitimately summed across, which would imply 1 factor (unidimensionality) called Past Direct Contact with Wildlife. Summation is appropriate if the factor is unidimensional and linear, or unidimensional and non-linear. If items are weighted and summed without considering unidimensionality, linearity, and factor structure, the weighting scheme is arbitrary with weak mathematical and theoretical support. Thus, final results may differ depending on the weighting scheme chosen. Unidimensionality and linearity were tested through scatterplots, correlations (Pearson's r), and contingency coefficients (CC)--the non-parametric r. Non-linearity and unidimensionality were evaluated through a Guttman simplex test.

Although the original A&K measurement model assumed 1 factor, or unidimensionality and linearity across all the selected wildlife-related activities, analysis suggested that the model might actually measure 3 separate factors instead: Consumptive Wildlife Activities, Non-Consumptive Wildlife Activities, and Living on a Farm. The tests for linearity were performed on all 1-3rd and 6-8th grade A&K Survey.

The tests for linearity showed that the Non-Consumptive items were not correlated with one another. The Consumptive items showed higher correlations, but they were still fairly low--e.g., The correlation between Youhunt and Fishing was 0.22 for 1-3rd grade and 0.15 for 6-8th. (The large sample size was a major reason why some of these low correlations appeared significant at the 0.001 level, since the significance test depends on N.) Scatterplots of all these items also did not suggest linearity.

Tests for non-linearity suggested that neither the Non-Consumptive nor the Consumptive items showed the Guttman simplex (Non-consumptive: $r_{1\text{-}3rd} = 0.59$, $r_{6\text{-}8th} = 0.49$; Consumptive: $r_{1\text{-}3rd} = 0.54$, $r_{6\text{-}8th} = 0.86$). Although the results were negative, this does not mean that another non-

linear relationship may explain their association.

Because strong linear relationships did not seem to exist among the Non-Consumptive and Consumptive items, the effects of each A&K item on children's responses to anthropomorphic wildlife cartoons were analyzed separately. One advantage to this is that wildlife managers are often interested in the influence of specific wildlife-related activities. Knowing that a person hunts, puts out food for wildlife, fishes, or has a family member who traps often provides them with more information than learning that an individual has a general consumptive or non-consumptive wildlife background. The latter does not reveal the specific behaviors comprising the backgrounds.

The effects of hunting and trapping backgrounds were also analyzed (6—8th grade only) because the 2 items measuring hunting or trapping (Do you hunt/trap, and Does someone in your family hunt/trap) had the highest correlations and CC's within the Consumptive items. The r and CC for the hunting items were 0.38 and 0.36 for the 1-3rd graders, and 0.39 and 0.36 for the 6-8th graders.

Further, the knowledge items were treated as a separate factor (called Knowledge of Michigan Wildlife), because they were not highly correlated with the wildlife-related activities. Knowledge factors are often Guttman scales, though a test for one did not reveal a Guttman simplex ($r_{1\text{-}3rd} = 0.20$, $r_{6\text{-}8rd} = 0.39$).

In summary, for both age groups the original Past Direct Contact with Wildlife factor was modified and evaluated by looking at each A&K item separately, a subject's hunting background, a student's trapping background, and knowledge score.

1-3rd Grade

Table 14 contains the percentages participating in the different wildlife-related activities according to the A&K Survey. More than 60% of this age group participated in every wildlife-related activity except living on a farm (8.7%) and accompanying someone while he or she hunted

(35.8%). The most popular activity was fishing.

Percentages of right and wrong answers to the knowledge items are presented in Table 15. Approximately 3/4 of these 1-3rd graders knew that deer live wild in Michigan, and over 1/2 believed that pheasants are found in the state. They were less familiar with the other species. Over 55% were incorrect about their ranges. Results for activity participation according to experimental group are found in Appendix H.

Table 14. Percentages of 1-3rd graders participating in wildlife-related activities according to the Activities and Knowledge Survey (N = 838).

Activity	Yes	No
Famhunt	62.1%	37.9%
Youhunt	35.8%	64.1%
Fishing	88.5%	11.3%
Camping	62.8%	37.2%
Putfood	61.6%	38.4%
WatchWL	71.0%	29.0%
GotoZoo	61.9%	37.9%
Camping	62.8%	37.2%
Livefarm	8.7%	91.3%

Table 15. Percentages of right and wrong answers to the knowledge items for 1-3rd graders responding to the Activities and Knowledge Survey (N = 838).

Knowledge item	Right	Wrong
Do deer live wild in MI?	74.3%	25.4%
pheasant	56.9%	42.8%
antelope	32.5%	67.2%
elk	37.5%	62.2%
ruffed grouse	20.5%	79.2
bighorn sheep	44.6%	55.0%

Student t and Mann-Whitney U Tests were used to evaluate any differences in the Physical, Anthropomorphic, and Moral Attributes scores of those who participated in a specific wildlife-related activity and those who did not. Only observations O_1, O_4, O_8 and O_9 are presented to show the possible impacts of the educational experiences without the confounding variables of order, test effect, etc. Again, O_4 is the pretest or control observation. O_1 and O_9 include subjects who saw just the NH presentation; O_8 is comprised of students who viewed the F video.

No strong, consistent relationship appeared between the children's participation in a wildlife activity and their attribution of physical, anthropomorphic and moral characteristics to real animals. Thus, in general, none of the wildlife-related activities measured in this study seemed to strongly influence how subjects responded to anthropomorphic wildlife cartoons. Results for each of the activities follow. Tables 16-22 provide the differences, means, confidence intervals, and 2-tailed probabilities for wildlife-related activities where a difference ($P \leq 0.05$) did occur in either the Student t or Mann-Whitney U Test.

Table 16. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 1-3rd graders whose families put food out for wildlife and those whose families do not.

Does your family put food out for birds, squirrels, deer or other wild animals?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	none						
O_8	none						
O_9	Physical	Putfood (10.65)	>	No Put (9.82)	(0.15-1.52)	0.02	0.006
	Moral	Putfood (14.71)	>	No Put (13.90)	(-.006-1.62)	0.07	0.02

*$P \leq 0.05$

The pretest (O_4) revealed that there were no significant differences between the students who put out food for wildlife and those who did not in their attribution of physical, anthropomorphic and moral characteristics to real wildlife when neither group had viewed either educational experience. The same held true for students who saw only the F presentation. However, after subjects viewed the NH video, those who fed wildlife had higher Physical and Moral Attributes scores. That is, wildlife "feeders" were more correct on the physical attributes of the 3 species and more concerned about the humane treatment of animals than non-feeders. No significant differences appeared for the Anthropomorphic Attributes factor.

Table 17. Difference in Physical, Anthropomorphic (Anthro) and/or Moral Attributes scores for 1-3rd graders who walk or drive to see wildlife and those who do not.

Have you gone with your family on a walk or drive to see wild animals?

O_x	Difference*				CI	t test	M-W U
O_1	none						
O_4	Physical	WatchWL (5.02)	>	No Watch (4.05)	(0.19-1.76)	0.02	0.01
	Anthro	WatchWL (19.35)	<	No Watch (20.64)	(0.28-2.29)	0.02	0.005
O_8	none						
O_9	none						

*$P \leq 0.05$

Significant differences appeared only with the pretest observation (O_4). Subjects who had taken a walk or drive to see wildlife had higher Physical Attributes scores and lower Anthropomorphic scores than those who had not. Thus, without viewing either of the educational experiences, wildlife watchers gave more correct responses to items concerning the physical attributes of the 3 species than non-watchers did. Further, they showed less anthropomorphic tendencies. After

exposure to the presentations, there were no differences between the 2 groups.

Table 18. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 1-3rd graders who live on a farm and those who do not.

Do you live on a farm and have animals like chickens, cows, pigs, horses, or sheep?

O_x	Difference*	Means	CI	t test	M-W U
O_1	Physical	Farm (10.88) > No Farm (9.83)	(0.41-1.69)	0.009	0.09
O_4	none				
O_8	none				
O_9	none				

*$P \leq 0.05$

The experience of living on a farm did not appear to influence subject response to the educational experiences. There were no significant differences between farm children and non-farm children before viewing either video. Results from the O_1 Student t Test suggested that after watching the NH video, children from a farming background scored significantly higher on the Physical Attributes items than those without this experience. However, the Mann-Whitney U Test showed no significant difference; neither did the tests for O_9.

Table 19. Difference in Physical, Anthropomorphic (Anthro) and/or Moral Attributes scores for 1-3rd graders who have gone to a zoo in the past year and those who have not.

Have you gone to a zoo in the past year?

O_x	Difference*	Means			CI	t test	M-W U
O_1	Anthro	GotoZoo (18.17)	>	No GoZoo (17.17)	(0.22-1.77)	0.02	0.006
O_4	Physical	GotoZoo (5.01)	>	No GoZoo (4.24)	(0.01-1.54)	0.05	0.07
O_8	Physical	GotoZoo (3.99)	<	No GoZoo (5.60)	(0.68-2.54)	0.001	0.001
	Anthro	GotoZoo (23.66)	>	No GoZoo (21.35)	(1.05-3.56)	0.000	0.000
O_9	Anthro	GotoZoo (18.84)	>	No GoZoo (17.61)	(0.24-2.22)	0.02	0.01

*$P \leq 0.05$

O_1, O_9 and O_8 suggested that students who had gone to a zoo in the past year were more anthropomorphic than those who had not after both groups had viewed either educational experience. Zoo visitors gave fewer correct answers for the Physical Attributes items than non-visitors after both saw the F presentation, but not following the NH video. When subjects had not viewed either video (O_4), zoo goers were more correct on the physical attributes of the 3 Michigan species than non-goers. However, the probabilities for this difference was much higher than those for the other observations (t = 0.05, M-W U = 0.07). The groups showed no differences in their concern for the right and wrong treatment of animals before or after viewing the presentations.

Table 20. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 1-3rd graders whose families go camping and those whose families do not.

Does your family go camping?

O_x	Difference*	Means	CI	t test	M-W U
O_1	none				
O_4	none				
O_8	Physical	Camping (5.13) > No Camp (4.04)	(0.19-1.98)	0.02	0.04
O_9	none				

*$P \leq 0.05$

A significant difference appeared only for O_8 (viewed the F presentation)--subjects who go camping were more correct on the physical attributes of the 3 species than were non-campers. The pretest (O_4) revealed no differences between campers and non-campers. Both groups appeared to respond similarly after watching the NH video (O_1, O_9).

Table 21. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 1-3rd graders who have gone fishing and those who have not.

Have you ever gone fishing?

O_x	Difference*	Means	CI	t test	M-W U
O_1	none				
O_4	Moral	Fishing (14.61) > No Fish (12.88)	(0.78-2.69)	0.009	0.003
O_8	none				
O_9	none				

*$P \leq 0.05$

Before viewing either of the videos, anglers appeared to be more concerned about the right and wrong treatment of animals. No differences emerged for the Physical and Anthropomorphic Attributes.

After viewing the NH or F presentation, there were no significant differences between the 2 groups.

No significant differences appeared between responses for participants with a hunting background (either hunted themselves or had a family member who hunted) and non-participants, before or after all viewed the videos. Thus, a hunting background did not seem to affect subjects' responses to the educational experiences. Analyzing the 2 components of a hunting background separately revealed that no differences occurred between the responses of subjects who had a family member who hunts and those who did not. After subjects viewed the NH presentation, children who had actually accompanied someone while he or she hunted were more concerned about the right and wrong treatment of animals than youngsters who had not.

Table 22. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 1-3rd graders who have gone hunting with someone and those who have not.

Have you ever gone with someone while he or she hunted with a gun or bow and arrow?

O_x	Difference*	Means	CI	t test	M-W U
O_1	none				
O_4	none				
O_8	none				
O_9	Moral	Hunt (14.97) > No Hunt (14.05)	(0.13-1.70)	0.03	0.03

*$P \leq 0.05$

The effects of knowledge of Michigan wildlife were analyzed by comparing subjects who correctly answered $\geq 1/2$ of the knowledge items and those who answered less than 50% right (Table 23). Such a division was made because most youngsters would probably know the range of very visible species (deer, pheasant), while only those students who had more contact with wildlife would recognize the range of the more obscure

species, e.g., ruffed grouse, and thus correctly answer ≥1/2 of the items.

Table 23. Difference in Physical (Phys), Anthropomorphic (Anthro) and/or Moral Attributes scores for 1-3rd graders who answered correctly ≥1/2 of the knowledge items (High Know) and those who correctly answered <1/2 (Low Know).

O_x	Difference*	Means	CI	t test	M-W U
O_1	Phys	High Know (10.15) > Low Know (9.34)	(0.23-1.39)	0.004	0.006
O_4	Phys	High Know (5.37) > Low Know (4.13)	(0.49-1.98)	0.001	0.002
O_8	Anthro	High Know (23.50) > Low Know (21.84)	(0.37-2.95)	0.01	0.02
O_9	none				

*$P \leq 0.05$

O_4 suggested that before subjects viewed either video, students with greater knowledge about what species are found in Michigan were more correct about the physical attributes of unfamiliar species. This tendency may have continued after both groups saw the NH presentation (O_1). O_8 suggests that more knowledgeable subjects showed more anthropomorphism following their exposure to the F educational experience. Both groups' anthropomorphic tendencies appeared similar prior to the videos and after the NH presentation. There were no differences between the 2 groups regarding their concern for the right and wrong treatment of animals.

6-8th Grade

Table 24 contains the percentages engaging in the different wildlife-related activities according to the A&K Survey. Over 30% of this age group participated in most of the wildlife-related activities listed in the A&K questionnaire. Fishing was the most popular activity in this age group (93%), similar to the 1-3rd graders. Fewer than 30%

of the subjects reported trapping, having a family member who traps, living on a farm, and belonging to a wildlife-related club (4-H, Girl Scouts, Boy Scouts, etc.).

Table 24. Percentages of 6-8th graders participating in wildlife-related activities according to the Activities and Knowledge Survey (N = 1362).

Activity	Yes	No
Famhunt	54.8%	45.0%
Youhunt	30.0%	70.0%
Fishing	93.0%	7.0%
Camping	61.4%	38.4%
Famtrap	6.0%	93.8%
Youtrap	3.2%	96.6%
Putfood	68.6%	31.0%
WatchWL	77.0%	22.8%
WLclubs	20.3%	79.6%
GotoZoo	58.1%	41.8%
Camping	61.4%	38.4%
Livefarm	9.6%	90.2%

Table 25 gives proportions of right and wrong answers to the knowledge items. As with the 1-3rd graders, the 6-8th graders were more knowledgeable about species that were very familiar and/or highly publicized. Almost all (93.7%) knew that deer live wild in Michigan. Over 3/4 were correct that pheasants were found in the state. About 60% also knew that wolves resided in Michigan, and roadrunners do not.

As with the 1-3rd graders, no strong, consistent relationships occurred between 6-8th graders' participation in wildlife activities and their attribution of physical, anthropomorphic or moral characteristics to real animals. Thus, none of the activities measured seemed to strongly influence how subjects responded to anthropomorphic wildlife cartoons. Tables 26-37 provide the differences, means, confidence

intervals, and 2-tailed probabilities for wildlife-related activities where a difference ($P \leq 0.05$) did occur in either the Student t or Mann-Whitney U Test for O_1, O_4, O_8 and O_9.

Table 25. Percentages of right and wrong answers to the knowledge items for the 6-8th graders responding to the Activities and Knowledge Survey (N = 1362).

Knowledge item	Right	Wrong
Do deer live wild in MI?	93.7%	6.2%
grizzly bear	23.5%	76.3%
pheasant	78.5%	21.4%
moose	48.0%	52.0%
antelope	37.3%	62.4%
elk	48.6%	51.0%
roadrunner	59.9%	31.3%
ruffed grouse	32.5%	67.1%
wolf	60.7%	38.8%
bighorn sheep	36.7%	62.9%

Table 26. Difference in Physical, Anthropomorphic and/or Moral Attributes score means, confidence intervals around the difference (CI), and Student t and Mann-Whitney U Tests 2-tailed probabilities for 6-8th graders with a hunting background (Youhunt or Famhunt) and those without.

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	Moral	Hunt (21.36)	<	No Hunt (23.35)	(0.76-3.31)	0.004	0.003
O_8	none						
O_9	Physical	Hunt (8.32)	<	No Hunt (7.77)	(-.007-1.11)	0.05	0.04

*$P \leq 0.05$

Before subjects viewed either educational experience, those with a hunting background appeared to be less concerned for the right and wrong treatment of animals than those who did not. No initial differences

appeared between the 2 groups regarding their attribution of physical characteristics to real wildlife. O_9 suggested that students with a hunting background were less correct on the physical attributes of animals following the NH presentation. O_1 did not show this trend. There were no significant differences between the responses of subjects who had a hunting background and those who did not after both saw the F video for any of the 3 factors (O_8). A hunting background did not seem to influence subject attribution of anthropomorphic characteristics to real wildlife before or after exposure to the educational experiences.

Similar results appeared when hunting background was separated into its 2 components. Comparing students who hunted and those who did not revealed that hunters were less concerned about the humane treatment of animals prior to watching the videos and after the F educational experience. O_1 suggested that this was also true after subjects viewed the NH presentation. Further, hunters appeared to be more correct in their attribution of physical characteristics to species following the NH video (O_9), but not before or after viewing the F presentation. There were no significant differences between hunters and non-hunters in their attribution of anthropomorphic characteristics to real animals.

Table 27. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who have hunted and those who have not.

Have you gone hunting with a gun or bow and arrow?

O_x	Difference*	Means			CI	t test	M-W U
O_1	Moral	Hunt (22.54)	<	No Hunt (24.51)	(0.27-3.67)	0.02	0.02
O_4	Moral	Hunt (20.17)	<	No Hunt (22.84)	(1.27-4.08)	0.000	0.000
O_8	Moral	Hunt (21.63)	<	No Hunt (23.44)	(0.38-3.24)	0.02	0.008
O_9	Physical	Hunt (8.47)	>	No Hunt (7.99)	(0.041-0.91)	0.04	0.03

*$P \leq 0.05$

Children with a family member who hunts were initially less concerned about the right and wrong treatment of animals than children who did not have a hunting family member (O_4). However, there were no differences between the 2 groups regarding their attribution of physical and anthropomorphic characteristics to wildlife prior to the presentations. After the F educational experience, no significant difference emerged between the 2 groups for any of the factors. O_9 suggested that following the NH video, youngsters with a hunter in the family answered more of the Physical items correctly. There were no significant differences for the Anthropomorphic factor in the 4 comparisons.

Table 28. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who have a family member who hunts and those who do not.

Does anyone else in your family go hunting with a gun or bow and arrow?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	Moral	Famhunt (32.92)	<	No Fhunt (33.84)	(0.31-2.94)	0.02	0.02
O_8	none						
O_9	Physical	Famhunt (8.34)	>	No Fhunt (7.82)	(0.025-1.03)	0.04	0.02

*$P \leq 0.05$

Table 29. Difference in Physical, Anthropomorphic (Anthro) and/or Moral Attributes scores for 6-8th graders with a trapping background (Youtrap or Famtrap) and those without.

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	Moral	Trap (19.00)	<	No Trap (22.33)	(0.40-6.25)	0.01	0.03
O_8	Moral	Trap (20.04)	<	No Trap (23.23)	(0.54-5.84)	0.005	0.01
O_9	Anthro	Trap (26.07)	<	No Trap (28.95)	(0.56-5.21)	0.05	0.08

*$P \leq 0.05$

A trapping background seemed to affect subjects' concern for the humane treatment of animals, before they viewed either video and after students experienced the F presentation. Children who had trapped or had a trapper in the family were less concerned than those who did not in both cases. After students saw the NH video, subjects experiencing a non-trapping lifestyle showed greater anthropomorphic tendencies (O_9). No significant differences appeared between the 2 groups for the Physical Attributes factor.

Separating trapping background into its components showed similar results. Initially, 6-8th graders who trapped showed less concerned for the right and wrong treatment of animals than non-trappers (O_4). This difference also occurred after both groups saw the F video, though the test probabilities were much higher ($t = 0.06$, M-W U = 0.05). No differences appeared between the 2 groups for the Physical Attributes factor before or after viewing the F presentation. Results from O_1 and O_9 suggested that following the NH educational experience, non-trappers were more concerned about the humane treatment of animals, and less correct on the physical attributes of real wildlife. There were no significant differences between trappers' and non-trappers' attribution of anthropomorphic characteristics prior to or after the presentations.

Only one significant difference emerged when comparing scores for

youngsters having a family member who trapped and those who did not. Children with a trapping family member showed less concern for the right and wrong treatment of animals after the F educational experience.

Table 30. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who have trapped and those who have not.

Have you ever trapped wild animals for their fur?

O_x	Difference*	Means			CI	t test	M-W U
O_1	Moral	Trap (17.20)	<	No Trap (24.32)	(2.46-11.78)	0.000	0.005
O_4	Moral	Trap (16.43)	<	No Trap (22.32)	(2.52-9.26)	0.001	0.004
O_8	Moral	Trap (18.83)	<	No Trap (23.02)	(0.067-8.30)	0.06	0.05
O_9	Physical	Trap (9.15)	>	No Trap (8.15)	(0.42-1.58)	0.004	0.04

*$P \leq 0.05$

Table 31. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who have a family member who traps and those who do not.

Does anyone else in your family trap wild animals for their fur?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	none						
O_8	Moral	Famtrap (19.96)	<	No Ftrap (23.22)	(0.51-6.02)	0.005	0.01
O_9	none						

*$P \leq 0.05$

Table 32. Difference in Physical, Anthropomorphic (Anthro) and/or Moral Attributes scores for 6-8th graders whose families put food out for wildlife and those whose families do not.

Does your family put food out for birds, squirrels, deer or other wildlife?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	none						
O_8	none						
O_9	Anthro	Putfood (27.63)	<	No Put (30.58)	(0.96-4.94)	0.003	0.01
	Moral	Putfood (23.25)	>	No Put (21.83)	(0.038-2.81)	0.05	0.05

*$P \leq 0.05$

Comparing responses between children who had families that fed wildlife and those who did not revealed that significant differences emerged only after subjects viewed the NH educational experience (O_9). Prior to viewing either video or after the F presentation, the 2 groups showed no differences. Following the NH video, children who put out wildlife food were less anthropomorphic and more concerned about the right and wrong treatment of animals than those who did not. There were no differences in their attribution of physical characteristics to real wildlife.

Table 33. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who walk or drive to see wildlife and those who do not.

Have you gone with your family on a walk or drive to see wildlife?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	none						
O_8	Physical	WatchWL (2.93)	>	No Watch (2.38)	(0.064-1.04)	0.04	0.03
O_9	Physical	WatchWL (8.39)	>	No Watch (7.61)	(0.20-1.36)	0.01	0.01
	Moral	WatchWL (23.23)	>	No Watch (21.47)	(0.34-3.19)	0.02	0.02

*$P \leq 0.05$

O_4 revealed that before viewing either video, there were no differences between responses for children who took a trip to see wildlife and those who did not. O_8 suggested that following the F presentation, children who participated in this activity correctly answered more of the items addressing the physical attributes of animals than non-participants. This same tendency also appeared after both groups watched the NH video (O_9). Further, wildlife watchers showed greater concern for the right and wrong treatment of wildlife following the NH educational experience. This did not occur after the F video. The 2 groups showed no differences in their anthropomorphic tendencies before or after the educational experiences.

Table 34. Difference in Physical, Anthropomorphic (Anthro) and/or Moral Attributes scores for 6-8th graders who live on a farm and those who do not.

Do you live on a farm and have animals like chickens, cows, pigs, horses, or sheep?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	Moral	Farm (19.82)	<	No Farm (22.24)	(0.24-4.61)	0.10	0.05
O_8	Anthro	Farm (34.50)	<	No Farm (39.30)	(0.83-8.77)	0.02	0.02
O_9	Physical	Farm (8.79)	>	No Farm (8.12)	(0.19-1.16)	0.009	0.11

*$P \leq 0.05$

Children from a farming background may be initially less concerned about the humane treatment of animals than youngsters without this lifestyle (O_4). This difference in concern did not appear after both groups viewed either video, however. After viewing the F presentation, children residing on a farm showed less anthropomorphic tendencies than youngsters not doing so. O_9 suggested that there was no such difference following the NH video, but farm children were more correct in their attribution of physical characteristics to animals.

Table 35. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who belong to a wildlife-related club and those who do not.

Do you belong to 4-H, Boy Scouts or Girl Scouts?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	none						
O_8	none						
O_9	Physical	WLclubs (8.68)	>	No Clubs (8.14)	(-0.06-1.14)	0.10	0.04

*$P \leq 0.05$

Belonging to a wildlife-related club did not seem to influence children's responses to the anthropomorphic wildlife cartoon experience. Comparing wildlife club members and non-members prior to viewing the videos revealed no significant differences in their responses. No differences emerged after subjects watched the F presentation either. Although O_9 suggested that wildlife club members may have correctly answered more Physical items than non-members, inclusion of zero in the confidence interval indicates possible sampling error. No differences occurred for the other 2 factors following the NH video.

Table 36. Difference in Physical, Anthropomorphic (Anthro) and/or Moral Attributes scores for 6-8th graders who have gone to a zoo in the past year and those who have not.

Have you gone to a zoo in the past year?

O_x	Difference*	Means			CI	t test	M-W U
O_1	Anthro	GotoZoo (27.83)	>	No GoZoo (25.91)	(0.052-3.78)	0.05	0.03
O_4	none						
O_8	none						
O_9	Physical	GotoZoo (8.40)	>	No GoZoo (7.90)	(0.036-0.98)	0.04	0.10

*$P \leq 0.05$

Responses of youngsters who visited a zoo in the past year did not significantly differ from those who did not for all 3 factors--before viewing either video or after exposure to the F presentation. Following exposure to the NH educational experience, zoo visitors appeared to be more anthropomorphic and possibly more correct on the physical attributes of the 3 species. However, their concerns for the right and wrong treatment of animals did not differ from non-visitors.

Table 37. Difference in Physical, Anthropomorphic and/or Moral Attributes scores for 6-8th graders who have gone fishing and those who have not.

Have you ever gone fishing?

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	none						
O_8	none						
O_9	Physical	Fishing (8.29)	>	No Fish (7.25)	(0.24-1.84)	0.01	0.005

*$P \leq 0.05$

The fishing experience did not appear to have a strong overall impact on subject responses to the educational experiences. A significant difference emerged only for O_9, viewing the NH video. Anglers possibly answered more Physical Attributes items correctly than did non-anglers.

There were no significant differences between responses for children who camped and those who did not for all 3 factors. Thus, the camping experience did not seem to affect youngsters' responses to the NH or F presentation.

Information for the knowledge items are found in Table 38. As with the 1-3rd graders, students answering at least 50% of the knowledge questions right were compared with those correctly answering less than 50% of the items. This division was made for the same reasons as those for the younger age group.

Results were similar to those for the 1-3rd graders. Subjects with greater knowledge of Michigan species scored higher on the Physical items than those with less knowledge, before and after viewing either video. Although no differences in the 2 groups' anthropomorphism appeared before or after the NH presentation, high knowledge students showed less anthropomorphic tendencies following the F educational experience. The 2 groups did not seem to differ in their concern for the humane treatment of animals at any time.

Table 38. Difference in Physical (Phys), Anthropomorphic (Anth) and/or Moral Attributes scores for 6-8th graders who answered correctly ≥1/2 of the knowledge items (High Know) and those who correctly answered <1/2 (Low Know).

O_x	Difference*	Means			CI	t test	M-W U
O_1	none						
O_4	Phys	High Know (4.20)	>	Low Know (3.42)	(0.28-1.29)	0.003	0.007
O_8	Phys	High Know (3.03)	>	Low Know (2.63)	(0.01-0.80)	0.05	0.08
	Anth	High Know (38.02)	<	Low Know (40.20)	(0.37-3.97)	0.02	0.03
O_9	Phys	High Know (8.50)	>	Low Know (7.65)	(0.35-1.35)	0.001	0.003

*$P \leq 0.05$

Interviews

1-3rd Grade

The interview sample for the younger age group was 103 subjects, with 43 viewing only the fantasy educational experience (subsequently referred to as F subjects), 36 seeing only the natural history video (NH subjects), and 24 watching both presentations (F+NH subjects). Both males and females were interviewed.

When F and F+NH students were asked to name the 6 characters in the F presentation, the majority of them (F = 81.4%, F+NH = 87.5%) recalled ≤3 characters. The mean response was only 1.7 characters for F and 1.9 names for F+NH subjects. These children were also asked to identify Max, Kerry and Stu (i.e.,"What is Max"?). F students could correctly identify fewer characters than could NH children. Only 18.6% of F subjects identified Max as a marten, while 79.2% of the F+NH students associated Max with the real-life species. Most F students (55.8%) classified Max as a fox or wolf; only 8.3% F+NH subjects made this incorrect association.

All of the F+NH subjects identified Kerry as a kingfisher. Only 20.9% of the F group responded correctly. Most stated that Kerry was a bird (58.1%), while a few called her a bluejay (9.3%) or bluebird (4.7%). The character Stu was accurately identified by 83.3% of the F+NH group. The rest of these subjects thought he was a mouse or rat (12.5%). The F students classified Stu as either a mouse or rat (32.6%), mole (23.3%), or shrew (16.3%). About 11.6% were not sure what Stu was.

Several different approaches attempted to discern whether the children saw the characters as a symbol of the real species, or simply characters in a story. Based on the following results, the majority of F and F+NH students appeared to think of the characters as actual animals. First, about 75% of both groups said that people camping in Michigan could see Max in the woods if they looked hard enough. When asked how they would know that it was Max, 72.1% of the F group and 83.3% of the F+NH subjects referred to the marten, giving some behavior characteristic of the species (e.g., he would be on all fours, he would make some animal sounds, he would be up in a tree, etc.). For comparison, the NH subjects were asked if people camping in Michigan could see a marten in the woods. Approximately 88.9% stated that they could, 5.6% said they could not, and 2.8% were unsure.

A second approach involved questions about Kerry and whether Kerry will die someday. When asked how they knew that Kerry will die someday, 88.4% and 91.7% of the F and F+NH subjects, respectively, gave an answer implying that Kerry was a real animal. Almost all gave real-life causes for Kerry's death--hunting, trapping, everything dies, no food, etc. No students mentioned that Kerry will die because she will go off the air, be erased or not drawn anymore, etc. About 4% in each of these groups made some distinction between the cartoon Kerry and real kingfishers.

The third tactic was a series of questions about Stu's age and how Stu will change as he grows older. Most of the F and F+NH subjects thought Stu was a grown-up (41.9%, 58.3% respectively), while 25% of

each group called him a child. Many students stated that Stu would not always look as old as he appeared in the video (F = 58.1%, F+NH = 66.7%), and they provided a variety of changes that would take place as he aged. For the F group, 30.2% gave specific morphological changes (e.g., grow taller, fur would get longer); 41.9% stated that he would "grow up" or get older; 4.7% provided a human attribute (grow a beard or mustache); and 4.7% said that Stu's fur would change color as he aged (e.g., become grey). F+NH subject responses were similar. About 45.8% gave morphological changes, 29.2% said that Stu would grow up or get older, and 8.3% mentioned a fur color change.

The last approach to the symbol-vs-story character question involved a sequence of 3 slides with 2 of the cartoon characters: 1) Kurt sees smoke, 2) he flies toward it and sees trees afire, and 3) he sees Stu on the ground amidst burning flora. When asked whether Kurt would help Stu, 97.7% and 95.8% of the F and F+NH students answered affirmatively. They were then asked why Kurt would help Stu, and the majority (F=81.4%, F+NH=79.2%) provided an anthropomorphic response--e.g., they are friends, Kurt wouldn't want him to get hurt, he would pick him up with his beak, etc. About 7% of the F students gave an anthropomorphic answer but also mentioned that Stu was an animal. One F+NH student gave an "ecological response", i.e., containing accurate animal behavior without anthropomorphism. Two F+NH students (8.3%) mentioned the Fantasy educational experience in their response, or asked whether the question referred to the cartoon video or reality.

When asked "Would you help Stu?", most of the F and F+NH students (90.7%, 87.5% respectively) answered positively. Their primary reasons for assisting Stu implied that they perceived Stu as a real animal. Approximately 56% (F students) and 46% (F+NH) gave justifications such as "I like animals", "He's an animal", or "He's a part of the environment/nature". The next most popular response was not wanting Stu to get hurt or to die (23.3% = F, 25% = F+NH). A noticeable proportion of The F+NH subjects (20.8%) also provided an anthropomorphic reason for

wanting to help Stu--e.g., He's nice or my friend. Only 4.7% of the F students gave such a response.

The final question following the slide sequence--"Would a wild kingfisher help a wild shrew?"--was posed to these students and the NH students as well. The NH youngsters saw no slides, but received a non-anthropomorphic oral description of a forest fire with a shrew on the ground and a kingfisher overhead. After students responded to this question, they were asked to give justifications (Table 39).

Table 39. Percentages of the 1-3rd grade interview groups providing an ecological or anthropomorphic reason for a wild kingfisher helping/not helping a wild shrew.

	N	Ecological[4]	Anthropomorphic
NH[1]	36	22.2%	72.2%
F[2]	43	23.3%	62.8%
F+NH[3]	24	20.8%	75.0%

[1]NH = students who saw the natural history educational experience
[2]F = students who viewed the fantasy educational experience
[3]F+NH = students who watched both presentations
[4]An ecological justification contained no anthropomorphism, but accurately described animal ecology.

Students in the F and F+NH groups were asked to decide whether Kurt was a bird, person or cartoon. When first given the choice of bird or person, considerably more subjects in both groups identified him as a bird (F = 70%, F+NH = 92%). Further, when next asked whether Kurt was a cartoon or person, approximately 86% and 83.3% of the F and F+NH groups, respectively, identified Kurt as a cartoon.

When finally asked whether Kurt was a real bird or a cartoon, the students were more divided. About 50% of the F+NH subjects said that Kurt was a real bird, while 41.7% identified him as a cartoon. One student was unsure; another stated that he was both a real bird and a cartoon. For the F group, 11.6% identified Kurt as a real bird, 51.2% called him a cartoon, and 9.3% stated that he was both.

Most of the children watched cartoons at home (F = 69.8%, F+NH = 83.3%). Only the F+NH group contained a few students who did not regularly watch cartoons (16.7%). Animal characters comprised most of the subjects' favorite cartoons. In the F group, 58.1% of the subjects gave the name of a cartoon that had an animal as the main character (e.g., *Teenage Mutant Ninja Turtles, Rescue Rangers, Care Bears*). Only 4.7% cited a program with people as main characters (e.g., *Superheroes, Dennis the Menace, Super Mario Brothers)*. The favorite cartoons of the remaining 7% contained non-animal characters--e.g., *Mini Monsters, Beetlejuice*. Approximately 70.8% of the F+NH students indicated an animal cartoon as their favorite. Only 4.2% had a favorite program in one of the other 3 categories--i.e., people, non-animal characters, or machines/robots. (Percentages within each group do not add up to 100% because the TV-related questions were added to the interview form after the first group of 1-3rd graders were interviewed. Thus, the remaining percentages are missing values.)

When asked to define one of their favorite characters ("What is _____?"), the majority of both the F and F+NH groups (F = 69.2%, F+NH = 70.8%) identified the character as a person or the animal it caricatured--e.g., Dale is a chipmunk, Donatello is a turtle. Only 2 F+NH students stated that the character was a cartoon.

The primary reasons why these 1-3rd graders watch cartoons were they are funny/fun (F = 44.2%, F+NH = 33.3%), or the student had nothing else to do (F = 14%, F+NH = 12.5%). A few students in each group watched cartoons because they liked them or they were interesting.

When asked if people are supposed to learn things when they watch cartoons at home, 39.5% of the F subjects responded "Yes", 14% said "No", and 16.3% answered "Sometimes". For the F+NH group, 62.5% said "Yes", 8.3% answered "No", and 29.2% responded "Sometimes". When probed, the "Sometimes" subjects in both groups indicated that people are supposed to learn from cartoons at home when the program had a message or lesson in it. If not, the cartoon was just for fun. Their

examples of "fun" and "educational" cartoons, however, varied and often conflicted. For example, one student said that people are not supposed to learn from *Alvin and the Chipmunks*, while another youngster stated that *Chipmunks* had taught her to help people and not always think of herself. Appendix I contains several examples of what subjects had learned from watching syndicated television cartoons. About 58% of the 1-3rd graders (F = 64.5%, F+NH = 50%) either stated that people are supposed to learn things when they watch cartoons at home because they contain a lesson or moral, or they gave a specific example of a cartoon program and lesson they had learned.

Almost all of the subjects in each group answered affirmatively (F = 62.8%, F+NH = 83.3%) to the question "Are people supposed to learn things when they watch cartoons at school?". Only 1 or 2 students in each group answered negatively or "Sometimes". The "Sometimes" subjects cited cartoons such as *Peter Pan*, *Lady and the Tramp*, and Donald Duck as those for entertainment only.

6-8th Grade

A total of 107 older students were interviewed, with 28 viewing only the F presentation, 41 seeing solely the NH experience, and 38 watching both videos. These older subjects remembered more character names in the F presentation than did the 1-3rd graders. The mean for number of characters remembered for F students was 4.1 and 2.53 for F+NH subjects. The mode for F youngsters was 6, and 5 and 2 for the F+NH group.

When asked to identify Max, 78.6% of the F students stated that he was a marten. The next most common response was fox or wolf (10.7%). Although the F+NH subjects also showed a high percentage identifying Max as a marten (68.4%), 21.1% were not sure what Max was.

The majority of both interview groups stated that persons camping in Michigan could see Max in the woods if they looked hard enough (F = 82.1%, F+NH = 78.9%). A large proportion of the NH students (78%) said

that people camping in Michigan could see a marten in the woods. When asked how the campers would know that it was Max, 92.9% and 97.4% of the F and F+NH students, respectively, referred to characteristics of the real animal.

The 6-8th graders were shown the same slide sequence of Kurt, the forest fire and Stu. When asked if Kurt would help Stu if Stu were in trouble, 78.6% of the F group said "Yes", while 17.9% responded negatively. Only 1 student inquired if the question referred to the cartoon or "real life". Results for the F+NH students were less skewed. Only 55.3% stated that Kurt would help Stu, and 36.8% said that he would not. Three F+NH subjects (7.9%) asked whether the question referred to a real kingfisher or the cartoon.

These F and F+NH students gave primarily 4 different types of responses to why Kurt would/would not help Stu: an ecological reason (e.g., "It's not in an animal's nature to help one another."), an anthropomorphic reason, an answer containing both anthropomorphism and a reference to real animals (e.g., "All forest animals work together."), or a reference to the F video (e.g., "They helped each other in the video."). Table 40 provides the percentages of students falling into these 4 categories.

Table 40. Percentages of 6-8th graders' reasons to why Kurt would/would not help Stu.

	N	Ecological[3]	Anthropomorphic	Animal + Anthro[4]	Referred to F Video
F[1]	28	10.7%	35.7%	25.0%	21.4%
F+NH[2]	38	28.9%	23.7%	13.2%	26.3%

[1] F = students who viewed the fantasy educational experience
[2] F+NH = students who saw both the fantasy and natural history video
[3] An ecological justification contained no anthropomorphism, but accurately described animal ecology.
[4] Animal + Anthro signifies that the response referred to a real animal but in an anthropomorphic way.

One interesting observation about the 2 age groups' frame of references for this question was noted. Most of the 1-3rd graders responded as if the question referred to the F story or the cartoon characters--e.g., Kurt would help Stu because they were friends. The 6-8th graders, however, appeared to think more in terms of actual wild kingfishers and shrews. Although their answers were often still anthropomorphic, their immediate frame of reference was real animals. Hence, the frame of references for the 2 age groups seemed to differ, or each group interpreted the interviewer's frame of reference differently.

When asked "Would you help Stu?", 92.9% of the F subjects responded positively, 3.6% said that they would not, and 3.6% were unsure. About 81.6% of the F+NH students said "Yes", 13.2% answered negatively, and 2.6% were not sure whether they would help Stu. Both groups' justifications fell into 3 main categories (Table 41). Either they referred to Stu as a real animal, did not want him to get hurt or die, or gave an anthropomorphic reason. Only 1 or 2 students in each group gave another justification.

Table 41. Percentages of 6-8th graders' reasons for why they would/would not help Stu.

	N	It is an animal	Anthropomorphic	Don't want it hurt/to die	Other
F[1]	28	60.7%	0%	32.1%	7.1%
F+NH[2]	38	65.8%	18.4%	10.5%	2.6%

[1]F = students who viewed the fantasy educational experience
[2]F+NH = students who saw both the fantasy and natural history video

As with the younger age group, all 3 interview groups were asked if a wild kingfisher would help a wild shrew, and why or why not. Table 42 presents the percentages of their justifications.

Table 42. Percentages of the 6-8th grade interview groups providing an ecological or anthropomorphic reason for a wild kingfisher helping/not helping a wild shrew.

	N	Ecological[4]	Anthropomorphic
NH[1]	41	61.0%	39.0%
F[2]	28	46.4%	53.6%
F+NH[3]	38	50.0%	47.4%

[1]NH = students who saw the natural history educational experience
[2]F = students who viewed the fantasy educational experience
[3]F+NH = students who watched both presentations
[4]An ecological justification contained no anthropomorphism, but accurately described animal ecology.

The older F and F+NH children were asked to decide whether Kurt was a real bird or a cartoon. In the F group, 50% identified him as a real bird, 39.3% called Kurt a cartoon, and 7.1% said that he was both. Only 36.8% of the F+NH students labelled Kurt a real bird; 42.1% identified him as a cartoon and 21.1% stated that he was both.

The majority of the older students watched television cartoons at home (F = 85.7%, F+NH = 78.9%). Only 14.3% (F students) and 18.4% (F+NH) said that they did not watch cartoons at home. As with the younger children, animal cartoons comprised most of the older students' favorite cartoons. For the F group, 78.6% of them named a cartoon containing an animal for their favorite cartoon. Only 3.6% cited programs with people, and 3.6% listed shows containing some other creature. Favorite cartoons of the F+NH subjects were more evenly distributed: 57.9% were animals, 10.5% featured people, 2.6% were machines (e.g., *Transformers*), and 15.8% featured something else. When asked to identify a character in their favorite shows, all of the students in both groups called the character the person or animal it caricatured. For example, Leonardo of *Teenage Mutant Ninja Turtles* was always identified as a turtle, never a cartoon or a person.

The 3 main reasons why these 6-8th graders watched cartoons were they are funny or fun (F = 39.3%, F+NH = 34.2%), there is nothing else to do (F = 21.4%, F+NH = 26.3%), or they are interesting (F+NH = 7.9%).

About 1/2 of each group agreed that people are supposed to learn things when they watch cartoons at home (F = 50.0%, F+NH = 52.6%). A sizeable proportion stated that learning occurs only sometimes (F = 42.9%, F+NH = 34.2%)--i.e., when there is a lesson or moral emphasized. Appendix I provides examples of students' quotes regarding what they have learned from watching cartoons at home. About 3/4 of both groups (F = 77%, F+NH = 68%) gave an example of a specific lesson that they had learned from a cartoon, or stated that people are supposed to learn a moral from watching cartoons at home. Approximately 7.1% and 13.2% of the F and F+NH students, respectively, felt that people are not supposed to learn things when they watch cartoons at home.

Almost all of the students in both groups believed that people are supposed to learn things when they watch cartoons at school (F=100%, F+NH=97.4%).

Gender Differences

Activities and Knowledge Survey

A Chi^2 analysis revealed gender differences in both age groups for participation in wildlife-related activities and knowledge of Michigan wildlife. When differences occurred, males had higher participation and knowledge scores than did females. Males were more involved in consumptive activities, and more knowledgeable about the ranges of the wildlife species, except for the most familiar species--deer. The only activity that had greater female participation was involvement in a wildlife-related club (4-H, Girl Scouts, Boy Scouts) for 6-8th graders. Overall, the older children had more gender differences (15 out of 21 A&K items) than the 1-3rd graders (8 out of 14 A&K items). Tables 43 and 44 present the differences for those items with probabilities $\leq$ 0.05.

Table 43. Activities and Knowledge items showing a gender difference (X^2, $P \leq 0.05$), and % of 1-3rd graders (male, female) participating in activity or answering knowledge item correctly (N = 838).

Activities & Knowledge item	X^2	P	Male	Female
Famhunt	6.31	0.01	35.0%	27.1%
Youhunt	62.44	0.000	25.6%	10.3%
Camping	3.70	0.05	34.8%	27.9%
Fishing	39.48	0.000	50.4%	38.2%
Do pheasants live wild in MI?	8.08	0.005	32.7%	24.4%
Do elk live wild in MI?	7.13	0.008	22.2%	15.4%
Do ruffed grouse live wild in MI?	3.93	0.05	12.3%	8.3%
Do bighorn sheep live wild in MI?	4.36	0.04	25.5%	19.3%

Table 44. Activities and Knowledge items showing a gender difference (X^2, $P \leq 0.05$), and % of 6-8th graders (male, female) participating in activity or answering knowledge item correctly (N = 1362).

Activities & Knowledge item	X^2	P	Male	Female
Wildlife Clubs	5.26	0.02	8.9%	11.4%
Youhunt	279.0	0.0000	25.5%	4.6%
Famhunt	7.84	0.005	29.4%	25.5%
Fishing	29.55	0.0000	48.6%	44.4%
Youtrap	24.40	0.0000	2.8%	0.4%
Famtrap	10.07	0.002	4.0%	1.9%
Do grizzly bears live wild in MI?	5.18	0.02	13.2%	10.4%
Do pheasants live wild in MI?	6.08	0.01	40.9%	37.7%
Do moose live wild in MI?	38.66	0.0000	28.4%	19.7%
Do antelope live wild in MI?	39.91	0.0000	22.9%	14.5%
Do elk live wild in MI?	31.07	0.0000	28.3%	20.5%
Do roadrunners live wild in MI?	36.94	0.0000	36.8%	28.9%
Do ruffed grouse live wild in MI?	50.57	0.0000	21.0%	11.7%
Do wolves live wild in MI?	18.69	0.0000	33.5%	27.5%
Do bighorn sheep live wild in MI?	62.80	0.0000	23.7%	13.1%


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Natural History and Cartoon Surveys

Student t and Mann-Whitney U tests on O_1, O_4, O_8 and O_9 were used to study gender differences for subjects' Physical, Anthropomorphic and Moral Attributes responses to the educational experiences. These analyses revealed a significant difference ($P \leq 0.05$) for only the Physical Attributes items in O_1 for the 1-3rd graders (Table 45). Thus, males were possibly more correct in their attribution of physical characteristics of the 3 species following the NH presentation. There were no differences between responses for males and females in their anthropomorphism, and concern for the right and wrong treatment of animals before and after either video.

Table 45. Difference in Physical, Anthropomorphic and/or Moral items score means, confidence intervals (CI), and Student t and Mann-Whitney U Tests 2-tailed probabilities for 1-3rd grade males and females.

O_x	Difference*	Means	CI	t test	M-W U
O_1	Physical	Male (10.19) > Female (9.62)	(0.056-1.09)	0.03	0.06
O_4	none				
O_8	none				
O_9	none				

*$P \leq 0.05$

More differences emerged for the older age group (Table 46). Females appeared more concerned about the right and wrong treatment of animals before or after viewing the videos. Females also showed more anthropomorphism following exposure to the F educational experience; however, because the confidence interval included zero, sampling error could have caused this difference. Thus, both sexes appeared to have similar anthropomorphic tendencies across these observations. O_9 suggested that females may have answered more of the Physical Attributes items incorrectly than did males after both groups watched the NH presentation.

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Table 46. Difference in Physical, Anthropomorphic and/or Moral items scores for 6-8th grade males and females.

O_x	Difference*	Means			CI	t test	M-W U
O_1	Moral	Male (22.80)	<	Female (25.63)	(1.62-4.04)	0.000	0.000
O_4	Moral	Male (20.88)	<	Female (23.36)	(1.21-3.74)	0.000	0.000
O_8	Anth	Male (38.14)	<	Female (39.96)	(-0.02-3.65)	0.05	0.02
	Moral	Male (21.11)	<	Female (24.79)	(2.43-4.92)	0.000	0.000
O_9	Phys	Male (8.59)	>	Female (7.77)	(0.38-1.26)	0.000	0.000
	Moral	Male (21.94)	<	Female (23.81)	(0.60-3.14)	0.004	0.000

*$P \leq 0.05$

A Chi^2 analysis was also performed on each item in the NH and C Surveys for gender differences in O_1, O_4, O_8 and O_9. For both age groups, no one item showed a consistent gender difference ($P \leq 0.05$) across these observations.

Interviews

Table 47 gives the percentage of males and females in the interview groups.

Table 47. Percentage of males and females in the 3 interview groups.

	Saw F video		Saw NH video		Saw F and NH videos	
	Male	Female	Male	Female	Male	Female
1-3rd	60.5	39.5	52.8	47.2	33.3	66.7
6-8th	60.7	39.3	51.2	48.8	42.1	57.9

Contingency tables (Chi^2) were constructed to analyze any gender differences within each of the 3 interview groups--F, NH, F+NH. No gender differences occurred for the older children. Only a few items

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showed gender differences for the 1-3rd graders. No differences appeared with the 1-3rd graders who saw only the NH educational experience (N = 36). Three items showed a difference for the students viewing only the F video (N = 43). The F+NH group who saw both videos (N = 24) had only one item suggesting a gender difference. All of these discrepancies seemed to have reflected the greater number of males than females in the F group, and females than males in the F+NH group.

Path Analysis

Previous linear tests on the original variable Past Direct Contact with Wildlife variable revealed non-linearity among its items which invalidated summation of responses (See Methods). However, for this path analysis it was assumed that greater participation in these wildlife activities should expose individuals to more direct contact with wildlife, and/or greater knowledge of wildlife. An analysis was performed to test this assumption. First, in each age group the knowledge score means (from the Activities & Knowledge Survey) of those participating in each of the wildlife activities was compared to those not participating. The mean differences showed that for every item or activity, participants had higher knowledge scores than non-participants--i.e., participants in hunting, fishing, feeding wildlife, etc. knew more about which wildlife species existed in Michigan than did non-participants. A Student t Test revealed that all the differences were significant at the 0.05 level except for GotoZoo for the 1-3rd graders (Tables 48 and 49). Correlations and contingency coefficients between each wildlife activity and knowledge score, however, were low; all appeared $\leq$ 0.23 (Appendix J).

Currently, there is no standardized scale which reflects how much direct contact with wildlife is encouraged by the different activities. A scale based on the differences between participants' and

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Table 48. Differences between mean knowledge scores for 1-3rd grade participants and non-participants in wildlife-related activities (N = 838).

Activity	Yes	No	Difference	Confidence Interval
Putfood	2.84	2.40	0.44*	(0.26 - 0.62)
WatchWL	2.78	2.41	0.37*	(0.17 - 0.57)
Livefarm	3.25	2.62	0.63*	(0.30 - 0.96)
Famhunt	2.85	2.39	0.46*	(0.28 - 0.64)
Youhunt	3.05	2.46	0.59*	(0.40 - 0.78)
GotoZoo	2.71	2.60	0.11	(-0.08 - 0.30)
Camping	2.76	2.52	0.24*	(0.05 - 0.04)
Fishing	2.74	2.16	0.58*	(0.31 - 0.85)

* $P \leq 0.05$

Table 49. Differences between mean knowledge scores for 6-8th grade participants and non-participants in wildlife-related activities (N = 1362).

Activity	Yes	No	Difference	Confidence Interval
Putfood	5.58	4.55	1.03*	(0.75 - 1.13)
WatchWL	5.45	4.57	0.88*	(0.57 - 1.19)
Livefarm	6.01	5.17	0.84*	(0.47 - 1.21)
WLClubs	5.81	5.11	0.70*	(0.39 - 1.01)
Famhunt	5.45	4.98	0.47*	(0.20 - 0.73)
Youhunt	6.01	4.89	1.12*	(0.86 - 1.38)
GotoZoo	5.40	5.05	0.35*	(0.09 - 0.61)
Camping	5.51	4.83	0.68*	(0.41 - 0.95)
Fishing	5.38	3.62	1.76*	(1.24 - 2.28)
Famtrap	5.78	5.21	0.57*	(0.05 - 1.09)
Youtrap	6.98	5.19	1.79*	(1.19 - 2.39)

* $P \leq 0.05$

non-participants' knowledge score means was created to avoid an arbitrary weighting scheme. First, a sample of approximately 75% of each age group was randomly selected (615/838 of 1-3rd graders, 1000/1362 of 6-8th graders), and the knowledge score mean differences were calculated for participants and non-participants. The activity

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with the greatest difference was given a weight of 1.0. For example, participants in trapping showed the greatest knowledge score mean discrepancy (D=1.97) for the 6-8th graders. Residents on a farm had the largest mean difference (D=0.64) for 1-3rd grade participants and non-participants. Thus, these subjects received a 1.0 for these items during coding. Non-participants received a 0. Next, weights for the other activities were established by calculating the percentage of their mean differences' over the greatest difference. For example, the knowledge score mean difference for anglers and non-anglers was 1.57 for 6-8th graders. The resulting weight for participating in fishing was 1.57/1.97 or 0.80. Thus, 6-8th grade participants received a 0.80 for this item while non-participants received a 0.

Creating this linear weighting scheme allowed summation of the wildlife-related activity items. The sum became an individual's Past Direct Contact with Wildlife composite score. Although correlations between these Past Direct Contact with Wildlife scores and subjects' knowledge scores were low (1-3rd = 0.32, 6-8th = 0.34), the non-parametric contingency coefficients which take into account the dichotomous scaling were high: 1-3rd = 0.86, 6-8th = 0.87. Knowledge score means, mean differences and weights for each item in both age groups are found in Appendix J along with coding schemes for all models.

Theoretical Model #1

The sample size for the path analysis was 749 subjects, 689 6-8th graders and 60 1-3rd graders. Theoretical Model #1 (Figure 6), was tested for each age group. Neither the uncorrected nor corrected model (accounts for measurement error) for both age groups fit the data (Tables 50 and 51), and the X^2 test of the model suggested a poor fit: X^2 = Sum of Squared Error x N. The X^2 for the 6-8th grade model corrected for attenuation was 1236.25 and 988.05 for the uncorrected model. The 1-3rd grade X^2 test was 153.25 for the corrected model and 76.76 for the uncorrected. All were much greater than X^2 for 0.05

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significance and 14 df which is 23.7 (df = #correlations - #paths). Although the confidence intervals suggested that some of the deviations (e.g., $r_{2,6}$ for 6-8th grade corrected model) were caused by sampling error, most implied that sampling error alone did not cause the deviations. Further, some of the signs for the resulting correlations were opposite from those predicted in the original model, definite evidence for a poor fit (e.g., correlation between Perceive Educational Experience as Real Wildlife and Moral Attributes).

Table 50. Matrices for Theoretical Model #1 for 1-3rd graders: original correlations, path coefficients, predicted correlations, and deviation. Correlations corrected for measurement error are italicized.

Original Correlations

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	1.00	*-0.04*	*0.11*	*-0.36*	*-0.99*	*0.81*	*-0.15*
Contact	-0.03	1.00	*0.40*	*-0.07*	*0.16*	*-0.08*	*0.59*
Gender	0.11	0.29	1.00	*-0.08*	*-0.07*	*0.12*	*-0.29*
SeeAsWL	-0.36	-0.05	-0.08	1.00	*0.41*	*-0.10*	*-0.11*
Physic	-0.88	0.10	-0.06	0.36	1.00	*-0.87*	*0.08*
Anthro	0.55	-0.04	0.08	-0.07	-0.52	1.00	*-0.12*
Moral	-0.11	0.31	-0.21	-0.08	0.05	-0.06	1.00

Path Coefficients

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	0.00	*0.00*	*0.00*	*-0.36*	*0.00*	*0.00*	*0.00*
Contact	0.00	1.00	*0.40*	*-0.08*	*0.00*	*0.00*	*0.00*
Gender	0.00	0.29	1.00	*-0.01*	*0.00*	*0.00*	*0.00*
SeeAsWL	-0.36	-0.05	-0.03	1.00	*0.41*	*-0.10*	*-0.11*
Physic	0.00	0.00	0.00	0.36	1.00	*0.00*	*0.00*
Anthro	0.00	0.00	0.00	-0.07	0.00	1.00	*0.00*
Moral	-0.00	0.00	0.00	-0.08	0.00	0.00	1.00

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Predicted Correlations

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	1.00	*0.04*	*0.11*	*-0.37*	*-0.15*	*0.04*	*0.04*
Contact	0.03	1.00	*0.40*	*-0.10*	*-0.04*	*0.01*	*0.01*
Gender	0.11	0.29	1.00	*-0.08*	*-0.03*	*0.01*	*0.01*
SeeAsWL	-0.36	-0.07	-0.08	1.00	*0.41*	*-0.10*	*-0.11*
Physic	-0.13	-0.03	-0.03	0.36	1.00	*-0.04*	*-0.05*
Anthro	0.03	0.01	0.01	-0.07	-0.03	1.00	*0.01*
Moral	0.03	0.01	0.01	-0.08	-0.03	0.01	1.00

Deviation (original - predicted)

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	0.00	*-0.08*	*0.00*	*0.01*	*-0.84**	*0.77**	*-0.19*
Contact	-0.06	0.00	*0.00*	*0.03*	*0.20*	*-0.09*	*0.58**
Gender	0.00	0.00	0.00	*0.00*	*-0.04*	*0.11*	*-0.30**
SeeAsWL	0.00	0.02	0.00	0.00	*0.00*	*0.00*	*0.00*
Physic	-0.75*	0.13	-0.03	0.00	0.00	*-0.83**	*0.13*
Anthro	0.52*	-0.05	0.07	0.00	-0.49*	0.00	*-0.13*
Moral	-0.14*	0.30*	-0.22*	0.00	0.08	-0.07	0.00

* denotes deviations with a $P \geq 0.05$

Table 51. Matrices for Theoretical Model #1 for 6-8th graders: original correlations, path coefficients, predicted correlations, and deviation. Correlations corrected for measurement error are italicized.

Original Correlations

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	1.00	*-0.02*	*-0.01*	*-0.19*	*-0.92*	*0.69*	*-0.05*
Contact	-0.02	1.00	*0.27*	*0.04*	*0.10*	*-0.07*	*-0.08*
Gender	-0.01	0.23	1.00	*-0.08*	*0.09*	*-0.07*	*-0.32*
SeeAsWL	-0.16	0.03	-0.07	1.00	*0.22*	*-0.20*	*-0.06*
Physic	-0.86	0.08	0.08	0.18	1.00	*-0.71*	*0.05*
Anthro	0.60	-0.05	-0.06	-0.15	-0.58	1.00	*-0.04*
Moral	-0.04	-0.06	-0.27	-0.04	0.04	-0.03	1.00

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Path Coefficients

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	0.00	*0.00*	*0.00*	*-0.19*	*0.00*	*0.00*	*0.00*
Contact	0.00	1.00	*0.27*	*0.06*	*0.00*	*0.00*	*0.00*
Gender	0.00	0.23	1.00	*-0.10*	*0.00*	*0.00*	*0.00*
SeeAsWL	-0.16	0.05	-0.08	1.00	*0.22*	*-0.20*	*-0.01*
Physic	0.00	0.00	0.00	0.18	1.00	*0.00*	*0.00*
Anthro	0.00	0.00	0.00	-0.15	0.00	1.00	*0.00*
Moral	-0.00	0.00	0.00	-0.04	0.00	0.00	1.00

Predicted Correlations

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	1.00	*0.0*	*-0.01*	*-0.19*	*-0.04*	*0.04*	*0.01*
Contact	0.00	1.00	*0.27*	*0.04*	*0.10*	*-0.01*	*0.00*
Gender	-0.01	0.23	1.00	*-0.08*	*-0.02*	*0.02*	*0.00*
SeeAsWL	-0.16	0.03	-0.07	1.00	*0.22*	*-0.20*	*-0.06*
Physic	-0.03	0.00	-0.01	0.18	1.00	*-0.04*	*-0.01*
Anthro	0.02	0.00	0.01	-0.15	-0.03	1.00	*0.01*
Moral	0.01	0.00	0.00	-0.04	-0.01	0.01	1.00

Deviation (original - predicted)

	EducExp	Contact	Gender	SeeAsWL	Physic	Anthro	Moral
EducExp	0.00	*-0.02*	*0.00*	*0.00*	*-0.88**	*0.65**	*-0.06*
Contact	-0.02	0.00	*0.00*	*0.00*	*0.09**	*-0.06*	*-0.08**
Gender	0.00	0.00	0.00	*0.00*	*0.11**	*-0.09**	*-0.32**
SeeAsWL	0.00	0.00	-0.07	0.00	*0.00*	*0.00*	*0.00*
Physic	-0.83*	0.08*	0.09*	0.00	0.00	*-0.67**	*0.06*
Anthro	0.58*	-0.05	-0.07	0.00	-0.55*	0.00	*-0.05*
Moral	-0.05	-0.06	-0.27*	0.00	0.05	-0.04	0.00

* denotes deviations with a P $\geq$ 0.05

Theoretical Model #2

A second model was designed to explain the data (Figure 15). Results from the interviews and analyses of subjects viewing only the F

THEORETICAL MODEL #2
(1-3RD AND 6-8TH GRADE)

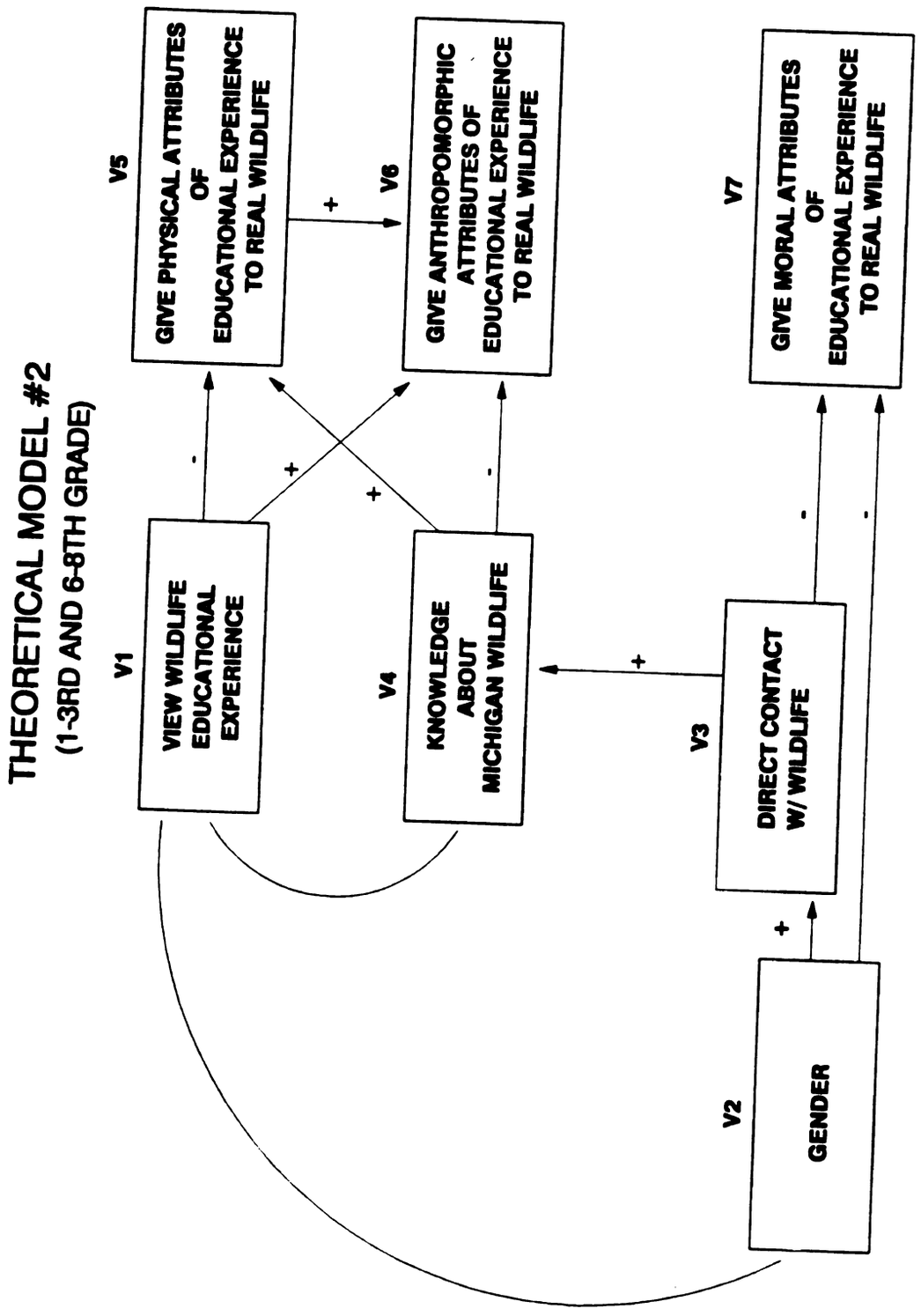


Figure 15. Theoretical model #2 (1-3rd and 6-8th grade).

presentation suggested that subjects perceived the educational experience as real wildlife regardless of its medium. Thus, the variable, Perceive Educational Experience as Real Wildlife, was dropped for this alternate model. This decision is supported by Potter (1988) who proposed that perception of television reality is a contingent, not intervening variable. Knowledge of Michigan Wildlife was added as a variable because the Student t and Mann-Whitney U tests suggested that it appeared to influence subjects' Physical, Anthropomorphic and Moral scores. LaHart (1978) and Westervelt and Llewellyn (1985) concurred, believing that knowledge of wildlife was an important variable influencing wildlife attitudes. Correlations (uncorrected) between knowledge score and all variables appear in Table 52.

Table 52. Correlations between knowledge score and other variables for Theoretical Model #2 (1-3rd and 6-8th grade). Correlations do not account for measurement error.

Knowledge Score	EducExp	Gender	Contact	Physic	Anthro	Moral
1-3rd	-0.04	-0.09	0.49	0.14	0.22	0.35
6-8th	-0.10	0.29	0.39	0.18	-0.58	-0.03

The model was tested for both age groups (Tables 53 and 54). The uncorrected 6-8th grade model fit the data according to the X^2 test ($X^2 = 5.14 < X^2_{.05,\ 12} = 21.0$). However, the model corrected for attenuation did not fit: $X^2 = 58.8$. The path from which educational experience was viewed (View Wildlife Educational Experience) to the Physical score was very high (0.91), as were those between Past Direct Contact with Wildlife and knowledge score, and Physical and Anthropomorphic scores: 0.54 and -0.49 respectively. Four deviations could not be explained by sampling error alone.

The uncorrected 1-3rd grade model fit the data ($X^2 = 15.2$, $X^2_{.05,\ 12} = 21.0$), but the corrected model did not. In fact, the statistical software could not generate estimated paths or predicted correlations

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using the corrected correlations. The uncorrected model revealed several large deviations (-0.18, 0.20, -0.23, 0.30), but only 0.30 appeared to be caused by something other than sampling error alone. This finding, and the apparent fit of the uncorrected model, were most likely due to the small sample size (N = 60).

Table 53. Matrices for Theoretical Model #2 for 1-3rd graders: original correlations, path coefficients, predicted correlations, and deviation. Correlations corrected for measurement error are italicized.

Original Correlations

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	1.00						
Gender	0.11	1.00					
Contact	-0.27	0.29	1.00				
Knowl	-0.06	-0.09	0.49	1.00			
Physic	-0.88	-0.06	0.10	0.14	1.00		
Anthro	0.55	0.08	-0.04	0.22	-0.52	1.00	
Moral	-0.11	-0.21	0.31	0.35	0.05	-0.06	1.00

Path Coefficients

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	0.00						
Gender	0.00	0.00					
Contact	0.00	0.29	0.00				
Knowl	0.00	0.00	0.49	0.00			
Physic	-0.87	0.00	0.00	0.09	0.00		
Anthro	0.33	0.00	0.00	0.28	-0.27	0.00	
Moral	0.00	-0.33	0.40	0.00	0.00	0.00	0.00

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Predicted Correlations

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	1.00						
Gender	0.11	1.00					
Contact	0.03	0.29	1.00				
Knowl	0.02	0.14	0.49	1.00			
Physic	-0.87	-0.08	0.01	0.07	1.00		
Anthro	0.57	0.10	0.14	0.26	-0.54	1.00	
Moral	-0.02	-0.21	0.31	0.15	0.03	0.03	1.00

Deviation (original - predicted)

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	0.00						
Gender	0.00	0.00					
Contact	-0.30*	0.00	0.00				
Knowl	-0.08	-0.23	0.00	0.00			
Physic	-0.01	0.02	0.09	0.07	0.00		
Anthro	-0.02	-0.02	-0.18	-0.04	0.02	0.00	
Moral	-0.09	0.00	0.00	0.20	0.02	-0.09	0.00

* denotes deviations with a $P \geq 0.05$

Table 54. Matrices for Theoretical Model #2 for 6-8th graders: original correlations, path coefficients, predicted correlations, and deviation. Correlations corrected for measurement error are italicized.

Original Correlations

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	1.00	*-0.01*	*-0.02*	*-0.12*	*-0.92*	*0.69*	*-0.05*
Gender	-0.01	1.00	*0.27*	*0.34*	*0.09*	*-0.07*	*-0.32*
Contact	-0.02	0.23	1.00	*0.54*	*0.10*	*-0.07*	*-0.08*
Knowl	-0.10	0.29	0.39	1.00	*0.23*	*-0.18*	*-0.06*
Physic	-0.86	0.08	0.08	0.18	1.00	*-0.71*	*0.05*
Anthro	0.60	-0.06	-0.05	-0.13	-0.58	1.00	*-0.04*
Moral	-0.04	-0.27	-0.06	-0.04	0.04	-0.03	1.00

Path Coefficients

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	0.00	*0.00*	*0.00*	*0.00*	*-0.91*	*0.23*	*0.00*
Gender	0.00	0.00	*0.27*	*0.00*	*0.00*	*0.00*	*-0.32*
Contact	0.00	0.23	0.00	*0.54*	*0.00*	*0.00*	*0.00*
Knowl	-0.85	0.00	0.39	0.00	*0.12*	*-0.04*	*0.00*
Physic	0.40	0.00	0.00	0.09	0.00	*-0.49*	*0.00*
Anthro	0.00	0.00	0.00	-0.05	-0.23	0.00	*0.00*
Moral	-0.00	-0.27	0.00	0.00	0.00	0.00	0.00

Predicted Correlations

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	1.00	*-0.01*	*0.00*	*0.00*	*-0.91*	*0.68*	*0.00*
Gender	-0.01	1.00	*0.27*	*0.15*	*0.03*	*-0.02*	*-0.32*
Contact	0.00	0.23	1.00	*0.54*	*0.07*	*-0.05*	*-0.08*
Knowl	0.00	0.09	0.39	1.00	*0.12*	*-0.10*	*-0.05*
Physic	-0.85	0.02	0.04	0.10	1.00	*-0.71*	*-0.01*
Anthro	0.59	-0.01	-0.03	-0.07	-0.57	1.00	*0.01*
Moral	0.00	-0.27	-0.06	-0.02	0.00	0.00	1.00

Deviation (original - predicted)

	EducExp	Gender	Contact	Knowl	Physic	Anthro	Moral
EducExp	0.00	*0.00*	*0.02*	*-0.12**	*-0.01*	*0.01*	*-0.05*
Gender	0.00	0.00	*0.00*	*0.20**	*0.06*	*-0.05*	*0.00*
Contact	0.02	0.00	0.00	*0.00*	*0.03*	*-0.01*	*0.00*
Knowl	-0.10*	0.20*	0.00	0.00	*0.11**	*-0.08**	*-0.01*
Physic	-0.01	0.06	0.04	0.08*	0.00	*-0.01*	*0.06*
Anthro	0.01	-0.05	-0.02	-0.06	-0.01	0.00	*-0.05*
Moral	-0.04	0.00	0.00	-0.02	0.04	-0.03	0.00

* denotes deviations with a $P \geq 0.05$

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Theoretical Model #3

A third model was proposed to explain the data. It took into account the test and order effects revealed by comparing the observation (O_x) Physical, Anthropomorphic and Moral Attributes means. The model differed between the 2 age groups because different relationships between the test effect, Moral score and Gender existed within each group. Both models contained the variables in Model #2, but included EEorder (viewing order of the Educational Experiences) and Tooktest (whether subjects took a test between the video presentations). Moral Score and Gender were omitted from the 6-8th grade model because their Moral Score seemed influenced primarily by Gender, and Gender did not affect the other measured variables. The 1-3rd grade theoretical model included Moral score and Gender because another variable besides Gender (i.e., taking a test) seemed to affect their Moral scores. Figures 16 and 17 present the 2 models. The correlation between EEorder and Tooktest for 1-3rd grade was 0.52 and 0.34 for 6-8th grade. Correlations for EEorder and Tooktest with all other variables appear in Table 55.

Table 55. Correlations for EEorder and Tooktest with other variables in Theoretical Model #3 (1-3rd and 6-8th). Correlations for 1-3rd are italicized; all values do not account for measurement error.

	Contact	Knowledge	Gender	Physic	Anthro	Moral
EEorder[1]	*-0.04* -0.42	*-0.18* 0.23	*0.00*	*-0.13* 0.10	*0.06* 0.11	*-0.02*
Tooktest[2]	*-0.02* -0.30	*0.11* -0.09	*-0.11*	*0.10* 0.18	*-0.18* -0.24	*0.11*

[1]EEorder was coded: 0 = viewed NH last, 1 = viewed F last
[2]Tooktest was coded: 0 = no, 1 = yes

Data from Experimental Groups 1, 2 and 4 were used for this path analysis. Sample sizes were 416 for 6-8th grade and 432 for 1-3rd grade. Neither the uncorrected or corrected model for both age groups fit the data. For the 6-8th graders, the uncorrected X^2 was 48.7, and

THEORETICAL MODEL #3

(1-3RD GRADE)

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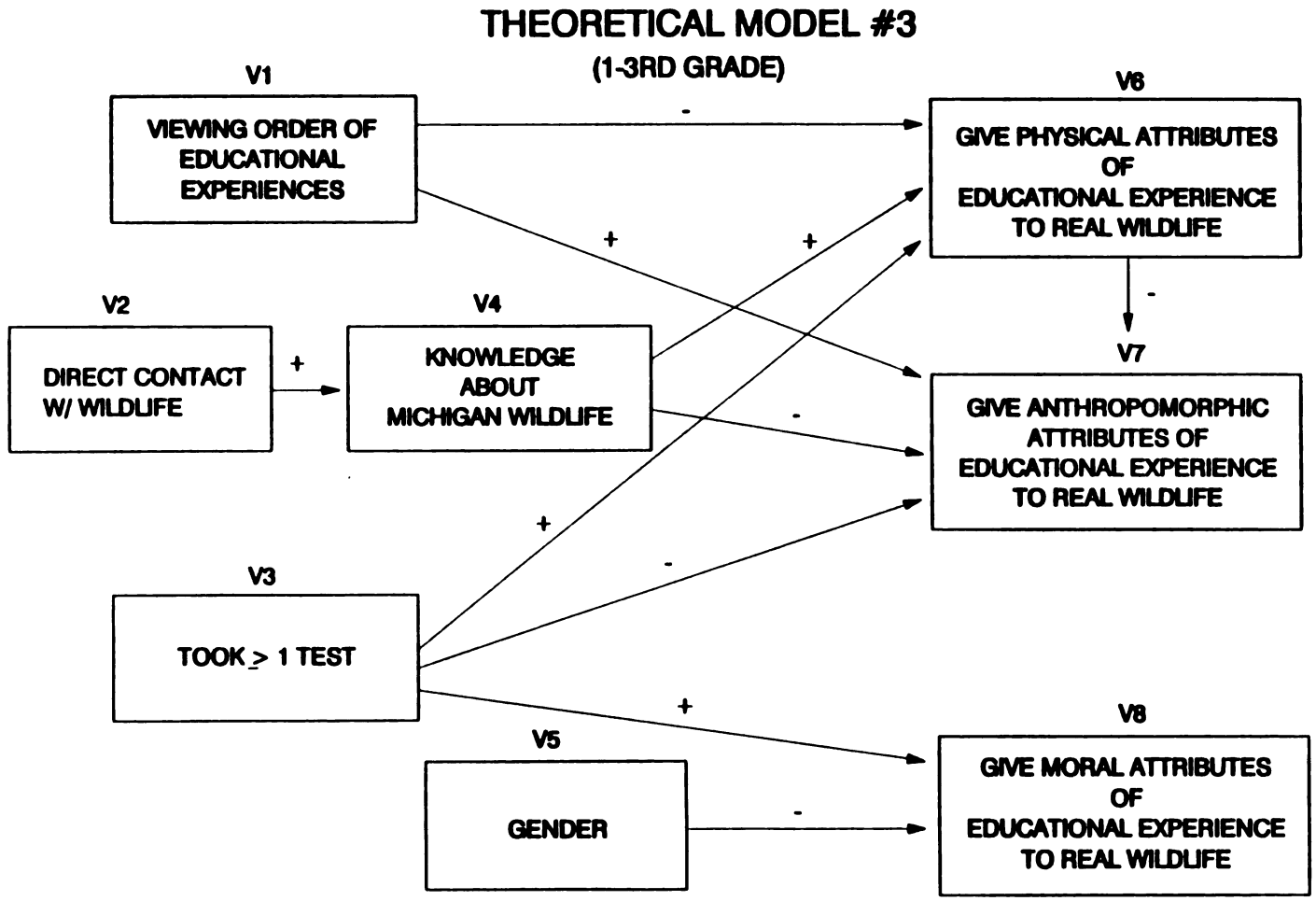


Figure 16. Theoretical model #3 (1-3rd grade).

THEORETICAL MODEL #3

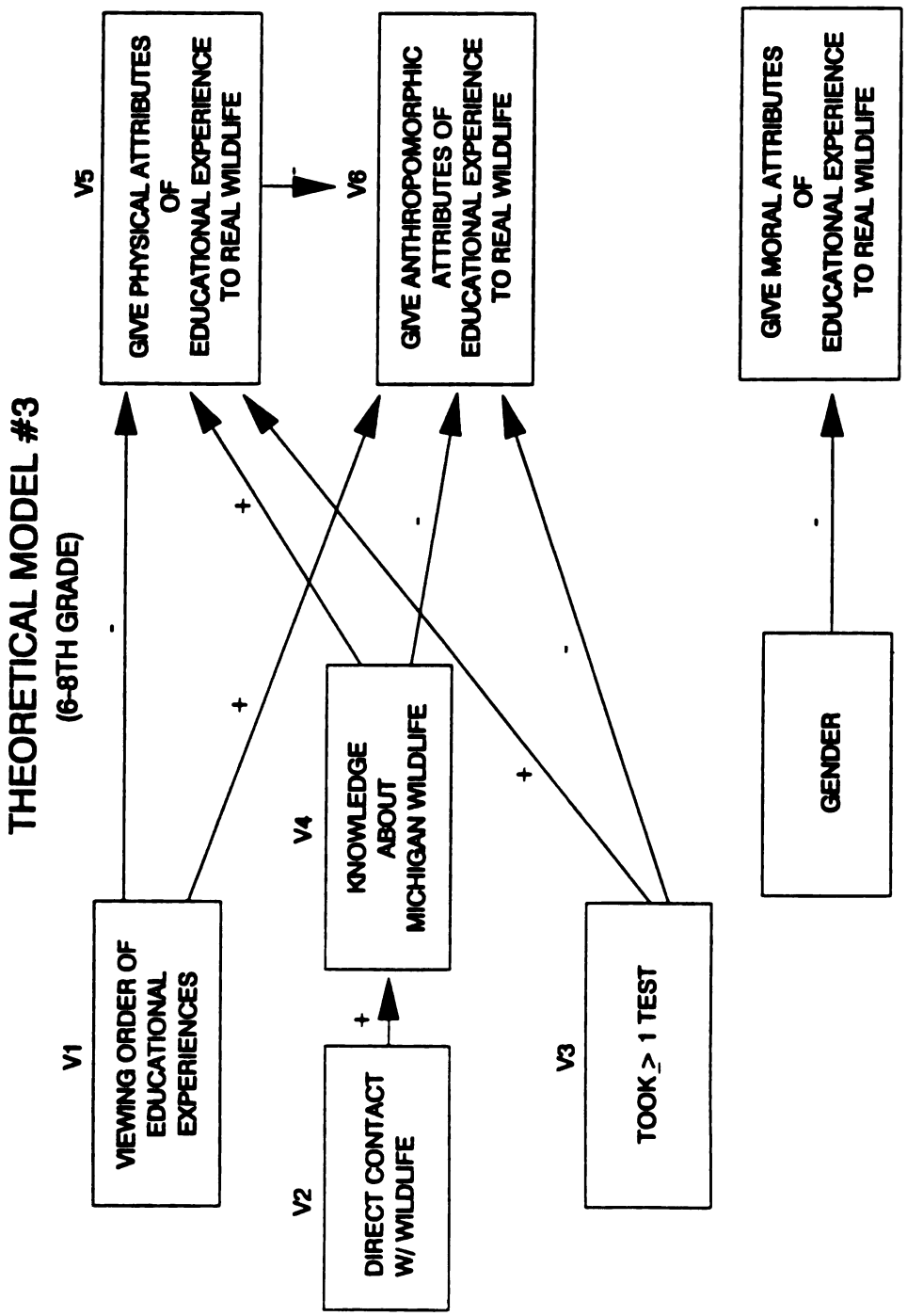


Figure 17. Theoretical model #3 (6-8th grade).

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the corrected X^2 was 85.09 ($X^2_{.05,\ 7}$ = 14.1). The 1-3rd X^2 values were uncorrected = 87.63 and corrected = 223.12 ($X^2_{.05,\ 18}$ = 28.9.) Large residuals plagued all models, and path coefficients were low (Tables 56 and 57).

No further alternate models were proposed. The low path coefficients and unpredicted higher correlations between variables suggested the inclusion of constructs not measured in this study.

Table 56. Matrices for Theoretical Model #3 for 1-3rd graders: original correlations, path coefficients, predicted correlations, and deviation. Correlations corrected for measurement error are italicized.

Original Correlations

	EE Order	Contc	Took test	Know	Gend	Phys	Anth	Moral
EEOrder	1.00	*-0.06*	*0.52*	*-0.25*	*0.00*	*-0.15*	*0.09*	*-0.03*
Contact	-0.04	1.00	*-0.03*	*0.54*	*0.28*	*0.13*	*-0.06*	*0.08*
Test	0.52	-0.02	1.00	*0.15*	*-0.11*	*0.11*	*-0.27*	*0.15*
Know	-0.18	0.28	0.11	1.00	*0.22*	*0.39*	*-0.41*	*0.19*
Gender	0.00	0.20	-0.11	0.16	1.00	*0.15*	*-0.13*	*-0.15*
Phys	-0.13	0.08	0.10	0.25	0.13	1.00	*-0.50*	*0.35*
Anth	0.06	-0.03	-0.18	-0.20	-0.09	-0.30	1.00	*-0.44*
Moral	-0.02	0.04	0.11	0.10	-0.11	0.23	-0.22	1.00

Path Coefficients

	EE Order	Contc	Took test	Know	Gend	Phys	Anth	Moral
EEOrder	0.00	*0.00*	*0.00*	*0.00*	*0.00*	*-0.13*	*0.12*	*0.00*
Contact	0.00	0.00	*0.00*	*0.54*	*0.00*	*0.00*	*0.00*	*0.00*
Test	0.00	0.00	0.00	*0.00*	*0.00*	*0.13*	*-0.25*	*0.13*
Know	0.00	0.28	0.00	0.00	*0.00*	*0.34*	*-0.19*	*0.00*
Gender	0.00	0.00	0.00	0.00	0.00	*0.00*	*0.00*	*-0.13*
Phys	-0.19	0.00	0.17	0.20	0.00	0.00	*-0.38*	*0.00*
Anth	0.12	0.00	-0.21	-0.10	0.00	-0.24	0.00	*0.00*
Moral	0.00	0.00	0.10	0.00	-0.10	0.00	0.00	0.00

Predicted Correlations

	EE Order	Contc	Took test	Know	Gend	Phys	Anth	Moral

Predicted Correlations

	EE Order	Contc	Took test	Know	Gend	Phys	Anth	Moral
EEOrder	1.00	*-0.06*	*0.52*	*-0.03*	*0.00*	*-0.07*	*0.02*	*0.07*
Contact	-0.04	1.00	*-0.03*	*0.54*	*0.28*	*0.19*	*-0.18*	*-0.04*
Test	0.52	-0.02	1.00	*-0.02*	*-0.11*	*0.06*	*-0.21*	*0.15*
Know	-0.01	0.28	-0.01	1.00	*0.15*	*0.34*	*-0.32*	*-0.02*
Gender	0.00	0.20	-0.11	0.06	1.00	*0.04*	*-0.02*	*-0.15*
Phys	-0.10	0.06	0.08	0.20	-0.01	1.00	*-0.47*	*0.00*
Anth	0.04	-0.04	-0.16	-0.14	0.02	-0.29	1.00	*-0.03*
Moral	0.05	-0.02	0.11	-0.01	-0.11	0.01	-0.02	1.00

Deviation (original - predicted)

	EE Order	Contact	Tooktest	Knowledge	Gender	Physical	Anthro	Moral
EEOrder	0.00	*0.00*	*0.00*	*-0.22**	*0.00*	*-0.07*	*0.07*	*-0.10**
Contact	0.00	0.00	*0.00*	*0.00*	*0.00*	*-0.06*	*0.11**	*0.12**
Test	0.00	0.00	0.00	*0.17**	*0.00*	*0.06*	*-0.05*	*0.00*
Know	-0.17*	0.00	0.12*	0.00	*0.07*	*0.05*	*-0.09**	*0.21**
Gender	0.00	0.00	0.00	0.10	0.00	*0.11**	*-0.12**	*0.00*
Phys	-0.03	0.02	0.02	0.05	0.14*	0.00	*-0.03*	*0.35**
Anth	0.02	0.01	-0.02	-0.06	-0.11*	-0.01	0.00	*-0.42**
Moral	-0.07	0.06	0.00	0.11*	0.00	0.22*	-0.20*	0.00

* denotes deviations with a $P \geq 0.05$

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Table 57. Matrices for Theoretical Model #3 for 6-8th graders: original correlations, path coefficients, predicted correlations, and deviation. Correlations corrected for measurement error are italicized.

Original Correlations

	EEOrder	Contact	Tooktest	Knowl	Physical	Anthro
EEOrder	1.00	*-0.49*	*0.34*	*0.27*	*0.11*	*0.13*
Contact	-0.42	1.00	*-0.35*	*0.26*	*-0.09*	*0.09*
Tooktest	0.34	-0.30	1.00	*-0.11*	*0.19*	*-0.29*
Knowl	0.23	0.19	-0.09	1.00	*0.01*	*-0.05*
Physical	0.10	-0.07	0.18	0.01	1.00	*-0.16*
Anthro	0.11	0.07	-0.25	-0.04	-0.13	1.00

Path Coefficients

	EEOrder	Contact	Tooktest	Knowl	Physical	Anthro
EEOrder	0.00	*0.00*	*0.00*	*0.00*	*0.05*	*0.33*
Contact	0.00	0.00	*0.00*	*0.26*	*0.00*	*0.00*
Tooktest	0.00	0.00	0.00	*0.00*	*0.18*	*-0.40*
Knowl	0.00	0.19	0.00	0.00	*0.02*	*-0.18*
Physical	0.04	0.00	0.17	0.02	0.00	*-0.12*
Anthro	0.26	0.00	-0.33	-0.13	-0.09	0.00

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Predicted Correlations

	EEOrder	Contact	Tooktest	Knowl	Physical	Anthro
EEOrder	1.00	*-0.49*	*0.34*	*-0.13*	*0.10*	*0.20*
Contact	-0.42	1.00	*-0.35*	*0.26*	*-0.08*	*-0.06*
Tooktest	0.34	-0.30	1.00	*-0.09*	*0.19*	*-0.29*
Knowl	-0.08	0.19	-0.06	1.00	*0.00*	*-0.19*
Physical	0.10	-0.06	0.18	0.00	1.00	*-0.16*
Anthro	0.15	-0.03	-0.25	-0.13	-0.13	1.00

Deviation (original - predicted)

	EEOrder	Contact	Tooktest	Knowl	Physical	Anthro
EEOrder	0.00	*0.00*	*0.00*	*0.40*	*0.01*	*-0.07*
Contact	0.00	0.00	*0.00*	*0.00*	*-0.01*	*0.15*
Tooktest	0.00	0.00	0.00	*-0.02*	*0.00*	*0.00*
Knowl	0.31	0.00	-0.03	0.00	*0.01*	*0.14*
Physical	0.00	-0.01	0.00	0.01	0.00	*0.00*
Anthro	-0.04	0.10	0.00	0.09	0.00	0.00

* denotes deviations with a $P \geq 0.05$

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DISCUSSION

Physical Attributes

Without information to the contrary (e.g., NH educational experience) the children were willing to accept the physical characteristics of the cartooned wildlife as reality. Thus, they believed that shrews move slowly, kingfishers ate berries, and martens spend much time on the ground. These findings contradict Wilson and Shaffer (1965), Snow (1974), and Dorr (1983) who proposed that children associate cartoon material or animation exclusively with fantasy, distortions of reality and caprice. Results agree with studies emphasizing the educational effectiveness of cartoons (e.g., Caldwell 1973, Kauffman and Dwyer 1974, Parlato et al. 1980) because the children readily learned the content of the F presentation. Both age groups were also willing to accept the NH video information as reality. Children's learning about wildlife from both of these media types support findings by Richmond and Morgan (1977), LaHart (1978), and Westervelt and Llewellyn (1985)--i.e., individuals can learn wildlife-related information from vicarious contacts such as the media.

Results suggested that the physical attributes information in the NH video had a stronger impact on the children than the opposing material in the F educational experience; however, viewing the NH presentation containing accurate information failed to totally prevent or reverse the influence of the F experience. Thus, although the children were exposed to correct material presented by narration and actual photographs, their responses reflected the false information communicated by the cartoon and fantasy experience. The cartoon experience was strong enough to "compete" with the realistic

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presentation for the youngsters' acceptance.

Test and order effects appeared--i.e., taking the survey after watching the NH video reinforced its content, and the last video presented had the greater effect on subject response. Thus, these effects suggest means to "correct" some of the misconceptions about the physical attributes of real animals possibly fostered by a fantasy cartoon experience.

Anthropomorphic Attributes

The strength of the effect of the anthropomorphic attributes information in either video was not as strong as the influence of the physical attributes information. This may have partially been due to the subjects' strong anthropomorphic tendencies before the experiment as suggested by the pretest, other mean comparisons, and interview results. Past research also adds support (Pomerantz 1977, LaHart 1978, Bowd 1984, Westervelt and Llewellyn 1985): Youngsters in the primary grades through high school readily gave human-like characteristics to animals.

Although this effect was weak, the NH video did have a stronger influence than the F educational experience did. However, like with the Physical Attributes information, the NH presentation could not fully counteract the anthropomorphic influence in the cartoon, for both age groups attributed more anthropomorphic attributes to the real animals after viewing the F video. This finding supports research by Wong (1985) but contradicts Pomerantz and Hair (1988). They reported that children who read *Ranger Rick*, a conservation education magazine featuring an anthropomorphic cartoon raccoon dialoguing with other cartooned wildlife, did not show more anthropomorphism than non-readers.

Subjects taking a test after the NH video had lower anthropomorphic scores than students seeing both videos with no intermediate survey. Why taking the test lowered the students' Anthropomorphic Attributes scores is unknown. Perhaps certain wording

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on the survey, or the act of responding to the questions somehow reinforced the NH information. An order effect also occurred--the last video viewed had the greater impact on the children's Anthropomorphic scores. The test and order effects may suggest ways to counteract the anthropomorphic influence in a fantasy cartoon experience. Engaging in some activity (e.g., a test) which reinforces non-anthropomorphic material may help discourage anthropomorphic tendencies encouraged by a cartoon. Viewing a natural history experience with non-anthropomorphic information after a related fantasy video may have a similar impact.

Moral Attributes

An age difference appeared for the effects of the anthropomorphic cartoon experience on students' ascription of moral attributes to real wildlife. There was no treatment effect for the 1-3rd graders, i.e., this cartoon experience did not affect their concern for the right and wrong treatment of animals. However, a test effect occurred: Subjects taking the survey more than once had higher Moral Attributes scores (expressed more concern for humane or moral treatment of an animal). Repeatedly encountering questions about the moral treatment of the 3 species may have helped these young children interpret the questions and decide their positions on such difficult issues. Another explanation for the test effect is that it reflected a sensitization of the youngsters to new information. Neither video covered the content in the Moral items; thus, when the 1-3rd graders first encountered these questions, they were sensitized to issues concerning the right and wrong treatment of animals. Repeated encounters to the items most likely helped them decide their position on these issues.

Results for the 6-8th graders revealed no treatment, test or order effects for the Moral Attributes factor (after exclusion of O_7 which had a much lower sample size and a disproportionate number of urban subjects). However, these youngsters appeared to be highly concerned

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about the right and wrong treatment of animals as seen by the pretest. Their strong interest in the humane treatment of animals precedes that predicted by Kellert and Westervelt's (1983) developmental model of children's attitudes towards wildlife. They predicted that an increase in ethical concern, welfare and kind treatment of animals appears later, between 8-11th grade.

The lack of a treatment effect for both age groups suggests that this anthropomorphic wildlife cartoon experience did not influence children's concern for the right and wrong treatment of animals. However, other anthropomorphic cartoon experiences may--especially ones that contain a moral lesson, as suggested by the interview results.

Natural History and Cartoon Survey Items

Physical and Anthropomorphic Items

The pretest (O_4) results revealed that although the 3 species were assumed to be unfamiliar to 1-3rd graders, some subjects knew a few of their more blatant characteristics. For example, >45% of the students correctly answered the questions about a kingfisher's call, and whether or not a kingfisher mainly eats berries. Their correctly answering the latter item may have partially been due to the bird's name which alludes to its eating habits. Two Anthropomorphic items in the pretest received high scores: whether a marten feels lonely when it is by itself, and whether a shrew sometimes hates other shrews. The second question also received high marks when subjects saw only the NH educational experience, along with the question about whether a marten feels happy when it is by itself. Thus, subjects responded anthropomorphically to these questions about whether an animal hates or feels happy without viewing the F presentation. These results support Inagaki's (1989) work. He found that children were more anthropomorphic with human mental characteristics usually weakly associated with the brain--i.e., emotions and feelings. In turn, children are less anthropomorphic with

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mental characteristics strongly associated with the brain (e.g., thinking). Findings for O_8 may support his hypothesis. These children saw only the F educational experience; yet certain items in both observations received low Anthropomorphic scores--does a shrew care about its looks, does a kingfisher make future plans, does a shrew think about getting old, and does a shrew know right from wrong. Most of these questions involve more thinking than emotions.

The same trends seen with the younger children appeared with the older subjects. A few Anthropomorphic items related to emotion and feelings received high scores regardless of which video was viewed. For example, the question regarding whether a shrew hates was answered anthropomorphically by O_4 (pretest) and O_1 and O_9 (saw NH video). Again, this supports proposals by Inagaki (1989) who suggested that children were more anthropomorphic with human mental characteristics usually weakly associated with the brain, such as emotions and feelings.

Moral Items

For both age groups, the children consistently marked "wrong" the items about killing. The younger subjects perceived the idea of killing a kingfisher to have it stuffed for a museum, and having a shrew as a pet as wrong. These 2 actions were also consistently marked wrong by the 6-8th graders along with the issue of capturing a marten to use its fur for warm gloves. Thus, 1 out of the 3 items about killing the animal were seen as wrong by the 1-3rd graders, while the older youngsters clearly saw 2 of the 3 items as wrong. Perhaps the 6-8th graders felt that the third question--killing shrews digging up the flowers in someone's yard--was less wrong (more right) because of the human benefits. This would be consistent with findings by Richmond and Morgan (1977), Pomerantz (1986a) and Pomerantz and Hair (1988) who found that children's general attitude toward the environment is more negative when the object of concern impinges directly on their lives or requires personal sacrifice. Further, subjects' opposition to killing the

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kingfisher and marten, yet not the shrew, support findings by Tamir and Sever (1980). Almost all of their students (7-10th grade) condemned the use of birds and mammals in experiments that required sacrificing the animals, while only half condoned the loss of reptiles, amphibians and mice--a creature similar to the shrew.

The children's tendency to accept actions that benefitted humans, or ones not requiring the sacrifice of an animal, was also seen with their response to the question about putting a marten in a zoo. This act met both of these criteria, and it consistently was seen as less wrong by both age groups. Trapping and transferring kingfishers was another non-fatal action profiting humans in another state. It, too, was perceived as less wrong by both 1-3rd and 6-8th graders.

Past Direct Contact with Wildlife

1-3rd Grade

More than 60% of these Michigan 1-3rd graders participated in every wildlife-related activity presented except living on a farm (8.7%) and accompanying someone while he or she hunted (35.8%). The most popular activity was fishing (88%) which is consistent with Westervelt and Llewellyn's (1985) study. However, no strong, consistent relationship appeared between the children's participation in a wildlife activity and their attribution of physical, anthropomorphic and moral characteristics to real animals. Certain patterns did appear across some of the observations. After they saw either educational experience, 1-3rd graders who had gone to a zoo in the past year had higher Anthropomorphic scores. Perhaps this trend reflects an urban influence since children near or in a city would have more opportunities to visit a zoo.

The majority were more correct about the ranges of familiar Michigan species (deer, pheasant) than unfamiliar ones (ruffed grouse, elk, etc.). These findings support work by Kellert and Berry (1980) who

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reported that the public is most knowledgeable about highly familiar species and those involved with emotional issues--especially large attractive and phylogenetically higher animals. More knowledgeable students had higher Physical Attributes scores before they saw either presentation and after the NH video. Hence, knowledge of Michigan wildlife may have influenced some of the youngsters' attribution of physical characteristics to real animals.

After subjects saw the F educational experience, more knowledgeable students appeared to show more anthropomorphic tendencies. It is unknown why this difference occurred, because one would expect more knowledgeable students to be less anthropomorphic. However, knowledge items only measured students' familiarity with certain species' ranges, not their knowledge of physiological or mental properties of wildlife. Inagaki (1989) believed that children were less anthropomorphic when they strongly associated human mental characteristics (emotions and feelings) with the brain. Thus, the more knowledgeable students may not have been learned in the subject matter which may lead to less anthropomorphism.

6-8th Grade

At least 54% of this age group participated in all but 5 of the wildlife-related activities listed in the A&K questionnaire. Percentages for the 6-8th graders and 1-3rd graders were similar for all activities, except 54.8% of the older age group compared to 62.1% of the younger had a family member who hunted. This greater number of family-member hunters in the younger age group was not expected since past surveys indicate a decrease in the number of hunters nationally (U.S. Fish and Wildlife Service 1988). Fishing was the most popular activity for 6-8th graders, similar to the 1-3rd graders. Low involvement (20.3%) in a wildlife-related club (4-H, Girl Scouts, Boy Scouts, etc.) supports findings by Westervelt and Llewellyn (1985) who found their youngsters' least popular activities as those requiring more commitment

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As with the 1-3rd graders, no strong, consistent relationships occurred between 6-8th graders' participation in wildlife activities and their attribution of physical, anthropomorphic or moral characteristics to real animals. Thus, in general, none of the activities measured in this study seemed to strongly influence how subjects responded to anthropomorphic wildlife cartoons. However, as with the younger age group, certain patterns appeared across some of the observations. Two "consumptive" activities had more differences between participants' and non-participants' responses--trapping and hunting. Before either video and after the F presentation, subjects with a trapping background (personally trapping or having a family member who traps) were less concerned about the right and wrong treatment of animals than those who did not. This difference seemed to be stronger when subjects actually engaged in trapping than when they just had a family member who trapped. A hunting background showed a similar but weaker trend. Subjects with a hunting background (personally hunting or having a family member who hunts) initially had less concern for the humane treatment of wildlife than those who did not. After exposure to either video the difference remained only for subjects who personally hunted. Thus, the actual trapping or hunting experience appeared to have a greater impact on 6-8th graders' concern for the humane treatment of animals than did the experience of just having a hunter or trapper in the family.

Although it appears that trappers and hunters may be less susceptible to the Moral Attributes influence of the anthropomorphic cartoon, results from comparing observation means (and the path analysis discussed subsequently) warn against this conclusion. These analyses revealed that the F video did not affect either age groups' attribution of Moral characteristics to real animals. Further, the effect of the Moral Attributes influence in both educational experiences was weak. Thus, another factor besides participating in hunting or trapping was contributing to the differences in subjects' Moral Attributes scores.

The older students knew more than the younger subjects about which species are found in Michigan. This concurs with results by Dahlgren et al. (1977) who reported that as people aged, they scored higher on wildlife knowledge questions. As with the 1-3rd graders, the 6-8th graders were more knowledgeable about species that were very familiar and/or highly publicized--deer, pheasant, wolves and roadrunners. Perhaps youngsters were familiar with the ranges of wolves and roadrunners because the wolves on Isle Royale (an island in Lake Superior), are often publicized. The syndicated *Roadrunner* cartoon always presents the species and its coyote predator in a desert-like habitat, something clearly not found in Michigan. This degree of publicity may also have contributed to the students' greater knowledge of Michigan moose and elk over ruffed grouse and bighorn sheep. Although the ruffed grouse is very common in Michigan, it has not received the degree of media coverage extended to moose and elk. The Michigan Department of Natural Resource have attempted and publicized several moose reintroductions in the state. Elk have received attention through the popular elk-viewing areas in the Pigeon River region in the northern part of the lower peninsula. Therefore, the students were more likely to know that these 2 species resided in the state because of the greater publicity they had received. Further, elk and moose are much larger and higher on the phylogenetic scale than ruffed grouse. These suppositions agree with findings by Kellert and Berry (1980): the public is most knowledgeable about highly familiar species, those involved in emotional issues, large attractive animals, and species higher up on the phylogenetic scale.

As with the 1-3rd graders, 6-8th graders more knowledgeable in Michigan wildlife species scored higher on the Physical items. These students also had lower Anthropomorphic scores after they saw the F presentation. Thus, knowledge of Michigan wildlife may have influenced some of the youngsters' attribution of physical and anthropomorphic characteristics to real animals.

The slight impact of the different wildlife activities on both age groups' responses to the anthropomorphic cartoon may partially be explained by Potter (1988) and/or Inagaki (1989). Potter reviewed studies showing that people's perception of TV reality depended more on an indirect source of information (interpersonal contacts) than personal direct experience. Thus, although one might expect subjects participating in wildlife-related activities to have lower anthropomorphic tendencies because they have direct contact with wildlife and more opportunities to watch animals' non-anthropomorphic behavior, they could show high anthropomorphism because their source about animal attributes may comes from indirect sources of information. According to Inagaki (1989), biology teachers may be one of these indirect sources or interpersonal contacts. He believed that because they do not directly address the mental properties of humans in their classes, children do not strongly associate emotions and feelings with the brain. This weak association leads to anthropomorphic perceptions of animals and other non-humans.

Interviews

1-3rd Grade

Unless they saw the NH video, most of the younger children did not associate the cartoon characters with the 3 Michigan species. The majority of F subjects thought that Max, Kerry, Stu, etc. were something other than a marten, kingfisher, and shrew--e.g., a wolf, bluebird, and mouse. When the characters were introduced in the beginning of the F video, either the names were spoken too quickly for the children to grasp them, they meant nothing to them, or the species names were interpreted as last names--e.g., Max marten could be interpreted as "Max Martin". One student even stated that Kerry was a kingfisher because "that's her last name". Without the correct frame of reference the children probably did not know that the marten, kingfisher and shrew

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mentioned in the survey referred to animals, or were the same species caricatured in the F presentation. Although the youngsters may not have identified the cartoon characters as the 3 species, they may have associated the inaccurate characteristics (physical and/or anthropomorphic) to the species they thought the characters represented anyway--e.g., a wolf, bluejay and mouse. For example, a child may have concluded that since Max looks like a fox, and Max doesn't like to be alone, then foxes must not like to be alone.

The 1-3rd graders saw the cartoon characters as depicting the real species, as suggested by their responses to the questions about Max in the woods, Kerry dying, and whether Kurt or they themselves would help Stu in the fire. Their identifying the characters as real animals does not support the "realism theory" of picture processing which predicts that abstract visuals (such as cartoons) may not communicate the intended message because of loss of cues such as detail. It does agree with the alternative, "information theory"--pictorials limited to essential information will facilitate learning better than ones presenting more complex material. The subjects' perceiving the characters as depicting the real species also helps explain why 5th graders in a study by Wong (1985) agreed that anthropomorphic drawing of a deer or a duck "would die someday". They did not think that the cartoon drawing itself would actually expire, but believed that the represented species would. Past research supports this. Inagaki and Hatano (1987), working with Japanese kindergartners, believed that youngsters have some of the knowledge needed to differentiate between objects that are humans and non-human, animate and inanimate. Berzonsky et al. (1988) showed that development of animistic judgment parallels that of sentiency judgment--i.e., individuals realize that humans are capable of having intentions, beliefs, and wants whereas inanimate objects and plants are not.

Although they saw the cartoon as a symbol of a real species, half of the 1-3rd graders who saw both educational experiences had difficulty

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deciding whether Kurt kingfisher was a cartoon or a real bird. They could choose between person and bird (selecting bird), and person and cartoon (choosing cartoon), but they could not decide whether Kurt was a cartoon or a real bird. The difficulty was probably due to the fact that Kurt was clearly a cartoon yet he also represented a real bird to them. In fact, 1 or 2 students in each group (F+NH and F) did state that he was both. The F students had not seen the NH video and may not have known that a kingfisher was actually a real bird; thus only a few (11.6%) were able to answer that Kurt was a real bird. An alternate explanation for both groups' difficulty was that perhaps subjects were not sure what the interviewer wanted--what her frame of reference was.

The F+NH children's decision that Kurt was a real bird was probably based on Dorr's (1983) third criteria of something being "real" on television--an object or event is real because it happened to the viewer or his or her acquaintances. Hence, Kurt was a real bird because they had seen actual photographs of kingfishers (or the bird he represented) in the NH video. F subjects lacked this information, so those who stated that Kurt was real were probably already familiar with kingfishers, or used Dorr's "deemed possible" criteria--i.e., although an object or event is made-up, it is possible. It seems unlikely that any of these 1-3rd graders used Dorr's first criteria of reality--an object is real because it exists exactly as is even without TV. They saw the characters as depicting the real species, not as simply cartoon characters in a story. If true, this supposition does not agree with Dorr's (1983) proposal that children at this age use primarily the first criteria of reality, existing exactly as is without TV. Not until 3rd grade do they equate reality with "possible", and only adolescents and adults define "real" on TV as something probable or representative. These youngsters appeared to equate reality with both "possible" and "probable".

The F+NH students' difficulty in deciding whether Kurt was a cartoon or a real bird may also help explain the findings of Quarfoth

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(1979). Her work on children's perceptions of human, cartoon and puppet television characters suggested that 3-4th graders and older children became animistic when queried about the characteristics and existence of cartoons. Perhaps they were not being animistic--i.e., seeing them as alive--but simply trying to blend the confusing information that a cartoon is not tangible outside of the television set, yet it symbolizes something that is real in the world. Consequently, their attempt may surface as animistic thinking.

The interviews revealed that 1-3rd graders were very anthropomorphic in their perceptions of these 3 wildlife species, even those in the NH group who did not see the F educational experience. About 72% of the NH students responded anthropomorphically when asked if a wild kingfisher would help a wild shrew. Most of the subjects in all 3 interview groups gave anthropomorphic answers when asked if Kurt or the students themselves would help Stu. These findings support past work. Pomerantz (1977), LaHart (1978), Bowd (1984), and Westervelt and Llewellyn (1985) found that children have strong anthropomorphic or personification tendencies despite their knowledge of wildlife. Kellert and Westervelt (1983) reported that their subjects interpreted ecological processes in anthropomorphic terms. High school students in Jungwirth (1979) and Bartov's (1981) study used anthropomorphic explanations for biological processes. Ramsey (1989) believed that 1-3rd graders give anthropomorphic answers because they associate some degree of anthropomorphism with certain animals.

A high proportion of these 1-3rd graders watched syndicated television cartoons at home. This percentage concurs with past work on children's television viewing habits (Lyle and Hoffman 1972, Liebert and Schwartzberg 1977, Forge and Phemister 1987, Huston et al. 1987). Further, animal cartoons comprised the majority of subjects' favorite cartoons, which agrees with Sebastian and Borton (1982) who found that children preferred animal characters that acted like humans over human characters.

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Although the majority watched TV cartoons at home because they were fun or funny, or they did not have anything else to do, these 1-3rd graders expected to learn from them--especially if the program had a lesson or moral in it. Potter (1988) found that certain TV viewing motives seemed to consistently correspond to higher perceptions of reality: to learn about things or information, and to become aroused. Thus, if these children expected to learn from these cartoons, the first motive, they may have perceived them as reality. This scenario would support the warnings of Bryan and Jansson (1973) and More (1978). They believed that vicarious wildlife experiences, like watching cartoons or reading children's stories, often generate inaccuracies and misconceptions about real animals because they often contain completely unscientific information (More 1977). This study's findings that subjects readily accepted the unscientific cartoons as reality support their belief. Using Potter's (1988) components of perceived reality, subjects' perceptions could be either semantic reality (believing in the reality of the message's meaning), or social expectation/perceived utility reality (how applicable TV lessons are to a viewer's own life). The various morals or lessons described by the subjects (Appendix I) illustrate these 2 components.

The children not only expected to learn from cartoons, but they willingly accepted the presented moral as well. This was inferred by the majority of the subjects reciting a lesson they had learned or stating that there was a lesson to be learned from most TV cartoons. Snow (1974) and Dorr (1983) proposed that animation signals to children that program content is fantasy, but these findings suggest that the youngsters may still expect and accept a lesson presented in a show. If so, children's future behaviors related to the lesson or moral may be modified. This idea is consistent with Forge and Phemister (1987) who reported that prosocial cartoons influenced young children's behavior.

Subjects also expected to learn from cartoons watched at school, probably because the setting is educational. Thus even though animation

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may signal to children that program content is fantasy (Snow 1974, Dorr 1983), other factors such as the setting may influence their expectations and acceptance of the information. For example, Salomon (1983) studied the amount of mental effort invested by inner city minority children watching *Sesame Street*. He found an increase in their investment when the children's mothers watched alongside them. Salomon hypothesized that the mothers' presence led the youngsters to perceive the program as more demanding or "serious" and warranting greater attention and effort to learn.

6-8th Grade

Most of the findings for the older subjects were similar to those for the 1-3rd graders. The 6-8th graders also saw the cartoon characters as depicting the real animals. When asked if Max could be seen in the woods, or if they themselves would help Stu in the forest fire, the majority of both the F and F+NH groups responded as if the character represented the actual species. Exposure to the NH educational experience did not appear to influence their frame of reference.

Even at 12-14 years of age, many of these children still showed anthropomorphic tendencies. These findings are consistent with past research that found anthropomorphism in older children, e.g., Jungwirth (1979) and Bartov (1981) with high school students. However, seeing the NH educational experience may have curbed the 6-8th graders' anthropomorphism slightly. When asked if Kurt would help Stu, the F+NH students provided more ecological and fewer anthropomorphic responses than the F subjects. Responding to the question "Would a wild kingfisher help a wild shrew?" F students provided the most anthropomorphic responses, followed by F+NH subjects, and then NH subjects. The NH group had the highest percentage of ecological justifications to this question, and the F students had the least. The F+NH subjects were intermediate between the 2 groups.

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As with the 1-3rd graders, the older subjects were divided when presented with identifying Kurt as a cartoon or a real bird. However, seeing the NH video seemed to give them a different frame of reference. About 21% of the F+NH group stated that Kurt was both a cartoon and a real bird, while only 7.1% of the F subjects responded this way. Perhaps the latter were not sure whether the bird that Kurt represented was an actual wild species or simply an invented one. Or, possibly, both groups did not understand what the interviewer's frame of reference was, i.e., what she wanted.

This age group still watched syndicated TV cartoons at home, and, like the 1-3rd graders, their favorite cartoon programs contained animals, the characters were symbols of whatever they were intended to represent, and the subjects watched cartoons because the programs were funny or fun, or there was nothing else to do. The majority believed that people are supposed to learn from cartoons viewed at home, especially from shows that contain a lesson or moral. They also readily accepted the lessons of the cartoons, since 72% either described a lesson they had learned from a past TV cartoon, or explained that cartoons contain morals people are supposed to learn when they watch them. The 6-8th graders also believed that people are supposed to learn from cartoons viewed at school. Thus, even at this age (12-14 years old), cartoons can impact youngsters' perceptions of animals, the environment and other subjects presented in these programs.

Gender Differences

Activities & Knowledge Survey

Findings support past research comparing male and female participation in wildlife-related activities. Males had higher participation in all activities except for involvement in a wildlife-related club for the 6-8th graders. For both age groups, more males were involved in consumptive activities than were females. Male

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subjects were also more knowledgeable about the ranges of the wildlife species, except for the most familiar species--deer. Higher wildlife knowledge in males agrees with past studies (Richmond and Morgan 1977; Kellert and Berry 1980, 1984; Kellert and Westervelt 1983, Westervelt and Llewellyn 1985).

Natural History and Cartoon Surveys

Overall, there appeared to be no gender difference for the effects of an anthropomorphic wildlife cartoon on 1-3rd and 6-8th graders' attribution of physical, anthropomorphic and moral attributes to real animals. Dwyer (1967), Katzman and Nyenhuis (1972) and Hurt (1987) support this finding; they found no sex differences in their learning tasks involving pictorial material.

However, a few patterns appeared that may support other past research. Hogan (1980) reported that female subjects projected more human emotions onto non-humans than did men. The present study found that when gender differences occurred in the 6-8th graders, males had lower Anthropomorphic and Moral Attributes scores and higher Physical scores. The females consistently greater concern about the right and wrong treatment of wildlife concurs with past research by Pomerantz (1977), Kellert and Berry (1980, 1984), Kellert and Westervelt (1983), and Westervelt and Llewellyn (1983).

Interviews

No gender differences appeared in the interviews. This agrees with Hogan (1980) and the results for the NH and C Surveys. The overall lack of a gender difference when processing an anthropomorphic wildlife cartoon appears consistent with past animism studies. Animism does not depend on gender (Mikulak 1970, Fu and Billingham 1980, Wolfinger 1982).

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Age Differences

Overall, the 2 age groups did not differ much in the nature of their final responses to the anthropomorphic wildlife cartoon experience. One important difference that appeared was the weaker anthropomorphic tendencies in the 6-8th graders. This was seen in their interview responses plus the strength of effect for the anthropomorphic information in the 2 videos; eta^2 was weaker for the older group than for the younger. Most of the differences related to exogenous variables in the theoretical models. For example, the 6-8th graders knew more about Michigan wildlife than the younger students. This most likely occurred because they have had more opportunities to learn about the environment. Second, there were more gender differences with the older age group than the younger. Again, this was probably due to the older students having more opportunities for consumptive activities, and males tending to participate in such behaviors more than females.

Another difference was the number of cartoon character names recalled during the interviews. The older subjects remembered more of the characters' names than did the 1-3rd graders. They also correctly associated the characters with the 3 species, a relationship not understood by the younger children. Perhaps the older ones had better listening skills to pick up the characters' names in the introduction of the F video, or they just assumed the association between the characters and animals when confronted with the 3 species on the surveys.

Another interesting finding was that the 1-3rd graders' concern for the humane treatment of animals increased after they took an NH or C Survey (the "test effect"), while the 6-8th graders' interest remained the same, i.e., high, regardless of the number of tests answered. The developmental characteristic of the subjects' responses to moral questions about wildlife (i.e., children's moral orientations towards the environment stabilizing with increasing age) agrees with past research and theories (Pomerantz 1986a).

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Path Analysis

The original theoretical model failed for both age groups. Alternative models were created and tested, but failed also. Thus, only a few general conclusions may be drawn from this analysis. First, the NH and F educational experiences affected children's attribution of only the physical and anthropomorphic characteristics to real animals. The relationship between which video and the Physical Attributes score was very strong (uncorrected: 1-3rd = -0.88, 6-8th = -0.86), and, considering measurement and sampling error, it is doubtful that any other variable strongly intercedes these 2 factors.

The impact of the videos on the Anthropomorphic Attributes score was also great (uncorrected: 1-3rd = 0.55, 6-8th = 0.60). The smaller correlation may suggest an intervening variable in this relationship. Results from the orthogonal contrasts support this. The Total Sum of Squares (SS) for the 1-3rd grade analysis was 2404.00, while the SS for the effect was only 706.70. Thus, the effect explained only a small portion of the change of Anthropomorphic Attributes scores. The same trend appeared with the older age group: SS_T = 35799.34, $SS_{contrast}$ = 5538.70.

Second, a spurious relationship appears to exist between the Physical Attributes and Anthropomorphic Attributes scores with their unpredicted high correlation (uncorrected: 1-3rd = -0.52, 6-8th = -0.58.) Perhaps the confounding variable is the process by which a child integrates his or her physical knowledge of an animal with his or her anthropomorphic tendencies. This same variable could also be the intervening factor between the videos and the Anthropomorphic Attributes score. The negative sign denotes that the greater one's knowledge of mental or physical properties of a species, the weaker one's anthropomorphic tendencies. This is consistent with Inagaki's (1989) conclusion on the role of biological knowledge when individuals try to predict the nature of things. He proposed that anthropomorphism of

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mental properties (feelings and emotions) will decrease as subjects realize that properties of thinking, feeling and sensation are closely associated with the brain. The results from confirmatory factor analysis of the final Anthropomorphic Attributes measurement model support this. The factor loadings and communalities for the items related to feelings and emotions (i.e., whether a shrew hates, a marten feels happy, or a marten feels lonely) differed from those for thinking-type questions--e.g., a kingfisher thinks about getting old, a kingfisher makes plans. Those for the "emotion" items were lower. The lower correlations could have been due to the fact that these items were affected by whether or not the individuals closely associated these mental properties with the brain.

Third, subjects' attribution of moral characteristics to real animals did not depend on the educational experiences, but gender. This is supported by the results from the orthogonal contrasts and eta^2 which suggested that the strength of effect of the Moral Attributes information was very weak. Although a relationship existed between Gender and Moral Attributes, the correlation was low (uncorrected: 1-3rd = -0.21, 6-8th = -0.27)--suggesting intervening variables not measured in this study. Perhaps one of the confounding factors was a student's pretreatment moral value system; it would affect an individual's concern for the right and wrong treatment of animals.

In the first 2 models, a direct path was predicted between Gender and Past Direct Contact with Wildlife. The analysis revealed that this path coefficient was much lower than 1.0; thus intermediate variables must exist in this relationship. Perhaps family structure, an urban or rural background, the existence and influence of a mentor, or something else facilitates male and female past direct contact with wildlife.

Another direct path predicted in 2 models was between Past Direct Contact with Wildlife and Knowledge of Michigan Wildlife. Again, the correlation was much lower than 1.0, suggesting an intervening variable(s). Several studies have found that wildlife TV show watchers

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scored higher on wildlife knowledge questions than non-watchers (Richmond and Morgan 1977, LaHart 1978, Westervelt and Llewellyn 1985). Pomerantz and Hair (1988) reported that regular readers of a children's conservation education magazine were more knowledgeable about wildlife and ecological concepts than non-readers. Thus, one of the intervening variables could be related to consumption of wildlife TV or magazine material. Other possible factors are an individual's residential location or recreational occupation as suggested by work of Bryan and Jansson (1973) and Dahlgren et al. (1977).

Summary

The major findings of this study follow.

1. Children of both age groups (1-3rd and 6-8th grade) were willing to accept both accurate and erroneous information regarding physical characteristics of the cartooned wildlife as reality. No variable seemed to mediate this relationship between the Physical Attributes information in the videos and their attribution of physical characteristics to real wildlife.

2. Viewing the NH educational experience containing accurate Physical Attributes information failed to totally prevent or reverse the influence of the F experience for both age groups.

3. A "test effect" occurred with both age groups--i.e., taking the survey after watching the NH video reinforced its content. Thus, perceptions of the physical attributes of the animals were less affected by the subsequent cartoon experience.

4. For both age groups, an "order effect" appeared for the Physical Attributes information. The last video presented had the greater effect on subject response.

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5. The Physical Attributes information in the NH video had a stronger impact on both age groups' perceptions than the contrasting information in the F educational experience. The strength of this effect in both videos was strong.

6. The impact of the Anthropomorphic Attributes information in both educational experiences was not very strong. Yet, for both age groups the NH video did have a stronger effect than the F presentation. It could not fully counteract the anthropomorphic influence of the cartoon, however, for both age groups attributed more anthropomorphic characteristics to the real animals after viewing the F educational experience.

7. Pretest results showed strong anthropomorphic tendencies in both age groups. The 6-8th graders were less anthropomorphic than the 1-3rd graders, before and after viewing either educational experience.

8. A test effect appeared for the Anthropomorphic Attributes information in both age groups. Subjects taking a test after the NH video had lower anthropomorphic scores than students seeing both videos with no intermediate survey.

9. There was an order effect for the Anthropomorphic Attributes information for both age groups; the last video viewed had the greater impact on the children's Anthropomorphic scores.

10. An age difference appeared for the effects of the anthropomorphic cartoon experience on the students' ascription of moral attributes to real wildlife.

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11. The cartoon experience did not affect the 1-3rd graders' concern for the right and wrong treatment of animals.

12. A test effect occurred with the 1-3rd graders' ascription of moral attributes to real wildlife. Subjects taking the survey more than once had higher Moral scores (expressed more concern for humane or moral treatment of an animal).

13. The impact of the moral rights/welfare influence in both the F and NH 1-3rd grade educational experiences was about equal and quite weak.

14. There was no treatment, test or order effect for the Moral Attributes factor for 6-8th graders.

15. Pretest results showed that the 6-8th graders were highly concerned about the right and wrong treatment of animals.

16. Both the 1-3rd and 6-8th graders scored higher on anthropomorphic items reflecting emotion and feeling than on those describing thinking. This may partially be due to the fact that children are more anthropomorphic with human mental characteristics usually weakly associated with the brain--i.e., emotions and feelings.

17. Children in both age groups considered Moral Attributes items about killing to be wrong. Subjects tended to be more accepting of actions that benefitted humans and/or did not require sacrificing the animal.

18. None of the wildlife-related activities measured in this study seemed to influence either age groups' response to anthropomorphic wildlife cartoons. However, a few relationships were apparent.

a. Most of the 1-3rd graders who had visited a zoo in the past year had higher Anthropomorphic scores, possibly reflecting an urban influence.

b. Students in both age groups that were more knowledgeable about Michigan wildlife tended to be less affected by the distorted Physical Attributes information in the F video.

19. Both 1-3rd and 6-8th graders appeared to perceive the cartoon characters as depictions of the real species.

20. Both groups regularly watched television cartoons at home.

21. The 1-3rd and 6-8th graders watched cartoons at home because they were funny or fun, or the children had nothing else to do.

22. Both age groups' favorite TV cartoons featured animals.

23. Subjects in both age groups expected to learn from watching cartoons at home--especially if the program had a moral in it.

24. The 1-3rd and 6-8th graders reported that they expected to learn a lesson or moral in TV cartoons.

25. Both age groups expected to learn from cartoons watched at school.

26. Males had higher participation in almost all of the wildlife-related activities measured, especially consumptive ones.

27. Males were more knowledgeable about which wildlife species live wild in Michigan.

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28. In general, gender did not influence how subjects in either age group were affected by an anthropomorphic wildlife cartoon, specifically subject ascription of physical, anthropomorphic and moral attributes to real animals.

29. The 6-8th grade females had consistently higher Moral scores; they were more concerned about the humane or moral treatment of wildlife.

30. More gender differences with the wildlife-related activities appeared with the 6-8th graders than with the younger age group.

31. A spurious relationship appeared to exist between the Physical and Anthropomorphic Attributes factors. The confounding variable may be the process by which a child integrates his or her physical knowledge of an animal with his or her anthropomorphic tendencies.

32. This confounding variable may also intervene the effects of the educational experiences' anthropomorphic information and subjects' attribution of anthropomorphic characteristics to real wildlife.

33. Subjects attribution of moral characteristics to real animals did not depend on the educational experiences, but gender. However, this relationship is confounded by other variables not measured in the study, e.g., an individual's pretreatment moral value system.

The research null hypotheses were interpreted as follows.

H_{o1}. Regardless of which wildlife educational experience an individual views, he or she will perceive it as depicting real wildlife. That is, there is no difference between the effects of an educational experience containing realistic photographs and one

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using anthropomorphic cartoons on an individual's perception of whether that experience portrays real wildlife.

H_{o2}: There is no difference between the 2 age groups' perception of a wildlife educational experience. Both perceive it as depicting real wildlife.

These hypotheses were not rejected since the interviews showed that both age groups saw the cartoon characters as depicting real wildlife. Further, both age groups were influenced by the inaccurate physical information and the anthropomorphic characteristics of the cartooned wildlife.

H_{o3}. Regardless of how much past direct contact with wildlife an individual has experienced, he or she will perceive a wildlife educational experience as depicting real wildlife. That is, there is no difference between the perception of an individual having high past direct contact with wildlife and an individual experiencing low past direct contact.

Results suggested that the wildlife-related activities had no impact on both age groups' attribution of physical, anthropomorphic and moral characteristics to real wildlife. Thus, this hypothesis was not rejected.

H_{o4}. There is no difference between males and females in their perception of the educational experience. Both sexes will perceive it as depicting real wildlife.

No strong gender difference appeared in how the anthropomorphic wildlife cartoon affected subjects' perceptions of real wildlife. Hence, this hypothesis was not rejected.

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H_{o5}. There is no difference between the 2 age groups (1-3rd and 6-8th) in the amount of their past direct contact with wildlife.

This hypothesis was not specifically tested by this study because the factor Past Direct Contact with Wildlife was modified, and no combined score for both age groups was generated.

H_{o6}. There is no difference between the sexes in the amount of their past direct contact with wildlife.

Males in both age groups participated in more wildlife-related activities than did females. They also were more involved in more consumptive behaviors. If one assumes that greater participation in these activities leads to greater past direct contact with wildlife, then this hypothesis can be rejected.

H_{o7}. There is no difference between an individual who perceives the educational experience as depicting real wildlife and one who does not in their ascription of the physical attributes presented in the educational experience to real wildlife.

This hypothesis was not statistically tested, but evidence from the interviews suggest its rejection since the majority of subjects perceived the educational experiences as depicting real wildlife.

H_{o8}. There is no difference between an individual who perceives the educational experience as depicting real wildlife and one who does not in their ascription of any anthropomorphic attributes in the educational experience to real wildlife.

Although this hypothesis was not statistically tested, interview results suggested that most of the subjects perceived the educational experiences as depicting real wildlife; thus the hypothesis was rejected.

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H_{09}. There is no difference between an individual who perceives the educational experience as depicting real wildlife and one who does not in their ascription of moral attributes to real wildlife.

This hypothesis was not statistically tested, but evidence suggest its rejection since the educational experiences did not appear to affect children's ascription of moral attributes to real wildlife.

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WILDLIFE MANAGEMENT IMPLICATIONS

This study has many implications for wildlife management. It provides strong evidence that children are susceptible to erroneous information and anthropomorphic messages conveyed unintentionally or incidentally through cartoons--a medium commonly used by conservation organizations and preservationist groups.

First, if designers of conservation education material wish to incorporate anthropomorphic wildlife cartoons for their appeal and effectiveness, they should do so only for that reason--i.e., to stimulate interest. They should avoid using cartoons to represent actual species because children up to at least 14 years of age will likely perceive the characters as depicting real animals and transfer any fallacious information to the species.

Designers should also choose cartoon characters that are very anthropomorphic or human-like, not closely resembling the representative species. Cartoons such as Mickey Mouse or Woody Woodpecker illustrate this level of anthropomorphism; they are actually humans "in fur". Semi-anthropomorphic characters--e.g., Bambi--should be avoided because their more realistic appearance will more likely encourage children to see them as representing real wildlife and take any of their human-like qualities as reality.

Because information from the NH video corrected some of the misconceptions fostered by the cartoon video, all conservation education experiences involving anthropomorphic cartoons should also include realistic information about the presented species. There should always be a balance of realism and fantasy to counter any fallacies prompted by the cartoon.

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use them with caution. They should review the material for any inaccuracies and balance them with realistic, accurate information. This is very important. Since children see the cartoon as representing the real animal, and pictures are highly memorable (Fleming 1979, Bogue 1982), children will learn and accept a cartoon's information until truth replaces it.

The finding that children expect and accept morals or lessons of syndicated TV cartoon exposes the possible impacts of anti-hunting and anti-trapping cartoons such as *Seabert the Seal*. Past *Seabert* episodes contained definite morals or lessons usually detrimental to wildlife management--e.g., "Many wild animals are disappearing from the earth because man is hunting them and destroying their natural habitats", "I was a fool. I didn't know. I thought animals were useless; that they were idiots, but they are kinder than humans." Further, concepts presented in these cartoons were erroneous, e.g., "Once upon a time civilized man and beasts of the wild lived together in harmony, neither threatening the other's future existence." If children accept and integrate such information and values into their value and belief systems, they will most likely develop biased and inaccurate views of wildlife ecology, behavior and management, and misconceptions about the role of consumptive activities. Misinformed and biased future citizens will not be able to effectively respond to the ever increasing challenges and complexities of present and future resource management.

Other cartoons containing animals may also influence children's perceptions of wildlife, even if their lessons or morals are unrelated to animals. For example, one subject mentioned that *Dink the Dinosaur* "teaches people about dinosaurs". Another stated that from *Looney Tunes* he learned that "dogs don't like cats". Ecology and animal behavior are most likely not the main focus of these cartoons. Yet, the children accepted this "peripheral" information as reality.

The finding that youngsters expect and accept morals in cartoons also suggests that natural resource educators should provide morals in

their own cartoon presentations. Furthermore, these lessons should accurately present information and values. If morals or lessons are not given, children may formulate their own, and their conclusions will be based on information given in the cartoon--factual or not.

Pomerantz (1977), Richmond and Morgan (1977) and Gilbert (1982) proposed that TV may be the greatest influence on children's attitudes toward wildlife. This study supports their supposition. Cartoons were still a part of the children's TV-viewing habits even at 14 years of age. Further, their favorite cartoons included animals characters, children considered the cartoon characters as depicting real species, and they expected and readily accepted the morals presented in the programs. These findings, plus the growing popularity of videos, computers and other forms of visual media in our society, hold important implications for wildlife managers and conservation educators. Professionals must be aware of what is being taught through television and other media, and seriously consider how they are shaping public attitudes and perceptions of wildlife and its management. Cartoons like *Seabert the Seal* stress the humanistic and moralistic values of wildlife, and encourage individual action. Managers and educators must provide realistic information on populations and species to balance these concerns, so that motivated citizens have a full understanding of ecological principles and relationships when working through value choices.

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LIMITATIONS OF STUDY

Measurement Models

Confirmatory Factor Analysis of the Anthropomorphic and Moral Attributes measurement models revealed that the Moral Attributes scale for both age groups had "higher" construct validity than the Anthropomorphic models. All the validity tests suggested that its items were better measures of the Moral Attributes factors than the questions for the Anthropomorphic Attributes construct. However, the low factor loadings and communalities of both models implied that measurement can be improved. Perhaps the low correlations with the Anthropomorphic items were partly due to combining both thinking and feeling/emotional mental properties on the same factor. If the subjects did not know the mental capacities of the animals and thus strongly associated thinking with the brain while weakly connecting emotions, their responses for the feeling-related items would likely be more anthropomorphic. This intervening process involving knowledge of an animals' mental capacities would generate lower factor loadings and communalities for all the Anthropomorphic questions because the items would not all load on the same construct. Construct validity would also be less acceptable as a result.

The Moral Attributes model for the 6-8th graders had higher validity than the one for the 1-3rd graders. Part of this was due to the greater number of items on the older age group's model and more anchor points on their Likert and Semantic Differential scales.

Confirmatory factor analysis suggested that 1 item, "If a kingfisher met a squirrel in the woods it would be shy and fly away from the squirrel", was poor. Face validity supported this because subjects

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might have interpreted shy in more than one way: as bashful, or as fearful of something. Thus, the kingfisher could be shy of the squirrel and fly away because it was afraid of it--a perspective not necessarily anthropomorphic. Or, the kingfisher could be shy and flee because it was bashful, which is a more anthropomorphic response. Either interpretation could have occurred with this question.

The measurement model for Past Direct Contact with Wildlife needs modification. Creation of new, more sensitive and/or additional items is necessary to measure the factor as originally proposed, or to discern whether subfactors exist.

Finally, the general validity concerns about Likert and Semantic Differential Scales apply to these instruments. First, because the Anthropomorphic and Moral Attributes scales are bounded on both ends, subjects are prevented from giving answers outside the provided range. Thus, the full range of the subjects' responses may not be represented.

Second, the scales also imply that their endpoints (adjectives or agreement statements) are polar opposites. This assumption impedes discover of whether or not such a polarity actually exists.

Third, providing only 3 or 5 levels between the endpoints promotes a "lumpiness problem"--i.e., 5 categories imply that only 5 types of people exist in the population in relation to the construct. In addition, we cannot tell how "lumpy" the population truly is.

Fourth, assuming that all like responses are equal jeopardizes content validity. A "Strongly disagree" toward the concept that a marten knows the difference between right and wrong is not necessarily equivalent to a "Strongly disagree" toward the idea that shrews are picky eaters. Further, a "Strongly disagree" for 1 subject was assumed equivalent to a "Strongly disagree" for another since individual scores were totaled to provide various group scores. The validity of this assumption is also questionable. These problems are inherent in most Likert and semantic differential scales and not easily solvable.

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Educational Experiences

Although the language in the educational experiences was assumed appropriate for each age group, some of the 6-8th grade children (or their teachers) commented that the F video was "too childish". The language, story or appearance of the characters could have resulted in such opinions, and future research should consider these variables--making sure that they fit the age group. If they do not, the full effects of an anthropomorphic cartoon might not be revealed because the students did not enjoy or were bored with the presentation. Further, both age groups expected the cartoons to "move" or be animated because they were in a video format. Budget limitations prevented such media sophistication.

Overall, the majority of the teachers provided very positive comments about the educational experiences and the experimental process. Several of them used the material beyond their intended use, e.g., incorporating the cartoon characters in art projects or other environmental education activities after the data were collected.

Testing Procedure

The timing of the testing procedure may have affected children's expectations of the F educational experience. Teachers began the experiment within in a month or two of Earth Day 1990, an event that brought much attention to the environment. Thus, the children were probably more interested in environmental issues and concepts at this time, and their expectations of the accuracy of the cartoon video may have been higher than at other times of the year. However, even if the children expected to learn from the F educational experience because of the Earth Day hype, subjects who saw the conflicting NH and F educational experiences would still have to make a decision on which video represented reality. Findings suggest that many youngsters

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accepted the physical and anthropomorphic attributes of the cartoon.

Path Analysis

Measurement error existed in all variables even though the reliabilities were good. If measurement error occurs in any intervening variable, a "poor" model may look like it fits the data, or a "good" model may appear to fail. Thus, future studies need to attempt to correct measurement error and improve reliabilities. Also, because these models had >1 independent variable, interactions amongst the factors may exist. To gain a clearer understanding of the effects of children's responses to anthropomorphic wildlife cartoons, future studies need to test more complex models, incorporating interactions and other variables not measured in this study--e.g., an individual's moral value system, family structure, knowledge of wildlife behavior and physical or mental characteristics, etc.

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FUTURE RESEARCH

This study provides strong evidence that children are susceptible to erroneous information and anthropomorphic messages conveyed unintentionally or incidentally through cartoons. The full extent of these influences remains to be determined and provides many opportunities for future research.

1. Since this study used still cartoons, the consequences of enhancing cartoon images through animation or other means need to be established. Animism research showed that movement greatly affects how children process and perceive visual presentations.

2. Use of cartoons in various ways may influence how children respond. For example, do cartoon characters used to narrate an otherwise realistic educational message have undesired effects on student perceptions of animals? Or, do cartoon educational experiences not intending to increase anthropomorphism or moralistic attitudes--e.g., solely have ecological messages--increase the anthropomorphic tendencies in the viewers, or their moralistic concern for animals?

3. This study measured influences of cartoons in an educational setting. Are children still influenced by anthropomorphic cartoons that are clearly recreational or for entertainment?

4. The moral attributes defined in this study should be refined and researched to explore differences in animal welfare vs animal rights concerns.

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5. Given the results of this study, it appears useful to assess the extent of public exposure to and full impacts of selected popular cartoon features which may impact public attitudes regarding wildlife and wildlife management (e.g., *Seabert the Seal, Smokey Bear, Ranger Rick, Captain Planet*). Possible opportunities to intercept or counter such information should be investigated, and appropriate material provided.

6. Many issues in all 3 components of learning from a visual (Bogue 1982)--nature of the presentation, nature of learner, and nature of learning task--need to be addressed in future research as a result of this study. For the nature of presentation component, past research contains very little, if any, guidelines for designing cartoons for older children. Because visual literacy is developmental and these children have different expectations of media, principles for production are needed for this age level.

7. Another issue that warrants investigation is the relationship between the degree of abstraction in a picture and communication of its intended message. For example, when do children not see the cartoon character as a symbol of the real animal because it is too abstract? This issue is important in general education and conservation education as our society becomes more media- and visually-oriented and dependent.

8. Since learner cognitive styles and visual literacy both affect how individuals process visuals, researchers need to discover ways to validly and reliably measure these processes. Further, identifying criteria for when these concepts need to be addressed to ensure valid interpretation of results is critical.

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9. Past research on the nature of the learning task explains that one must match the learning task with the learner's cognitive style. Universal definitions of global and linear tasks are needed so curriculum developers and media specialists have guidelines to design more effective educational material.

10. More theoretical models on the effects of anthropomorphic wildlife cartoons on children's perceptions of real wildlife need to be proposed and tested. Because this was a pioneer study, many of the variables possibly influencing the process were unknown and/or could not be addressed in a model. Future studies should incorporate possible confounds to better understand the variables and relationships involved when children are exposed to anthropomorphic wildlife cartoons.

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APPENDICES

APPENDIX A

Project Approval by University Committee on Research Involving Human Subjects (UCRIHS)

MICHIGAN STATE UNIVERSITY

UNIVERSITY COMMITTEE ON RESEARCH INVOLVING
HUMAN SUBJECTS (UCRIHS)
206 BERKEY HALL
(517) 353-9738

EAST LANSING • MICHIGAN • 48824-1111

February 13, 1990 **IRB# 89-098**

R. Ben Peyton
Fisheries and Wildlife
Natural Resources Bldg.

Dear Dr. Peyton:

RE: "THE EFFECTS OF CHILDREN'S PERCEPTIONS OF WILDLIFE AND THEIR USE OF ENVIRONMENTAL EDUCATION MATERIAL **IRB# 89-098**"

The above project is exempt from full UCRIHS review. I have reviewed the proposed research protocol and find that the rights and welfare of human subjects appear to be protected. You have approval to conduct the research.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval one month prior to February 13, 1991.

Any changes in procedures involving human subjects must be reviewed by UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to our attention. If we can be of any future help, please do not hesitate to let us know.

Sincerely,

Daniel A. Bronstein, S.J.D.
Vice Chair, UCRIHS

JKH/sar

MSU is an Affirmative Action/Equal Opportunity Institution

APPENDIX B

Final Scripts for Natural History and Fantasy Educational Experiences

NATURAL HISTORY SCRIPT
1-3rd grade

VIDEO	AUDIO
FADE TO CHYRON: "Three you don't always see - Part I"	(MUSIC IN) (MUSIC OUT)
CUT TO CAM 1: Slide #1 - Michigan woods and lake	"Michigan is full of wildlife. The forests, meadows, river banks, lake shores, and ponds hold all sorts of interesting wild animals."
CAM 2: Slide #2 - Deer	"When driving or hiking anywhere in Michigan, you might see deer,"
CAM 1: Slide #3 - Raccoon	"raccoon,"
CAM 2: Slide #4 - Ducks	"and ducks and geese."
CAM 1: Slide #5 - Porcupine	"If you're in northern Michigan, you may see a porcupine."
CAM 2: Slide #6 - Marten walking up log	"Although it is easy to see wildlife in Michigan, there are some wild animals that people almost never see. One of these wild animals is the marten. The marten is an animal, about the size of a squirrel, that lives in pine forests in Michigan."
CAM 1: Slide #7 - Marten on snowy log	"It is mostly brown with light orange fur on its throat and chest."
CAM 2: Slide #8 - Marten high up in branches	"The marten is a great climber. It spends much of its time climbing around in tall pine trees. Martens even sleep and build their nests in hollow trees, stumps and logs."
CAM 1: Slide #9 - Marten in snow	"Although martens spend most of their time in trees, they hunt on the ground. Martens usually look for food at night and in the dim light of morning and early evening."
CAM 2: Slide #10 - Mouse	"Martens mainly eat mice, squirrels, rabbits, and other small animals. Sometimes they eat insects, birds, fruit, and nuts."

CAM 1: Slide #11 - Marten climbing up trunk	"A marten hunts, eats and sleeps alone. It does almost everything by itself."
CAM 2: Slide #12 - Marten running across snow	"When one marten meets another marten, it usually chases it away."
CAM 1: Slide #13 - Baby marten	"The only time a marten spends time with another marten is when they have baby martens."
CAM 2: Slide #14 - Red pine trees	"Let's go over what we've learned about martens. The marten lives in large pine forests in Michigan."
CAM 1: Slide #15 - Marten on pine branch	"The marten is a great climber. It spends most of its time climbing around in tall pine trees."
CAM 2: Slide #16 - Marten in hole in snow	"The marten does most things alone. You will not find martens together in a group."
	(MUSIC IN & UNDER)
CUT TO CAM 1: Slide #17 - Lake Michigan coast	"Next time we'll look at another wild animal in Michigan that people may not know much about."
CHYRON: "End of Part I"	(MUSIC UP)
FADE TO BLACK	(MUSIC OUT)
CHYRON: "Three you don't always see - Part II"	(MUSIC IN)
	(FADE OUT MUSIC)
CUT TO CAM 2: Slide #18 - Marten on forest floor	"Last time we looked at the marten, an animal that lives in Michigan's pine forests."
CAM 1: Slide #19 - Marten next to tree trunk	"Remember that the marten is an excellent climber. It spends most of its time climbing around in tall pine trees."
CAM 2: Slide #20 - Marten with teeth showing	"The marten does almost everything alone."
CAM 1: Slide #21 - Kingfisher by river	"Another wild animal in Michigan that people may not know much about is the kingfisher. This bird lives near water."
CAM 2: Slide #22 - Kingfisher's bushy crest	"The kingfisher is about the size of a pigeon. It has bluish grey feathers on its back, and white feathers on its throat and breast. The feathers on the top of its head stick up."

CAM 1:	**Slide #23 - Kingfisher with fish**	"Kingfishers live near rivers, ponds, lakes, and bays because kingfishers eat fish. That's probably why they are called "kingfishers". These birds are very good at catching and eating fish."
CAM 2:	**Slide #24 - Kingfisher in tree**	"Kingfishers will usually sit on a branch above the water and wait for a small fish to swim near them."
CAM 1:	**Slide #25 - Kingfisher diving into water**	"When it sees a fish, the kingfisher will dive headfirst into the water to catch it with its strong bill."
CAM 2:	**Slide #26 - Kingfisher pair with female vocalizing**	"Even if you don't see a kingfisher when you're near a river or lake, you will probably hear one. Kingfishers have a very loud call that sounds like a rattle."
		(KINGFISHER CALL)
CAM 1:	**Slide #27 - Female kingfisher on branch**	"Because kingfishers make a lot of noise with this "rattling call", they are easy to find. You can find a kingfisher by following its loud call."
		(KINGFISHER CALL)
CAM 2:	**Slide #28 - Pond in woods**	"Let's go over what we've learned about the kingfisher. The kingfisher is a bird that lives near water in Michigan."
CAM 1:	**Slide #29 - Kingfisher pair**	"The kingfisher makes a loud rattling noise."
		(KINGFISHER CALL)
CAM 2:	**Slide #30 - Kingfisher bringing fish to young**	"And the kingfisher eats fish."
		(MUSIC IN & UNDER)
CAM 1:	**Slide #31 - Log, leaves and mushrooms**	"Next time we'll look at a very small animal in Michigan that few people see."
CHYRON:	**"End of Part II"**	**(MUSIC UP)**
FADE TO BLACK		**(FADE OUT MUSIC)**

CHYRON: "Three you don't always see -Part III"		(MUSIC IN & UNDER) (FADE OUT MUSIC)
CUT TO CAM 2: Slide #32 - Female kingfisher		"Last time we learned about the kingfisher. The kingfisher is a bird that lives near water."
CAM 1:	Slide #33 - Kingfisher flying to nest	"The kingfisher eats fish."
CAM 2:	Slide #34 - Kingfisher pair with female vocalizing	"The kingfisher makes a lot of noise with its loud rattling call." (KINGFISHER CALL)
CAM 1:	Slide #35 - Overhead shot of shrew in dirt	"Another wild animal in Michigan that people don't often see is the shrew. People don't often see shrews because shrews are very small. Some shrews are smaller than mice."
CAM 2:	Slide #36 - Shrew next to stick	"Shrews are grayish brown and have long tails."
CAM 1:	Slide #37 - Close up of shrew with nose to ground	"Shrews' noses are long and pointed."
CAM 2:	Slide #38 - Meadow with creek	"Shrews can live in many places: brushy or grassy places near water,"
CAM 1:	Slide #39 - Log and ferns	"under leaves and logs on the forest floor,"
CAM 2:	Slide #40 - Open field	"and in open fields."
CAM 1:	Slide #41 - Termites	"In these areas shrews find their main foods--insects, spiders and worms."
CAM 2:	Slide #42 - Shrew with grub	"Shrews are almost always eating. They have huge appetites. If they are not sleeping, they are eating."
CAM 1:	Slide #43 - Shrew eating grasshopper	"Shrews look for food during the day and during the night. They eat insects all the time."
CAM 2:	Slide #44 - Shrew running through leaves	"Shrews are also very fast. They dart quickly under leaves and logs when looking for food. Shrews are always eating and moving."
CAM 1:	Slide #45 - Shrew next to log	"Let's go over what we've learned about shrews, kingfishers and martens. Shrews are tiny animals that eat insects and worms day and night. Shrews are always eating."
CAM 2:	Slide #46 - Shrew next to flowers	"Shrews are always moving, too. They are very fast."

CAM 1:	Slide #47 - Kingfisher on sloping branch with fish in bill	"The kingfisher lives near water and eats fish."
CAM 2:	Slide #48 - Kingfisher on post with dirt in bill	"Kingfishers make a lot of noise with their loud rattling call."
		(KINGFISHER CALL)
CAM 1:	Slide #49 - Marten in pine tree with dead squirrel	"The marten lives alone in pine forests. It eats mice and other small animals."
CAM 2:	Slide #50 - Marten running down tree trunk	"The marten is a good climber and spends most of its time in trees."
CAM 1:	Slide #51 - Shrew in pine needles	"The marten, kingfisher and shrew are only 3 of the many kinds of wild animals found in Michigan. Michigan has a lot of wildlife."
CAM 2:	Slide #52 - Children in woods	"The next time you're driving or hiking around Michigan think about all the wild animals around you--"
		"the ones you see,"
CAM 1:	Slide #53 - Wood duck pair	(MUSIC IN & UNDER)
CAM 2:	Slide #54 - Marten on log	"and the ones you don't see. Even if people don't see some types of wildlife, they are still important. All the different kinds of wildlife are important to keep nature working."
		(MUSIC UP)
FADE TO BLACK		(FADE OUT MUSIC)

FANTASY STORY SCRIPT
1-3rd grade

VIDEO	AUDIO
FADE TO TITLE: "Select Respect"	(MUSIC IN)
CUT TO CAM 1: FS VIS #1 - Kurt Kingfisher	VO: "This is the story of..." Kurt: "Kurt Kingfisher"
QUICK FADE TO/FROM BLACK TO CAM 2: VIS #2 - Kerry Kingfisher	Kerry: "Kerry Kingfisher"
QUICK FADE TO/FROM BLACK TO CAM 1: VIS #3 - Stu Shrew	Stu: "Stu Shrew"
QUICK FADE TO/FROM BLACK TO CAM 2: VIS #4 - Sandy Shrew	Sandy: "Sandy Shrew"
QUICK FADE TO/FROM BLACK TO CAM 1: VIS #5 - Max Marten	Max: "Max Marten"
QUICK FADE TO/FROM BLACK TO CAM 2: VIS #6 - Mindy Marten	Mindy: "Mindy Marten"
FADE TO BLACK	
FADE TO CAM 1: FS VIS #7 - Kurt and Kerry Kingfisher looking for fruits & nuts to eat	(MUSIC OUT)
DISSOLVE TO CAM 2: FS VIS #8 - Kurt and Kerry Kingfisher eating	Kerry: "Boy, I love these red berries. MMMmmmmm! What have you found, Kurt?"
	Kurt: "I'm eating some of these little brown nuts and dandelion stems. Wow! What a great lunch! We should come here to eat all the time!"
CUT TO CAM 1: FS VIS #9 - Kingfishers looking up and listening	Kerry: "Hey, what was that? Someone's coming."
	Kurt: "Quick! Hide!"
CUT TO CAM 2: FS VIS #10 - Kingfishers hiding behind bushes and trees	Stu: "Why here's some more of those delicious red berries."
PAN RIGHT & ZOOM INTO SHREWS	Sandy: "We can't eat too many of them, Stu. Remember, they're pretty fattening."
	Stu: "But they taste so good!"
	Sandy: "I'm just looking out for our waistlines, Stu. We've been eating a lot lately."

CUT TO CAM 1: VIS #11 CU OF KINGFISHERS	Stu:	"Hey, there's Kurt and Kerry. Hello there! Whatcha doing? Are you gathering some food, too?"
ZOOM OUT TO FS: ALL FOUR CHARACTERS	Sandy:	"Aw, come on out and talk with us. Don't be so shy. We won't bite. What are you doing?"
CUT TO CAM 2: VIS #12 CU OF KINGFISHERS	Kurt:	(quietly) "Yes, we're gathering nuts and berries, too."
ZOOM OUT TO FS: ALL FOUR CHARACTERS	Sandy:	"Boy, I can barely hear you, Kurt. You speak so softly. Did you try some of these red berries?"
	Kerry:	"Yes, we've been snacking on them all day. They're great."
CUT TO CAM 1: FS VIS #13 - Shrews	Sandy:	"All day?! Wow! You'd better be careful. Those berries are really fattening. It's not good to eat a lot of them."
	Stu:	"Yea, be careful. Remember that you gotta have a good diet and take care of your body. We do. We stay healthy and slim."
CUT TO CAM 2: FS VIS #14 - Shrews talking to kingfishers	Sandy:	"Hey, we've got lots of good food here to share. Why don't you have a picnic with us?"
	Kerry:	"Well..."
	Stu:	"Aw, c'mon. Don't be so shy! We'll have it RIGHT here. Bring the food over, Sandy!"
CUT TO CAM 1: FS VIS #15 - Kingfishers and shrews spreading picnic down on wildflowers	Kurt:	"Would you like to try some of these little brown nuts? They're delicious. We've got a whole bunch of them."
	Stu:	"Oh, no thanks. They're much too fattening. We're trying to cut down on fats in our diet."
	Sandy:	"Yea. We don't eat everything that comes along, you know."

CUT TO CAM 2: FS VIS #16 - Shrews and kingfishers throwing shells, peels, husks, and other waste all over the forest

Stu: "But these dandelion greens are sure great. Yum! Try some of these, Sandy!"

Sandy: "They <u>are</u> good. What fun this picnic is! And what a beautiful day."

Kerry: "Yes, and the woods are so quiet and peaceful."

CUT TO CAM 1: FS VIS #17 - Shrews jumping up and looking around and kingfishers flying into the trees

SFX: laughter, talking
Kurt: "Oh my gosh! What's all that noise! Hide, everybody!"

CUT TO CAM 2: FS VIS #18 - Shrews investigating the commotion; martens running, playing tag

Max: "I got you! I got you, Mindy! You're it!"

Mindy: "No, you didn't! You missed me!"

Stu: "It's Max and Mindy."

CUT TO CAM 1: FS VIS #19 - Martens running through the picnic area, scattering food everywhere

Mindy: "Ha ha, Max! You can't catch me! You run too slow! In fact, you run like Stu!"

Max: "No way! No one's as slow as Stu! I'll get you!"

CUT TO CAM 2: FS VIS #20 - Shrews angrily yelling at startled martens

Stu: "Hey! Watch where you're going! Are you crazy or something?!"

Sandy: "Yea! Look at what you've done to our picnic! Watch out! You're stepping on our food!"

CUT TO CAM 1: FS VIS #21 - Martens with their heads down and shrews angrily looking on

Max: "G-Gosh. We're sorry. We didn't even see your picnic."

Mindy: "Yea. We were having so much fun playing tag. We didn't see your food or anything."

Max: "We were just playing. We didn't mean to wreck your picnic. We're sorry."

CUT TO CAM 2: FS VIS #22 - Martens and shrews talking

Mindy: "You see, this morning Max and I were feeling really lonely. Usually we do stuff with our cousins, but this week they're visiting some friends on the other side of the lake."

Max: "So to stop feeling lonely, we decided that we would play some games anyway."

Mindy: "We've been playing games together all morning. Hey, why don't you join us?"

Max: "Yea! Tag is great fun! C'mon! Play with us!"

Mindy: "Wait a minute, Max. Maybe Stu and Sandy won't like tag because they're sorta slow. They'd get tagged and be 'it' a lot."

CUT TO CAM 1: VIS #23 CU OF SHREWS POINTING

Sandy: "Well, thank you for asking us, but did you know that besides messing up our picnic you scared Kurt and Kerry away?"

Max: "We did?"

ZOOM OUT TO FS: ALL FOUR CHARACTERS

Stu: "Yes, and now they're hiding in the trees."

CUT TO CAM 2: FS VIS #24 - Shrews and martens talking with kingfishers looking on

Mindy: "Gee, we're sorry about scaring them. We know that they're shy and don't like lots of noise. We didn't mean to frighten them. Please tell them that for us."

ZOOM IN TO KINGFISHERS

Sandy: "I think that it would be nice if you apologized to Kurt and Kerry yourselves. Go on up and tell them that you're sorry."

CUT TO CAM 1: FS VIS #25 - Martens looking appalled at the thought of climbing trees

Max: "What?! Climb up there and see them?! No way! I'm afraid of heights!"

Mindy: "Me, too! I'm scared to climb way up there. What if I slip? I'd fall down and break my head! No thank you!"

	Max:	"We're sorry for scaring Kurt and Kerry, but we can't climb up to apologize. That's TOO high and TOO scary."
CUT TO CAM 2: FS VIS #26 - Shrews calling up to the kingfishers	Stu:	"Oh, all right. We didn't know that you were so scared of being up high. We'll call Kurt and Kerry down then. Hey, Kurt! Kerry! Please come down! Max and Mindy want to tell you something."
CUT TO CAM 1: FS VIS #27 - Kingfishers flying down and talking with martens and shrews	Max:	"We're sorry for scaring you. We didn't mean to. We were just having fun."
	Kerry:	"Well, it's O.K. But you really should show more respect for others."
	Kurt	"Yea. You should show more respect for others and the things that belong to them."
CUT TO CAM 2: FS VIS #28 - The 3 species talking	Sandy:	"What's that? What's RESPECT?"
	Max:	"Yea, what's RESPECT mean?"
	Kurt:	"RESPECT means caring for others and taking care of the things that belong to them."
CUT TO CAM 1: FS VIS #29 - Shrews talking with thought bubble showing the ruined picnic	Stu:	"Does showing respect for someone's picnic mean taking care of it? Not bothering the food or those eating it?"
	Kerry:	"Yes. Showing respect for someone's picnic means not bothering it because the picnic is important to them."
CUT TO CAM 2: VIS #30 CU OF LEFT KINGFISHER TALKING WITH THOUGHT BUBBLES	Kerry:	"There are lots of ways of showing respect for others. When someone's working or playing, you show respect by not bugging them."
PAN RIGHT TO CU OF RIGHT KINGFISHER & BUBBLE	Kurt	"Or you politely ask them if you can join them, talk to them, or ask them a question."

ZOOM OUT TO FS	Kerry:	"We should always respect one another because <u>everyone</u> is important."
CUT TO CAM 1: FS VIS #31 - Martens posing questions to kingfishers	Max:	"What about things? Can you show respect for things?"
	Kerry:	"You sure can. You can show respect for, or take care of, lots of things."
CUT TO CAM 2: VIS #32 CU OF 6 ANIMALS	Mindy:	"Then why didn't you show respect for these wildflowers and the rest of the woods? You smashed these flowers with your picnic, and then threw trash all over the place."
PAN TO RIGHT - ZOOM IN ON FLOWERS	Max:	"That wasn't showing respect for nature or the wildflowers."
CUT TO CAM 1: FS VIS #33 - Kingfishers and shrews looking sad	"Kurt:	"I feel terrible. Look at what we did."
	Sandy:	"Yea. We didn't show respect for nature at all."
	Kerry:	"We need to take good care of nature because it's our home."
	Stu:	"Nature is a part of <u>everybody's</u> home, Kerry. So we've got to respect it--or take care good of it."
CUT TO CAM 2: FS VIS #34 - Martens talking, with thought bubbles reviewing what they should respect	Max:	"Let's go over again what we should respect--or take care of. We should respect the things that belong to others,"
ZOOM IN TO BUBBLE #1	Mindy:	"We should respect others' time alone,"
PAN TO BUBBLE #2	Max:	"Or their time spent working and playing,"
PAN TO BUBBLE #3	Mindy:	"And we should respect nature."
CUT TO CAM 1: FS VIS #35 - Shrews talking, with bubbles listing ways to respect the environment	Stu:	"Some ways that we can respect nature are:"
ZOOM IN TO BUBBLE #1	Sandy:	"Staying on trails,"

PAN TO BUBBLE #2	Stu:	"Leaving wildflowers alone,"
PAN TO BUBBLE #3	Sandy:	"Picking up trash,"
PAN TO BUBBLE #4	Stu:	"And using only what we need."
	Sandy:	"Yea. Like picking only as many berries as we can eat."
ZOOM OUT TO FS	Stu:	"How about returning stuff to nature that can be used again by someone else? That's called 'recycling', I think."
	Sandy:	"Yep. That's a good one, Stu."
CUT TO CAM 2: FS VIS #36 - Kingfishers talking, with thought bubbles	Kurt:	"And there are many ways to show respect for others."
ZOOM IN TO BUBBLE #1	Kerry:	"Like leaving their things alone,"
PAN RIGHT TO BUBBLE #2	Kurt:	"Taking care of things you borrow,"
PAN RIGHT TO BUBBLE #3	Kerry:	"Not disturbing others while they're working, playing or relaxing,"
ZOOM OUT TO FS	Kurt	"and not making fun of others."
	Kerry:	"Right! That's a good one."
CUT TO CAM 1: FS VIS #37 - Shrews	Kerry:	"We show respect for Sandy and Stu by not making fun of them. We shouldn't make fun of how they move slowly."
	Kurt:	"Or how much they care about their weight and how they look."
CUT TO CAM 2: FS VIS #38 - Martens	Stu:	"And we show respect for Max and Mindy by not making fun of how they're afraid of being high up in trees."
	Kerry:	"And how they like to make friends and play with each other all the time."

CUT TO CAM 1: FS VIS #39 - Kingfishers

Mindy: "And finally, we show respect for Kerry and Kurt by not making fun of their being so shy all the time."

Sandy: "And the way they talk so softly."

Stu: "Yea. Because we care about them, we don't joke about how they really like to eat those fattening nuts and berries."

CUT TO CAM 2: FS VIS #40 - All 3 species talking

Max: "So respect means taking care of something or somebody because you know that they're important."

Kurt "I'm going to remember that. And show respect for nature and all of my friends."

CUT TO CAM 1: VIS #41 CU OF MARTENS WAVING GOOD-BYE

(MUSIC IN & UNDER)

Mindy: "Hey, thanks for telling us about respect. We'll move somewhere else to play tag so we don't disturb your picnic."

PAN LEFT TO KINGFISHERS & SHREWS

Kerry: "And we'll clean up our trash."

Stu: "And straighten up these wildflowers."

ZOOM OUT TO FS

Kurt: "See you later!"

Max: "Bye bye!"

(MUSIC UP)

FADE TO BLACK

(FADE OUT MUSIC)

CHYRON: CREDITS

NATURAL HISTORY SCRIPT
6-8th grade

VIDEO	AUDIO
FADE TO CHYRON: "Three not often seen"	(MUSIC IN) (MUSIC OUT)
CUT TO CAM #1: Slide #1 - Michigan woods and lake	"Michigan is full of wildlife. The forests, meadows, river banks, lake shores, and ponds hold all sorts of interesting wild animals."
CAM 2: Slide #2 - Deer	"When driving or hiking anywhere in Michigan, you might see deer,"
CAM 1: Slide #3 - Raccoon	"raccoon,"
CAM 2: Slide #4 - Ducks	"and ducks and geese."
CAM 1: Slide #5 - Porcupine	"If you're in northern Michigan, you may see a porcupine."
CAM 2: Slide #6 - Marten walking up log	"Although it is easy to see wildlife in Michigan, there are some wild animals that people almost never see. One of these wild animals is the marten. The marten is an animal, about the size of a squirrel, that lives in pine forests and forests with both pine and hardwood trees."
CAM 1: Slide #7 - Marten on snowy log	"The marten is mostly brown with light orange fur on its throat and chest."
CAM 2: Slide #8 - Marten high up in branches	"The marten is an excellent climber. It spends much of its time climbing around in tall pine trees. Martens even sleep and build their nests in hollow trees, stumps and logs."
CAM 1: Slide #9 - Marten in snow	"Although martens spend most of their time in trees, they hunt on the ground. Martens usually look for food at night and in the dim light of morning and early evening."
CAM 2: Slide #10 - Mouse	"Martens mainly eat mice, squirrels, rabbits, and other small animals. Sometimes they eat insects, birds, fruit, and nuts."
CAM 1: Slide #11 - Marten climbing up trunk	"A marten hunts, eats and sleeps alone. It doesn't do anything with other martens except when it mates or raises a litter of young."

CAM 2:	Slide #12 - Marten running across snow	"In fact, when one marten meets another marten, it usually chases it out of that part of the forest. Martens hunt by themselves because there are only so many mice and other animals in an area for them to eat."
CAM 1:	Slide #13 - Marten in pine tree with dead squirrel	"Catching small animals to eat is not easy either. By hunting alone and keeping other martens away, a marten has more chances of getting enough food to eat."
CAM 2:	Slide #14 - Red pine trees	"Martens need pine forests to live. Another way of saying this is that martens need a specific habitat. 'Habitat' is everything an animal needs to live. This includes the animal's food, water, shelter, oxygen, and living space. The marten's habitat is found in large pine forests."
CAM 1:	Slide #15 - Marten range map	"The yellow areas on this map of Michigan show where martens are found in our state."
CAM 2:	Slide #16 - Marten next to tree trunk	"The marten is one wild animal in Michigan that few people see. It lives in large pine forests, is a good climber, and spends most of its time alone."
CAM 1:	Slide #17 - Kingfisher next to river	"Another wild animal in Michigan that people may be unfamiliar with is the kingfisher. This bird lives near water and is about the size of a pigeon. It has bluish gray feathers on its back, and white feathers on its throat and breast. The feathers on its head form a bushy crest."
CAM 2:	Slide #18 - Kingfisher pair	"The male kingfisher has a broad blue band on its breast. The female kingfisher has 2 bands on its breast--one blue and one rust-colored."
CAM 1:	Slide #19 - Kingfisher with fish	"Kingfishers live near rivers, ponds, lakes, and bays because kingfishers eat fish. That's probably why they are called "kingfishers". These birds are very good at catching and eating fish."
CAM 2:	Slide #20 - Kingfisher in tree	"Kingfishers will sit on a branch above the water and wait for a small fish to swim near them. Or, sometimes the kingfisher will hover like a helicopter above the water."

CAM 1:	Slide #21 - Kingfisher diving into water	"When it sees a fish, the kingfisher will dive headfirst into the water to catch it with its strong bill."
CAM 2:	Slide #22 - Kingfisher pair with female vocalizing	"Even if you don't see a kingfisher when you're near a river or lake, you will probably hear one. Kingfishers have a very loud call that sounds like a rattle." (KINGFISHER CALL) "Because kingfishers make a lot of noise with this "rattling call", they are easy to locate. You can find a kingfisher by tracking its loud call."
CAM 1:	Slide #23 - Kingfisher range map	"This map of Michigan shows that kingfishers are found throughout the state. The yellow area is where kingfishers are found all year round. During their nesting season, spring and summer, kingfishers are also found in the pink area. Although kingfishers are found throughout Michigan, they can only live in areas with open, clean water."
CAM 2:	Slide #24 - Kingfisher on sloping branch holding fish in bill	"So, the kingfisher, like the marten, has very specific habitat needs. Remember that habitat is everything an animal needs to live. The kingfisher needs clean water which contain lots of small fish."
CAM 1:	Slide #25 - Kingfisher nest in dirt bank	"The kingfisher also needs high banks around the water, because it digs a deep hole in the sand or gravel of the banks for a nest."
CAM 2:	Slide #26 - Marten climbing down tree	"So far we've talked about 2 wild animals in Michigan that people may not often see. The marten lives alone in pine trees. It is a good climber."
CAM 1:	Slide #27 - Kingfisher bringing fish to young	"The kingfisher makes a loud rattling noise and eats fish." (KINGFISHER CALL)
CAM 2:	Slide #28 - Overhead shot of shrew in dirt	"Another wild animal in Michigan that people don't often see is the shrew. People don't often see shrews because shrews are very small. Some kinds of shrews are smaller than mice. In fact, shrews are some of the smallest mammals in the world. They may be only 2 and 1/2 inches long."

CAM 1:	Slide #29 - Shrew next to stick	"Shrews are grayish brown and have long tails. Their noses are long and pointed."
CAM 2:	Slide #30 - Meadow with creek	"Michigan shrews need habitat also, but their habitat needs are not as specific as martens and kingfishers. Shrews live in all types of areas: brushy or grassy places near water,"
CAM 1:	Slide #31 - Log and ferns	"under leaves and logs on the forest floor,"
CAM 2:	Slide #32 - Open field	"and in open fields. In these areas shrews find their main foods--insects, spiders and worms."
CAM 1:	Slide #33 - Shrew eating grasshopper	"Shrews are almost always eating. They have huge appetites. If they are not sleeping, they are eating. They look for food during the day and during the night."
CAM 2:	Slide #34 - Shrew in pine needles	"Shrews eat so much that they will eat their own weight in food in one day. People cannot eat that much."
CAM 1:	Slide #35 - Hamburger boxes	"If you weighed 70 pounds, you would have to order at least 280 hamburgers at one time in a restaurant to eat like a shrew!"
CAM 2:	Slide #36 - Shrew running through leaves	"Shrews are always eating because they are so small and always moving fast. Small animals burn up energy much faster than large ones. Shrews could starve to death after only a few hours, while humans can go without food for many days."
CAM 1:	Slide #37 - Shrew with grub	"There are many types of shrews in Michigan, and they all eat a lot."
CAM 2:	Slide #38 - Shrew range map	"This map shows that shrews are found almost everywhere in Michigan. They don't have special habitat needs like the marten and kingfisher. Shrews can live in many different habitats: grassy areas, forests, swamps, and brush."
CAM 1:	Slide #39 - Marten on log	"Let's review the 3 types of Michigan wildlife we've looked at. First we looked at the marten. The marten lives alone in pine forests. They are good climbers and eat mice and other small animals."

CAM 2:	**Slide #40 - Female kingfisher**	"The second wild animal we looked at was the kingfisher. This bird lives near rivers and lakes because it eats fish. The kingfisher makes a lot of noise, and its call sounds like a very loud rattle."
		(KINGFISHER CALL)
CAM 1:	**Slide #41 - Shrew running through flowers**	"The shrew was the last wild animal we looked at. Shrews are very small animals with big appetites. They are fast animals, darting quickly under leaves and logs. Shrews live in many different types of habitats and are always eating and moving. They feed on insects day and night."
CAM 2:	**Slide #42 - Termites**	"All 3 of these wild animals are predators--which means that they eat other animals. The marten eats mice and squirrels, the kingfisher eats fish, and the shrew eats insects like these termites. Predators are very important because they help keep other wild animal populations and the environment healthy."
CAM 1:	**Slide #43 - Marten showing teeth**	"For example, without shrews and other insect eaters, we might have more insects than we'd care to have. Without martens we might have more mice or squirrels than we'd like to have. Predators help to keep our environment healthy."
CAM 2:	**Slide #44 - Kingfisher on branch with mud in its bill**	"Predators like the marten, kingfisher and shrew are only 3 of the many kinds of wild animals found in Michigan. Michigan has a lot of wildlife, and they are all important even if people don't see them very much. Each wildlife species has a special part in keeping our environment working."
CAM 1:	**Slide #45 - Children walking in woods**	"The next time you're driving or hiking around Michigan think about all the wildlife around you--"
CAM 2:	**Slide #46 - Wood duck pair**	"the ones you see,"
		(MUSIC IN & UNDER)
CAM 1:	**Slide #47 - Marten on forest floor**	"and the ones you don't see. Even if people don't see some types of wildlife, they are still important. All the different kinds of wildlife are important to keep our environment working."
FADE TO BLACK		(MUSIC UP) (FADE OUT MUSIC)
CHYRON: CREDITS		

FANTASY STORY SCRIPT
6-8th grade

VIDEO	AUDIO	
FADE TO TITLE: "Living Lightly"	(MUSIC IN)	
CUT TO CAM 1: FS VIS #1 - Max Marten	VO:	"This is the story of..."
	Max:	"Max Marten"
QUICK FADE TO/FROM BLACK TO CAM 2: VIS #2 - Mindy Marten	Mindy:	"Mindy Marten"
QUICK FADE TO/FROM BLACK TO CAM 1: VIS #3 - Kurt Kingfisher	Kurt:	"Kurt Kingfisher"
QUICK FADE TO/FROM BLACK TO CAM 2: VIS #4 - Kerry Kingfisher	Kerry:	"Kerry Kingfisher"
QUICK FADE TO/FROM BLACK TO CAM 1: VIS #5 - Stu Shrew	Stu:	"Stu Shrew"
QUICK FADE TO/FROM BLACK TO CAM 2: VIS #6 - Sandy Shrew	Sandy:	"Sandy Shrew"
	(MUSIC OUT)	
FADE TO BLACK		
FADE TO CAM 1: FS VIS #7 - Max Marten and Kurt Kingfisher sitting under a tree on a hot, sunny day		
DISSOLVE TO CAM 2: FS VIS #8 - Max Marten talking to Kurt Kingfisher munching on berries	Max:	"Ahhhh! What a beautiful day, Kurt. A bit warm though, don't cha think?"
	Kurt:	"Uh huh."
	Max:	"Hey, thanks again for letting me join you. I was feeling pretty lonely this morning and wanted some company. Usually I hang out and do stuff with my cousins, but this week they're visiting friends on the other side of the lake."
CUT TO CAM 1: FS VIS #9 - Kurt Kingfisher munching on berries	Kurt:	"Uh huh."
	Max:	"Yep, I was pretty lonely this morning. All of my cousins were gone. I just don't like being by myself in the woods."
	Kurt:	"Uh huh."

	Max:	"Man, you sure are quiet! It's hard to carry on a conversation with you. Don't you and your friends ever say very much?"
CUT TO CAM 2: FS VIS #10 - Max Marten looking excited while talking to Kurt Kingfisher	Max:	"Hey! I know what we can do today! I betcha some of my neighbors and some of your friends might like some company. Why don't we round everyone up and <u>do</u> something? Like have a party! Wouldn't that be fun?"
	Kurt:	"Uh huh."
ZOOM IN TO MAX	Max:	"Okay, here's the plan. You go round up all your friends around here, and I'll go find my neighbors. Tell them that we're going to have a party. There will be games, food, and all sorts of fun things. Sound good? Let's meet again in about an hour right under this tree, O.K.? Whaddya say, Kurt? Sound like a plan?"
	Kurt:	"Uh huh."
CUT TO CAM 1: FS VIS #11 - Max Marten and Kurt Kingfisher departing in excitement	Max:	"All right! Go get your friends, and I'll see ya in about an hour!"
	Kurt:	"Uh huh."
CUT TO CAM 2: FS VIS #12 - Kurt Kingfisher talking to kingfishers in a tree	Kurt:	"C'mon, Kerry. C'mon, everyone. Let's go join Max and his neighbors for games."
	Kerry:	"I dunno, Kurt. They are so rowdy and noisy. They scare me."
	Kurt:	"You won't have to say anything, just play. C'mon. It'll be fun. I know that you're shy. We're <u>all</u> shy. But games with Max should be fun. C'mon. Follow me!"

CUT TO CAM 1: FS VIS #13 - Kingfishers and martens all together in the woods

Max: "What an awesome crowd! This is great. We should get some good games going with all these folks."

Mindy: "Hey, everyone! Let's go down to the stream and play. It's so hot. The water will feel good."

CUT TO CAM 2: FS VIS #14 - Kingfishers and martens getting ready to leave for the stream

Max: "Good idea. C'mon! Let's go, everyone!"

CUT TO CAM 1: FS VIS #15 - Martens and kingfishers having mud fights, throwing dirt bombs, digging holes, etc. near the stream

SFX: Laughter, yelling

Mindy: "I got you! I got you, Max! Ha ha!"

Max: "Yuk! I've got mud in my ears!"

ZOOM IN TO KINGFISHERS

Kurt: "Man, this water feels great."

Kerry: "I like throwing these dirt bombs. Hey, let's see if we can hit Mindy."

CUT TO CAM 2: FS VIS #16 - Max and Mindy Marten talking

Max: "Hey, Mindy. Let's build a bridge across the stream."

Mindy: "What for?"

Max: "Oh, just for fun."

Mindy: "What'll we build a bridge with? Big rocks are too heavy to carry."

Max: "We could use branches. They'd work."

ZOOM IN TO MINDY

Mindy: "But how are we going to get branches? You know that we're too scared to climb up and get them. What if we slip and fall? No way. We're not climbing a tree to get any branches."

PAN TO MAX

Max: "Hmmm. I know! We could ask Kurt and Kerry to help us. They can fly up into the trees and break branches off with no sweat. Hey! Kurt! Kerry!"

CUT TO CAM 1: FS VIS #17 - Mindy and Max Marten talking to Kurt and Kerry Kingfisher

Mindy: "Hey, Kerry. Could you please do us a big favor and break off some tree branches for us? We want to build a bridge across the water."

Max: "Yea, and we're too scared to climb way up there and get them. Can you help us?"

ZOOM IN TO KINGFISHERS

Kerry: "Uhhh...I don't know."

Max: "What do you mean you don't know? C'mon you guys. Don't be so shy. All you need to do is fly up there and break off, let's say, 10 branches."

Mindy: "Yea, only about 10. C'mon. Help us."

CUT TO CAM 2: FS VIS #18 - Kingfishers talking with thought bubbles showing kingfishers sitting on branches

Kurt: "I don't know if that's such a good idea, Max. We like to sit and rest on these tree branches."

Kerry: "Yea, and lots of birds like to sit on them, too."

Kurt: "Plus the trees don't look very nice with all the branches broken off."

CUT TO CAM 1: VIS #19 CU OF MARTENS

Mindy: "We're not asking for <u>all</u> the branches--just maybe 10. C'mon, you guys. You're spoiling all the fun."

Max: "Yea. All we want to do is have a little fun, and you are ruining everything."

ZOOM OUT TO FS

Kurt: "*SIGH*. Oh, all right. C'mon, Kerry. Let's break off 10 branches for them."

Max: "All right! Good deal! You won't regret this, Kurt. It'll be the coolest bridge you've ever seen. Just wait."

CUT TO CAM 2: FS VIS #20 - Kingfishers breaking branches off and eating fruit

Kerry: "Hey, this tree has some yummy red berries in it. Look, Kurt."

Kurt: "This tree does, too. MMmmm! They taste good."

Kerry: "I guess breaking these branches isn't so bad if you get to eat while you're doing it."

Kurt: "(chuckling) Yea."

Mindy: "Good job, guys! Only about 5 more branches to go! Keep it up! The bridge is going to look <u>great</u>!"

CUT TO CAM 1: FS VIS #21 -Max and Mindy Marten dragging branches through the woods

Max: "Maybe we should ask Kurt and Kerry to break off more than 10 branches."

Mindy: "Yea. That way we can have a BIG bridge."

Max: "Maybe we can even secure the ends of the bridge so it won't float away or break in the winter and spring."

Mindy: "Now <u>that's</u> an idea!"

CUT TO CAM 2: FS VIS #22 - Martens tripping over shrews sitting in the grass

Max: "Oof! Ow! Ouch!"

Sandy: "Hey! Watch where you're going!"

Mindy: "Oops! We're sorry! We didn't even see you sitting here in the grass."

ZOOM IN TO SHREW

Max: "What are you doing?"

CUT TO CAM 1: VIS #23 CU OF SHREWS

Stu: "We're sorting foods, putting them in groups."

Mindy: "What kind of groups?"

Sandy: "Foods that we like and foods that we don't like."

ZOOM OUT TO FS

Stu: "And I'm sorting foods by what's good for us and what's not."

Max: "Why are you doing all of this?"

CUT TO CAM 2: FS VIS #24 - Shrews talking	**Stu:**	"We want to make sure that we're getting a good, balanced diet."
	Sandy:	"Right. We want to stay fit and trim. No flab, you know."
	Stu:	"So we don't eat just anything or everything. We watch our weight and diets very closely."
CUT TO CAM 1: FS VIS #25 - Martens talking about the activities down at the stream	**Max:**	"Wow. Sorting food sounds like a lot of work to me."
	Mindy:	"Yea, <u>too</u> much work. C'mon. Come play with us. We're down at the stream with Kurt, Kerry and all their friends, playing games."
	Sandy:	"What kind of games?"
	Max:	"Oh, water games, mud games...Some of us are even building a bridge. C'mon! Follow us!"
CUT TO CAM 2: FS VIS #26 - Martens running toward the stream, looking back at slow-moving shrews	**Max:**	"Hurry up, Stu! C'mon, Sandy! Everyone's waiting!"
	Mindy:	"Man, they are <u>SO SLOW</u>!"
	Max:	"No kidding. I could've run to the stream and back 4 times--at least!"
	Mindy:	"Come on, Stu! Hurry up!"
CUT TO CAM 1: FS VIS #27 - Shrews walking slowly	**Stu:**	"We're coming."
CUT TO CAM 2: FS VIS #28 - Martens standing proudly by the stream, with shrews in disbelief	**SFX:**	Laughter, yelling
	Max:	"Look, Stu and Sandy! Isn't this great? What a party!"
	Mindy:	"C'mon, Max. Let's get the bridge going! Bring your branches."
CUT TO CAM 1: VIS #29 CU OF SHREWS SCREAMING ("STOP!")	**"Stu & Sandy Shrew:**	"STOP!! STOP EVERYTHING!!"
ZOOM OUT TO FS Kingfishers flying into the trees	**Max:**	"Wh-what's wrong?!"

CUT TO CAM 2: FS VIS #30 -
Shrews talking to martens with kingfishers in trees

Stu: "Do you see what you're doing?"

Mindy: "What do you mean 'Do you see what you're doing?' We're just playing and having fun. What does it look like?"

CUT TO CAM 1: FS VIS #31 -
Shrews pointing to stream with its muddy water and fish rising to the surface for oxygen

ZOOM TO FISH

Sandy: "Look at what's happening to the stream."

Stu: "And the fish in the stream."

Mindy: "Oh, my gosh...Look! We're killing the fish!"

Max: "Quick! Hey! Somebody do something!"

CUT TO CAM 2: FS VIS #32 -
All talking

Sandy: "Don't worry. Once the water clears up a bit, the fish will be O.K."

Kerry: "Man, I feel TERRIBLE!"

Max: "Me, too. We didn't mean to hurt the fish--or anything else around here."

Kurt: Yea. We were just having a little fun."

CUT TO CAM 1: FS VIS #33 -
Shrews talking and pointing to the stream

Stu: "Whatever we do, in fun or not, we impact the environment somehow. Even if we don't mean to, we affect the environment all the time."

Sandy: "And the effects are not just local, or just around here."

Stu: "Yea. What we do to the stream here affects living things downstream, miles away."

Kurt: "Really?"

CUT TO CAM 2: FS VIS #34 -
Shrews talking with thought bubbles showing chain of events

ZOOM IN TO BUBBLE #1

Sandy: "You see, when you dig into the streambank for dirt clods, you weaken the bank. The loss of dirt and grass makes the bank loose or unstable."

PAN RIGHT TO BUBBLE #2	Stu:	"Yea. And over time a weak bank will be washed away by the stream and rainwater. The water slowly eats away at the dirt. Trees along the stream may even fall down as the dirt underneath them washes away."
PAN RIGHT TO BUBBLE #3	Sandy:	"And all that dirt in the water is really bad for fish and other living things needing clear, clean water."
ZOOM OUT TO FS	Stu:	"So, making dirt bombs doesn't hurt the bank too much today. But, remember, every little bit hurts."
CUT TO CAM 1: FS VIS #35 - Kingfishers talking with thought bubbles showing their need for clean water and dirt banks	Kerry:	"Wow. We didn't know that. I guess it's O.K. to play and have fun, but we gotta think about how our playing will change the environment, huh?"
	Kurt:	"Yea--especially us! We can't be dirtying and polluting the water, Kerry! We <u>need</u> water. We can only live near clean, clear water."
ZOOM IN TO LEFT SIDE OF BUBBLE	Kerry:	"And we can't be digging up the banks too much either, Kurt. If those high banks wash away, we won't have any place to have a nest."
	Kurt:	"Or our nests will wash away with the stream or rain--which is even worse."
CUT TO CAM 2: FS VIS #36 CU OF MAX & BUBBLE	Max:	"<u>All</u> of us need to be thinking about how we change the environment, Kurt. Look what we do by just playing. Throwing branches into the stream slows water flow,"
PAN RIGHT TO MINDY & BUBBLE	Mindy:	"the broken tree branches makes trees more open to disease and insects,"
ZOOM OUT TO FS	Max:	"and pulling the weeds and dirt out for dirt bombs disturbs insects living in the grass."

	Mindy:	"Man, <u>everything</u> we're doing is affecting the environment in some way!"
CUT TO CAM 1: FS VIS #37 - Shrews talking to kingfishers	Sandy:	"Even 'good' or 'necessary' activities affect the environment. When you dig into streambanks to make nests the holes weaken the banks and the dirt pollutes the water. Yet, building nests is something you need to do."
	Stu:	"So, even 'good' actions affect the environment."
CUT TO CAM 2: FS VIS #38 - Kingfishers talking	Kurt:	"Hmmm. It all seems to boil down to making choices."
	Mindy:	"What do you mean, Kurt?"
ZOOM IN TO KINGFISHERS	Kurt:	"Well, if we impact the environment in everything we do, each one of us must then choose <u>how much</u> he or she is going to hurt it. One can live wastefully, or one can live lightly in the environment."
PAN RIGHT TO MARTENS	Max:	"I see. No one <u>makes</u> you do something. Messing up the stream was everyone's individual choice."
CUT TO CAM 1: VIS #39 CU OF KINGFISHERS & SHREW	Kerry:	"Then it was our choice, actually <u>my</u> choice, to break the branches for the bridge. I didn't have to listen to Max and Mindy. <u>I</u> chose to break branches."
ZOOM OUT TO FS	Max:	"Yea, and <u>I</u> chose to build a bridge."
CUT TO CAM 2: VIS #40 CU OF SHREWS	Sandy:	"It's hard not to do what your friends say--or not to do what you've always done. But, each one of us has to think about how much his or her activity will affect the environment, here and far away."

ZOOM OUT TO FS	Stu:	"For example, Kurt and Kerry, you like to eat plants. You must think of the impact your choice of foods has on the environment. What does your eating plants do to the food supply here and far away?"
CUT TO CAM 1: FS VIS #41 - Shrews talking about martens	Sandy:	"Max and Mindy, you choose to do lots of things with your cousins. So, you need to think about the impact a big group has on the woods."
ZOOM INTO BUBBLE	Stu:	"Yea. How does tromping through the forest in a big group affect the environment?"
CUT TO CAM 2: FS VIS #42 - Kingfishers talking about shrews	Kerry:	"And you, Stu and Sandy, you choose to be concerned about your weight and what you eat. What you choose to eat affects the environment and what others can eat."
	Sandy:	"Yea, and then we <u>all</u> have to think about what we do with the waste from our food. Where we throw the shells, peels, bones and other stuff we don't eat changes the environment."
CUT TO CAM 1: VIS #43 CU OF MARTENS	Max:	"<u>Everything</u> we do--good or bad, intentional or unintentional--impacts the environment in some way."
	Mindy:	"What and how we eat, where we sleep,"
	Max:	"What and how we play and work...<u>everything</u> affects the environment."
ZOOM OUT TO INCLUDE KINGFISHERS	Kurt:	"So, in all that we do, we need to think about how much the environment will be changed, and then make a choice."
	Kerry:	But sometimes we can't help the changes we make on the environment."

ZOOM OUT TO FS	Stu:	"Yea, like our digging into the streambanks for worms. We <u>have</u> to eat."
	Kurt:	"Right. But many times one can choose <u>how much</u> he or she is going to eat or affect the environment."
CUT TO CAM 2: VIS #44 CU ON LEFT SHREW WITH THOUGHT BUBBLES	Sandy:	"Well, we all have some choices to make. I am going to choose to watch where I discard my trash, nutshells and fruit peels."
PAN TO RIGHT SHREW WITH BUBBLE	Stu:	"And I choose to speak quietly while in the woods so I won't disturb other living things."
CUT TO CAM 1: FS VIS #45 - Martens talking with thought bubbles showing new actions	Mindy:	"When we all get together with our cousins and neighbors, we should choose to impact the environment lightly."
ZOOM IN TO BUBBLE	Max:	"Yea, our group should stay on the trails while hiking through the woods. All of our feet stomping through the forest could damage some of the plants and animals."
	Mindy:	"And a big group makes a lot of noise, too!"
CUT TO CAM 2: FS VIS #46 - Kingfishers talking with thought bubbles showing new actions	Kerry:	"I choose not to break tree branches for fun."
	Kurt:	"I choose that too. I want to play lightly in the environment."
CUT TO CAM 1: VIS #47 CU OF MARTENS	Max:	"Wow. Think on this: Although choices are made by individuals, the consequences or impacts affect <u>everyone</u>."
ZOOM OUT TO INCLUDE KINGFISHERS	Kerry:	"You're right, Max. What I do affects you somehow. It might be through the air, water, food, land..."
	Max:	"Yea. <u>My</u> choice affects <u>you</u>."
ZOOM OUT TO FS	Kerry:	"And lots of other living things."

CUT TO CAM 2: FS VIS #48 - Cleaning up

(MUSIC IN & UNDER)

Mindy: "C'mon, everyone! Let's choose to clean up the mess we've made of the stream!"

Kurt: "Yea! I choose to do that!"

Stu: "I choose to do that, too!"

CUT TO CAM 1: Slide #1 - Department logo

(MUSIC UP)

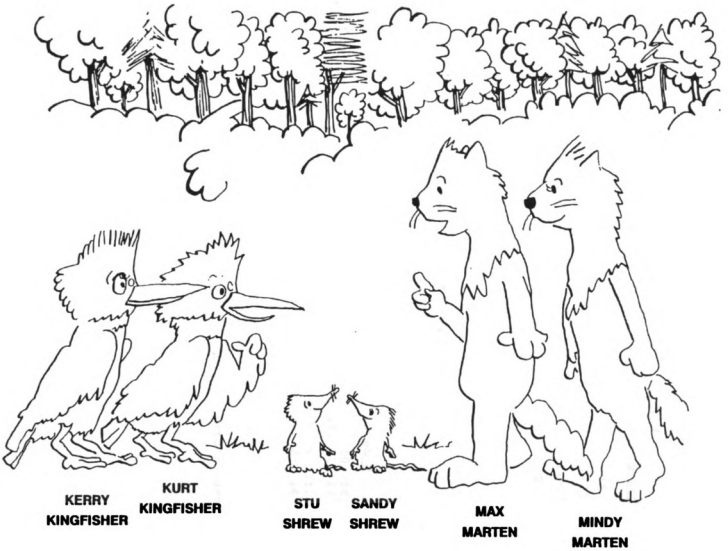
FADE TO BLACK

(FADE OUT MUSIC)

CHYRON: CREDITS

APPENDIX C

Example of Cartoons used in Fantasy Educational Experience


KERRY KINGFISHER
KURT KINGFISHER
STU SHREW
SANDY SHREW
MAX MARTEN
MINDY MARTEN

APPENDIX D

Final Measurement Models and Factors

Activities and Knowledge

Factor	Item #	
	1-3rd	6-8th
Gender	1, 2	22
Direct Contact with Wildlife	3-16	1-21
Knowledge of MI wildlife	11-16	12-21
Age		23

Natural History and Cartoon

1-3rd Grade

Factor	Item #
Physical Attributes	1, 6, 7, 9, 10, 14, 16, 17, 18, 19, 21, 22
Anthropomorphic Attributes	2, 3, 4, 5, 8, 11, 12, 13, 15, 20, 23, 24
Moral Attributes	25-30

(Increase each Moral Attributes Item # by 1 for the Cartoon Survey.)

6-8th Grade

Natural History

Factor	Item #
Physical Attributes	2, 4, 6, 7, 9, 10, 11-14
Anthropomorphic Attributes	16-28
Perceive Educ Exper as Real Wildlife	29, 30
Moral Attributes	31-36

Cartoon

Factor	Item #
Physical Attributes	2, 4, 6, 7, 9, 10, 11-14
Anthropomorphic Attributes	19-31
Perceive Educ Exper as Real Wildlife	32, 33
Moral Attributes	34-39

NAME _____

How old are you? _____

YES = _____

NO = _____

NOT SURE = _____

1. Are you a boy?..... 1

2. Are you a girl?..... 2

3. Does your family put food out for birds, squirrels, deer or other wild animals?..... 3

4. Have you gone with your family on a walk or drive to see wild animals?..... 4

5. Do you live on a farm and have animals like chickens, cows, pigs, horses, or sheep?..... 5

6. Does someone in your family go hunting with a gun or bow and arrow?..... 6

7. Have you ever gone with someone while he or she hunted with a gun or bow and arrow?..... 7

8. Have you gone to a zoo in the past year?..... 8

9. Does your family go camping?..... 9

10. Have you ever gone fishing?..... 10

11. Do deer live wild in Michigan?..... 11

12. Do pheasants live wild in Michigan?..... 12

13. Do antelope live wild in Michigan?..... 13

14. Do elk live wild in Michigan?..... 14

15. Do ruffed grouse live wild in Michigan?..... 15

16. Do bighorn sheep live wild in Michigan?..... 16

NAME _____

YES = _____

NO = _____

NOT SURE = _____

1. If you saw a wild marten,

   Would it be with other martens?..... | 1 |

2. Do you think a marten knows the difference between right and wrong?..... | 2 |

3. When a marten is by itself, do you think it feels lonely?..... | 3 |

4. Do you think a marten would be scared to climb a really tall pine tree?..... | 4 |

5. When a marten is by itself, do you think it feels happy?..... | 5 |

6. Where do wild martens spend most of their time?

Put a GREEN CIRCLE on the picture where wild martens spend most of their time.
Or, put a BLUE MOON somewhere on the page if you're not sure.



In the WATER



In the TREES

On the GROUND or
FOREST FLOOR



7. Think about what kind of call a kingfisher makes.

   Is it a quiet call?..... 7

8. Do you think a shrew cares about how pretty it looks?..... 8

9. Think about what kingfishers eat.

   Do kingfishers eat berries?..... 9

10. Do kingfishers eat fish?..... 10

11. Do you think a kingfisher makes plans for what it will be doing 3 weeks from now?..... 11

12. If a kingfisher met a squirrel in the woods would it hide and fly away from the squirrel?..... 12

13. Do you think a kingfisher worries about what other kingfishers think about it?..... 13

14. Think about the speed at which a shrew moves.

    Do shrews move slow?..... 14

15. Do you think a shrew sometimes hates other shrews?..... 15

16. Think about what shrews eat.

    Do shrews eat insects?..... 16

17. Do shrews eat fruit?..... 17

18. Think about when shrews eat.

    Do they eat only during the day?..... **18**

19. Do they eat all the time, day and night?..... **19**

20. Do you think most shrews worry about getting fat?..... **20**

21. Is a kingfisher bigger than a shrew?..... **21**

22. Is a shrew bigger than a marten?..... **22**

23. Do you think most shrews think about getting old?..... **23**

24. Do you think a shrew knows the difference between right and wrong?..... **24**

RIGHT = _____

WRONG = _____

NOT SURE = _____

25. Someone catches a marten in a trap and uses its fur for warm gloves..... **25**

26. Shrews are digging up the flowers in someone's yard. The person sets a trap to kill the shrews..... **26**

27. Someone traps kingfishers and takes them far away to another state that wants kingfishers..... **27**

28. Someone catches a marten to put it in a cage at the zoo..... **28**

29. Someone kills a kingfisher to have it stuffed to show in a museum..... **29**

30. Someone keeps a shrew in a cage at home as a pet..... **30**

The Cartoon Survey was identical to the Natural History Survey except for the following additional question.

25. Let's say you are watching T.V.
Would I be showing respect if I sat in a chair
and quietly read a book?..... **25**

Survey AK

NAME _____

CIRCLE YOUR ANSWER.

1.	Does your family put food out for birds, squirrels, deer, or other wildlife?	YES	NO	NOT SURE
2.	Have you gone with your family on a walk or drive to see wildlife?	YES	NO	NOT SURE
3.	Do you live on a farm and have animals like chickens, cows, pigs, horses, or sheep?	YES	NO	NOT SURE
4.	Do you belong to 4-H, Boy Scouts or Girl Scouts?	YES	NO	NOT SURE
5.	Have you gone hunting with a gun or bow and arrow?	YES	NO	NOT SURE
6.	Does anyone else in your family go hunting with a gun or bow and arrow?	YES	NO	NOT SURE
7.	Have you gone to a zoo in the past year?	YES	NO	NOT SURE
8.	Have you ever gone fishing?	YES	NO	NOT SURE
9.	Does your family go camping?	YES	NO	NOT SURE
10.	Have you ever trapped wild animals for their fur?	YES	NO	NOT SURE
11.	Does anyone else in your family trap wild animals for their fur?	YES	NO	NOT SURE
12.	Do deer live wild in Michigan?	YES	NO	NOT SURE
13.	Do grizzly bears live wild in Michigan?	YES	NO	NOT SURE
14.	Do pheasants live wild in Michigan?	YES	NO	NOT SURE
15.	Do moose live wild in Michigan?	YES	NO	NOT SURE

16. Do antelope live wild in Michigan?..... YES NO NOT SURE

17. Do elk live wild in Michigan?..... YES NO NOT SURE

18. Do roadrunners live wild in Michigan?..... YES NO NOT SURE

19. Do ruffed grouse live wild in Michigan?..... YES NO NOT SURE

20. Do wolves live wild in Michigan?..... YES NO NOT SURE

21. Do bighorn sheep live wild in Michigan?..... YES NO NOT SURE

22. Are you a boy or girl? (Check one) _____ BOY _____ GIRL

23. How old are you? _____ years old

NAME OF YOUR TEACHER _____

NAME OF YOUR SCHOOL _____

NAME OF YOUR SCHOOL'S TOWN OR CITY _____

Survey NH

NAME _____

CIRCLE THE CORRECT ANSWER.

1. Where would you most likely see a wild marten?

   a. in the oak forests of southern Michigan
   b. in the pine forests of northern Michigan
   c. on the grassy sand dunes along Lake Michigan
   d. on the farmlands of central Michigan

2. If you saw a marten it would probably be

   a. alone
   b. with another marten
   c. with several martens

3. Food, water, cover and space are part of an animal's

   a. habits
   b. nature
   c. habitat
   d. behavior

4. Martens eat mainly

   a. fish
   b. fruit and nuts
   c. mice and squirrels
   d. insects

5. Because martens and shrews are predators,

   a. they can live in many different types of habitat.
   b. they hunt mainly at night.
   c. they are very quiet.
   d. they help keep some wildlife populations healthy.

6. Where do wild martens spend most of their time?



a. In the WATER



b. In the TREES



c. On the GROUND
or FOREST FLOOR

7. Kingfishers make

   a. soft, quiet sounds
   b. pretty, robin-like sounds
   c. loud, rattling sounds

8. Where would you most likely see a kingfisher?

   a. in a hollow log
   b. in a hole in a pine tree
   c. in the grass near water
   d. on a branch along a river bank

9. Kingfishers eat mainly

   a. insects
   b. fish
   c. fruit
   d. fish and fruit

10. What does a kingfisher need in order to live?

   a. large pine forests
   b. a body of clean water
   c. berries and nuts
   d. a tree with holes in it

11. A kingfisher makes a nest

   a. on the branch of a tree
   b. in a hole in a tree
   c. on the ground in the grass and leaves
   d. in a hole in the bank of a river or stream

12. Shrews move

   a. in groups
   b. slowly
   c. only at night to avoid predators
   d. quickly

13. The amount of time a shrew spends eating is

    a. about the same as most animals
    b. much less than most animals
    c. much more than most animals

14. Shrews eat mainly

    a. insects
    b. fruit and nuts
    c. fish
    d. insects and fruit

15. Which of these species lives in pine forests, in open dry fields and in swamps?

    a. only the shrew
    b. only the marten
    c. only the kingfisher
    d. all 3 species

CIRCLE THE ANSWER WHICH SHOWS HOW YOU FEEL ABOUT THE STATEMENT.

EXAMPLE:

	STRONGLY AGREE	AGREE	NEITHER AGREE OR DISAGREE	DISAGREE	STRONGLY DISAGREE
All fathers are bad cooks.	SA	A	N	(D)	SD

This person doesn't believe that all fathers are bad cooks.

		STRONGLY AGREE	AGREE	NEITHER AGREE OR DISAGREE	DISAGREE	STRONGLY DISAGREE
16.	A shrew worries about how nice it looks.....	SA	A	N	D	SD
17.	A kingfisher thinks about getting old.....	SA	A	N	D	SD
18.	When a marten is by itself, it feels lonely.....	SA	A	N	D	SD
19.	A shrew sometimes hates other shrews.....	SA	A	N	D	SD
20.	If a kingfisher met a squirrel in the woods it would be shy and fly away from the squirrel..	SA	A	N	D	SD
21.	A marten knows the difference between right and wrong.....	SA	A	N	D	SD
22.	Shrews are picky eaters.....	SA	A	N	D	SD
23.	A kingfisher might worry about what other kingfishers think about it.....	SA	A	N	D	SD
24.	Shrews are concerned about how they affect the environment.....	SA	A	N	D	SD
25.	A kingfisher makes plans for what it will be doing 3 weeks from now.....	SA	A	N	D	SD
26.	A marten feels scared about climbing a tall pine tree.....	SA	A	N	D	SD
27.	A shrew knows the difference between right and wrong.....	SA	A	N	D	SD
28.	Most shrews worry about getting fat.....	SA	A	N	D	SD

		STRONGLY AGREE	AGREE	AGREE OR DISAGREE	NEITHER DISAGREE	STRONGLY DISAGREE
29.	Kingfishers die.....	SA	A	N	D	SD
30.	Martens always stay the same age.....	SA	A	N	D	SD

CIRCLE THE NUMBER WHICH SHOWS HOW YOU FEEL ABOUT THE STATEMENT.

EXAMPLE:

A farmer's dog keeps jumping the fence and running away. The farmer ties up the dog in the yard.

RIGHT 1 2 3 (4) 5 WRONG

The answer above means the person feels that tying up the dog in the yard is kind of wrong.

31. **Someone keeps a shrew in a cage at home as a pet.**

RIGHT 1 2 3 4 5 WRONG

32. **Someone catches a marten in a trap and uses its fur for warm gloves.**

RIGHT 1 2 3 4 5 WRONG

33. **Shrews are digging up the flowers in someone's yard. The person sets a trap to kill the shrews.**

RIGHT 1 2 3 4 5 WRONG

34. Someone catches a marten to put it in a cage at the zoo.

RIGHT 1 2 3 4 5 WRONG

35. Someone traps kingfishers and takes them far away to a state that wants kingfishers.

RIGHT 1 2 3 4 5 WRONG

36. Someone kills a kingfisher to have it stuffed to show in a museum.

RIGHT 1 2 3 4 5 WRONG

The Cartoon Survey was identical to the Natural History Survey except for the following additional questions.

16. Each person has an effect on the environment

a. once or twice a month
b. once or twice a day
c. all the time
d. never

17. Who makes the final decision about whether to affect the environment?

a. adults
b. no one. Impacts on the environment just happen.
c. people who run the government and big businesses
e. every person

18. How old do you think Stu in the video is? Is he

a. a baby
b. a child
c. a teenager
d. an adult

HOW DO YOU THINK EACH OF THESE ACTIVITIES IMPACT THE ENVIRONMENT?

		VERY BAD	BAD	NO IMPACT	GOOD	VERY GOOD
40.	Picking wildflowers	1	2	3	4	5
41.	Staying on trails while hiking	1	2	3	4	5
42.	Riding a 4-wheeler through the woods	1	2	3	4	5
43.	Pulling the bark or branches off of trees	1	2	3	4	5
44.	Riding in a car	1	2	3	4	5
45.	Heating your home	1	2	3	4	5
46.	Waterskiing	1	2	3	4	5

The following questions replaced the corresponding items in the NH Survey (e.g., Kingfishers die).

32.	Kurt in the video will die someday	SA	A	N	D	SD
33.	Max will always be the same age	SA	A	N	D	SD

APPENDIX E

Examples of Instructions, schedule, discussion questions, comments sheet, and thank-you letter for participating teachers

INSTRUCTIONS FOR RESEARCH PROJECT
(1-3rd grade)

Please read the following directions carefully before beginning any portion of the research project. If at any time you modify these instructions (e.g., extend the interim time, discuss the videos beyond the provided discussion questions, etc.), please let us know by writing them on the enclosed Comments Sheet. Any changes you make affect the research process, and we must account for them in the data analysis and interpretation. If you have any problems or questions at any time, please do not hesitate to call me.

Schedule (See chart)

There are 2 main parts to the educational unit:

1. Experiment (not optional!)
2. Environmental Education Activities (optional)

Environmental Education Activities: (optional)

The Michigan Wildlife Activity and Respect Activity are optional exercises.

However, if you choose to do the Michigan Wildlife Activity, it must be done **BEFORE** any experimental material is presented (as shown on the schedule).

The Respect Activity must be done **AFTER** all the experimental material and surveys are presented.

Of course, you may do either or both activities after you have completed and returned all research material back to us. Both activities include instructions for their use.

Schedule

Experiment: (not optional!)

EXPERIMENTAL GROUP 1

On the **1st** day of the experiment

- Show Part I of the Natural History Video ("Three You Don't Always See")
- Go over the Discussion Questions for Part I (marten)
- Give the Wildlife Activities & Knowledge Survey (yellow survey marked "Survey AK")

On the **2nd** day

- Show Part II of the Natural History Video
- Go over the Discussion Questions for Part II (kingfisher)

On the **3rd** day

- Show Part III of the Natural History Video
- Go over the Discussion Questions for Part III (shrew)

On the **4th** day

- rest

On the **5th** day

- Give the Natural History Survey (green survey marked "Survey NH")

On the **6th, 7th, 8th and 9th** day

- rest

On the **10th** day

- Show the Cartoon Video ("Select Respect")
- Go over the Discussion Questions for the Cartoon Video

On the **11th** day

- rest

On the **12th** day

- Give the Cartoon Survey (blue survey marked "Survey C")

Detailed instructions for each of the above activities follow.

Natural History Video - "Three you don't always see"

Time

Each video part with discussion takes about 10 minutes.

Introduction

1. Find the Natural History presentation on the videocassette. It follows the Cartoon presentation.

2. Introduce the Natural History video by stating that it is about Michigan wildlife, or 3 wild animal species in Michigan that few people see.

3. Explain that the video has 3 parts. For the next 3 days you will show one part each day and talk about what you saw. (Each part lasts about 4 minutes.)

Procedure

1. Show Part I on the 1st day of the experiment. It covers the behavior and habitat needs of the marten.

2. Turn off the video after you see "End of Part I". (Music signals the end of each part.)

3. Go over the provided Discussion Questions for Part I with your students.

4. Follow the same procedure for Part II (belted kingfisher) on the 2nd day of the experiment. Part II begins with music and the title ("Three you don't always see - Part II") about 30 seconds after the end of Part I.

5. Go over the provided Discussion Questions for Part II with your students.

6. Show Part III (shrew) on the 3rd day of the experiment.

7. Go over the provided Discussion Questions for Part III.

Cartoon Video - "Select Respect"

Time

20-30 minutes (video and discussion)

Introduction

The introduction and any discussion about this video are **critical** to the research project. How you talk about and describe the cartoon characters may affect your students' perceptions of them. Thus, **please follow the instructions below very carefully.** If you modify these in any way, please write them on the Comments Sheet.

1. Find the Cartoon presentation on the videocassette. It precedes the Natural History presentation.

2. Introduce the cartoon video by stating that it is a story about the environment or nature. **Do not say that it is about animals or has animals in it. This is extremely important!** This is what our experiment is trying to test--how children perceive wildlife cartoon characters.

3. Explain that the story has 6 characters (Do not say "animals") in it.

4. Hold up the picture of each character and state its name slowly (Max Marten, Mindy Marten, Kurt Kingfisher, Kerry Kingfisher, Stu Shrew, and Sandy Shrew).

Procedure

1. Show the cartoon video. It begins with music and lasts about 15 minutes.

2. STOP the video when the last frame and music fades. Do not let your students see the credits, or they may associate the characters with people. You have about 20 seconds after the music ends to stop the video.

3. Go over the provided Discussion Questions for the Cartoon Video.

Interim Periods (1, 4 or 6 days)

During these times, refrain from formally discussing any of the video material (Natural History or Cartoon). Discussion must be kept at a minimum since the experiment is primarily analyzing the effects of exposure to the videos.

Surveys

There are 3 different surveys:

1. Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK")
2. Natural History Survey (green survey marked "Survey NH")
3. Cartoon Survey (blue survey marked "Survey C")

Depending on which experimental group you are in, you will use either 2 or all 3 of these surveys with your class.

Stickers

Students answer all surveys using the 5 types of enclosed stickers:

YES = green circle

NO = red square

NOT SURE = blue "moon"

RIGHT = white box with black line

WRONG = yellow triangle

Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK")

Time: 20 minutes
Stickers needed: green circles, red squares, blue moons

Give this survey on the 1st day of the experiment. It has questions about students' experiences with wildlife, and familiarizes them with using stickers to answer the survey items. It is important that the students put their FULL NAMES on the survey so we can accurately combine their survey forms.

Natural History Survey (green survey marked "Survey NH")

Time: 20-30 minutes
Stickers needed: all

Give this survey on the assigned day(s) shown on your experimental group schedule. It is identical to the Cartoon Survey except for a few questions; thus, make sure you distribute the correct survey. It is important that the students put their FULL NAMES on the survey.

Cartoon Survey (blue survey marked "Survey C")

Time: 20-30 minutes
Stickers needed: all

Give this survey on the assigned day shown on your experimental group schedule. Again, it is identical to the Natural History Survey except for a few questions; thus, make sure you distribute the correct survey. It is important that the students put their FULL NAMES on the survey.

Surveys

Introduction

1. Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK"): Introduce this survey by explaining that some people who develop environmental education material want to know about their outdoor activities.

2. Natural History Survey (green survey marked "Survey NH"): Introduce the survey by explaining that you are going to ask them some questions about the video and the environment. Avoid calling it a "test" if possible. Emphasize that each person's answer is what is important because most of the questions have no right or wrong answer.

3. Cartoon Survey (blue survey marked "Survey C"): Introduce the survey by explaining that you are going to ask them some questions about the video and the environment. Avoid calling it a "test" if possible. Emphasize that each person's answer is what is important because most of the questions have no right or wrong answer.

Procedure for surveying

1. Pass out the surveys.

2. Have the students write their FULL NAME and AGE on all surveys.

3. OPTIONAL: Pass out rulers so students can line up questions and answer boxes as they move down the page. This was especially helpful with 1st graders in the pilot study.

4. Pass out the stickers. The following amounts should be sufficient for each student during the entire experiment:

YES (green circles)	=	1 sheet
NO (red squares)	=	1 sheet
NOT SURE (blue moons)	=	3 strips
RIGHT (white boxes)	=	1 strip
WRONG (yellow triangles)	=	7 triangles

Extra stickers have been provided for experimental groups using all 3 surveys.

5. With all surveys, practice using the stickers by placing them in the example area beneath the student's name and age on the front page (e.g., YES = _____). The RIGHT and WRONG stickers are not used until the last page of each survey. Practice using those when you begin that page.

6. When all students understand what each sticker means, begin the survey.
READ each question out loud to the class, and have students place their stickers in the answer boxes provided.

7. At the end of the survey, collect the stickers and surveys.

8. When all surveys have been completed, please use the mailing envelopes to return them and the Comments Sheet.

Experimental Group 1
(1-3rd grade)

You will need the following to complete your experimental unit:

* One 30-minute videocassette containing 2 presentations
  - Cartoon ("Select Respect")
  - Natural History ("Three you Don't Always See - Parts I, II and III")
* 6 cartoons (1 of each character)
* Discussion Questions (for each video presentation)
* Instructions for Research Project
* Comments Sheet
* Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK")
  - 1 per student
* Natural History Survey (green survey marked "Survey NH") - 1 per student
* Cartoon Survey (blue survey marked "Survey C") - 1 per student
* 5 types of stickers

If you have not received all of these materials, please contact us immediately.

Schedule

Experiment: (not optional!)

EXPERIMENTAL GROUP 5

On the **1st** day of the experiment

- Show the Cartoon Video ("Select Respect")
- Go over the Discussion Questions for the Cartoon Video
- Give the Wildlife Activities & Knowledge Survey (yellow survey marked "Survey AK")

On the **2nd** day

- rest

On the **3rd** day

- Give the Cartoon Survey (blue survey marked "Survey C")

Detailed instructions for each of the above activities follow.

NOTE: **DO NOT SHOW THE NATURAL HISTORY VIDEO AT ANY TIME DURING THE EXPERIMENT!! THIS IS EXTREMELY IMPORTANT!!** Only after you have mailed back all the surveys should you show the Natural History Video to your students.

Actually, we strongly recommend that you show the Natural History Video sometime after the experiment since the Cartoon Video contains erroneous information about the habitat needs and behavior of the marten, kingfisher and shrew.

YOUR CLASS BELONGS TO

EXPERIMENTAL GROUP 1

(6-8TH GRADE)

BEFORE EXPERIMENT (OPTIONAL)	EXPERIMENT (NOT OPTIONAL!)										AFTER EXPERIMENT (OPTIONAL)
DAY 1	2	3	4	5	6	7	8	9	10	11	12
MICHIGAN WILDLIFE ACTIVITY **	NATURAL HISTORY VIDEO	INTERIM	FIRST TEST	INTERIM				CARTOON VIDEO	INTERIM	SECOND TEST	ENVIRONMENTAL IMPACT ACTIVITY **

INTERIM = THESE PERIODS OF TIME HAVE BEEN PURPOSELY PLACED BETWEEN THE VIDEOS AND TESTS. PLEASE DO NOT SHORTEN OR LENGTHEN THEM IF POSSIBLE!

EACH VIDEO IS 15 MINUTES LONG.

EACH TEST WILL TAKE 20-30 MINUTES.

** THE ACTIVITIES BEFORE AND AFTER THE EXPERIMENT ARE OPTIONAL. EACH COULD BE DONE IN 30-45 MINUTES.

INSTRUCTIONS FOR RESEARCH PROJECT
(6-8th grade)

Please read the following directions carefully before beginning any portion of the research project. If at any time you modify these instructions (e.g., extend the interim time, discuss the videos beyond the provided discussion questions, etc.), please let us know by writing them on the enclosed Comments Sheet. Any changes you make affect the research process, and we must account for them in the data analysis and interpretation. If you have any problems or questions at any time, please do not hesitate to call me.

Schedule (See chart)

There are 2 main parts to the educational unit:

1. Experiment (not optional!)
2. Environmental Education Activities (optional)

Environmental Education Activities: (optional)

The Michigan Wildlife Activity and Environmental Impact Activity are optional exercises.

However, if you choose to do the Michigan Wildlife Activity, it must be done **BEFORE** any experimental material is presented (as shown on the schedule).

The Environmental Impact Activity must be done **AFTER** all the experimental material and surveys are presented.

Of course, you may do either or both activities after you have completed and returned all research material back to us. Both activities include instructions for their use.

Schedule

Experiment: (not optional!)

EXPERIMENTAL GROUP 1

On the **1st** day of the experiment

- Show the Natural History Video ("Three Not Often Seen")
- Go over the Discussion Questions for the Natural History video
- Give the Wildlife Activities & Knowledge Survey (yellow survey marked "Survey AK")

On the **2nd** day

- rest

On the **3rd** day

- Give the Natural History Survey (green survey marked "Survey NH")

On the **4th, 5th, 6th, and 7th** day

- rest

On the **8th** day

- Show the Cartoon Video ("Living Lightly")
- Go over the Discussion Questions for the Cartoon Video

On the **9th** day

- rest

On the **10th** day

- Give the Cartoon Survey (blue survey marked "Survey C")

Detailed instructions for each of the above activities follow.

Natural History Video - "Three Not Often Seen"

Time

20-30 minutes (video and discussion)

Introduction

1. Find the Natural History presentation on the videocassette. It follows the Cartoon presentation.

2. Introduce the Natural History video by stating that it is about Michigan wildlife, or 3 wildlife species in Michigan that few people see.

Procedure

1. Show the Natural History video. It covers the behavior and habitat needs of the marten, kingfisher and shrew. The video lasts about 15 minutes.

2. Stop the video when the last frame and music fade.

3. Go over the provided Discussion Questions for the Natural History video with your students.

Cartoon Video - "Living Lightly"

Time

20-30 minutes (video and discussion)

Introduction

The introduction and any discussion about this video are **critical** to the research project. How you talk about and describe the cartoon characters may affect your students' perceptions of them. Thus, **please follow the instructions below very carefully.** If you modify these in any way, please write them on the Comments Sheet.

1. Find the Cartoon presentation on the videocassette. It precedes the Natural History presentation.

2. Introduce the cartoon video by stating that it is a story about the environment. **Do not say that it is about animals or has animals in it. This is extremely important!** This is what our experiment is trying to test--how children perceive wildlife cartoon characters.

3. Explain that the story has 6 characters (Do not say animals) in it.

4. Hold up the picture of each character and state its name slowly (Max Marten, Mindy Marten, Kurt Kingfisher, Kerry Kingfisher, Stu Shrew, and Sandy Shrew).

Procedure

1. Show the cartoon video. It begins with music and lasts about 15 minutes.

2. STOP the video when the last frame and music fades. Do not let your students see the credits, or they may associate the characters with people. You have about 20 seconds after the music ends to stop the video.

3. Go over the provided Discussion Questions for the Cartoon Video.

Interim Periods (1, 4 or 6 days)

During these times, refrain from formally discussing any of the video material (Natural History or **Cartoon**). Discussion must be kept at a minimum since the experiment is primarily analyzing the **effects** of exposure to the videos.

Surveys

There are 3 different surveys:

1. Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK")
2. Natural History Survey (green survey marked "Survey NH")
3. Cartoon Survey (blue survey marked "Survey C")

Depending on which experimental group you are in, you will use either 2 or all 3 of these surveys with your class.

Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK")

Time: 10 minutes

Give this survey on the 1st day of the experiment. It has questions about students' experiences with wildlife. It is important that the students put their FULL NAMES on the survey so we can accurately combine their survey forms.

Natural History Survey (green survey marked "Survey NH")

Time: 15-25 minutes

Give this survey on the assigned day(s) shown on your experimental group schedule. It is identical to the Cartoon Survey except for a few questions; thus, make sure you distribute the correct survey. It is important that the students put their FULL NAMES on the survey.

Cartoon Survey (blue survey marked "Survey C")

Time: 15-25 minutes

Give this survey on the assigned day shown on your experimental group schedule. Again, it is identical to the Natural History Survey except for a few questions; thus, make sure you distribute the correct survey. It is important that the students put their FULL NAMES on the survey.

Surveys

Introduction

1. Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK"): Introduce this survey by explaining that some people who develop environmental education material want to know about their outdoor activities.

2. Natural History Survey (green survey marked "Survey NH"): Introduce the survey by explaining that you are going to ask them some questions about the video and the environment. Avoid calling it a "test" if possible. Emphasize that each person's answer is what is important because most of the questions have no right or wrong answer.

3. Cartoon Survey (blue survey marked "Survey C"): Introduce the survey by explaining that you are going to ask them some questions about the video and the environment. Avoid calling it a "test" if possible. Emphasize that each person's answer is what is important because most of the questions have no right or wrong answer.

Procedure for surveying

1. Pass out the surveys.

2. Have the students write their FULL NAME on all surveys.

3. When all students are finished with the survey, collect them.

4. When all surveys have been completed, please use the mailing envelopes to return them and the Comments Sheet.

Experimental Group 6
(6-8th grade)

You will need the following to complete your experimental unit:

* One 30-minute videocassette with the Natural History presentation, "Three Not Often Seen".

  Preceding the Natural History presentation is a Cartoon presentation, "Living Lightly". **DO NOT SHOW THE CARTOON PRESENTATION AT ANY TIME DURING THE EXPERIMENT!! THIS IS EXTREMELY IMPORTANT!!** Only after you have mailed back all the surveys should you show the Cartoon presentation to your students.

* Discussion Questions (for each video presentation)

* Instructions for Research Project

* Comments Sheet

* Wildlife Activities and Knowledge Survey (yellow survey marked "Survey AK")
  - 1 per student

* Natural History Survey (green survey marked "Survey NH") - 1 per student

If you have not received all of these materials, please contact us immediately.

DISCUSSION QUESTIONS
(1-3rd grade)

Natural History Video

PART I (MARTEN)

1. What is the name of the animal we just saw? (*marten*)

2. What does a marten look like?
(*brown, orange on its throat and chest, furry, long tail*)

4. Does the marten have any special markings on it?
(*orange on its throat and chest*)

5. How big is the marten? (*size of a squirrel*)

6. Where does a marten spend most of its time in the forest?
(*in the trees*)

7. What does a marten eat?
(*mostly mice, squirrels, and rabbits; sometimes fruit and nuts*)

8. Does a marten spend most of its time alone or with other martens?
(*alone*)

9. Has anyone ever seen a marten? Where?

PART II (KINGFISHER)

1. What is the name of the animal we just saw? (*kingfisher*)

2. What does a kingfisher look like?
(*blue feathers on its back and wings, white on its throat and breast, 1 or 2 stripes/bands across its breast, feathers on its head stick up, long bill*)

3. Does the kingfisher have any special markings on it?
(*white feathers on its throat and breast, white spot near eye, 1 or 2 stripes/bands across its breast, feathers on its head stick up*)

4. How big is the kingfisher? (*about the size of a pigeon*)

5. What does a kingfisher eat? (*fish*)

6. Where might you look for a kingfisher?
(*near a river, lake, stream, pond or bay*)

7. What kind of a call does a kingfisher have?
(*loud, "rattling" call*)

8. Has anyone ever seen a kingfisher? Where?

PART III (SHREW)

1. What is the name of the animal we just saw? (*shrew*)

2. What does a shrew look like?
(*very small, grayish brown, long tail, long pointed nose*)

3. What does a shrew eat? (*insects, spiders and worms*)

4. How big is a shrew? (*very small; some are smaller than mice*)

5. At what speed does a shrew move? (*quickly*)

6. What does a shrew spend most of its time doing?
(*eating, moving*)

7. When does a shrew eat? (*all the time, day and night*)

8. Has anyone ever seen a shrew? Where?

Cartoon Video

1. What were the names of the characters?
(*Max Marten, Mindy Marten, Kurt Kingfisher, Kerry Kingfisher, Stu Shrew, and Sandy Shrew*)

2. What does "respect" mean?
(*caring for others, taking care of others' things, taking care of nature, etc.*)

3. Kurt, Kerry, Stu, and Sandy were having a picnic. What did Max and Mindy do?
(*They ran through the picnic, scared Kurt and Kerry away, stepped on the food, etc.*)

4. Was that showing respect? Why or Why not?
(*No, because Max and Mindy did not care about the others' picnic; they bothered them and their food; they scared Kurt and Kerry.*)

5. Stu, Sandy, Kurt and Kerry were having a picnic. Did they show respect for nature? Why or Why not?
(*No, because they sat and dumped their food on the wildflowers; they threw their trash all over the place, etc.*)

6. What can we show respect for?
(*others, the things that belong to others, nature*)

7. How can we show respect for others?
(*leaving their things alone; not disturbing others while they're working, playing or relaxing, not making fun of others; asking if you can borrow something, etc.*)

8. Why should we show respect for others?
(*because every person is important*)

9. How can we show respect for the things that belong to others'?
(*leaving their things alone; taking care of things you borrow, etc.*)

10. Why should we show respect for things that belong to others?
(*because their things are important to them*)

11. How can we show respect for nature?
(*stay on trails; leave wildflowers alone; pick up trash; use only what you need; recycle things; etc.*)

12. Why should we show respect for nature?
(*because it's important to us; we need plants, animals and other living things to live; etc.*)

NAME _____

COMMENTS SHEET
(Please return this with the student surveys)

Modifications I made during the experimental unit:

___ NONE

___ I made the following changes:

Special observations on students' responses to the videos, discussion questions or tests:

Overall comments about the experimental unit:

May 31, 1990

^F1^ ^F2^ ^F3^
^F4^ ^F5^

Dear ^F1^ ^F3^:

Thank you again for helping with our research project. About 60 teachers from all over Michigan received the educational materials and performed a part of the experiment. We greatly appreciate your patience, enthusiasm and conscientiousness throughout the project. We couldn't have done it without you! An extra "thank you" goes to all the teachers who let us personally interview their students. Over 240 students were interviewed and this information will help us interpret the survey results.

Some teachers had questions regarding the purpose of the research, and information contained in the videos. The research was intended to begin to provide some insight into the effectiveness of cartoons as educational tools for teaching about ecology and wildlife. Some of the questions we explored with our research are...

> ...to what extent are cartoons accepted as educational experiences by young viewers? Do youngsters expect to learn from cartoons?
>
> ...is their perception of wildlife or ecology influenced by subtle messages in cartoons? (e.g., such as anthropomorphic, physical or natural history characteristics which are often exaggerated or misrepresented in order to make cartoons more interesting)
>
> ...to what extent are youngsters able to maintain a distinction between fantasy and reality when they are viewing cartoons?

It is important to assess the influence and effectiveness of cartoons on the ecological and wildlife perceptions held by youngsters for several reasons. First, cartoons are becoming an increasingly popular educational tool in wildlife education. Second, children are being increasingly exposed to cartoons using animal characters in the entertainment video business. Third, our society is becoming increasingly urban and our children have even less opportunity to experience "real" ecology, natural history and wildlife. An additional incentive for this research is that findings may suggest some insights into the effects of cartoon violence on child perceptions.

To get some answers to our research questions, we created 6 experimental groups. Since we repeated the experiment at both primary (1,2,3) and junior high (6,7,8) levels, we actually worked with 12 different experimental groups of students. Various combinations of viewing the cartoon video and the natural history video

were used so that many different treatment effects could be measured. As you and your students probably noticed, the cartoon characters exhibited some features that were not natural. The cartoon shrews were slow, rather than fast; cartoon martens were gregarious rather than solitary, etc. Some of these features were subtle; others were obvious, but none had a bearing on the "plot" of the story or the message being communicated (e.g. respect for others, responsibility for our environmental actions). The intent was to see whether youngsters accepted these characteristics as "natural" when they saw the cartoon. Since experimental groups saw different sequences (cartoon only, natural history only, cartoon first, natural history first, etc.), we should be able to sort out some of the learning and perception effects that occurred.

The activities which accompanied the videos and surveys were not part of the experimental treatment. These were provided so that the experiment would provide a good educational experience for the students in addition to generating data to further our educational science. One of our concerns throughout the planning of this experiment has been the welfare of the students. The conflict in cartoon/real animal characteristics was unavoidable given the nature of our research, and we hope you were able to utilize any confusion about the differences as a "teachable opportunity".

Scripts for the videos were reviewed by local teachers and education professors working with 1-3rd and 6-8th graders to assess readability and appropriateness of content. The videos were also pilot tested with over 380 students to further evaluate comprehension and students' reactions to the presentations. The majority of the students rated the videos positively, with lack of animation as the greatest "complaint". (Budget constraints made such media sophistication impossible.) Your comments on the materials will provide additional information on their effectiveness and possible limitations.

We have received your completed surveys. At the rate they are coming in and we are able to enter the data, we anticipate that we will be able to send you a summary of our findings sometime in August. Thank you again for all of your time and effort. If you have any additional comments or questions, please feel free to call us.

Sincerely,

Cynthia J. Wong
Research Assistant
(517) 353-0308

R. Ben Peyton
Professor
(517) 353-3236

APPENDIX F

Interview Questions

For subjects who viewed only the NH educational experience

1-3rd and 6-8th grade

Name

Grade

School

1. A few days ago you saw a video called "Three You Don't Always See". Tell me everything you can remember about what you saw and heard in the video.

2. If some people were camping in Michigan, they could see a marten in the woods if they looked hard enough Y N Not Sure

3. (If yes) How would they know that it was a marten?

   (If no) Why couldn't they see a marten?

Let's say that there is a forest fire in the woods. The trees are burning; the grass is burning. There is a wild shrew on the ground, and a wild kingfisher overhead.

4. Do you think a wild kingfisher would help a wild shrew if the shrew were in trouble? Y N Not Sure

5. Why or why not?

For subjects who viewed
only the F educational experience or both the F and NH videos

1-3rd grade

Name

Grade

School

1. A few days ago you saw a video called "Select Respect". Tell me everything you can remember about what you saw and heard in the video.

2. Do you remember the names of the characters in the video?

3. Think about Max & Mindy.
What are Max & Mindy?

4. If some people were camping in Michigan,
could they see Max in the woods
if they looked hard enough? Y N Not Sure

5. (If yes) How would they know that it was Max?

Would he look like this? Y N Not Sure

How would he look different?

If you heard him, would you
be able to understand him? Y N Not Sure

Why or Why not?

(If no) Why couldn't they see Max?

6. Think about Kurt & Kerry.
What are Kurt & Kerry?

7. Will Kerry die someday? Y N Not Sure

8. How do you know that Kerry will die someday?

9. Think about Stu & Sandy.
What are Stu & Sandy?

10. How old is Stu? Is he

-- a baby?
-- a child?
-- a teenager?
-- a grown up?

11. Will Stu always look this old? Y N Not Sure

(If yes) How do you know that Stu will always look this old?

(If no) How will he look different?

SLIDE SEQUENCE:

12. Do you think **Kurt** would help Stu if Stu were in trouble? Y N Not Sure

13. Why or why not?

14. Do you think **you** would help Stu if Stu were in trouble? Y N Not Sure

15. (If yes) Why would you want to help Stu?

(If no) Why wouldn't you help Stu?

16. Do you think **any wild kingfisher** would help **a wild shrew** if the shrew were in trouble? Y N Not Sure

17. Why or why not?

(How do you know...)

18. Is Kurt a bird or a person?

19. How do you know that Kurt is a _____?

20. Is Kurt a cartoon or a person?

21. How do you know that Kurt is a _____?

22. Is Kurt a real bird or a cartoon?

23. How do you know that Kurt is a _____?

24. Do you watch cartoons on TV at home? Y N Not Sure

25. What are your favorite cartoons?

26. Who is in the cartoon?

27. What is _____?

28. Why do you like to watch cartoons?

29. Are people supposed to learn things when they watch cartoons at home? Y N Not Sure

30. (If yes) Can you remember anything you have learned from watching cartoons at home?

(If no) Why not?

31. Are people supposed to learn things when they watch cartoons at school? Y N Not Sure

32. (If yes) Can you remember anything you have learned from watching cartoons at school?

(If no) Why not?

6-8th grade

Name

Grade

School

1. A few days ago you saw a video called "Living Lightly". Tell me everything you can remember about what you saw and heard in the video.

2. Do you remember the names of the characters in the video?

3. Which character is this?
What is Max?

4. If some people were camping in Michigan, could they see Max in the woods if they looked hard enough? Y N Not Sure

5. (If yes) How would they know that it was Max?

Would he look like this? Y N Not Sure

How would he look different?

If they heard Max, would they be able to understand him? Y N Not Sure

Why or Why not?

(If no) Why couldn't they see Max?

SLIDE SEQUENCE:

6. Do you think Kurt would help Stu if Stu were in trouble? Y N Not Sure

7. Why or why not?

8. Do you think you would help Stu if Stu were in trouble? Y N Not Sure

9. (If yes) Why would you want to help Stu?

(If no) Why wouldn't you help Stu?

10. Do you think any wild kingfisher would help a wild shrew if the shrew were in trouble? Y N Not Sure

11. Why or why not?

(How do you know...)

12. Is Kurt a bird or a person?

13. How do you know that Kurt is a _____?

14. Is Kurt a cartoon or a person?

15. How do you know that Kurt is a _____?

16. Is Kurt a real bird or a cartoon?

17. How do you know that Kurt is a _____?

18. Do you watch cartoons on TV at home? Y N Not Sure

19. What are your favorite cartoons?

20. Who is in the cartoon?

21. What is _____?

22. Why do you like to watch cartoons?

23. Are people supposed to learn things when they watch cartoons at home? Y N Not Sure

24. (If yes) Can you remember anything you have learned from watching cartoons at home?

(If no) Why not?

25. Are people supposed to learn things when they watch cartoons at school? Y N Not Sure

26. (If yes) Can you remember anything you have learned from watching cartoons at school?

APPENDIX G

Standard Deviations, Probabilities and Confidence Intervals for Observation Means (O_x)

Standard Deviations

1-3rd Grade

	Physical	Anthropomorphic	Moral
O_1	1.71	2.49	2.74
O_2	1.88	3.02	2.56
O_3	2.11	3.17	3.04
O_4	2.27	2.96	2.52
O_5	1.86	3.85	2.70
O_6	1.63	3.01	2.67
O_7	2.14	2.88	2.43
O_8	2.72	3.75	2.68
O_9	1.76	2.92	2.44

6-8th Grade

	Physical	Anthropomorphic	Moral
O_1	1.32	6.14	4.30
O_2	1.48	7.20	4.50
O_3	1.90	6.79	4.11
O_4	1.81	5.96	4.78
O_5	1.57	7.33	4.61
O_6	2.15	8.13	4.85
O_7	1.64	7.19	3.51
O_8	1.56	7.07	5.29
O_9	1.77	7.42	5.33

Probabilities and Confidence Intervals

"CI's overlap?" refers to the CI around the means for each observation. For example, if the CI for O_4 overlaps with the CI for O_9 for the Physical Attributes, a "Yes" appears in this column and implies that sampling error could have caused the difference. A "CI for difference" appears in those tables using a repeated measures t-test. It refers to the confidence interval for the difference between the 2 means. The difference may be as small or as large as these 2 numbers. If the CI includes a 0 then the H_0 cannot be rejected--i.e., there is no significant difference between the 2 means for these change scores.

1-3rd Grade

Repeated measures t-test of the effects of the Fantasy educational experience on subjects who had viewed the Natural History presentation (O_1 vs O_2)

	Physical	Anthropomorphic	Moral
Standard deviation	1.66	2.71	2.58
Confidence interval	(-0.26, -0.77)	(-0.67, 0.16)	(0.61, 1.41)
t	-3.95*	-1.20	4.95*

* denotes significance at $P \leq 0.05$

T-Test for effects of the Natural History Educational Experience (O_4 vs O_9)

Factor	P	CI's overlap?
Physical Attributes	0.05	no
Anthropomorphic Attributes	0.05	no
Moral Attributes	> 0.05	yes

T-Test for a pretest effect (O_5 vs O_8)

Factor	P	CI's overlap?
Physical Attributes	> 0.05	yes
Anthropomorphic Attributes	0.05	no
Moral Attributes	0.05	yes*

*CI overlap for Moral is slight: O_5 = (14.98 - 15.88)
O_8 = (14.03 - 14.98)

T-Test between change score means of O_1 vs O_2 and O_5 vs O_6

Factor	P	CI for difference	CI's overlap?
Physical Attributes	0.00	(4.92 - 5.90)	
Anthropomorphic Attributes	0.00	(2.30 - 3.81)	
Moral Attributes	> 0.05		

6-8th Grade

Repeated measures t-test of the effects of the Fantasy educational experience on subjects who viewed the Natural History presentation (O_1 vs O_2)

	Physical	Anthropomorphic	Moral
Standard deviation	1.23	6.59	3.15
Confidence interval	(-0.27, -0.36)	(-0.55, 1.52)	(-0.59, 0.36)
t	-5.69*	0.91	-0.49

* denotes significance at $P \leq 0.05$

T-Test for effects of the Natural History Educational Experience (O_4 vs O_9)

Factor	P	CI's overlap?
Physical Attributes	0.05	no
Anthropomorphic Attributes	0.05	no
Moral Attributes	> 0.05	yes

T-Test for a pretest effect (O_5 vs O_8)

Factor	P	CI's overlap?
Physical Attributes	> 0.05	yes
Anthropomorphic Attributes	0.05	no
Moral Attributes	> 0.05	yes

T-Test between change score means of O_1 vs O_2 and O_5 vs O_6

Factor	P	CI for difference	CI's overlap?
Physical Attributes	0.00	(4.56 - 5.41)	
Anthropomorphic Attributes	0.00	(5.51 - 9.67)	
Moral Attributes	> 0.05		

APPENDIX H

Wildlife-Related Activities by Experimental Group

Gender

	1-3rd Grade		6-8th Grade	
Exptl Group	Male	Female	Male	Female
1	46.0	54.0	53.4	46.6
2	61.3	38.7	43.8	56.2
3	52.6	47.4	51.5	48.1
4	52.9	47.1	46.1	53.9
5	55.5	44.5	52.7	47.3
6	50.4	49.6	54.1	45.9

Does your family put food out for birds, squirrels, deer, or other wildlife?

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	69.9	30.1	72.7	26.7
2	46.7	53.3	68.6	30.7
3	65.7	34.3	68.4	31.6
4	63.8	36.2	66.8	32.6
5	51.6	48.4	68.0	31.3
6	69.6	30.4	67.6	32.3

Have you gone with your family on a walk or drive to see wildlife?

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	70.6	29.4	71.6	27.8
2	72.3	27.7	76.3	23.7
3	67.9	32.1	80.6	19.4
4	83.3	16.7	76.2	23.8
5	68.8	31.3	81.3	18.4
6	63.0	37.0	75.1	24.9

Do you live on a farm and have animals like chickens, cows, pigs, horses, or sheep?

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	5.5	94.5	6.8	93.2
2	12.4	87.6	19.7	80.3
3	7.3	92.7	5.3	94.7
4	8.7	91.3	4.7	94.8
5	9.4	90.6	6.3	93.4
6	9.6	90.4	11.3	88.3

Have you gone hunting with a gun or bow and arrow?*

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	34.4	65.6	19.9	80.1
2	39.4	60.6	35.0	65.0
3	27.7	71.5	26.7	73.3
4	37.7	62.3	16.6	83.4
5	31.3	68.8	29.7	70.3
6	44.4	55.6	44.7	55.3

*Item is "Have you ever gone with someone while he or she hunted with a gun or bow and arrow?" for 1-3rd graders.

Does anyone else in your family go hunting with a gun or bow and arrow?*

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	54.0	46.0	41.5	58.5
2	66.4	33.6	55.8	43.8
3	62.8	37.2	57.8	42.2
4	57.2	42.8	30.6	68.9
5	59.4	40.6	60.2	39.8
6	74.1	25.9	73.5	26.5

*Item is "Does someone in your family go hunting with a gun or bow and arrow?" for 1-3rd graders.

Have you gone to a zoo in the past year?

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	69.9	30.1	59.7	40.3
2	63.5	36.5	41.6	58.4
3	59.1	40.1	64.1	35.9
4	59.4	40.6	79.8	19.7
5	54.7	45.3	51.2	48.4
6	63.0	37.0	60.3	39.7

Does your family go camping?

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	63.2	36.8	52.8	47.2
2	61.3	38.7	69.0	30.3
3	66.4	33.6	68.0	32.0
4	63.0	37.0	53.9	45.6
5	61.7	38.3	57.8	42.2
6	60.7	39.3	63.0	37.0

Have you ever gone fishing?

	1-3rd Grade		6-8th Grade	
Group	Yes	No	Yes	No
1	87.1	12.9	93.8	6.3
2	88.3	11.7	98.5	1.5
3	87.6	11.7	89.3	10.7
4	92.8	7.2	90.2	9.8
5	86.7	13.3	93.0	7.0
6	88.9	11.1	91.4	8.6

Items for 6-8th grade only

Do you belong to 4-H, Boy Scouts or Girl Scouts?

Experimental Group	Yes	No
1	12.5	87.5
2	45.6	54.4
3	13.1	86.9
4	13.5	86.5
5	16.4	83.2
6	13.2	86.4

Have you ever trapped wild animals for their fur?

Experimental Group	Yes	No
1	2.8	97.2
2	2.9	96.0
3	3.4	96.6
4	2.1	97.9
5	2.3	97.7
6	5.1	94.9

Does anyone else in your family trap wild animals for their fur?

Experimental Group	Yes	No
1	4.5	95.5
2	5.8	93.8
3	4.9	95.1
4	0.5	99.5
5	9.4	90.6
6	8.9	90.7

APPENDIX I

Examples of Lessons Learned from Cartoons

If mentioned by the subject, the cartoon from which the subject learned the lesson is italicized or in parentheses.

1-3rd Grade

Subjects who viewed only F educational experience

Don't take drugs. *(Cartoon All-Stars to the Rescue)*
Not "cutting" anybody
Bears were at the dentist, and if you have a loose tooth, use a kleenex.
There are bad things you learn, like jumping out of windows.
Ghosts are not true. *(Ghostbusters)*
A guy made a pair of wings. Don't do it.
Safety
If there's fire in your home, go to your neighbor's house.
Don't play with matches.
Don't play with matches unless your mom needs them. *(Bugs Bunny)*
In war, no one wins or loses. *(The Simpsons)*
Don't ride your bike in the street.
Don't cheat. *(Maxie's World)*
Help people. Don't always think of yourself. *(Alvin and the Chipmunks)*
How to count *(Sesame Street)*
What movie the family was using *(Teenage Mutant Ninja Turtles)*
Helpful hints (e.g., in case of a fire, shock) *(Police Academy)*
How to build a snowman *(Frosty the Snowman)*
How to be a cartoon worker. You could make things (cartoons) up.

Subjects who viewed both F and NH educational experiences

To love people *(Care Bears)*
Smoking, drinking and drugs are bad for you.
Help take care of our earth.
They have naughty words in them.
Alvin is so naughty when he cleans house. *(Alvin and the Chipmunks)*
Pooh learned that he can't fly because he's a bear. *(Winnie the Pooh)*
Say "No" to drugs.
Numbers, alphabet, adding, etc. *(Sesame Street)*
Don't steal.
Don't act like a hotshot. *(Kissyfur)*

Garfield was begging for cookies too much. Don't beg. *(Garfield)*

How to be nice to people. *(Care Bears)*

20 ways to save the earth.

Not to be greedy. *(Ducktales)*

Not to do what they're doing, or you'll get in trouble.

The *Teenage Mutant Ninja Turtles* are good and gentle people. They don't hurt you. They are friends.

6-8th Grade

Subjects who viewed only F educational experience

They do point out lessons and teach stuff: say "No" to drugs; don't pollute; say "No" to strangers; if someone is molesting you, tell someone. They are also entertaining and funny to watch.

Don't pollute the air or negatively impact the environment. *(Teenage Mutant Ninja Turtles* and *Alvin and the Chipmunks)*

Don't do drugs.

Don't start fires with matches or lighters.

Say "No" to strangers.

Teach about space and science *(Thundercats)*

Wrong ideas because kids get into mischief, like blowing up houses.

Teach you not to be bad or get into mischief. *(Alvin and the Chipmunks)*

Look both ways before crossing the street. *(GI Joe)*

Don't swim in any kind of storm. *(GI Joe)*

Challenging other people *(The Flintstones)*

Not to wander in the woods. *(Smurfs)*

Help people. Help the homeless.

Don't break things.

Not to play with fire

About drugs

Subjects who viewed both F and NH educational experiences

Most TV shows have a message that people are supposed to learn.

Some (the cartoon on drugs) teach you not to do things. Some help you learn things--important things about life.

Drugs

Trying to solve crimes without violence *(Rescue Rangers)*

Say "No" to drugs

Learn not to hurt animals. Do good. *(Teenage Mutant Ninja Turtles)*

Trust older people.

If you play jokes on friends, expect them to do it back.

Safety, don't talk to strangers

Funny "cut-downs"

Nature and the environment *(Sesame Street)*

Don't wander off.

How to count

Shows animals on farms *(Porky Pig)*

Dogs don't like cats *(Porky Pig)*

Share; help friends when they are in trouble.

Drugs, forest fires *(Alvin and the Chipmunks)*

Never try to balance something on your head. *(Alvin and the Chipmunks)*

Be careful about what you do. You can get hurt (e.g., electrocuted). *(Dennis the Menace)*

There are no such things as ghosts.

Don't hurt wild animals. Bring them home.

Littering

Dink the Dinosaur teaches you about dinosaurs.

What the world is coming to.

Forest fires *(Dennis the Menace)*

Not to play with matches

Sometimes you can't trust your babysitter. *(The Simpsons)*

People being rescued *(Rescue Rangers)*

Woody Woodpecker teaches you where they're found, what they eat, and that they live in the woods.

APPENDIX J

Path Analysis

Past Direct Contact with Wildlife Factor

Correlations and Contingency Coefficients with Knowledge Score

1-3rd Grade: N = 838
6-8th Grade: N = 1326

	1-3rd Grade		6-8th Grade	
Item	r	CC	r	CC
Putfood	0.16	0.18	0.21	0.22
WatchWL	0.12	0.13	0.16	0.20
Livefarm	0.13	0.17	0.11	0.13
Famhunt	0.16	0.17	0.10	0.12
Youhunt	0.21	0.23	0.23	0.23
GotoZoo	0.04	0.06	0.08	0.13
Camping	0.09	0.11	0.14	0.18
Fishing	0.14	0.15	0.19	0.23
WLClubs			0.12	0.15
Youtrap			0.14	0.16
Famtrap			0.06	0.08

Knowledge Score Means, Mean Differences and Weights

1-3rd Grade (Random sample N = 615)

Knowledge Score range = 0 - 6.0

Participants vs Non-participants

	Yes	No	Difference	Weight
Putfood	2.78	2.43	0.35	0.55
WatchWL	2.76	2.34	0.42	0.66
Livefarm	3.22	2.58	0.64	1.00
Youhunt	2.98	2.45	0.53	0.83
Famhunt	2.82	2.35	0.47	0.73
GotoZoo	2.66	2.61	0.05	0.08
Fishing	2.71	2.15	0.56	0.88
Camping	2.77	2.43	0.34	0.53

6-8th Grade (Random sample N = 1000)

Knowledge Score range = 0 - 10.0

Participants vs Non-participants

	Yes	No	Difference	Weight
Putfood	5.55	4.57	0.98	0.50
WatchWL	5.45	4.56	0.89	0.45
Livefarm	6.08	5.16	0.92	0.47
WLClubs	5.84	5.09	0.75	0.38
Youhunt	6.16	4.85	1.31	0.66
Famhunt	5.50	4.93	0.57	0.29
GotoZoo	5.40	5.03	0.37	0.19
Fishing	5.36	3.79	1.57	0.80
Camping	5.54	4.78	0.76	0.39
Youtrap	7.15	5.18	1.97	1.00
Famtrap	5.81	5.20	0.61	0.31

Coding

View Wildlife Educational Experience

1 = NH
2 = F

Direct Contact with Wildlife

Direct Contact with Wildlife Score using weighting scheme

Gender

0 = Female
1 = Male

Perceive Educational Experience as Real Wildlife

0 = No
1 = Yes

Give Physical Attributes of Educational Experience to Real Wildlife

Physical Attributes Score

Give Anthropomorphic Attributes of Educational Experience to Real Wildlife

Anthropomorphic Attributes Score

Give Moral Attributes of Educational Experience to Real Wildlife

Moral Attributes Score

Knowledge about Michigan Wildlife

Knowledge Score

Educational Experience Order

0 = Viewed NH last
1 = Viewed F last

Took a Test between viewing the NH and F educational experiences

0 = No
1 = Yes

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