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Academic authoritarians, language, metaphor, animals, & science

A few years ago a group of researchers in Scotland studying learning in apes did some experiments (involving opening boxes to get a piece of candy inside) that showed that chimpanzees learn in a variety of “flexibly adaptive” ways, and that 3 year old children being presented with a similar task most often did it in ways that appear to be less intelligent than the apes. They “suggest that the difference in performance of chimpanzees and children may be due to a greater susceptibility of children to cultural conventions.” (Horner and Whiten, 2005; Whiten, et al., 2004).

In my newsletter on puberty, I described some of the effects of foods and hormones on intelligence. Here, I want to consider the effects of culture on the way people learn and think. Culture, it seems, starts to make us stupid long before the metabolic problems appear.

For many years I described culture as the perceived limits of possibility, but people usually prefer to think of it as the learned rules of conduct in a society. In the late 1950s I was talking with a psychologist about the nature of “mental maps,” and I said that I found my way around campus by reference to mental pictures of the locations of things, and he said that his method was to follow a series of rules, “go out the front door and turn left, turn left at the first corner, walk three blocks and turn right, ….up the stairs, turn right, fourth office on the left.” He had been studying mental processes for about 40 years, so his claim made an impression on me.

I thought this style of thinking might have something to do with the growing technological preference for digital, rather than analog, devices. The complexity and continuity of the real world is made to seem more precise and concrete by turning it into rules and numbers.

Around the same time, I found that some people dream in vivid images, while others describe dreams as “listening to someone tell a story.”

Several years later, a graduate student of “language philosophy” from MIT told me that I was just confused if I believed that I had mental images that I could use in thinking. His attitude was that language, in its forms and in the ways it could convey meaning, was governed by rules. He was part of an effort to define consciousness in terms of rules that could be manipulated formally. This was just a new variation on the doctrine of an “ideal language” that has concerned many philosophers since Leibniz, but now its main use is to convince people that cultural conventions and authority are rooted in the nature of our minds, rather than in particular things that people experience and the ways in which they are treated.

George Orwell, whose novels showed some of the ways language is used to control people, believed that language should be like a clear window between minds, but knew that it was habitually used to distort, mislead, and control. Scientific and medical practices often follow the authority of culture and indoctrination, instead of intelligently confronting the meaning of the evidence, the way chimpanzees are able to do.

Not so many years ago, people believed that traits were “determined by genes,” and that the development of an organism was the result of--was caused by--the sequential expression of genes in the nucleus of the

fertilized egg. When B.F. Skinner in the 1970s said “a gestating baby isn't influenced by what happens to its mother,” he was expressing a deeply rooted bio-medical dogma. Physicians insisted that a baby couldn't be harmed by its mother's malnutrition, as long as she lived to give birth. People could be quite vicious when their dogma was challenged, but their actions were systematically vicious when they weren't challenged.

An ovum doesn't just grow from an oocyte according to instructions in its genes, it is constructed, with surrounding nurse cells adding substances to its cytoplasm. Analogously, the fertilized egg doesn't just grow into a human being, it is constructed, by interactions with the mother's physiology. At birth, the environment continues to influence the ways in which cells develop and interact with each other.

Even during adulthood, the ways in which our cells--in the brain, immune system, and other organs--develop and interact are shaped by the environment. When Skinner was writing, many biologists still believed that each synapse of a nerve was directed by a gene, and couldn't be influenced by experience.

Our brain grows into our culture, and the culture lives in our nervous system. If a person grows up without hearing people speak, he will have grown a special kind of brain, making it difficult to learn to speak. (Genie, wolf boy, Kaspar Hauser, for example.)

When we ask a question and find an answer, we are changed. Thinking with learning is a developmental process. But many people learn at an early age not to question. This changes the nature of subsequent learning and brain development.

In the 1960s, many textbooks were published that claimed to use scientific language theory to improve the instruction of English, from grade school level to college level. They didn't work, and at the time they were being published they appeared fraudulent to people who didn't subscribe to the incipient cults of “Generative Grammar” and “Artificial Intelligence” that later developed into “Cognitive Science.”

At the time that Artificial Intelligence was coming to the attention of investors and academicians, Neodarwinism had already cleansed the university biology departments of its opponents who advocated more holistic views, and the idea of a brain that was “hard-wired” according to genetic instructions had entered both neurology and psychology. The field concept was disappearing from developmental biology, as Gestalt psychology was disappearing from the universities and journals.

In the humanities and social sciences, a fad appeared in the 1960s, in which a theory of grammar advocated by Noam Chomsky of MIT was said to explain human thinking and behavior, and specialists in anthropology, psychology, literature, rhetoric, sociology, and other academic fields, claimed that it informed their work in an essential way. The rapid spread of a doctrine for which there was essentially no evidence suggests that it was filling a need for many people in our culture. This doctrine was filling some of the gaps left by the failure of genetic determinism that was starting to be recognized. It gave new support to the doctrine of inborn capacities and limitations, in which formulaic indoctrination can be justified by the brain's natural structure.

Chomsky was committed to an idealistic, “rationalist” doctrine of innate ideas, and to argue for that doctrine, which held that there are transcendent forms (or “deep structures”) that control mind, he disposed of the opposing “empiricist” approach to mind by claiming that children simply learn language so rapidly that it would be impossible to explain on the basis of learning from experience. Separating vocabulary from grammar, he acknowledged that each language is different, and can be learned as easily by the children of immigrants of different ethnicity as by children whose ancestors spoke it, but that all humans have a genetically encoded “universal grammar,” a “language organ.” It is this “inborn grammar” that allows children to learn what he said would be inconceivable to learn so quickly from experience.

The abstract, computational nature of the “inborn” functions of the “language organ” would make a nice program for a translating machine, and the absence of such a useful program, after more than 50 years of trying to devise one, argues against the possibility of such a thing.

Since Plato's time, some people have believed that, behind the changing irregularities of real languages, there is a timeless, context-free language. In the late 1950s, when I was studying language and the “ideal languages” of the philosophers, I realized that George Santayana was right when he pointed out that each time an artificial language is used by real people in real situations, it is altered by the experience that accrues to each component, from the context in which it is used. If real language were the model for mathematics, then the values of numbers would change a little with every calculation.

Adults are usually slower than children at learning a new language, but they can make the process much quicker by memorizing paradigms. With those models, they can begin speaking intelligible sentences when they know only a few words. These basics of grammar are often outlined in just a few pages, but listing irregularities and exceptions can become very detailed and complex. The grammar that children use isn't as subtle as the grammar some adults use, and college freshmen are seldom masters of the grammar of their native language.

There have been various studies that have investigated the number of words understood by children at different ages.

The Virginia Polytechnic Institute website says that

By age 4 a person probably knows 5,600 words

By age 5 a person probably knows 9,600 words

By age 6 a person probably knows 14,700 words

By age 7 a person probably knows 21,200 words

By age 8 a person probably knows 26,300 words

By age 9 a person probably knows 29,300 words

By age 10 a person probably knows 34,300 words

By age 20 a college sophomore probably knows 120,000 words

A dictionary with 14,000 words is a substantial book. The grammar used by a 6 year old person isn't very complex, because at that age a person isn't likely to know all of the subtleties of their language. There is no reason to assume that a mind that can learn thousands of words and concepts in a year can't learn the grammatical patterns of a language--a much smaller number of patterns and relationships--in a few years.

Idioms and clichés are clusters of words that are frequently used together in the same pattern to express a stereotyped meaning. There are thousands of them in English, and some of them have existed for centuries, while others are regional and generational. It is possible to speak or write almost completely in clichés, and they are such an important part of language that their acquisition along with the basic vocabulary deserves more attention than linguists have given it. A mind that can learn so many clichés can certainly learn the relatively few stereotypical rules of phrasing that make up the grammar of a language. In fact, a grammar in some ways resembles a complex cliché.

Recognition of patterns, first of things that are present, then of meaningful sequences, is what we call awareness or consciousness. There is biological evidence, from the level of single cells through many types of organism, both plant and animal, that pattern recognition is a basic biological function. An organism that isn't oriented in space and time isn't an adapted, adapting, organism. Environments change, and the organization of life necessarily has some flexibility.

A traveling bird or dog can see a pattern once, and later, going in the opposite direction, can recognize and find specific places and objects. An ant or bee can see a pattern once, and communicate it to others.

If dogs and birds lived in colonies or cities, as bees and ants do, and carried food home from remote locations, they might have a need to communicate their knowledge. The fact that birds and dogs use their vocal organs and brains to communicate in ways that people have seldom cared to study doesn't imply that their brains differ radically from human brains in lacking a “language organ.”

People whose ideology says that “animals use instinct rather than

intelligence," and that they lack "the language instinct," refuse to perceive animals that are demonstrating their ability to generalize or to understand language.

Organisms have genes, so a person could say that pattern recognition is genetically determined, but it would be a foolish and empty thing to say. (Nevertheless, people do say it.) The people who believe that there are "genes for grammar" believe that these mind-controlling genes give us the ability to generalize, and therefore say that animals aren't able to generalize, though their "instinctive behaviors" might sometimes seem to involve generalization.

In language, patterns are represented symbolically by patterned sounds, and some of those symbolically represented patterns are made up of other patterns. Different languages have different ways of representing different kinds of patterns.

"Things" are recognizable when they are far or near, moving or still, bright or dark, or upside down, because the recognition of a pattern is an integration involving both spatial and temporal components. The recognition of an object involves both generalization and concreteness.

Things that are very complex are likely to take longer to recognize, but the nature of any pattern is that it is a complex of parts and properties.

A name for "a thing" is a name for a pattern, a set of relationships.

The method of naming or identifying a relationship can make use of any way of patterning sound that can be recognized as making distinctions. Concepts and grammar aren't separable things, "semantics" and "syntax" are just aspects of a particular language's way of handling meaning.

As a child interacts with more and more things, and learns things about them, the patterns of familiar things are compared to the patterns of new things, and differences and similarities are noticed and used to understand relationships. The comparison of patterns is a process of making analogies, or metaphors. Similarities perceived become generalizations, and distinctions allow things to be grouped into categories.

When things are explored analogically, the exploration may first identify objects, and then explore the factors that make up the larger pattern that was first identified, in a kind of analysis, but this analysis is a sort of expansion inward, in which the discovered complexity has the extra meaning of the larger context in which it is found.

When something new is noticed, it excites the brain, and causes attention to be focused, in the "orienting reflex." The various senses participate in examining the thing, in a physiological way of asking a question. Perception of new patterns and the formation of generalizations expands the ways in which questions are asked. When words are available, questions may be verbalized. The way in which questions are answered verbally may be useful, but it often diverts the questioning process, and provides rules and arbitrary generalizations that may take the place of the normal analogical processes of intelligence. The vocabulary of patterns no longer expands spontaneously, but tends to come to rest in a system of accepted opinions.

A few patterns, formulated in language, are substituted for the processes of exploration through metaphorical thinking. In the first stages of learning, the process is expansive and metaphorical. If a question is closed by an answer in the form of a rule that must be followed, subsequent learning can only be analytical and deductive.

Learning of this sort is always a system of closed compartments, though one system might occasionally be exchanged for another, in a "conversion experience."

The exploratory analogical mind is able to form broad generalizations and to make deductions from those, but the validity of the generalization is always in a process of being tested. Both the deduction and the generalization are constantly open to revision in accordance with the available evidence.

If there were infallible authorities who set down general rules, language

and knowledge could be idealized and made mathematically precise. In their absence, intelligence is necessary, but the authorities who would be infallible devise ways to confine and control intelligence, so that, with the mastery of a language, the growth of intelligence usually stops.

In the 1940s and '50s, W.J.J. Gordon organized a group called Synectics, to investigate the creative process, and to devise ways to teach people to solve problems effectively. It involved several methods for helping people to think analogically and metaphorically, and to avoid stereotyped interpretations. It was a way of teaching people to recover the style of thinking of young children, or of chimps, or other intelligent animals.

When the acquisition of language is burdened by the acceptance of clichés, producing the conventionalism mentioned by Horner and Whiten, with the substitution of deductive reasoning for metaphorical-analogical thinking, the natural pleasures of mental exploration and creation are lost, and a new kind of personality and character has come into existence.

Bob Altemeyer spent his career studying the authoritarian personality, and has identified its defining traits as conventionalism, submission to authority, and aggression, as sanctioned by the authorities. His last book, *The Authoritarians* (2006) is available on the internet.

Altemeyer found that people who scored high on his scale of authoritarianism tended to have faulty reasoning, with compartmentalized thinking, making it possible to hold contradictory beliefs, and to be dogmatic, hypocritical, and hostile.

Since he is looking at a spectrum, focusing on differences, I think he is likely to have underestimated the degree to which these traits exist in the mainstream, and in groups such as scientists, that have a professional commitment to clear reasoning and objectivity. With careful training, and in a culture that doesn't value creative metaphorical thinking, authoritarianism might be a preferred trait.

Konrad Lorenz (who with Niko Tinbergen got the Nobel Prize in 1973) believed that specific innate structures explained animal communication, and that natural selection had created those structures. Chomsky, who said that our genes create an innate “Language Acquisition Device,” distanced himself slightly from Lorenz's view by saying that it wasn't certain that natural selection was responsible for it. However, despite slightly different names for the hypothetical innate “devices,” their views were extremely similar.

Both Lorenz and Chomsky, and their doctrine of innate rule-based consciousness, have been popular and influential among university professors. When Lorenz wrote a book on degeneration, which was little more than a revised version of the articles he had written for the Nazi party's Office for Race Policy in the late 1930s and early 1940s, advocating the extermination of racial “mongrels” such as jews and gypsies, most biologists in the US praised it. Lorenz identified National Socialism with evolution as an agent of racial purification. His lifelong beliefs and activities--the loyalty to a strong leader, advocating the killing of the weak--identified Lorenz as an extreme authoritarian.

When a famous professor went on a lecture tour popularizing and affirming the scientific truth and importance of those publications, and asserting that all human actions and knowledge, language, work, art, and belief, are specified and determined by genes, he and his audience (which, at the University of Oregon, included members of the National Academy of Sciences and Jewish professors who had been refugees from Nazism, who listened approvingly) were outraged when a student mentioned the Nazi origin and intention of the original publications.

They said “you can't say that a man's work has anything to do with his life and political beliefs,” but in fact the lecturer had just finished saying that everything a person does is integral to that person's deepest nature, just as Lorenz said that a goose with a pot belly and odd beak, or a person with non-nordic physical features and behavior and cultural preferences--should be eliminated for the improvement of the species. Not a single professor in the audience questioned the science that had justified Hitler's racial policies, and some of them showed great hostility toward the critic.

In the 1960s, a professor compared graduate students' scores on the

Miller Analogies Test, which is a widely used test of analogical thinking ability, to their academic grades. She found that the students who scored close to the average on the test had the highest grades and the greatest academic success, and those who deviated the most from the average on that test, in either direction, had the worst academic grades. If the ability to think analogically is inversely associated with authoritarianism, then her results would indicate that graduate schools select for authoritarianism. (If not, then they simply select for mediocrity.)

Although Bob Altemeyer's scale mainly identified right-wing, conservative authoritarians, he indicated that there could be left-wing authoritarians, too. Noam Chomsky is identified with left-wing political views, but his views of genetic determinism and a “nativist” view of language learning, and his anti-empiricist identification of himself as a philosophical Rationalist, have a great correspondence to the authoritarian character. The “nativist” rule-based nature of “Cognitive Science” is just the modern form of an authoritarian tradition that has been influential since Plato's time.

The first thing a person is likely to notice when looking at Chomsky's work in linguistics is that he offers no evidence to support his extreme assertions. In fact, the main role evidence plays in his basic scheme is negative, that is, his doctrine of “Poverty of the Stimulus” asserts that children aren't exposed to enough examples of language for them to be able to learn grammar--therefore, grammar must be inborn.

I think Chomsky discovered long ago that the people around him were sufficiently authoritarian to accept assertions without evidence if they were presented in a form that looked complexly technical. Several people have published their correspondence with him, showing him to be authoritarian and arrogant, even rude and insulting, if the person questioned his handling of evidence, or the lack of evidence.

For example, people have argued with him about the JFK assassination, US policy in the Vietnam war, the HIV-AIDS issue, and the 9/11 investigation. In each case, he accepts the official position of the government, and insults those who question, for example, the adequacy of the Warren Commission report, or who believe that the pharmaceutical industry would manipulate the evidence regarding AIDS, or who doubt the conclusions of the 9/11 Commission investigation.

He says that investigation of such issues is “diverting people from serious issues,” as if those aren't serious issues. And “even if it's true” that the government was involved in the 9/11 terrorism, “who cares? I mean, it doesn't have any significance. I mean it's a little bit like the huge amount of energy that's put out on trying to figure out who killed John F. Kennedy. I mean, who knows, and who cares...plenty of people get killed all the time. Why does it matter that one of them happens to be John F. Kennedy?"

"If there was some reason to believe that there was a high level conspiracy" in the JFK assassination, "it might be interesting, but the evidence against that is just overwhelming." "And after that it's just a matter of, uh, if it's a jealous husband or the mafia or someone else, what difference does it make?" "It's just taking energy away from serious issues onto ones that don't matter. And I think the same is true here," regarding the events of 9/11. These reactions seem especially significant, considering his reputation as America's leading dissenter.

The speed with which Chomskyism spread through universities in the US in the 1960s convinced me that I was right in viewing the instruction of the humanities and social sciences as indoctrination, rather than objective treatment of knowledge. The reception of the authoritarian ideas of Lorenz and his apologists in biology departments offered me a new perspective on the motivations involved in the uniformity of the orthodox views of biology and medicine.

In being introduced into a profession, any lingering tendency toward analogical-metaphoric thinking is suppressed. I have known perceptive, imaginative people who, after a year or two in medical school, had become rigid rule-followers.

One of the perennial questions people have asked when they learn of the suppression of a therapy, is “if the doctors are doing it to defend the profitable old methods, how can they refuse to use the better method even for themselves and their own family?” The answer seems to be that

their minds have been radically affected by their vocational training.

For many years, cancer and inflammation have been known to be closely associated, even to be aspects of a single process. This was obvious to “analog minded” people, but seemed utterly improbable to the essentialist mentality, because of the indoctrination that inflammation is a good thing, that couldn't coexist with a bad thing like cancer.

The philosophy of language might seem remote from politics and practical problems, but Kings and advertisers have understood that words and ideas are powerfully influential in maintaining relationships of power.

Theories of mind and language that justify arbitrary power, power that can't justify itself in terms of evidence, are more dangerous than merely mistaken scientific theories, because any theory that bases its arguments on evidence is capable of being disproved.

In the middle ages, the Divine Right of Kings was derived from certain kinds of theological reasoning. It has been replaced by newer ideologies, based on deductions from beliefs about the nature of mind and matter, words and genes, “Computational Grammar,” or numbers and quantized energy, but behind the ideology is the reality of the authoritarian personality.

I think if we understand more about the nature of language and its acquisition we will have a clearer picture of what is happening in our cultures, especially in the culture of science.

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Language & Communication Volume 23, Issue 1, January 2003, Pages 1-43. **“Remarks on the origins of morphophonemics in American structuralist linguistics,”** E. F. K. Koerner. Chomsky has led the public to believe that he originated things which he borrowed from earlier linguists.

Science. 2008 Feb 1;319(5863):569; author reply 569. **Comparing social skills of children and apes.** De Waal FB, Boesch C, Horner V, Whiten A. Letter

Curr Biol. 2007 Jun 19;17(12):1038-43. Epub 2007 Jun 7. **Transmission of multiple traditions within and between chimpanzee groups.** Whiten A, Spiteri A, Horner V, Bonnie KE, Lambeth SP, Schapiro SJ, de Waal FB. Centre for Social Learning and Cognitive Evolution and Scottish Primate Research Group, School of Psychology, University of St Andrews, St Andrews KY16 9JP, United Kingdom. **A.whiten@st-andrews.ac.uk** Field reports provide increasing evidence for local behavioral traditions among fish, birds, and mammals. These findings are significant for evolutionary biology because social learning affords faster adaptation than genetic change and has generated new (cultural) forms of evolution. Orangutan and chimpanzee field studies suggest that like humans, these apes are distinctive among animals in each exhibiting over 30 local traditions. However, direct evidence is lacking in apes and, with the exception of vocal dialects, in animals generally for the intergroup transmission that would allow innovations to spread widely and become evolutionarily significant phenomena. Here, we provide robust experimental evidence that alternative foraging techniques seeded in different groups of chimpanzees spread differentially not only within groups but serially across two further groups with substantial fidelity. Combining these results with those from recent social-diffusion studies in two larger groups offers the first experimental evidence that a nonhuman species can sustain unique local cultures, each constituted by multiple traditions. The convergence of these results with those from the wild implies a richness in chimpanzees' capacity for culture, a richness that parsimony suggests was shared with our common ancestor.

J Comp Psychol. 2007 Feb;121(1):12-21. **Learning from others' mistakes? limits on understanding a trap-tube task by young chimpanzees (Pan troglodytes) and children (Homo sapiens).** Horner V, Whiten A. Centre for Social Learning and Cognitive Evolution, School of Psychology, University of St Andrews, Fife, Scotland, UK. **Vhorner@rmy.emory.edu** A trap-tube task was used to determine whether chimpanzees (Pan troglodytes) and children (Homo sapiens) who observed a model's errors and successes could master the task in fewer trials than those who saw only successes. Two- to 7-year-old chimpanzees and 3- to 4-year-old children did not benefit from observing errors and found the task difficult. Two of the 6 chimpanzees developed a successful anticipatory strategy but showed no evidence of representing the core causal relations involved in trapping. Three- to 4-year-old children showed a similar limitation and tended to copy the actions of the demonstrator, irrespective of their causal relevance. Five- to 6-year-old children were able to master the task but did not appear to be influenced by social learning or benefit from observing errors.

Proc Biol Sci. 2007 Feb 7;274(1608):367-72. **Spread of arbitrary conventions among**

chimpanzees: a controlled experiment. Bonnie KE, Horner V, Whiten A, de Waal FB. Living Links, Yerkes National Primate Research Center, Atlanta, GA 30329, USA. **Kebonni@emory.edu** Wild chimpanzees (Pan troglodytes) have a rich cultural repertoire--traditions common in some communities are not present in others. The majority of reports describe functional, material traditions, such as tool use. Arbitrary conventions have received far less attention. In the same way that observations of material culture in wild apes led to experiments to confirm social transmission and identify underlying learning mechanisms, experiments investigating how arbitrary habits or conventions arise and spread within a group are also required. The few relevant experimental studies reported thus far have relied on cross-species (i.e. human-ape) interaction offering limited ecological validity, and no study has successfully generated a tradition not involving tool use in an established group. We seeded one of two rewarded alternative endpoints to a complex sequence of behaviour in each of two chimpanzee groups. Each sequence spread in the group in which it was seeded, with many individuals unambiguously adopting the sequence demonstrated by a group member. In one group, the alternative sequence was discovered by a low ranking female, but was not learned by others. Since the action-sequences lacked meaning before the experiment and had no logical connection with reward, chimpanzees must have extracted both the form and benefits of these sequences through observation of others.

Proc Natl Acad Sci U S A. 2006 Sep 12;103(37):13878-83. **Faithful replication of foraging techniques along cultural transmission chains by chimpanzees and children.** Horner V, Whiten A, Flynn E, de Waal FB. Centre for Social Learning and Cognitive Evolution, School of Psychology, University of St. Andrews, Fife KY16 9JP, United Kingdom. Observational studies of wild chimpanzees (Pan troglodytes) have revealed population-specific differences in behavior, thought to represent cultural variation. Field studies have also reported behaviors indicative of cultural learning, such as close observation of adult skills by infants, and the use of similar foraging techniques within a population over many generations. Although experimental studies have shown that chimpanzees are able to learn complex behaviors by observation, it is unclear how closely these studies simulate the learning environment found in the wild. In the present study we have used a diffusion chain paradigm, whereby a behavior is passed from one individual to the next in a linear sequence in an attempt to simulate intergenerational transmission of a foraging skill. Using a powerful three-group, two-action methodology, we found that alternative methods used to obtain food from a foraging device ("lift door" versus "slide door") were accurately transmitted along two chains of six and five chimpanzees, respectively, such that the last chimpanzee in the chain used the same method as the original trained model. The fidelity of transmission within each chain is remarkable given that several individuals in the no-model control group were able to discover either method by individual exploration. A comparative study with human children revealed similar results. This study is the first to experimentally demonstrate the linear transmission of alternative foraging techniques by non-human primates. Our results show that chimpanzees have a capacity to sustain local traditions across multiple simulated generations.

Nature. 2005 Sep 29;437(7059):737-40. **Conformity to cultural norms of tool use in chimpanzees.** Whiten A, Horner V, de Waal FB. Centre for Social Learning and Cognitive Evolution, School of Psychology, University of St Andrews, St Andrews, Fife, KY16 9JP, UK. **A.whiten@st-and.ac.uk** Rich circumstantial evidence suggests that the extensive behavioural diversity recorded in wild great apes reflects a complexity of cultural variation unmatched by species other than our own. However, the capacity for cultural transmission assumed by this interpretation has remained difficult to test rigorously in the field, where the scope for controlled experimentation is limited. Here we show that experimentally introduced technologies will spread within different ape communities. Unobserved by group mates, we first trained a high-ranking female from each of two groups of captive chimpanzees to adopt one of two different tool-use techniques for obtaining food from the same 'Pan-pipe' apparatus, then re-introduced each female to her respective group. All but two of 32 chimpanzees mastered the new technique under the influence of their local expert, whereas none did so in a third population lacking an expert. Most chimpanzees adopted the method seeded in their group, and these traditions continued to diverge over time. A subset of chimpanzees that discovered the alternative method nevertheless went on to match the predominant approach of their companions, showing a conformity bias that is regarded as a hallmark of human culture.

Anim Cogn. 2005 Jul;8(3):164-81. **Causal knowledge and imitation/emulation switching in chimpanzees (Pan troglodytes) and children (Homo sapiens).** Horner V, Whiten A. Centre for Social Learning and Cognitive Evolution, School of Psychology, University of St Andrews, St Andrews, KY16 9JU, UK. **Vkh1@st-andrews.ac.uk** This study explored whether the tendency of chimpanzees and children to use emulation or imitation to solve a tool-using task was a response to the availability of causal information. Young wild-born chimpanzees from an African sanctuary and 3- to 4-year-old children observed a human demonstrator use a tool to retrieve a reward from a puzzle-box. The demonstration involved both causally relevant and irrelevant actions, and the box was presented in each of two conditions: opaque and clear. In the opaque condition, causal information about the effect of the tool inside the box was not available, and hence it was impossible to differentiate between the relevant and irrelevant parts of the demonstration. However, in the clear condition causal information was available, and subjects could potentially determine which actions were necessary. When chimpanzees were presented with the opaque box, they reproduced both the relevant and irrelevant actions, thus imitating the overall structure of the task. When the box was presented in the clear condition they instead ignored the irrelevant actions in favour of a more efficient, emulative technique. These results suggest that emulation is the favoured strategy of chimpanzees when sufficient causal information is available. However, if such information is not available, chimpanzees are prone to employ a **more comprehensive**

copy of an observed action. In contrast to the chimpanzees, children employed imitation to solve the task in both conditions, at the expense of efficiency. We suggest that the difference in performance of chimpanzees and children may be due to **a greater susceptibility of children to cultural conventions,** perhaps combined with a differential focus on the results, actions and goals of the demonstrator.

Learn Behav. 2004 Feb;32(1):36-52. **How do apes ape?** Whiten A, Horner V, Litchfield CA, Marshall-Pescini S. Centre for Social Learning and Cognitive Evolution, Scottish Primate Research Group, School of Psychology, University of St. Andrews, St. Andrews, Fife, Scotland. **A.whiten@st-and.ac.uk** In the wake of telling critiques of the foundations on which earlier conclusions were based, the last 15 years have witnessed a renaissance in the study of social learning in apes. As a result, we are able to review 31 experimental studies from this period in which social learning in chimpanzees, gorillas, and orangutans has been investigated. The principal question framed at the beginning of this era, Do apes ape? has been answered in the affirmative, at least in certain conditions. The more interesting question now is, thus, How do apes ape? Answering this question has engendered richer taxonomies of the range of social-learning processes at work and new methodologies to uncover them. Together, these studies suggest that apes ape by employing a portfolio of alternative social-learning processes in **flexibly adaptive ways,** in conjunction with nonsocial learning. We conclude by sketching the kind of decision tree that appears to underlie the deployment of these alternatives.

http://www.ucc.vt.edu/stdysk/vocabula.html

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