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Psyc 302 Reading on Evolutionary Psychology

Leda Cosmides was interviewed by Alvaro Fischer and Roberto Araya for the Chilean newspaper, *El Mercurio* (portions of the interview, translated into Spanish, were published therein on October 28, 2001). This was part of a project entitled "New Paradigms at the Beginning of the Third Millennium", jointly sponsored by the Chilean Engineering Institute and the Chilean Academy of Sciences. The interview covered so many frequently asked questions that we decided to post it here.

Question 1 (Fischer & Araya): You and John Tooby are considered to be among the founders of evolutionary psychology. According to philosopher of mind, Dan Dennett, "you are doing some of the best work in Darwinian Psychology today" and "you seem to have uncovered a fossil of our Nietschean past". Can you explain what evolutionary psychology is, and how knowing that "our modern skulls house a stone age mind"[1] can help us to understand modern humans?

Cosmides: Evolutionary psychology is an *approach* to psychology, in which knowledge and principles from evolutionary biology are put to use in research on the structure of the human mind. It is not an area of psychology, like vision, reasoning, or social behavior. It is a *way of thinking* about psychology that can be applied to any topic within it.

When evolutionary psychologists refer to "the mind", they mean the set of information-processing devices, embodied in the human brain, that are responsible for all conscious and nonconscious mental activity, and that generate all behavior. What allows evolutionary psychologists to go beyond traditional approaches in studying the mind is that they make active use in their research of an often overlooked fact: That the programs comprising the human mind were designed by natural selection to solve the adaptive problems faced by our hunter-gatherer ancestors. It leads one to look for programs that are well-engineered for solving problems such as hunting, foraging for plant foods, courting mates, cooperating with kin, forming coalitions for mutual defense, avoiding predators, and so on. Our minds should have programs that make us good at solving these problems, whether or not they are important in the modern world.

At the same time, by understanding these programs, we can learn how to deal more effectively with evolutionarily novel circumstances. Consider, for example, that the only information available to hunter-gatherers about probability and risk was the frequency with which they encountered actual events. It looks like our "stone age mind" has programs designed to acquire and reason well about frequency data. Knowing this, evolutionary psychologists are developing better ways of communicating complex modern data about statistics. Let’s say you have a positive mammogram. How likely is it that you actually have breast cancer? The typical way of presenting the relevant data – in percents – makes this difficult. If you said that 1% of women randomly screened have breast cancer, and all of these test positive, but there is a 3% false alarm rate, most people mistakenly think a positive mammogram means they have a 97% chance of having breast cancer. But let me give you the same information in absolute frequencies – an

ecologically valid information format for a hunter-gatherer mind: Out of every 1000 women, 10 have breast cancer and test positive; 30 test positive but do not have breast cancer. So: out of every 1000 women, 40 will test positive, but only 10 of these will have breast cancer. This format makes it clear that, if you had a positive mammogram, your chance of having breast cancer is only 1 in 4…that is, 25%, not 97%.

So evolutionary psychology has many practical applications. It presents many possibilities for improving human life.

Question 2 (Fischer & Araya): *Some experts criticize the evolutionary approach because it generates only "after the fact" explanations, and that for any trait you can always make up an evolutionary explanation. What is your response to this criticism? Can the evolutionary approach help to generate testable novel predictions about animal or human behavior?*

Cosmides: There is nothing wrong with explaining facts that are already known: no one faults a physicist for explaining why stars shine or apples fall toward earth. But evolutionary psychology would not be very useful if it were only capable of providing explanations after the fact, because almost nothing about the mind is known or understood: there are few facts, at the moment, to be explained! The strength of an evolutionary approach is that it can aid discovery: it allows you to generate predictions about what programs the mind might contain, so that you can conduct experiments to see if they in fact exist. My own work on programs specialized for cheater detection is one example. The prediction that we would have mental programs that make us very good at detecting cheaters in situations of social exchange (reciprocation) can be easily generated from Trivers' model of reciprocal altruism, which was published in 1971. But in 1971, no one knew if the human mind has such programs. So I tested for their presence – a decade later. The existence of cheater detection programs was not previously known; the evolutionary approach allowed them to be discovered. An explanation cannot be "after the fact" if the fact it explains was not previously known.

What about evolutionary explanations of phenomena that are already known? Those who have a professional knowledge of evolutionary biology know that it is not possible to cook up after the fact explanations of just any trait. There are important constraints on evolutionary explanation. More to the point, every decent evolutionary explanation has testable predictions about the design of the trait. For example, the hypothesis that pregnancy sickness is a byproduct of prenatal hormones predicts different patterns of food aversions than the hypothesis that it is an adaptation that evolved to protect the fetus from pathogens and plant toxins in food at the point in embryogenesis when the fetus is most vulnerable – during the first trimester. Evolutionary hypotheses – whether generated to discover a new trait or to explain one that is already known – carry predictions about the design of that trait. The alternative – having no hypothesis about adaptive function – carries no predictions whatsoever. So which is the more constrained and sober scientific approach?!

Question 3 (Fischer & Araya): Other social scientists criticize the evolutionary approach to human behavior, because it is too closely tied to biology. That has led in the past, they say, to abhorrent political projects, including racism and extermination policies, and can also lead to

genetic determinism, seen as reductionist and incompatible with a humanist view of humankind. What do you respond to that?

Cosmides: The world has many people with evil motives, who will twist whatever ideas are around them to their own ends. Hitler, for example, was more influenced by folk notions about "blood" (found everywhere) than by any real biological knowledge. His ideas were also influenced by Northern European mythology and folklore – yet no one would suggest that these should not be studied because of the dreadful purposes to which they were turned.[2]

Since the Enlightenment, people have been trying to build bridges between disciplines, and when they do, new insights are achieved and humanity benefits. Should the healing arts have been kept separate from biology? If they had, we would not have antibiotics and modern medicine. Should psychology be kept separate from biology? If it is, we will never understand how the mind works. As a result, we will never understand how to make war less likely, how to cure autism, how to help people understand risk, or how to prevent racism, to name just a few problems on which evolutionary psychologists are making progress. Indeed, if we keep psychology separate from biology, people will continue to believe that "race" is a sensible concept; in contrast, human population biology tells us that humanity is not divided into distinct "races".

As to genetic determinism, this is a phrase without any meaning. Evolutionary psychologists think that behavior is a joint product of the information in our environments and the programs in our heads. These programs, in turn, were created during our lifetime through a dynamic interaction between our genes and the environment. Which genes we have is a function of past environments, which, over deep time, selected for some genes over others: some were retained in the human genome, and others were eliminated from it. This set of propositions is not particularly controversial – almost every psychologist, evolutionary or not, would agree with them. Is this "genetic determinism"? One might as easily call it "environmental determinism": the environment selected the genes, the environment was a crucial factor in building the programs, the environment provides the input to the programs. But why call it "determinism" at all? Saying that our decisions are reached based on information, as processed by our minds, is a compliment, not an insult. Is it more "dignified", more "humanistic", to think that everything we do is random? Wouldn't that make us something less than rational beings?

Question 4 (Fischer & Araya): You embrace a computational view of the mind that considers the brain as an information-processing machine. Several psychologists and neuroscientists criticize this view as outmoded, and adopt an "embodied" approach or a "wet mind" approach where the words "representation" and "information" are somehow forbidden, and the software is not independent of the hardware. What do you think of their critique?

Cosmides: When people claim that the "software" is not independent of the "hardware", I don't know what they are really saying. It is of course true that the programs in our heads are embodied in neural tissue. But one still needs to describe those programs: What information do they take as input, what inferences are made, what decision rules are triggered, what behavior is generated. The brain's function is to generate behavior that is sensitively contingent upon information from the environment. How, then, can you ban words like "information", and still study what the brain was designed to do?

Some people think that findings from neuroscience will place constraints on what kind of programs our brains can implement. When neuroscience is farther along, perhaps that will happen. But right now, these claims are terribly overblown. Moreover, those that make them are usually unfamiliar with the astonishing variety of animal behavior. There are birds that navigate by the stars, bats that echolocate, langur monkeys that commit infanticide, titi monkeys that do not; there are lions that hunt in teams, cheetahs that hunt alone, monogamous gibbons, polyandrous seahorses, polygynous gorillas… There are millions of animal species on earth, each with a different, yet highly complex, way of life. The exact same set of programs is not going to make cheetahs hunt alone and lions hunt in teams and gazelles not hunt at all. For such diversity of behavior to exist across species, each species must have a different set of cognitive programs. Yet all of these programs are embodied in the same basic neural tissue. That is why I doubt that facts about neural tissue are going to be sufficient to account for which programs exist in the human mind and which do not.

Question 5 (Fischer & Araya): Evolutionary psychology challenges the Standard Social Science Model's[3] basic claim about human nature, namely, that the human mind is able to "learn" whatever external (cultural) patterns are presented to it. Could you explain in what sense postmodernism and structuralism (to name a few theories), would not be compatible with an evolutionary view of our behavior?

Cosmides: We learn certain things very easily: Everyone learns their native language during the first four years of life, without being explicitly taught – no one needs schooling to master their mother tongue. Other things are difficult to learn: reading, calculus, and chess require explicit instruction, and not everyone masters them. To understand learning, you need to understand the program*s* – plural – that cause it. And these programs differ from one domain to the next. If you want to change society, you need to understand these programs, not denounce them. Not enough is known to say that one set of ideas or another is "unlearnable"; if we understand how learning works in different domains, we might be able to find ways of teaching ideas that are currently difficult (as in the probability example).

I have no problem with the postmodernist goal of understanding how ideologies and power relations affect discourse in a society – indeed, I think evolutionary psychology has a lot to contribute to this. Nor do I have a problem with the idea that certain concepts are "socially constructed". By understanding our evolved cognitive programs, we can understand how this is possible, which information is filled in by others, and which information is generated by evolved inferences that go beyond the information given by the cultural environment. But I do have a problem with the notion that everything in our heads originated totally on the "outside" – the information in the environment is just too underdetermined for this proposal to work. I also have a problem with the claim that everything is learned via the same program (always unspecified!), and that every idea is as easy to learn as the next. This notion of an "equipotential" mind is known to be wrong. And talk about noxious political implications – the idea of equipotentiality supported some of the biggest blood baths of the 20th century: How many millions have died because a Stalin or Mao or Pol Pot thought it would be easy to mold human nature to their will?

Question 6 (Fischer & Araya): Biologist Lee Dugatkin has shown that some fish, belonging to a species with miniscule brains, can imitate mate selection strategies from older individuals who

have been artificially "fooled" into following behaviors opposed to their genetically-based male selection strategies. This suggests that cultural (imitative) transmission and gene/culture interactions are underestimated forces in evolutionary biology. What is your opinion about these forces? Are they capable of overriding some domain-specific algorithms produced by natural selection and thus challenge your critique of the Standard Social Science Model?

Cosmides: I suspect that the programs that cause fish to imitate mate selection strategies are themselves domain-specific. People assume that imitation is simple to engineer into a brain, but it is not. It requires very sophisticated programs, which latch on to narrowly specified kinds of information while ignoring volumes. (Note that the fish in question are acquiring mate selection criteria – not food selection criteria, predator avoidance strategies, methods of swimming, foraging routines, etc, and they aren't confusing what counts as good food with what counts as a good mate…). So I don't think imitation "over-rides" domain-specific algorithms; instead, I think that domain-specific algorithms make it possible.

We should not be surprised that it was possible to "fool" the older fish via artificial means. Evolved programs operate well within the parameters of the ancestral environments that selected for their design. Meddling scientists were not part of the fish's ancestral environment; hence they could not have evolved programs designed to buffer their mate selection mechanisms against variation introduced by human experimenters! It is not possible to design an omniscient program – one that cause fit behavior no matter what environment it finds itself in.

Question 7 (Fischer & Araya): Most people implicitly assume that the brain is a general problem solver. Instead, you have suggested that the human brain contains several domain-specific algorithms, and have used the analogy of a "Swiss Army knife" to describe it. Can you tell us what you mean by this?

Cosmides: The Swiss Army knife is a flexible tool. Its flexibility is not the result of having just one tool that is applied to all problems. Instead, it is a bundle of tools, each well-designed for solving a different problem – scissors for cutting paper, corkscrew for opening wine, toothpick for cleaning teeth. Each solves a different problem well, thereby providing flexible problem solving ability. Similarly, the human mind does not have just one blunt tool for solving all problems – and if it did, we would be very limited indeed. Each human mind contains a large number of programs, each well-designed for solving a different adaptive problem: choosing a good mate, caring for children, foraging for food, avoiding predators, navigating a landscape, forming coalitions, trading, defending one's family against aggression, and so on. We are flexible problem solvers in part because our minds contain so many well-engineered tools.

I have discovered that some people misunderstand the Swiss Army knife metaphor – they think the claim is that these programs do not share information or work together. All these functionally specialized, domain-specific programs are designed to work together to produce behavior. They share information, pass it back and forth, and so on.[4]

Question 8 (Fischer & Araya): You and your colleagues have shown empirical evidence for a "cheater detection device" in our mind, closely tied to reciprocal altruism and social cooperation. Can this mechanism help us understand the way in which our social life is knitted together?

Does this allow for the coexistence (depending on the social context) of egoism and altruism in our behavior?

Cosmides: Evolutionary game theory shows that social exchange (trade; cooperation for mutual benefit) cannot evolve unless those who give benefits to others are able to detect cheaters (individuals who take benefits without reciprocating) and avoid being exploited by them in the future. A program designed to incur reproductive costs to benefit the reproduction of others – even those that never return the favor – would be selected out.

As humans, we take for granted the fact that we can help each other by trading goods and services. But most animals cannot engage in this kind of behavior – they lack the programs that make it possible. It seems to me that this human cognitive ability is one of the greatest engines of cooperation in the animal kingdom. When no coercion is involved, trades happen because each person wants what the other has – each is better off after the transaction than before (otherwise, they would not agree to it). And when this is combined with modern technology, it allows people from opposite ends of the earth to help one another. Yes, people who produce the same goods are in competition with one another – but they are competing for the opportunity to *improve the lives* of those who want their goods. So we all get better and better (over historical time) at helping one another. As species go, this sounds pretty nice to me.

Question 9 (Fischer & Araya): You have defined an emotion as a "superordinate program whose function is to direct the activities and interactions of the subprograms governing perception; attention; inference; etc.". According to your view, can we in principle design a superordinate algorithm that will provide emotions and feelings to a robot? If so, what kind of conditions must such an algorithm satisfy?

Cosmides: Yes, you could give emotions in the sense I mean them to a robot. Indeed, you would have to in order to produce a robot that could flexibly engage in many different kinds of behaviors. Would it have the same phenomenology as you do? Would it "feel" the same as you do when you feel angry or joyful? I don't know. But then again, I don't know if your experience of the color red is the same as mine (although, given a set of color chips, I can know that we both think red is more similar to purple than to green; that is, that the functional relationships between our perception of the stimuli are the same). Scientists have made progress in understanding color vision, even though they cannot solve these problems about the *quality* of experience, of phenomenology. Similarly, John Tooby and I are suggesting that scientists can make progress in understanding emotions, even though we cannot solve these questions of phenomenology any better than the vision scientists can.

Question 10 (Fischer & Araya): Psychoanalysis is not only a widely known mind therapy, but also an approach to understanding the mind. What can you say about its scientific and predictive value? Is it compatible with evolutionary psychology?

Cosmides: Many psychoanalysts attend evolutionary psychology conferences. Freud thought of himself as applying Darwinian thinking to the mind. Evolutionary biology has progressed since Freud wrote, however. Some of his insights remain valuable; others, such as the idea that every child secretly wants to have sex with their parents, do not make sense in light of current

knowledge about the evolution of inbreeding avoidance. More generally, evolutionary psychology can eventually form the basis of increasingly better ways of helping people who are experiencing emotional pain. And I take it that that is the ultimate goal of psychoanalysis. So yes, the goals of evolutionary psychology and psychoanalysis are compatible, and many of their assumptions (e.g., that the mind contains domain-specific programs) are as well. At present, they differ somewhat in their claims about the design of some of these programs.

Question 11 (Fischer & Araya): Is consciousness an adaptation, a byproduct, or a random effect? If it is an adaptation, what is its adaptive value? Is it exclusively human, or do other animals have it? Can a machine be conscious?

Cosmides: If by "consciousness" you are referring to my quality of experience – the feeling of being an "I" – I can no more answer that question than I can the questions about the phenomenology of red, green, anger and joy. But I think there are other meanings of the term. One is a pool of information in working memory that can be accessed by many different inferential programs. Another is the ability to metarepresent information – to suppose things that aren't (yet) true, to represent another person's beliefs (e.g., "I think that you believe that the chocolate is in the box"), and to imagine fictional or counterfactual situations – all without becoming confused about what is real and what is not. This kind of proposal can be empirically tested; one can have alternative theories of the adaptive function of the computational machinery that makes it possible. I do not know whether other animals have programs with these properties (my guess is that chimps do to a limited extent) – there is no way to know without first saying what kind of program you mean, and then testing the species in question. But yes, such programs could exist on machines – machines could be "conscious" in this sense. But when you ask the question, I think you really want to know whether they would experience themselves as conscious, and whether things would "matter" to them. A much more complicated question.

Question 12 (Fischer & Araya): You have said that you foresee a time when the term "evolutionary psychology" will be abridged to plain "psychology", because there will be no differences between them. Can you elaborate on that and tell us what is next, in terms of challenges and practical implications, for evolutionary psychology?

Cosmides: At some point, evolutionary biology will be a standard part of graduate training in psychology, just as every biologist needs to know chemistry and physics. Biologists don't learn chemistry and physics because biology can be "reduced" to these fields. They learn it because it enriches their understanding of biological processes. The same enrichment will happen when psychologists learn evolutionary biology (and, by the way, when biologists learn more cognitive science).

When psychologists come to understand evolutionary biology, they will know how to frame questions about adaptive function, and they will ask questions about the human mind that they do not now ask. They will look for programs that no evolutionarily-naïve person would ever suspect exist. At this point, it will be silly to talk about *evolutionary* psychology. It will just be psychology. But it will no longer be isolated from the rest of humanity's knowledge. Psychology will, at that point, be an integrated discipline: one that has confidently taken its place among the

many valuable fields of knowledge, doing its part to create the bridges that enrich each field and us all.

Editor's Notes:

1. This evocative phrase was coined by William Allman, author of *Stone Age Mind*.

2. John Tooby points out that bad biology should be rooted out wherever it occurs: Hitler's biology was incorrect – and so were the biological ideas that supported left-wing holocausts (Stalin, Mao, Pol Pot; see question 5). Critiques of the "bad biology" behind Hitler's ideas have been useful – and many. But the academic community has produced few critiques of the "bad biology" that led to the many genocides inspired by "environmental determinism". One would think these would be equally useful.
3. For a full discussion of the Standard Social Science Model (SSSM), see the essay, "Psychological Foundations of Culture", by Tooby & Cosmides, in *The Adapted Mind: Evolutionary psychology and the generation of culture* (1992, NY: Oxford University Press. J. Barkow, L. Cosmides, & J. Tooby, editors).
4. Jerry Fodor's notion of a "module" incorporated the notion of information encapsulation (along with eight other criteria, all associated with what he meant by a module, but none – including encapsulation – either necessary or sufficient). For some reason, many authors have grafted Fodor's ideas about encapsulation onto our framework (see, e.g., Mithen's book, *The Prehistory of the Mind*). But information encapsulation plays no particular role in what counts as a cognitive adaptation. Some computational adaptations may be information encapsulated; others will not be. The claim that a mechanism is a functionally specialized, domain-specific cognitive adaptation does not imply that it is information encapsulated. That is, there is NO a priori reason to assume that a cognitive adaptation's operations are walled off from input from semantic memory or any other database within the mind (indeed, one might think this situation will be rare). (Perhaps an analogy will help: The fact that the heart is functionally specialized for pumping blood does not mean that its operations are walled off from those of the lungs, the muscles, or the brain…)