Title: RELI 328, Lecture 2
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Part I

1. Purpose

This lecture sets the stage for the cognitive science of religion. I describe the intellectual grounds for the cognitive revolution, and explore the application of cognitive science to language. By the end of this lecture, you will understand why common sense intuitions about learning a language are misleading and lead to distortions. Such lessons apply to learning in other domains. Do they apply to religion? The discussion in the first part will enable us to appreciate the motivations for a cognitive science of religion.

2. What is "Cognition?"

Cognition, in the widest sense of this term, refers to an organism's way of linking perception to action. Minds transform acquired or innate information for refinement, storage, retrieval, prediction, and action. Stripped to its basics, then, all cognition involves the manipulation of data structures by the application of rules.

Taken alone, the observation that thought transforms information according to rules is neither controversial nor interesting. For what else could thought be? This observation, though obvious, has important implications. The observation suggests the prospect of can analyzing cognition computationally. Of course, our brains do not compute like a desktop Computer. (As mentioned last week: birds fly, airplanes fly – each differently and yet each according to Bernoulli's principles, which we can use to explain these different modes of locomotion .) The recognition, however, that thought has computational qualities of has lead psychologists to radically revise their conception of psychological science. Cognitive psychology focusses on the the informational processing capacities of the human mind. Cognitive psychology is a science in search of algorithms.

3. Combinatorial Explosion and the Frame Problem

We assume that thought is, in some basic respect, computational. Importantly, information processing takes time. The problems we solve, however, are astonishingly complex. The complexity of these problems only became apparent when computer engineers attempted to design computers capable of solving them. Many of the puzzles about how we manage to think as we do remain unsolved.

Consider a simple example. Suppose Peter has only 10 behavioral options in his repertoire. He can stand, sit, bite, leap, utter 'TRULY,' ...etc with ten choices. Suppose further that Peter can initiate at most only 10 behaviors each minute. This means that after one minute the sequence of behaviors available to Peter is 1010 (a hundred billion.) After two minutes there are 1020 possibilities, and after a mere 10 minutes there are 10100 possibilities – a number exceeding the number of electrons in the universe. Even small data sets give rise to what computer scientists call 'NP-hard' problems (nondeterministic polynomial-time hard) – by which they mean: very complex.

Our minds, then, are confronted with a 'combinatorial explosion' (Cosmides and Tooby 1992). Search spaces need to be dramatically narrowed. Likely answers need to be anticipated. Yet the world we encounter is never the same twice. We cannot fully anticipate what remains unknown. How, then, do we assess accurately and respond adaptively?

The modular theory of mind emerged in the 1970's as the leading candidate architecture to describe the psychological organization of the human mind (Fodor 1985) (though not without recent controversy, see: Sterelny 2003; Barsalou, Niedenthal, Barbey, and Ruppert 2003). And it is this theory that Atran (2002) and most other cognitive scientists of religion embrace. Modular designs consist of a number of smaller computational subsystems organized to process information over specific task domains. Large unsolvable problems are decomposed into smaller, discrete, and so tractable problems. Cognitive scientists suppose that much of these modular designs are innate, and developmentally entrenched. Selection forges the these designs over evolutionary deep time.

4. Example Language

There are over 7,000 human mutually unintelligible languages. Such languages appear, on the face of it, substantially different. Monolingual speakers of "English," "Japanese," "Swahili," "Greek," "Hindi," and others cannot communicate in language with each other, or at least not effectively. Communication degrades to hand gestures, pantomimes, and loud by unitelligible locutions - POUR FAVOREEEY HOMBRE, WHEEEERE ISSS THEEE TOILEEETTTT??? That languages differ has been made vivid to every ill-prepared tourist who has ranged into territories whose inhabitants exclusively speak another.

Even the same language varies over time. A speaker of Chaucer's English could not communicate with a native of Belfast, or of Sydney, or Detroit. An unbroken chain of only twenty-odd generations of mutually intelligible English speakers, however, separates us from Chaucer. 14,000 years from now no one will speak our English. Our descents will find our speech as incomprehensible.

Pronunciations of words vary. Germans say, "rot" to mean "red," not intending the "rot" of "rotten wood". French speakers use "raison" to denote "correct" instead of that black dried fruit; they say "anniver- saire" to mean "birthday," instead of "anniversary" and "blanc" to mean "white" not "black" [see (Harman 1998)].

Grammars also vary. English displays relatively stable word order, regularity, with adjectives typically preceding nouns that they modify, and subjects usually preceding transitive verbs, and (though less frequently) intransitive verbs. Yet differences among languages in this respect seem quite extreme. Aboriginal speakers of the Australian language Warlpiri use case markers to convey grammatical relations and noun modification. In certain Native American languages, there are few noun phrases within clauses, and grammatical relations are expressed by attaching strings of agreement affixes onto verbs (Pinker and Bloom 1990). More basic differences include rules governing the designation of subject and object, either by word order, as in English and Japanese, or by case, as in German, Latin and Czechoslovakian (Pinker 1999)—a bane to those of us who study these languages as adults. Lots of apparent differences here.

We observe that children learn the language of those around them. An African born in Toronto utters English sentences ending with "eh?" instead of speaking, say, Swahili or Affricans.

Language seems to be something children pick up from their surroundings.

Call linguistic externalism the view that explains linguistic competence as structured through local acquisition events. Many theoretical versions of linguistic externalism are possible. I'm interested in the version that most closely approximates our common sense view that language has something to do with acquiring an artefact called "language" from a community or culture. Folk linguistic externalism undertakes some- thing like the following commitments: Languages are public tools for communication shared by members of different linguistic communities.

There are different languages. These communal tools are acquired through learning. Roughly, something "external"— a language — is internalised by individuals in the course of development through cultural exposure.

Each of these assumptions turns out to be false. Noticing why will help us to see where folk externalism about religion goes wrong.

Consider linguistic difference. While pronunciations vary, grammatical variation is tightly constrained. It is not the case that grammatical differences of the kind that distinguish English from French or Cherokee are rigid. English speakers can invert subject-predicate word orders, for example: "The instructor was driven to drink by the student's passive sentences". In fact, English speakers do sometimes employ case mark- ers, for example, "'s" for possession as in: "the student's passive sentences". We can produce ergative constructions, replacing "the bottle broke" for "I broke the bottle". Moreover, there are converse orderings of English - like constructs in apparently grammatically distinct languages [For dis cussion see (Pinker and Bloom 1990)].

Focusing on the grammatical component more closely we find invari- ant principles of sentence formation children never learn. Take a descrip- tive generalization called the coordinate structure constraint. This constraint exposes fundamental differences in structure between sen- tences of the following form:

1.) Mary saw Peter with Paul.
2.) Mary saw Peter and Paul.

In English, questions can be formed by inserting a question word at the head of the sentence, followed by an auxiliary verb. Hence:

1.) Whom did Mary see Peter with?
However this transformation doesn't work when the question word is conjoined with another noun phrase, as in:

2.) Whom did Mary see Peter and?

Children never explicitly learn the coordinate structure constraint, nor do they ever say, "Whom did Mary see Peter and?" because the constraint is hard-wired.

Internal knowledge extends beyond the construction of sentences to the meanings of words (as opposed to their pronunciations). Word mean- ings possess extremely complicated relational properties that we never learn. Chomsky illustrates this point through the following examples. Take "house" in the sentence "Peter is near the house". Notice the implication is

that Peter is outside, not standing near the inside wall. So it is with “car,” “airplane,” or even an impossible object like “rectangular sphere”: we assume the same for “Peter is standing near the rectangular sphere” (i.e. near the exterior surface). Similarly, when we say “Peter painted the house red” the default assumption is that he did something to the outside, not the inside. If Peter cleans the house, how ever, the default assumption is that he rearranges objects on the inside. We conceive of “house” therefore as an exterior surface with internal spaces, both of which have complex properties. Chomsky notes that “home” has different implicit properties. If I have shifted my house from New York to Moscow, I have moved a massive wooden object. Notice I convey a different understanding when I say that I have shifted my “home” from New York to Moscow. “Home” has both a concrete and abstract aspect. Exploring “home” further we note its abstract prop- erties differ from those of “book,” which is also concrete and abstract but in different ways. You and I can simultaneously read the same book even if we live at opposite ends of the planet, but you and I can- not simultaneously live in the same house or home at opposite ends of the planet (Chomsky 2000: 31-37, 62-66).

Not just grammar, then, but substantial semantic components of the psychological systems that produce language remain invariant. Strikingly, it appears that we all think from the same mental dictionary, with vari- ation limited largely to conventions of pronunciation, how we say “black” “home” “Moscow” and other words.
Linguistic externalism is committed to the view that we learn these intricate meanings and grammatical rules through acquisition events, but this is implausible because competence emerges from severely limited exposure, a “poverty of stimulus”. Acquiring the massive and largely tacit knowledge required for linguistic understanding and generalisation is computationally intractable within the time of childhood development. Children are simply never exposed to all that they know.

Rather than thinking of language as an acquired artefact, linguists think of language as a “mental organ”, which develops along a more or less fixed schedule, in response to environmental inputs but whose intricate structure cannot be explained meaningfully in virtue of those inputs (Pinker 1994).6 We assume as much with ordinary organs (the spleen, liver, eardrums . . .) whose organic design and development can- not be meaningfully explained in terms of “food”.

Clearly, it would mislead the English-speaking tourist to say: “Don’t worry about China—you speak the same language”. Yet we can under- stand the differences without appeal to artefacts called “languages”. The differences adhere to the slight variation in language faculties or “lan- guage organs” of individual speakers (linguists call these “I-languages”). I say to you, “Bring your translation book”. You understand these words because my I-language specifies the linguistic (phonetic, seman- tic, structural) properties of the sentences that you hear. The state of your I-language is similar to mine because you have been exposed to a community of speakers of a related linguistic heritage. This enables you to select an appropriate analogue with which to interpret my utter- ances with sufficient precision for understanding. Individuals unlike us whose I-languages develop in different environments may not be able to select an appropriate analogue if the state of their I-language differs too much (again variation in I-languages is limited pronunciations and a handful of grammatical rules).

Notice that we can account for the tourist’s failure to communicate in China, or for the differences between Italian and German courses entirely on these terms, without appeal to public entities or artefact, which individuals grasp partially through “learning” aspects of them. Social exposure explains some conventional aspects of language, but the skill is structured through biological endowment.

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6. Summary

Cognitive science focusses on how the brain works much as a computer programmer focusses on a computers progammes, by thinking about how the mechanism translates information of one kind into another.

Recognizing the difficult of the problems the human brain routinely solved led to a new type of psychology called cognitive science.

A key implication of this psychology is that the human brain computes information by dividing labour. Another is that many of the brains programmes are given from innate biological endowment. Language shows us the intricacies of those “mental organs” that enable knowledge without learning.

Part II

1. Purpose

Religion appears throughout individual and social experience. Yet assuming only nature, what does religion cognition respond to, and predict? What is responsible for religious “programmes” and how do they work. Such questions occupy the cognitive science of religion. Before considering answers, we must clarify how nature builds mental designs.

2. Genes and Culture

Evolution: Genetic and Cultural

All research in the life sciences assumes Darwin’s theory of evolution by natural selection. Natural selection can be stated simply. Given (i) variation in a population of (ii) hi-fidelity replicators, it follows that (iii) compete, functional designs will accumulate. This simple idea explains nature’s manifold and exquisite designs. Darwin aptly referred to such designs as "endless forms most beautiful and most wonderful" (Darwin, 1989 [1859]). Nature is beautiful,

wonderful, and its complexity is, importantly, endless.

Natural selection is the starting point, not the terminus, for biological inquiry. Biologists ask: why this diversity rather than another? How do specific systems within this diversity operate? How are they related to others? By which steps did each evolve? Endless forms, endless questions! The principle of integration suggests that researchers consider how evolution matters to the investigation of religions, as among Nature's endless forms most beautiful and wonderful.

Religious traits belong to humans. There are many ways to describe humans, none even remotely comprehensive.. Setting the chimera of explanatory completeness to the side, there can be no principled reason to avoid approaching humans as creatures of nature. We are organisms; what else could we be? Organisms are collections of phenotypic traits. A phenotypic trait is a manifest characteristic or property of an organism. Phenotypic traits result from an interaction of genetic factors called genotypes with environmental factors, which vary. Biologists use the concept of a norm of reaction to describe possible ways in which variation in genotypes and variation in environments cause variation in phenotypic traits (Sterelny & Griffiths, 1999). Phenotypic traits can be classified according to four basic norms of reaction.

2.1. Genetically Determined Traits

Some genotypes lead to identical phenotypic traits across a broad spectrum of environments. For all intents and purposes, it is appropriate to say that genes determine such traits. The genes that code for eye pigmentation are insensitive to normal environmental influences; therefore, it is reasonable to say that iris pigmentation is a genetically determined trait.

2.2. Environmentally Determined Traits

Some phenotypic traits are substantially explained by environmental variance. Bob's Australian accent, for instance, is clearly not the result of specific Australian accent genes. Were Bob born to an exclusive Swahili speaking community he would have no Australian accent because he would not speak English. For all intents and purposes, Bob's specific accent is environmentally determined.

Notice however that the level at which a researcher specifies an interest in a trait allows different norms of reaction within a general category of interest. Bob's dog Cannibal does not acquire any accent whatsoever because Cannibal acquires no grammatical human language. The more general trait of having a human language shows a deeper reliance on the human genome. With respect to having some language, Bob's capacities in this domain are genetically determined. Key social inputs are required for language to develop; however, these inputs trigger growth of a genetically designed faculty, which linguists call the language faculty (Chomsky, 2000). In turn, as Bob's language develops, his pronunciations, his lexicon, and a few grammatical rules will reflect environmental determinants. Each such trait may have a different norm of reaction.

2.3. Additive Traits

Some phenotypic traits result from an interaction between genotypes and environments so that traits vary as environments vary, and the variance is in the same direction. Consider. Debbie and Ed's mathematical abilities differ. Such differences depend both on their genotypes and on their environments. In the same environment, Debbie is better than Ed at maths. However if Ed were to receive extra training, that is, were to inhabit a different environment to Debbie's, Ed's abilities will match and exceed those of Debbie.

2.4. Non-additive Traits

Some phenotypic traits result from an interaction between genotypes and environments so that traits vary as environments vary, but the variance is in different directions. Consider. Fred and Gale are equally pale in environments that lack sunlight, yet when exposed to sunlight, Fred turns red and Gale turns brown. Each changes colour, but in divergent ways.

Our discussion about norms of reaction, though brief, is sufficient to warn against any simplistic explanation of "religion" as determined by one or several factors, genetic or cultural. Core properties of religion appear to be genetically determined, though we shall see the jury remains out. Other specific religious traits vary with environments. For any trait of interest, general or variable, each of the four norms of reaction might, in principle, apply. We cannot say which applies, or how, before investigating. Researchers are currently undertaking such investigations. They are formulating testable hypotheses about how specific religious traits arise, what they do, and how they are transmitted. Such hypotheses are being put to the test. It is early days, however, and much remains unknown.

To a crude approximation, cultural evolution literatures focus on the dynamics that cause culturally specific religious traits, for example, whether one worships Zeus or worships Odin. Genetic evolution literatures, on the other hand, focus on the dynamics that cause pan-human psychological traits –whether one believes in some kind of super-nature (Bulbulia, 2008b; Geertz, 2010; Gervais et al., 2011). New research is beginning to integrate cultural and genetic models [see (Rowthorn, 2011), discussed below]. For now readers should bear in mind that cultural and genetic approaches each seek explanations at different levels of biological organisation. If readers take nothing else from this discussion, we hope they will understand that in the biology of religion, nature and nurture are nowhere opposed.

To organise our survey, we use the biologist's distinction between proximate and ultimate explanations. Proximate explanations investigate the developmental, neural, and ecological causes of religious traits. Evolutionary explanations investigate the historical dynamics that elaborate and conserve such proximate designs.

3. Development

Hypotheses for the genetic determination of core properties of religious traits would be convincing were young children to exhibit an easy, untutored mastery of religion. On the other side, hypotheses for social constructivism would be made stronger from evidence that children's religiosity required significant education. When evaluating research about childhood religiosity, we must be cautious about inferring too much from individual studies. To repeat, norms of reaction might operate differently for different components of religiosity, which, to repeat, are many and various [see (Bulbulia, 2005)]. For example, having a supernormal belief of some kind might be genetically determined, yet the desire for sacrifice might be socially determined, and socially/environmentally expressed. Because we have to start somewhere, we begin our review with the trait of believing in supernormal agents or powers of some type. Does it take a religious education for children to believe in God/s of one kind or another?

i.Teleo-functional bias

Deborah Kelemen hypothesises that children are "intuitive theists." By this term she means that children naturally attribute teleological functions to objects in their world, including uncreated objects such as animals, landscapes, and weather patterns (Kelemen, 2004; Kelemen

et al. 2005). For example, when asked "what is this for?" American 4-5 year olds ascribe functions to both living kinds ("lions go in the zoo") and to inert kinds ("clouds are for raining") (Kelemen, 1999). Only among 9-10 year olds do preferences for teleological explanations subside [For similar effects among British children, see (Gelman & Kremer, 1991)]. Kelemen argues that such "promiscuous teleology" among young children is not likely to have been learned from their parents, who explicitly prefer non-teleological explanations. The preference for teleology appears to be genetically determined.

Importantly, children do not merely attribute functions indiscriminately to the world. They also prefer to attribute functional designs to the intentions, purposes, and actions of supernatural agents. When the developmental psychologist Margret Evans asked children: "How do you think the very first [item here] got to on earth?" Evans discovered that 8-10 year-olds from both fundamentalist and non-fundamentalist American homes favoured supernatural explanations ("God made it"), over natural explanations ("a person made it"), and over impersonal explanations ("it just happened") (Evans, 2000). According to Evans's analysis, only among 11-13 year old non-fundamentalists are non-theological preferences popular (Evans, 2001).

What about adults? Kelemen's results show that adults, too, are prone to teleological preferences, at least when they are not permitted full reflection. For example, when adults are required to respond quickly to questions about the purpose of inanimate objects, adults ascribe purposes and intentions to such objects (Kelemen & Rosset, 2009). These effects under "cognitive loading" are common even among trained scientists. Kelemen suggests that teleological ascriptions under cognitive loading offer preliminary evidence for a general psychological bias for teleology. Adults overcome teleology only with effort. Why might such a result be interesting to classically trained scholars of religion? Some scientists have hypothesised that teleological attributions, when combined with agency attributions, lie at the heart of genetically structured designs that universally favour religiosity. We next consider a few such positions.

ii. Religion's Universals

Consider a common supernatural concept: "ghost". Probing this concept, we see how heavily it relies on the tacit folk psychological under- standings that organise our interpretations of "person". For example, a ghost will be interpreted to have psychological states—beliefs, desires, memories, attitudes, intentions and plans. No one ever teaches a child that a "ghost" may possess complicated intentions, beliefs, desires, and plans: we just assume this. Some aspects of folk physics and biology are also retained; it is easy to imagine that a ghost can communicate or can be seen at a distance or can move through physical space— perhaps threateningly towards you with its ghost fangs exposed. We think to these unreflective interpretations without ever noting the odd-ity of inference to physical properties from entities imaged as immaterial. We do not pause to consider how immaterial beings can think with no brains—though we would pause at the idea that a chunk of dirt or atmosphere could think without brains. We assume without inquiry the relevant causal connections. Nor do we do generally wonder how an immaterial spirit tooth—no matter how long and pointy— may injure (for what exactly is long and pointy?). Moreover some understandings are more salient. We think to the view that a ghost is capable of moving through walls more readily than that it may move through the centre of the sun, or a refrigerator. It knows where you are hiding is more salient that it knows you enjoy burritos. We do not learn much beyond a few encyclopaedic details of ghosts: instead folk psychological understandings do the thinking for us, generating rich inferences that allow us to represent and communicate about ghouls.

The constraints imposed by intuitive psychology on the articulation and scope of religious concepts are, in turns out, extreme, and lead to inferences that, for example, fly in the face of philosophical theologies…..

4. Cognitive Optimum Theory

The cognitive anthropologist Pascal Boyer hypothesises that religious concepts endure from their effects on memory. Boyer hypotheses that we do not learn religion as we learn the periodic table, by rote. Rather the hypothesises that religious concepts are largely given from highly structured, innate mental faculties. Boyer holds the view that conceptual knowledge, generally speaking, develops much like organs of our bodies, relatively invariantly, barring serious impairments, as a species property. It may seem incredible that interpretations and perspectives that we never learn structure the concepts we use to think. Yet this view is widely accepted among most linguists, cognitive anthropologists, developmental psychologists, and others in the cognitive sciences. Debates centre only on the extent of the environmental contribution. The most impressive evidence for genetic structuring comes from the observation that learning is computationally constrained. Children cannot examine all interpretations of the world before forming ideas about it, and acting on such ideas. From computational considerations alone, it is clear that much of what the children know must already arrive from genetic resources. Adding to these a priori mathematical considerations are data about the rate and manner of childhood language acquisition. Such data are inconsistent with the predictions of social constructivism. Children express language too quickly to learn it (Chomsky, 2000).

Boyer's model holds that religious concepts are minimally modified natural concepts. His idea is that religious concepts violate a few, but not many, of the default assumptions that govern conceptual interpretations. Satan is understood to be not merely a serpent, but one who talks; Ganesh's proboscis is an elephant's trunk – not merely a large nose. The dissonance between intuitive expectations and their minimal violation renders religious concepts memorable, and facilitates their transmission (Boyer, 1994; 2001). Religious concepts are easily learned because they are maximally uncanny. Several studies have supported Boyer's model [For a recent example, see: (Fondevila et al., 2011)].

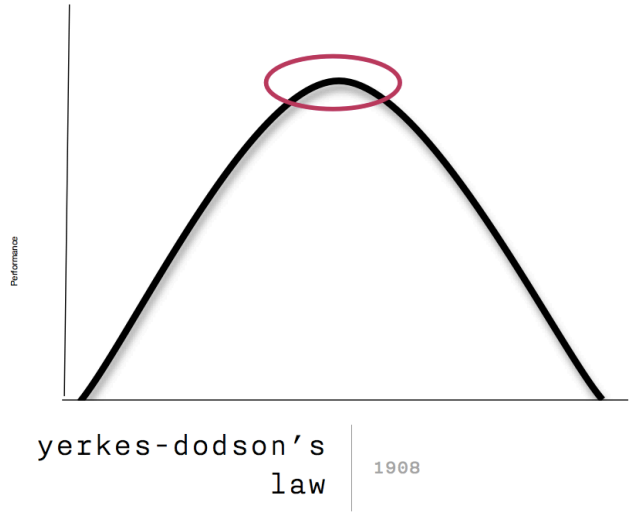
Barrett and Keil observe that in spite of subscribing to anti-anthropo- morphic theologies, religious persons in India and the United States imagine deities as ordinary persons, different in minimal (but arresting) respects from ordinary persons. Devotees notionally understood and subscribe to theological positions that depict the gods as unlike persons, yet their interpretations belied a powerful anthropomorphising tendency (Barrett and Keil 1998). This tendency holds irrespective of culture and epoch beca use the intuitive psychology of persons is largely invariant (Knight, SousaXXX).

Furthermore, though supernatural concepts vary—some rely on intuitions governing persons, others places, and others, powers and forces—they always explicitly violate a few, but not many of these tacit assumptions. Ghosts may be able to move, but unlike us they can move through walls, which is startling. God may be like a man, but unlike a man he has the power to read minds, or create a universe, or punish and reward you for all you've done, also startling. Hence, any individual's religious concepts will retain much of the structure of intuitive psy- chology.

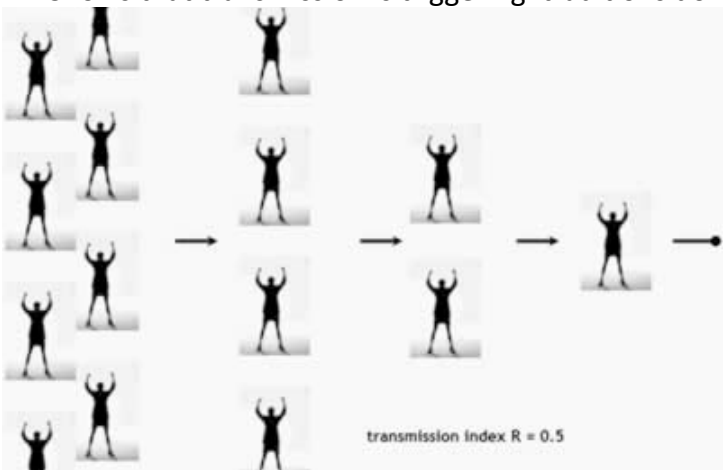
Yet they will also contain a few violations of that implicit knowledge, and this makes religious concepts memorable (Boyer 1994). Boyer hypothesizes: it is precisely because religious concepts violate implicit assumptions for the relevant kinds that religious concepts are interest- ing and memorable, and thus easily spread in populations. Critically, the violations, though arresting, must be minimal, because religious con- cepts that are too complex (violate too many expectations) become too difficult to recall (Boyer 2000; Boyer 2001; Atran 2004). For each religious person grows a religiosity that is unique.

Strengths

i. Consistent with enduring psychological principles: Yerkes Dodson's law



ii. Shows that transmission is triggering: traditions do not exist.



Weaknesses

i. Concepts are not beliefs

The mickey mouse problem

ii. Not all learning is triggering.

5. Summary

Thus, on the cognitivist view, religious cognition materializes from a mind already guided by expectations about the natural world it will encounter. Religious concepts violate these intuitive expectations in minimal ways, eliciting our “passion for surprise and wonder” to adopt Hume’s idiom (Hume 1993).12 The panhuman mental architecture of folk psychology heavily structures and constrains religiosity.

The methods appropriate to the study of religious cognition are, on this early conception of the field, the methods appropriate to the study of the cognitive systems that underwrite religious cognition.