

## The Cognitive Structure of Baseball (and its Implications for Human Uniqueness)

Ray Jackendoff

Tufts University

The enterprise I've been engaged in for most of my professional life is attempting to uncover the mental structures that underlie human abilities. Most of my efforts have been directed at language, but I've also worked on music, spatial perception, and social cognition. So it occurred to me to look at baseball, which turns out to present a domain of surprising richness. Any game would do for much of my exposition, but baseball has certain special kinds of complexity, and besides, I like it.<sup>1</sup>

Here's the problem: As far as I know, the notion of games – individual and team games – is culturally widespread. In particular, lots of eleven-year-old American kids understand how baseball works. It doesn't seem like rocket science. Nevertheless, children learn it. How? I want to show first, what kind of complexity it actually involves, and second, how each of the pieces involved in understanding baseball draws on more general aspects of human cognition that are themselves pretty subtle. The fact that they all play a role in baseball serves to emphasize how integrated and interactive human cognition is, even in children.

Of course our ape relatives, while they may play, do not play *games*. So it's also of interest to ask what aspects of the cognitive structure of games are specifically human, and what parts might be part of our primate heritage. I'll pursue this question as well, albeit mostly speculatively.

I set aside all the complexities of perception and motor control that it takes to throw, catch, bat, and run. These aren't simple by any means, and both kids and professional baseball players have to practice these skills intensely. Here, though, I want to look at the parts of our understanding of the game that *aren't* physical.

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<sup>1</sup> Much of the material I'll discuss is treated at greater length in my *Language, Consciousness, Culture* (MIT Press, 2007).

What is a game like baseball? It involves (a) two teams (b) in competition, (c) behaving according to certain stipulated rules of the game. Let's look first at teams. A team consists of a number of individuals, each of whom conceptualizes him- or herself as cooperating with the others toward a joint goal. Taking this apart:

### **1. Joint intentions, joint actions, joint goals<sup>2</sup>**

Normally you can only intend your own action, not someone else's. But – intending to move a sofa *together* with you is more than me picking up my end plus you picking up your end. Playing a duet with my friend Steve is more than me playing my part while simultaneously he happens to play his part. Rather, the conceptualization of such actions involves all these components:

- WE are moving the sofa.
- My part is picking up this end.
- Your part is picking up the other end.
- I am obligated to you to do my part. If I don't do it, you are entitled to sanction me in some way.
- You are obligated to me to do your part. If you don't do it, I'm entitled to sanction you in some way

This conceptualization of a "joint intention" or a "jointly intended action" is invoked in any sort of cooperative activity, including even conversation and shaking hands.

In some sense a jointly intended action "pretends" or "simulates" our sharing of our minds. It requires monitoring of each other in order to achieve coordination, and also in order to detect cheating. I should point out that this is a different notion of cooperation from the evolutionary psychologists' notion of reciprocal altruism, where I do something nice for you and you then spontaneously return the favor. Reciprocal altruism does not involve both parties conceptualizing the pair of actions as a single coordinated action. Similarly, the notion of

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<sup>2</sup> The material in this section is based on work by Margaret Gilbert, John Searle, Michael Bratman, Herbert Clark, and *Language, Consciousness, Culture*, chapters 5 and 8.

cooperation through jointly intended action is different from what is called “cooperation” in prisoner’s dilemma situations. In prisoner’s dilemma, there is no communication between participants; so-called cooperation is when each chooses a course of action that will benefit both *if* by chance the other does so as well.

Sometimes it isn’t important that there be a match in the other participant’s head. For instance, a mother communing with her infant acts as though the interaction is jointly intended, but the infant probably doesn’t have any such commitments. On the other hand, a con man is producing the *appearance* of jointly intended action with his victim, but really has quite a different intention in mind.

The capacity for jointly intended action may be specifically human: the evidence for joint intention in apes is shaky (Tomasello). Probably the best place to look would be collective hunting, play situations, consensual grooming, and sex. Even if other primates do engage in joint actions in these domains, they certainly do not apply joint intention to the huge and creative variety of actions that humans do.

For instance, turning back to baseball: The members of a team understand themselves to have the joint intention of playing together to beat the other team. Furthermore, in the course of the game, there arise many short-term joint actions on the field. For example, the pitcher is not just throwing the ball at the catcher, the two of them have a joint intention that the ball get from the pitcher to the catcher in a certain way meant to fool the batter. And if a ball is hit to the shortstop, he initiates a joint action of throwing to the first basemen to put the runner out. These sorts of jointly intended actions happen very fast, and require practice so that coordination is automatic.

## **2. Competition**

Again, the joint goal of each team is to beat the other. What is “beating the other”? In a broad sense, beating someone amounts to achieving dominance. Dominance, unlike joint intention, is an evolutionarily old construct, found even in chickens. It manifests itself as one individual regularly deferring to another in distribution of resources such as food, territory, and

sex. In humans, dominance hierarchies are rampant, for instance in the relation of parents to children, teachers to students, and bosses to employees, in the hierarchy of nobility, in the hierarchy of military command, and so forth.

Dominance is often established by a struggle of some sort. Games model (or simulate) this struggle.

In humans, dominance hierarchies can be applied not just to individuals but to groups such as social classes, caste systems, and the relation of an empire to its colonies. The struggle for dominance here manifests itself as war or revolution or mass protest. Team sports model or simulate this struggle.

As pointed out by John Searle and Michael Bratman, games have a more complicated structure than just a struggle for dominance. The participants in the game, whether individuals or teams, *agree* to play the game, so there actually a larger joint goal of playing against each other. In baseball, the umpires also participate in this joint intention.

Figure 1 shows the embedded structure of a game between two individuals: competition framed within cooperation. Figure 2 adds the extra complexity of team members cooperating in collectively competing with another team, all of this under a collective agreement to play.

*Figure 1: Game between individuals*

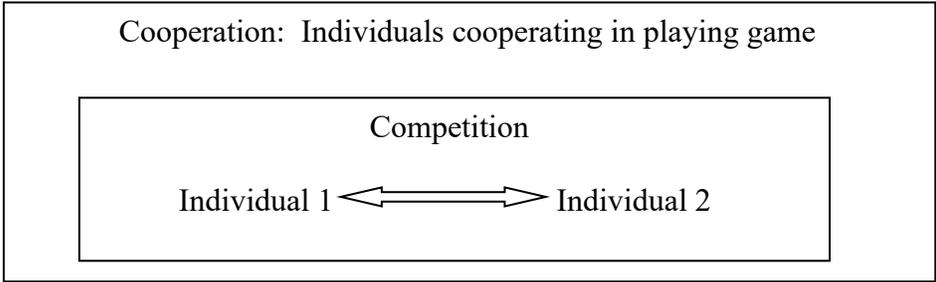
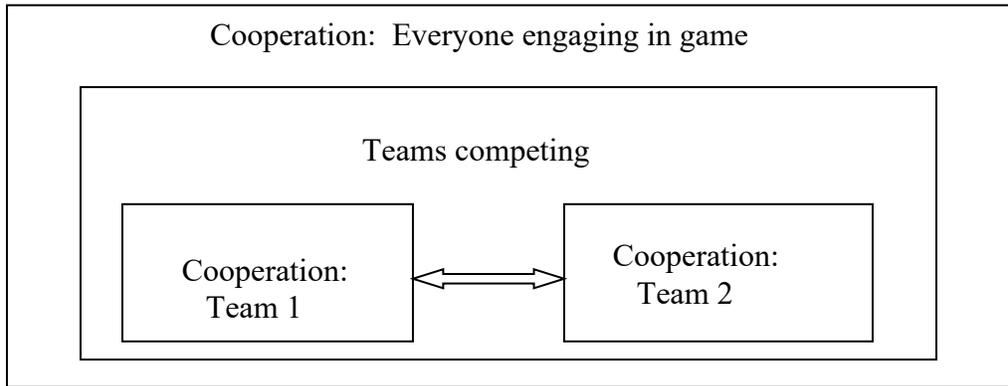
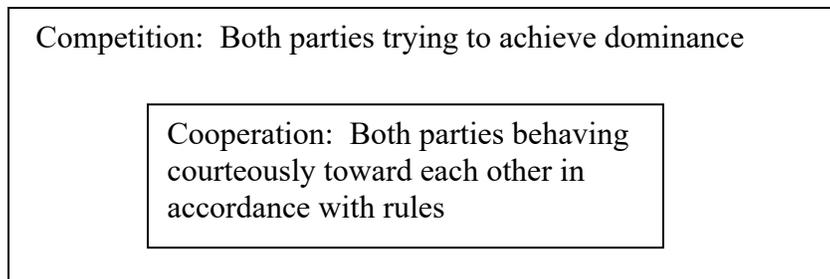


Figure 2: Team sport



There are other cases of this sort of embedding in human activity. Bargaining and trading, as well as legal proceedings, require cooperation between the parties involved. But these activities take place within a larger frame of each participant trying to get the best of the other:

Figure 3: Bargaining/Trading/Legal proceedings



During the course of a game, the outer frame of cooperation can break down under stress, resulting in raw unframed aggression (think of hockey players punching each other out – or, much more rarely, baseball players).

### **3. Balls, strikes, outs, runs**

The next piece of game-playing is playing according to *rules*. Let's start with some of the entities defined by the rules in baseball: balls, strikes, outs, runs.

What is a strike? It's not a particular physical action. Rather, in order to understand strikes and their role in the game, we have to conceptualize the game on two "planes" or "tiers" at once: the *physical tier* and the abstract *game tier*. A strike is an entity on the game tier: if a batter has three of them, he's out – where an out is one more entity on the game tier.

How do you get a strike? Various physical actions "count as" strikes, i.e. are "inputs" to the strike count.

- Swinging at a pitched ball and missing
- Not swinging at a pitch that goes through the strike zone (a physical space defined by the rules)
- If the batter does not yet have two strikes, hitting a foul ball (a ball that lands in or rolls into a physical space defined by the rules) that is not caught.

The "output" of a strike, i.e. its role on the game tier, is that an action that counts as a strike adds one to the batter's current strike count (which is often recorded on the scoreboard). But the strike count doesn't just depend on these actions. It also depends on the game tier. One doesn't just accumulate strikes: the strike count is reset to zero after a batter completes his turn at bat, either by striking out (getting three strikes), walking (getting four balls), or hitting the ball into play.

Outs have an even more complex set of inputs, most of them on the physical tier (e.g. a fly ball that is caught, a ball in play reaching a fielder who then touches first base with some body part before the runner who has hit the ball into play touches first base), and at least one on the game tier (getting three strikes). Outs also have outputs on both the physical tier and the game tier. On the physical tier, a batter or baserunner who is out must leave the field. On the game tier, if a batter or baserunner is out, this adds to their team's "out count" for the current inning (another counter). When the out count reaches three, the inning is over, the out count is reset to zero, and the other team comes to bat (or the game is over, if the inning count has reached nine and the score is not tied).

Winning the game is defined in terms of the game tier: the team with the most runs at the end wins. Each sort of game specifies what counts as winning: in pingpong it's getting 21 points first; in races it's getting to the finish line first, in golf it's having the lowest number of strokes.

In addition to strikes, outs, and so on, there are other physical things that "count" on the game tier. Primary among them is "the ball" (which ceases to be "the ball" once it is hit out of the park and a new ball is put into play), "fair territory," "second base," and the catcher tagging a baserunner (so he is out). Many other physical things play no role on the game tier: the spectators, the hot dogs, and the catcher *blocking* the plate to make it harder for a runner to score.

The notion of multiple tiers, one of which is not physical (or) sensory-motor is not confined to games. James Pustejovsky's notion of "dot-objects" that exist in multiple metaphysical domains includes a great number of phenomena.

- A book is a physical object (one tier) that conveys information (another tier). The word *book* involves both tiers, and a description of a book can invoke both: "*A User's Guide to Thought and Meaning* weighs less than a pound in paperback [physical tier], and it's not too hard to understand [information tier]." On the other hand, there are blank books (no information), and e-books (different physical instantiation), so the tiers can be cut loose from each other.
- A university is a group of buildings (physical tier) plus a social institution. "Indiana University is located in Bloomington, Indiana and teaches dozens of subjects."
- A chess piece is a physical object plus what it counts as in the game (king, knight, pawn, etc.). You could play chess with rocks or people as pieces, as long as their game role is stipulated. Some people can play chess in their head, with virtual pieces. You couldn't play chess with mice as pieces, because they wouldn't stay put (think of Alice in Wonderland's croquet game with hedgehogs as balls and flamingos as mallets).
- Money has a physical instantiation (coins, bills, checks, bits in a computer) plus its monetary value (which is a counter like strikes). John Searle distinguishes these two, calling the physical instantiation a "brute fact" and the monetary value an "institutional fact."

- Ceremonies such as weddings involve performing a particular action (physical tier) that *counts as* establishing that these two people are married (institutional or social tier). Shaking hands is a tiny little ceremony, whereby performing the requisite action counts as establishing social solidarity and/or mutual respect (even if insincere).
- Wearing certain clothes (physical tier) can count as a symbol of social class (social tier).
- In many cultures, a person is conceived of as a linked physical body and a “mind,” “soul,” or “self.”<sup>3</sup> There can be bodies without souls: corpses and perhaps zombies. And there can be souls without bodies: ghosts, spirits, and perhaps angels. Souls can be linked to bodies in unusual ways such as reincarnation (soul moves successively from body to body), body transformation (frog becomes prince), body-switching (mother and daughter exchange bodies in *Freaky Friday*), and spirit possession (one soul gets invaded/displaced by another). Even if these phenomena have never been observed, we can imagine them, are fascinated by them, and build them into cultural/religious beliefs and practices. One’s personal identity goes with the soul, not with the body: in *Freaky Friday*, the mother and daughter wake up in each other’s *bodies*, not in each other’s *minds*.

Do any other primates have these sorts of conceptualizations? It seems possible that their social roles such as the dominance hierarchy, kinship relations, and alliances are on a “social tier.” Chimpanzees have been observed to have greeting “rituals” parallel to shaking hands or high-fiving, and these probably have significance on a social tier. Aside from that, there is no evidence for primate thought in terms of multiple tiers, certainly not the great variety of human instances, of which the list above is representative.

#### 4. Rules

The rules of a game are norms that are adopted for the time being, by agreement as part of participating in the joint activity.

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<sup>3</sup> Pointed out by Paul Bloom and also in *Language, Consciousness, Culture*, chapter 5.

Human conceptualization includes many kinds of norms, all of which involve a relation to an action: <sup>4</sup>

- Obligations are norms to perform actions one is obligated to perform. For example, a promise is an obligation one has taken upon oneself to perform some action, and keeping or fulfilling the promise is actually performing the action. Receiving an order puts one under obligation to perform some action, and obeying the order consists of actually performing it.
- Religious norms involve actions that the religion says one should do, for instance participating in worship and refraining from eating pork.
- Legal norms involve actions stipulated by a government, such as driving on the right and paying taxes.
- Rules of etiquette are norms concerning social practices, such as putting the fork on the left of the plate.
- Customs are further norms concerning social practices, such as what everyone is expected to wear.
- Moral rules are norms such as not cheating your customers, not beating your children, and choosing appropriate sexual partners.

The actions involved in norms all come with social consequences. Unlike rules of a game, many of them, especially moral rules, may seem universal and given, but they (mostly) vary considerably from culture to culture (consider, for instance, different cultures' moralities concerning slavery and homosexuality).

Some religious norms overlap with moral norms, for instance "don't murder." Others don't, for instance "don't eat such-and-such" and "say the following prayers after eating." Some legal norms attempt to replicate moral norms, such as laws against slavery or against abortion, while others don't, such as laws about driving on the right and about the duties of the parks commission.

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<sup>4</sup> *Language, Consciousness, Culture*, chapters 9-11.

Moral rules aren't just about preventing harm, as has been assumed by many current thinkers (using trolley problems etc.<sup>5</sup>): they also govern sexual behavior, childrearing, showing respect, group loyalty, and in some cultures, what you eat.<sup>6</sup>

The point of a norm is that if you violate it by doing a proscribed action, certain designated individuals are entitled to do something bad to you.

- If it's an obligation, the person to whom you're obligated can sanction you.
- If it's a legal norm, the government or its representatives can punish you, as stipulated in laws.
- If it's a moral norm, rule of etiquette, or a custom, everybody can think less of you, speak ill of you, and/or shun you.
- If it's a religious norm, God (or the gods) will punish you.
- If it's a rule of a game, adherence to it is part of the larger cooperation in playing the game. Sometimes there are further "metarules" that stipulate the outcome of a violation (for instance, in basketball, what happens when a player is fouled). Sometimes the opponent says "Not fair!" and there's negotiation. In baseball, the umpire adjudicates.

There is nothing like this in primate societies. In some chimpanzee societies, there are apparently "customs" of a sort, things everyone does that are not found in other chimpanzee communities, but there is nothing like societal disapproval for not adhering to them.

There is an important difference between rules/norms and strategies (even though both of them can be expressed in terms of "you should do X" or "you have to do X"). The consequences of performing an action that violates a rule always involve the possibility of sanction by other people. So the point of adhering to a norm is that you avoid social sanction. By contrast, the point of a strategy is that if you adhere to it, you increase your chance of achieving some benefit. Compare the strategy of eating certain foods, which is aimed at improving your health or digestion, to obeying a moral/religious rule about eating certain foods, which is aimed at avoiding social (or divine) disapproval.

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<sup>5</sup> E.g. John Mikhail, Marc Hauser.

<sup>6</sup> Jonathan Haidt

In baseball, strategies are not stated in the rules, but people know you “should” do them. For instance, if there is a runner on third base and less than two outs, the infield should play in, presumably to increase the probability of throwing the runner out at home. The rules of chess are pretty simple, but the strategies are hugely complex.

## 5. Frames and roles

The rules of baseball stipulate a frame with a set of roles: batter, pitcher, catcher, fielders, runners, umpires. Erving Goffman talks about roles in “framed” events such as a theater performance, with roles for actors, stagehands, audience, and ushers. There are no formal rules, only customs, for these events. When the performance is over, the participants drop their roles and become just people.

There are many other sorts of framed events, for example lectures, classes, weddings, court sessions, and legislatures. The roles of a framed event are on a tier of social interaction that governs the actions and relationships within the frame.

In baseball, the roles are part of the game tier. Each role provides a different way of fitting into the joint action and a different set of norms. Unlike in many other games, players in baseball shift roles in the course of the game, from being a fielder, with a customary position and role in the field, to being a batter, with a position in the batting order and the goal of becoming a baserunner, to being a baserunner, with the goal of scoring.

The umpire has an interesting role in the frame. He has final say about what physical actions *count as*: out or safe, strike or ball, fair or foul ball. That is, he makes performative declarations of truth – though his judgments better be pretty close to everyone else’s or he’s in trouble. (There are some interesting philosophical issues about truth here.)

Baseball, like theater, also has roles for non-players such as umpires, managers, and coaches (who, depending on the formality of rules adopted, may or may not be mentioned in the

rules), plus roles dictated by custom, such as spectators, grounds crew, and hot dog sellers, who are not part of the rules at all.

In chess, each *piece* has a role, again on the game tier.

We can understand not only our own roles in one of these frames, but others' roles. An informed spectator at a baseball game knows exactly what everyone is supposed to do.

Some roles, such as acting Hamlet in a single performance and being a bride in a wedding are temporary. Others, such as being a Supreme Court judge and being a wife, are (relatively) permanent. And some people *become* their roles!

There is nothing like this (as far as I know) in other primates.

## 6. Teams and other groups

Some teams are assembled on the spot, as in a sandlot game. But a lasting team, such as the University's football team or the Boston Red Sox, is not just a collection of people united in a joint action – it constitutes a social group.

There are many different sorts of groups in human society: not just teams but also teenage cliques, clubs, bands, families and extended families, social classes, ethnic and religious groups, professions, universities, and nations. Again, each of these groups is not just a random aggregation like the people on a bus.

There appears to be a universal logic associated with any group:

- If you're in my group, I'll cooperate with you, extend myself on your behalf, and expect the same from you. That is, there is a mutual commitment to norms of behavior.
- If you're not in my group, I'll compete with you, and I expect the same from you.

This logic is the foundation of morality, which empirically turns out to be extremely group-specific: Treat other individuals *in your group* with consideration. This is what maintains group cohesion, punishing freeloaders and defectors.<sup>7</sup>

The intensity of the second rule is subject to considerable cultural variation. Groups differ in their mores about how to treat members of other groups, on a scale from benign to brutal.

Groups have criteria for membership, often either descent or taking part in an initiation (or both, as in bar mitzvahs, which make someone who is Jewish by descent count as a Jewish adult). Groups often presume a sharp distinction between members and nonmembers, and demand some sort of “purity.” This purity can be manifested in unease with mixed ancestry, and/or with an insistence on homogeneity of language, dress, and behavior. Such criteria appear even in academia: I count as a linguist because I studied with Chomsky and have a Ph.D. in linguistics (proper descent and initiation). But my status is somewhat dubious because I also talk about psychology. But I don’t count as a psychologist because I don’t do experiments (improper behavior).

Being a member of a group instills a certain pride: “We’re great!” “I gain in stature by being a member!” (And everyone else stinks!). “My country, right or wrong.” One of the worst sanctions a group can impose is expulsion, which is like losing part of oneself.

I conjecture that humans conceptualize a group as a sort of “superindividual,” whose members are essentialized to a stereotype. [[Leviathan?](#)]

- The identity of the group is maintained even if all members change. The Boston Red Sox of 1995 had entirely different membership from the Red Sox of 2011. The Juilliard Quartet has gone through something like 3 first violinists, 4 second violinists, 2 violists, and 3 cellists since its founding in the 1940s. Nevertheless, fans of either one are fans of the group primarily, and of its members secondarily.

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<sup>7</sup> Richard Alexander, Irenäus Eibl-Eibesfeldt, Margaret Gilbert, Robert Boyd and Peter Richerson.

- Groups, like individuals, can be in a dominance relationship. Other things being equal, any member of a dominant group is dominant to any member of a subordinate group.
- Groups, like individuals, can form alliances and maintain rivalries. Other things being equal, any member of a friendly group is my friend; any member of a rival group is my rival.
- There can be “a will of the group” different from any particular individual’s will.

Teams can serve as proxies for larger groups such as cities or high schools. And the game can be taken to stand for (or even create) a rivalry between institutions, to the extent that fans of one team will beat up a rival team’s fans (think of brawls among soccer fans).

On the other hand, as we saw above, participating in the game at all involves cooperation and thereby creates a sense of larger groups. An extreme case is the Olympics, which always carry a strong overtone of asserting universal siblinghood, especially in events like the opening ceremony.

Primate societies also have a sense of group, with the same logic of groups. Depending on the species, each male or each female has to leave his or her birth group at maturity and find a new group. An individual trying to join a group has a very difficult time being accepted. The process requires much patience and delicacy. (Females have a somewhat easier time than males because they can offer sexual favors.) But there is no evidence of the sorts of overlapping and hierarchical groups found in humans, such as baseball teams. And there is no evidence of the conceptualization of a group as a “superindividual.”

## **7. Fodor’s Problem**

Jerry Fodor never put it this way, but the point I want to make in this section is implicit in an important argument in *The Language of Thought*.

The assumption behind any theory of mental representation is that human concepts are the product of a formal combinatorial system based on a set of primitives. This seems to be the

only way their elaborate structure can be explained. Under this assumption, the expressive power of the system may well be infinite, but it is still limited by the dimensions or degrees of freedom available in the formal system. You can't create 5-dimensional geometry out of 3-dimensional primitives. You can't build elliptical things with rectangular Legos – only approximations to elliptical things. You can't build phonology out of syntactic primitives.

Presumably the human conceptual system acquired its basic structure – its degrees of freedom or dimensionality – through evolutionary processes. Yet now it seems open-ended in a way that goes way beyond adaptive considerations. For example, in baseball, what is the evolutionary source of the game tier, such that we can stipulate rules in terms of it? What is it about human cognition that enables us to make up new game tiers at will?

This question isn't just about games. I suspect that scientific theories are also a sort of "game tier." We create new ways of "counting" observable events on the abstract "theory tier", and on this tier we do calculations whose output predicts physical outcomes. How do we invent new theories and function so easily in them? Religions probably also have an element of this sort of abstraction. And one might describe mathematics as *all* "game tier."

Here is the question all these cases raise: What sort of formal system has the generative power to create indefinitely many new systems of thought? And how did it evolve? One might imagine that the evolution of this system as a part of human cognition had something to do with the great "cognitive leap" of humans around 50,000 years ago, where we see the apparent advent of symbolic behavior such as decorations, graves, and paintings. These artifacts suggest that humans of that period had begun to understand the world in terms other than its physical and narrow social aspects.

Does this cognitive innovation have something to do with having language? Probably, but precisely how? Was it a necessary precursor of language? Or was it a *product* of having language? Why? I don't want more of just-so stories so commonplace in evolutionary theories of human language, cognition, and culture: I want a real formal analysis.

## 8. Why do we like games?

Or music? Or art? Or stories? Or religious experience? They have no evident material value, yet we expend huge amounts of resources on them. We decorate our houses, our implements, and ourselves. Again, there's no counterpart in other primates!

Evolutionary psychologists will say that either:

- These activities/experiences had adaptive value for humans, such that the individuals who participated in them or experienced them had a chance of having more surviving offspring than those who didn't. Those who derived pleasure from these activities were more likely to indulge in them. The model for this explanation is the enjoyment of sex: those organisms that derived pleasure from sex presumably sought after it more intensely, hence had it more often, hence had more offspring.  
– or:
- The ability to appreciate and enjoy these activities/experiences were byproducts of some other adaptive cognitive innovation. The model for this explanation is Pinker's hypothesis that the faculty of music is basically "auditory cheesecake," overstimulating pre-existing pleasure centers for auditory experience.

In either case, the trick is to figure out:

- What it was about the activity in question that led to more surviving offspring.
- If it was a byproduct, what it was a byproduct *of*, and how *that* was adaptive.
- What the antecedent cognitive abilities were from which this innovation could have taken place, such that hominids had them and chimpanzees do not.
- How and why *those* cognitive antecedents evolved.

Similar questions are asked for evolution of the language faculty. There is a huge amount of discussion, but the answers are almost completely speculative. There is virtually no evidence on which a strong claim can be based. I don't think we should expect anything better for this far less well understood area of human activity.

## 9. Human uniqueness

To summarize, baseball presents a sizable spectrum of conceptual abilities not found in other primates, or found only in rudimentary form.

- Joint intentions and cooperation: Probably only human
- Competition (as opposed to mutual aggression): Probably only human
- Abstract “tiers” on which actions can be understood: In other primates, limited to local social roles
- Norms (moral, legal, etiquette, custom, rules of games) which incur institutionalized sanctions if violated: Probably only human
- Frames and roles: In other primates, only dominance and kinship
- Groups: Present in other primates
- Group as “superindividual”: Probably only human

The concepts involved in baseball are complex. Kids manage to learn baseball by scaffolding on all these other conceptual abilities that are present for other purposes. But these abilities in turn present a challenge to theories of human cognitive evolution: they are all ways that human cognition is unique, or nearly so. So understanding the cognitive structure of baseball is something to keep us busy for a long time!