Evolution's Pedagogy: An Adaptationist Model of Pretense and Entertainment

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ABSTRACT

The portrayal of the actions of fictive characters for purposes of entertainment is a familiar phenomenon. Theories that seek to explain why we are attracted to such fictions and whether we learn from them have produced no consensus and no adequate overall account. In this paper, we present the hypothesis that entertainment relies on cognitive adaptations for pretend play. As a simplified model system, we draw on our field study of children's chase play, which is characterized by an elementary form of pretense. The children pretend, at first without consciously representing their pretense, to be chased by predators. The details of this behavior, widespread among mammals, indicate that the biological function of the game may be to train predator-evasion strategies. Chase play, we suggest, evolved in early mammals because it enabled cheap and plentiful resources to be used to train strategies for events that are rare, dangerous, and expensive. More generally, we argue that pretense is used to access spaces of possible actions in order to locate and practice new strategies. It relies on the creation of a simulated scenario and requires sophisticated source monitoring. The simulation is experienced as intrinsically rewarding; boredom is a design feature to motivate the construction of a more appropriate pedagogical situation, while the thrill of play signals optimal learning conditions. The conscious narrative elaboration of chase games involves an elementary form of role play, where we propose a virtual agent is created that tracks and acts on the memories required for coherent action within the simulation. These complex if familiar design features, we suggest, provide a minimalist functional and adaptationist account of the central features of entertainment: that it is fun, that it involves us imaginatively and emotionally, and that it has a tacit pedagogical effect. The model provides a principled and testable account of fiction-based entertainment grounded in evolutionary and cognitive processes.

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1. Introduction

The portrayal of the actions of fictive characters in oral presentations and dramatic enactments has been a mainstay of entertainment worldwide for thousands of years. It remains a major part of most people's lives today, supporting a large and diverse industry of printed books, radio and television programs, movies, and video games. Why is this activity taking place? We suggest a cognitive and evolutionary framework may help to provide an important dimension of a coherent answer. In this spirit, we will examine the phenomenon from the complementary perspectives of functional outcomes, motivation, cognitive implementation, and adaptive design, raising the following questions: Is there a cognitive yield from imaginative immersion in fictive scenarios? What motivates us to allocate resources to gather information about the activities of individuals we know not to exist? What are the cognitive processes that allow us to become emotionally and imaginatively involved in fictional presentations? Finally, do these processes have a distinct evolutionary history and design? While we adopt a broad Darwinian framework to respond to these questions, we will argue that a revised conception of function is necessary to respond adequately to these questions.

The idea that audiences are affected by fiction-based entertainment appears early and persists. In Plato's *Republic*, Socrates argues that young minds should be fashioned with carefully censored poetic tales (373 BC). Elizabethan London forbade the construction of theaters within the city limits. Richardson's novel *Pamela* explicitly aimed to improve morals through entertainment (1748). More recently, a large number of studies have in part vindicated this long-standing conviction by documenting that mass media entertainment does appear to influence our attitudes, dispositions, and behaviors (Federman, 1998). Yet when we know that the characters and events portrayed are fictitious, entirely or in part, why should be attracted to them, engage with them imaginatively, and be so profoundly influenced by them?

The answer is far from obvious, as a quick sampling of the wide range of theories of fiction in live performances, in print, and in movies makes evident. Aristotle (350 BC) proposed that poetry "tends to express the universal," or "how a person of a certain type on occasion speak or act, according to the law of probability or necessity." Yet the hypothesis that fictive characters are statistical composites of real subjects is surely false; fiction is full of idiosyncratic and downright unrealistic characters. Moreover, there is no evidence that this is a psychologically realistic theory of reception; in fact, the typical is likely to be boring. Acknowledging that fiction is a form of fantasy, Freud (1908) proposed that "every single fantasy is the fulfillment of a wish, a correction of unsatisfying reality." This leaves us with the puzzle of why imagining the actions of others manages to fulfill the reader's desires. Worse, a corollary of his thesis that "a happy person never fantasies" is the implausible proposition that you need to be unhappy to be entertained. When the illusion of fiction works, Pinker (1997) more simply suggests, its pleasures are the same as those of real life. In a movie, we get to "hobnob with important people, fall in love with ravishing men and women, protect loved ones, attain impossible goals, and defeat wicked enemies" (p. 539). Yet even if you thought that what you see on the silver screen were happening for real, you would surely notice that you are sitting in a seat watching, not hobnobbing and falling in love. According to Hobbs (1990), literary fictions are thought experiments where we learn from seeing others act out the logic of hypothetical scenarios. In a similar vein, Carroll (1999) has suggested that literature and its oral antecedents "provide models of behavior and help regulate the complex cognitive machinery through which humans negotiate their social and cultural environments" (p. 159). While these learning-oriented approaches are plausible, they fail to explain why we are typically attracted to fiction for its entertainment value, apparently oblivious to what it teaches us. Rozin (1996) has proposed tearjerkers are like hot peppers in making your body respond as if in trouble, even as you know you are really safe. Such "benign masochism," where you get a pleasure that comes from knowing better than your body, functions to expand the range of options in life by testing how close to the edge of the cliff you can go without falling off. This intriguing hypothesis deals with only certain kinds of entertainment; it also assumes we identify with on-screen characters, a short-hand for

a curious phenomenon that surely needs explaining. Miller (2000) gives a new twist to the idea that art is a form of display, situating it within sexual selection theory as the ebullient output of a courtship machine. On this hypothesis, however, it becomes a puzzle why our attitudes and behaviors should become influenced by fiction. While several of these theories provide useful ideas, they present at best partial accounts. As a minimal requirement, an adequate theory must be able to account for the basic facts of entertainment: that it is fun, that we get imaginatively and emotionally involved, and that it has a tacit pedagogical effect.

While oral storytelling and printed texts can confidently be identified as the cultural predecessors of the recent technologies of mechanical reproduction and dissemination of words and images, the basic cognitive capacity for creating and enjoying imaginative fictions is harder to explain. To situate the effects of fiction in an evolutionary perspective, we may need to identify relevant adaptations enlisted from other domains. Citing Horace (20 BC) that the purpose of literature is "to delight and instruct," Pinker (1997) argues it is "helpful to distinguish between the delight, perhaps the product of a useless technology for pressing our pleasure buttons, from the instruction, perhaps a product of cognitive adaptation" (p. 539). The key theoretically interesting feature of entertainment, however, is precisely that it does not seem possible to pry the two apart. Even if we are only interested in being entertained, we end up being influenced. This close integration may indicate that we are dealing with an adaptation where the surface motivation conceals an unconscious function. We would not wish to argue, for instance, that we should distinguish between the delight of eating and sex as products of a useless technology for pressing our pleasure buttons and the adaptive functions of nourishment and reproduction. Natural selection tracks results, leading to the intimate association of motivational and functional systems. In this paper, we propose to view the attractiveness of entertainment as well as the tacit learning associated with it as an effect of ancestral adaptations for pretend play. More specifically, we propose that in pretend play, evolution has produced a suite of cognitive adaptations designed to make use of surplus resources in a safe environment to train strategies for dealing with dangerous or expensive situations that have not yet occurred. For reasons that will become clear below, we refer to this proposal as the *organizational-mode hypothesis*.

We draw on both evolutionary psychology and cognitive science for our theoretical framework. The data in which this argument is grounded are from observations of children's chase play in a naturalistic setting (see Owens, Steen, Hargrave, Flores, and Hall, under submission, and Owens and Steen, under submission). Based on this material, we develop the hypothesis that chase play evolved as a result of selection pressure to lower the cost of developing predator evasion skills. Adaptation, Williams (1966) has warned, "is a special and onerous concept that should be used only when it is really necessary" (p. 4). In the spirit that "it should be attributed to no higher a level of organization than is demanded by the evidence" (pp. 4-5), we develop a minimalist theory of pretense. The challenge is to identify a suite of cognitive processes "as components of some special problem-solving machinery" (Williams, 1985, p. 1). Evidence of special design include such factors as "efficiency, complexity, precision, specialization, and reliability, which, like a key fitting a lock, render the design too good a solution to a defined adaptive problem to be a coincidence" (Cosmides & Tooby, 1992, p. 62). We sketch out a cognitive model of pretense to argue that the elementary kind of pretense required for chase play is a remarkably elegant and uniquely suited solution to the highly complex adaptive problem of how to make use of plentiful resources in a safe environment to improve and customize the organism's response to a dangerous and expensive situation that has not yet occurred.

In the following, we begin section 2 by discussing the broad phenomenon of pretend play. In section 3, we examine the kinds of selection pressures that are relevant to the evolution of pretend play, situating pretense within the broader framework of an adaptive domain for self-construction. In section 4, we present the adaptive problem that we propose chase play evolved to solve, along with the resources available for its solution. In section 5, we elaborate on the nature of the solution, proposing that even elementary forms of pretend play form part of an evolved pedagogy with criteria for optimal learning conditions and dedicated motivational structures. In section 6, we present a model of the cognitive architecture of pretense, emphasizing the tension between a simulation requirement and a source monitoring requirement. In section 7, we examine the preconditions, cognitive processes, and pedagogical results of role play and narrative play in chase games. In section 8, we outline a general model of how and

what children learn from the various forms of chase play. We end with a summary and outlook pointing to possible applications of the model.

2. Pretend Play

In pretend play, a bench can become a spaceship, the playground can be transformed into a faraway planet, and your friend can be turned into a terrifying alien monster. While you are engaged in pretend play, you retain the awareness that your spaceship is really a bench, that you have not traveled into outer space, and that your friend is not a monster. Such instances of pretend play, prototypically associated with young children, are common and familiar. The full distribution of the phenomenon is more difficult to determine. Many species of animals engage in activities that resemble children's pretend play, such as play fighting and play chasing. Certain forms of popular and mass entertainment, such as theatrical performances and movies, appear to involve culturally elaborate forms of pretend play. The enjoyment derived from pretending to be someone you are not, doing something you are not really doing, in a place where you are not located, using resources you don't actually have, is such a common experience that we rarely stop to consider how paradoxical it is. A good model of children's pretend play may be helpful for understanding a range of related phenomena.

Early research on animal play, focusing on different aspects of the phenomenon, formulated two divergent hypotheses that continue to appear in today's discussions: that it is fun but useless and that it has a training function. Spencer (1872-73) proposed that play is an expression of surplus energy and that it has no function other than to relieve boredom. In a landmark study, Groos (1898) argued that juvenile play serves to practice adult behaviors, a view elaborated by Fagen (1981). Without denying the continuity with animal play, early work in developmental psychology tended to focus on the intellectual and social dimensions of play (Piaget, 1962; Vygotsky, 1967; see Fein, 1981 for a review). Only in the last decade or so have cognitive scientists taken a serious interest in pretend play, spurred by Leslie's (1987) claim that pretense is structurally similar to mental-state attribution. Researchers have focused on explaining pretense in terms of a more general theory of metarepresentations (e.g., Currie, 1998; Harris, 1994; Lillard, 1993; Perner et al., 1994). Nichols and Stich

(2000) propose that pretense is a form of hypothetical reasoning. The major adaptationist account to incorporate the cognitive perspective is Cosmides and Tooby (2000), who propose to account for pretense in terms of the evolution of the more general ability to bind representations by scope operators.

The excitement surrounding pretense opens for the possibility of a fruitful synthesis of ethological, evolutionary, and developmental approaches with cognitive modeling. Even if pretense should eventually turn out to belong to a larger category of metarepresentational abilities, an adequate account of pretense must be compatible with the ethological material. If animals pretend, as we will argue they do, a theory that makes pretense dependent on complex metarepresentational abilities unique to humans must be wrong. Conversely, an evolutionary account that is compatible with the presence of pretense in juvenile mammals may lead us to understand the minimal cognitive mechanisms required to pretend, providing us with a sharply focused theory. This in turn may help us build more accurate models of metarepresentational abilities as well as of culturally elaborated forms of pretense.

An evolutionary approach to pretend play faces well-known difficulties: our distant ancestors are dead and cannot be observed, several extinct species separate us from our closest living relatives, the conditions under which the relevant adaptations arose are in some cases no longer present, and fossil remains will be of limited use because play does not appear to require a dedicated morphology. A possible source of cues to the evolutionary history of pretense is present in children's spontaneous play. To gain insight into the basic structure of elementary forms of pretense in a naturalistic setting, we have undertaken a study of chase play in early childhood (see Owens, Steen, Hargrave, Flores, and Hall, under submission). Children's chase play has not previously been the subject of systematic study (Power, 2000), perhaps because it may appear to be trivially elementary. The occurrence of chase play has been amply documented across a large number of species of mammals (Aldis, 1975; Biben, 1983; Byers, 1984; Fagen, 1981; Müller-Schwarze, 1984; Powers, 2000; Symons, 1978). The basic features of children's chase play, including a range of fairly stereotypical behaviors such as pretend stalking, rearing, roaring, and biting, present a high degree of structural similarity with

animal chase play (Aldis, 1975). These cues suggest that chase play is a form of pretend predation, a hypothesis we develop in greater detail below. Shared cues permit cross-species chase play; anecdotally, some of children we observed reported being more comfortable playing chase with their dogs than with their playmates. The continuity between human and animal chase play suggests that the behavior has persisted across millions of years of evolutionary history. These factors make chase play an excellent candidate for probing the cognitive design, natural function, evolutionary history, and developmental trajectory of pretense, following Tinbergen's (1963) proposal for the four dimensions of ethological research. Burghardt (1997) has proposed a fifth, that of "private experience." In chase play, we have the advantage of being able to speak to the children and to participate in games ourselves and thus to gain access to the subjective phenomenology of play. Chase play represents as it were a fossilized cognitive and behavioral complex, providing us with an excellent opportunity to study an elementary form of pretend play.

3. The Organizational Domain

A child is faced with the task of constructing herself as a multidimensional being with a rich set of relations to the objective world, to her community, and to herself. There is a seamless continuity between the self-assembly of the physical body, the development of the embodied mind, and the construction of the social child. Some of the information necessary for this process of self-construction is located in the genes, some of it is found in the environment, and some is found in the minds of others or in the objects they create and manufacture. These levels interact and rely on each other for their timely expression. While evolutionary theory has conventionally been focused on the development of physiological and cognitive structures that enable survival and propagation, evidence of adaptations for self-construction have been accumulating, cutting across the dichotomies of nature and nurture, instinct and learning (Fagen, 1975; Cosmides & Tooby, 1992).

The constraints and opportunities faced by the task of constructing a particular adaptation differ in systematic ways from those encountered by the actual execution of the adaptation. These differences define two distinct adaptive domains, the *organizational* and the *executive* (cf. Tooby &

Cosmides, 2000). In the executive domain of a prey animal, for example, we find its predators and their behaviors. Through natural selection, statistical patterns and regularities in the predator-prey interactions end up favoring certain adaptations over others. A gazelle, say, may develop a capacity for estimating exactly when it needs to use the highly visible behavior of stottering as a signal to the predator that the latter has been spotted and that a chase would be a waste of its time; a femur may become elongated and permit swifter flight. These behavioral patterns and physiological structures must be be actualized afresh in the ontogeny of each individual through the development of physiological and cognitive mechanisms. Such mechanisms have a *biological function*, that is to say, the function that the mechanism was designed to solve, by virtue of its past successes (Millikan, 1984, 1993). In cognitive terms, the executive domain of a conceptual module is defined as "all the information that it is the module's biological function to process" (Sperber, 1994, p. 52).

The organizational domain is characterized by a different set of adaptive pressures and gives rise to a distinct set of adaptations. Here, natural selection can be predicted to act on variables that affect the conditions under which a mechanism can be constructed, elaborated, calibrated, customized to local conditions, and rendered optimally functional. The action of the genes can only take place in highly constrained conditions; from conception through adulthood, their expression depends on the presence of appropriate physiological, environmental, and social contexts. Natural selection acts on the organism's relation to these contexts, which constitute its organizational domains. This allows features of the environment to be enlisted that have no relevance to the proper function of the mechanism. In the simplest case, such features consist of invariances that can be used to stimulate or calibrate executive systems. Thus, Tooby and Cosmides (2000) propose that our fascination for sunsets and starry nights may serve to calibrate our visual systems. If so, the optical characteristics of starlight encode, in a distributed form, part of the design specification of the visual system. More generally, the organizational domain consists of affordances in the environment that facilitate various aspects of self-construction, including learning.

Applications of evolutionary theory to the understanding of behavior have generally assumed that the relevant adaptive domain, or environment

of evolutionary adaptedness, is the executive domain, or the domain defined by what Millikan (1984, 1993) and Sperber (1994) call the biological or proper function of an adaptation. The notion of an organizational domain provides a potentially important corrective to this conceptual framework. It specifies a new set of biologically significant phenomena that may play a role in the construction of the adaptation, even if they have no functional relation to its executive performance.

4. The Evolution of Pretense

The notion of an organizational domain makes it possible to address the central paradox of play research: that it is characterized as at once purposeless and functional. On the one hand, it appears to be undertaken as an end in itself and to confer no observable practical benefits on its participants. For Bekoff and Byers (1981), this is a defining characteristic: "Play is all motor activity performed postnatally that appears to be purposeless, in which motor patterns from other contexts may often be used in modified forms and altered temporal sequencing." On the other hand, a large number of play theorists have concluded that play among children and animals is functional, aiding in what is broadly characterized as individual and social self-construction (e.g., Corsaro, 1985; Symons, 1978; Fagen, 1975; Bruner, 1972; Vygotsky, 1966; Piaget, 1962). Fagen's (1981) landmark study defines play as "behavior that functions to develop, practice, or maintain physical or cognitive abilities and social relationships" (p. 65). The solution to this puzzle is to situate the function of play in the organizational rather than in the executive domain. Its purpose relates to self-construction, it is driven by a distinct motivational system, and the activity maps in complex ways onto subsequent behavior.

Play is primarily a mammalian adaptation, although some species of birds play (Fagen, 1981). Fagen (1974) links the occurrence of play in mammals to an investment in individual offspring, a juvenile period, and large brains. Locomotor and chase play is found in rodents and ungulates; most species of advanced predators and primates play. Play fighting and play chasing are ubiquitous (Aldis, 1975). Species that don't play rely on pre-programmed skills for survival and undergo rapid maturation. "There is no persuasive evidence that reptiles play," MacLean (1990) writes, "and the alleged play of feather tossing that occurs among some

birds appears almost accidental and of short duration. Hence, it might be argued that individual play, and most particularly long bouts of social play, represents a uniquely mammalian trait" (p. 559). It is beyond the scope of this paper to explain why this might be so; the transition from reptiles to mammals involves a large number of interacting adaptations. It is instructive to consider, however, that the defining mammalian characteristics of endothermy and lactation may have created an adaptive topology that favored a vast expansion of the organizational domain (cf. Burghardt, 1984).

Consider the case of chase play. Young animals of all species are favorite targets for predation, precisely because they lack the advanced motor skills and defensive behaviors that allow adults to escape. While repeated encounters with the predator may improve the relevant skills, each encounter, even as it has pedagogical value, carries the highest possible risk, that of death. In comparison to reptiles, mammals are burdened with a very high resting metabolism that requires a sharply increased food intake. This budget, however, must be met to ensure survival; once it is met, there is little gained in adopting the reptilian strategy of preserving energy by lying still. The high fixed costs imposed by endothermy has the effect of lowering the marginal cost of motor activities. Young mammals in addition are heavily subsidized by their lactating mothers, providing them with an evolutionarily unprecedented resource that we might term leisure. The continuing pressure of predation combined with leisure sets up a unique adaptive problem and opportunity. The evolutionary solution, as Aldis (1975) was first to note, "has been play in which peers become substitute predators, prey, etc." (p. 158). Such pretense appears designed to lower the cost of training by allowing it to take place in the absence of a real threat, utilizing resources the animal has already largely paid for. In pretense, common, cheap, and safe features of the environment can be enlisted to create an approximate simulation of rare, expensive and dangerous events.

In order for pretense to evolve in the domain of predation, a basic schema to handle predator detection and responses must already be in place. An elementary predator schema is present already in amphibians (Ewert, 1987) and birds, as shown by the classic experiments of Spalding (1873a, b), Lorenz (1939), and Tinbergen (1948, 1951); for a reassessment, see Canty and Gould (1995). In the case of humans, Barrett (1999) presents

preliminary evidence for a domain-specific inference schema that uses motion and gaze information as inputs and generates predictions concerning likely future behavior. The inference system is likely to make use of a limited repertoire of representations of the predator's internal states. Eye-direction detection, for instance, may be processed to yield the inference that the predator does or does not know where you are, a piece of information that has vital consequences for predicting behavior. Since chase play requires that a conspecific adopt the role of chaser, the simplest model would assume that the predator schema is a single schema with perspective-switching, in effect a predator-prey schema. The schema may be informationally encapsulated, in Fodor's (1983) sense; its initial output may simply be evasive behavior in the form of domain-specific fixed action patterns (Barrett, 1999). For pretense to be useful, we must presuppose that the action patterns of the predator schema are capable of becoming more effective with practice. This condition would be satisfied if the genes contained incomplete instructions for building effective predator evasion behaviors, relying on a naturally occurring organizational domain for the completion of the adaptation. Such an arrangement would also allow for the schema to be customizable to local species and behavioral contingencies. In the arms race between predator and prey, the ability to adopt unexpected strategies will be favored. During an actual chase, experimentation is risky; the fleeing animal must rely on action patterns that are well established. Pretend play provides a highly favorable low-cost opportunity for searching the possibility space of evasive action to locate effective strategies and for perfecting the skills required for a successful execution of these strategies under pressure.

Natural selection cannot have acted directly to favor pretend play. If a young mammal failed on some given occasion to engage in chase play, this would not have caused the immediate death of the individual. In fact, it is frequently observed that over the short term, play increases rather than decreases the risk of injury and predation. Harcourt (1991) reports that a remarkable 22 of 26 fur seals he observed killed by sea lions were attacked while playing, even though play occupied only 6% of their waking hours. While this high proportion is unlikely to represent the norm, it underlines the potential cost of play. Such costs must be compensated for in order for the cognitive adaptations for play to persist. The benefits of play can

only appear in long-term statistical correlations between play behavior and survival rates. Even slight but consistently positive differences in predator evasion abilities will be passed on. A training theory of play implies that it is the quality of the self-construction that results from play, for instance in the form of continuously improved and locally varied evasion strategies, that is being tracked by natural selection.

A related objection against Groos' (1898) initial formulation of the training hypothesis was raised by Hall (1904). Drawing attention to the apparent mismatch between what children train and what they end up doing as adults, he proposed that play does not prepare for adult life but instead recapitulate in ontogeny the stages of past phylogeny. Bowlby's (1969) landmark work clarified that adaptations must necessarily be constructed in relation to an ancestral set of conditions, the environment of evolutionary adaptedness, or EEA (for a discussion, see Foley, 1995-96). This exposes organisms to adaptive lag, or precisely the type of mismatch Hall noted. The concept of the EEA obviates the need for a theory of recapitulation. The claim that pretense is an adaptation for learning is thus not intended to imply that pretense actually accomplishes this biological function on any given occasion. Rather, in our evolutionary past, the ability to engage in pretense was reliably correlated with improved chances of survival. Children's chase play provides a good example of adaptive lag. The risk of being attacked by a predator is slight in most contemporary societies and is typically dwarfed by the danger of being run over by a car, yet — if our hypothesis is correct — children devote a great deal of time and energy practicing predator evasion. This is not to say there are no contemporary benefits from playing chase, only that the benefits the activity appears designed to deliver are no longer well targeted.

In this section, we have proposed that chase play evolved in response to the persistent pressure of predation and the high cost of training evasion skills. Pretense, we suggest, bears the telltale mark of an adaptive design for exploiting readily available resources in a safe environment to train expensive and dangerous future behavior.

5. The Organizational Mode

The evolution of pretend play resulted in a vast extension of the organizational domain. In fact, in pretense, the organizational domain is

defined opportunistically and has no clear demarcation. A ball of yarn can serve a cat as a target for pretend play and train hunting skills, even though it does not form part of the executive domain of adaptations for hunting. When it comes to self-construction, the interpretation of the environment is no longer directly subject to natural selection; instead, it is the mind's ability to make non-standard use of environmental affordances that matters. The distinction between an executive and an organizational domain must be recast as a distinction between two cognitive modes, an executive and an organizational. In the executive mode, the exercise of a particular mechanism is undertaken to accomplish its biological function. In the organizational mode, the general ability to perform the function is enhanced, but the function itself is not performed. The two modes differ along five major dimensions of ethology (Burghardt, 1999): in their evolutionary history, in their cognitive design, in their developmental history, in the function of the behavior they give rise to, and in their subjective phenomenology. The adaptations that arise in relation to the organizational domain are designed to improve the eventual functioning of an evolved mechanism. They must do so without unduly interfering with the executive operation of a particular function. An important dimension of the selective pressure acting on an organism in its organizational domain is to make use of resources that are not required or not even useful in the executive mode, such as otherwise useless objects and leisure time.

The activities that take place in the organizational mode typically require a high level of skill in the executive mode; they may be dangerous or demand resources not readily available to the player. In play, the developing individual can rehearse various components of a complex action and gradually assemble them, at leisure and in the absence of pressures and distractions. Following our hypothesis, such activities should be initiated only when basic executive needs have been met; the player must feel safe and at leisure to enter the organizational mode. Anecdotal evidence supports this prediction. "Normally, playing occurs only in a relaxed situation," Rensch (1973) writes, "free from physiological pressures and threats from the environment" (p. 104). If the organism is fed, rested, safe, and warm, this creates an opportunity for devoting spare resources to self construction. Surplus energy is a critical factor: "one of the strongest relationships found in play research is that play is remarkably sensitive

to environmental context and the players' physical and nutritional state" (Burghardt, 1999). Under the right circumstances, the player will tend to adopt strategies for optimizing her utilization of environmental resources to achieve effective learning.

Characteristic of behaviors in the organizational mode is that they take place spontaneously, are experienced as intrinsically rewarding, and do not rely on the formation of a conscious intention to learn. As Spencer (1872-3) perceptively noted, play is spurred by boredom. In the adaptationist perspective, boredom is an innovation of the organizational mode, designed to prompt the individual to engage in appropriate learning activities. If pretend play is designed by natural selection, we would expect it to have a motivational component. In fact, once we accept that play is a form of training, which a large number of play theorists do (e.g., Symons, 1978; Fagen, 1975; Bruner, 1972; Vygotsky, 1966; Piaget, 1962), the absence of any conscious intention to train skills or even any awareness that skills are being trained in play is a powerful argument in favor of the adaptationist hypothesis. The absence of a need for a conscious intention to accomplish the biological function suggests it may be appropriate to place pretend play with sex and eating, activities that have evolved dedicated motivational systems that can be independently manipulated. The thrill of chase play, in this view, does not derive from an intention to construct predator evasion skills, any more than the joys of sex depend on a desire to reproduce. In this way, the initial puzzle that a functional behavior should be subjectively be experienced as purposeless but fun receives a satisfactory solution.

Pretense, we suggest, represents one of the central cognitive innovations of the organizational mode. It is designed to solve a particularly complex adaptive problem, that of improving performance on a task in the absence of the normal eliciting conditions. Pretense allows the young mammal or child to make use of affordances in its environment to devise learning situations that are safe, readily available, and developmentally appropriate. This amounts to saying that natural selection acts on the organizational mode to elaborate what might be termed an evolved pedagogy. The developmentally and contextually calibrated boredom and thrill of play can now be understood as motivational and regulatory mechanisms designed to optimize the kind of learning that benefited our ancestors in the environment of evolutionary adaptedness.

By situating pretense within an evolutionary framework, we wish to demonstrate that many otherwise puzzling and apparently unmotivated features of pretend play, such as the delight that accompanies seemingly pointless behavior, the boredom caused by certain stimuli or by inactivity, and the presence of theatrical activators, such as the pretend pawing, stalking, grasping, and biting characteristic of chase play, can helpfully be modeled as the result of an extremely complex adaptive problem, that of making use of present resources to improve your responses to aspects of your environment that are not currently present to you. The distinction between an organizational and an executive mode allows us to think about the development of pretense in a systematic fashion as a component of an evolved pedagogy. This adaptationist claim in turn has implications for the kinds of processes we need to look for in a cognitive model of pretense.

6. The Cognitive Design of Pretense

The constraints on pretense as an adaptation for learning are severe: the simulated event must be convincing enough to activate the cognitive and physiological subsystems sufficiently to provide meaningful practice; at the same time, a distinction must be maintained between pretense and reality. These constraints may be referred to as the simulation requirement and the source monitoring requirement. We present some of our observational data on chase play to bring out the paradoxical character of pretend play and develop a model in terms of mental space theory (Fauconnier, 1994), starting with the problem of source monitoring.

When our preschool subjects were asked why they were running away from their friend in a chase game, they invariably affirmed that they were being chased for real and that they were afraid for real. This would seem to indicate that the fleers interpreted the event in the executive mode. These responses, however, were typically made with a big smile; moments later, the two antagonists might be playing together amicably in a different activity (Owens et al., under submission). While it is clear from the children's behavior that they at some level track that the chase is a form of make-believe and that they are not being chased in the executive mode, there is little reason to suppose they are continuously and explicitly representing this in short-term memory. More generally, it is important to note that our model of chase play as an elementary form of pretense

does not require the players to have a theory of pretense, or even to be consciously aware that they are pretending.

Children's chase games show a gradient of development. In what we term classic chase, which predominates until the age of three and is occasionally seen even in adult chases, the players engage in chasing and fleeing behavior without an explicit narrative content. Classic chase is the form of chase play that is most strongly continuous with animal play. At some point between the ages of 3 and 5, children typically develop elaborate narrative chase games, where the chaser takes on the explicit role of a monster or some specific predator. We have no evidence that classic chase requires or typically involves the recollection of past memories and the display of mental images in consciousness to guide their play and suggest that as a rule it does not. In the minimalist variant of the model of pretense that we propose, the act of pretense is unconscious. Moreover, the participants do not have an understanding of the biological function of their behavior and typically are not inclined to question the purpose of their play. Adults are sometimes brought to wonder about their own incongruous behavior. Anecdotally, one of our friends reported asking why his two-year old son found the threat that his father would commit filicide such an enjoyable prospect; another reported asking his wife why he growled at their young child. Even when the question is explicitly asked, however, the answer is far from intuitively obvious. The almost complete cognitive impenetrability of the finely regulated activity of chase play rules out episodic memory as the core organizing factor and strengthens the hypothesis that the behavior is designed by natural selection to operate independently of an explicit understanding of its biological purpose.

When children are playing chase, a large number of apparently contradictory cues regulate the pretend scenario. On the one hand, the fleers are typically smiling, giggling, and laughing, signaling that they are having fun and that they appreciate what their playmates are doing. The chaser typically displays a stereotypical playface, characterized by a wide open mouth smiling and fixedly raised eyebrows, signaling good intentions. On the other, the chaser stalks threateningly, rears, growls, and grasps after his or her designated victim, while the fleers appear desperate to escape the chaser's clutches. Speech acts within the game display the same ambivalence. The initiating vocalization of the chaser is characterized by

a high-pitched and exaggeratedly modulated voice that appears to signal the organizational mode; the words might be "I'm gonna get you!" When a child begs, "Chase me!," her voice bursting with excitement, the request has no coherent meaning in the executive mode, since being chased implies an attempt to evade an undesirable situation. Instead, it must necessarily be interpreted as a form of pretense. Chasers not only self-handicap but are assumed to be self-handicapping by the fleers, who typically prefer to be chased by people who in reality can easily outrun them. When the chaser makes menacing gestures and threatens to catch the child, the fleer will giggle, laugh, or squeal excitedly in response, all the while smiling broadly. The excitement is often so intense the would-be giggle is drawn into a long, high-pitched squeal. A play sequence may end in capture or simply fizzle out; if the child is captured, the chaser may hug the child and at the same time make biting gestures. Adults frequently participate in chase games and appear to have no more of a theory of what they are doing than the children. After capturing a little girl and lifting her up, a teacher in the preschool playground was overheard saying, "What am I going to do with you? Eat you?" The girl giggled; she knew her teacher would not eat her "for real" and yet the idea of being eaten was experienced as enjoyable.

In terms of Fauconnier's (1994) mental space theory, these contradictory signals serve to establish the presence of a pretend space embedded within and secured by an executive space. Mental spaces are here used to track the *source* or *type* of a particular piece of information; that is to say, to handle the problem of source monitoring (cf. Mitchell & Johnson, 2000). Nichols and Stich (2000) propose that the pretend scenario is constructed in what they term a Possible World Box. This construct is compatible with our notion of a pretend space and we find their model of great interest. We are skeptical, however, to their proposal that pretense is a special form of hypothetical reasoning, if by this they mean a general capacity for producing mental images consciously tracked as counterfactual. In our model, pretense does not require mental images and may be unconscious and indeed cognitively impenetrable. While hypothetical reasoning is typically associated with humans and may define a uniquely human cognitive adaptation, the elementary form of pretense we see in chase play appears to be an early mammalian adaptation. Where hypothetical reasoning is

domain-general, we propose pretense initially was likely strictly limited to training domain-specific skills, such as predator-evasion and fighting.

Using Leslie's (1995) criteria, we define a behavior as pretense when there is a suspension of basic semantic relations of existence, reference, and truth. Existence is suspended in games with imaginary chasers, which occur when a child cannot recruit a peer or adult to be the chaser. Reference is suspended in narrative chase play, where the players use mental imagery to guide their play. In all chase play, truth is suspended in relation to the chaser's intentions and the fleer's response. The adaptive problem is to track the selective suspension of these semantic relations in one set of interpretations at the same time as existence, reference, and truth retain their canonical executive values in a second and incompatible set of interpretations. Mental spaces appear suited to solve this problem, constituting in effect a system of pretense monitoring.

During the course of the pretend play, the integrity of the pretend space must be maintained both internally and in relation to the executive space. The chaser's playface and calibrated self-handicapping serves as a constant reminder to the fleeing child that the conditions for play are present. Crucially, it signals that the intentions of the chaser are to provide optimal learning conditions for the fleer. Classic chase would more accurately be termed "flee play" (Gene Lerner's suggestion, personal communication), since the implied goal of the game is to practice evasion. The chaser is thus technically doing the fleer a favor, allowing him to enlist her resources in a simulation he effectively controls. At the same time as the fleer must continually be reassured that the executive conditions remain right for maintaining the game, the pretend space must be sustained. Here, the chaser gets a big reward in the form of a thrilled squeal if he rears, growl, stalks, and grasps, simulating a multiplicity of threatening situations.

It is not uncommon, however, to see small children get worried and afraid in the middle of a game, especially if it is sustained for a long time; suddenly, they lose confidence in the safety of the pretend space and desire a return to the executive mode. Minor distractions in the executive space must be evaluated and may suffice to collapse the pretend space in an instant. A long playset chase with three girls was not interrupted by our videotaping, for instance, but when the large tires that the children play on were rolled into adjacent playground, the girls stopped playing and ran to

the fence to check out the action. Likewise, as would be expected from an adaptationist perspective, the pretend mode remains closely dependent on a continuing appraisal of the availability of all necessary executive resources. At the same time, the creation and maintenance of appropriate pretend spaces is experienced as intrinsically rewarding, and children who initially are timid in their chase play frequently develop ingenious strategies to increase their comfort, for instance by insisting on being carried by an adult when being chased, by designating sanctuaries where the chaser is not allowed to approach them, and by holding the hand of an older sibling.

Using Fauconnier and Turner's (1998, in press) conceptual integration model, classic chase accomplishes the act of pretense through a single-scope blend between the perception of a friendly playmate and the predator schema. This can also be described as an elementary metaphorical mapping, where the friendly playmate is the source and the predator schema the target (Lakoff & Johnson, 1980). These blends draw selectively from the features afforded by their environment; for instance, the chaser's mouth and eyes are mapped onto the mouth and eye definitions in the predator schema. While the blend is used to constitute the pretend space, the canonical interpretation of the perceptual input is maintained in the executive space. Activators such as self-handicapped growling, biting, and clawing help to define an arousing pretend space by effectively tapping into the predator schema. Even if a particular activator does not fit all the executive input requirements of the predator schema, in pretend play, the input conditions are relaxed and even poor approximations can do the job.

When very young children sometimes become afraid during a chase, this may be because the complexity of the pretend space dominates their short-term memory to the point where the executive space is crowded out. To meet the simulation requirement, the blend must be realistic enough to activate all the relevant inferences of the predator-prey schema, including very strong emotions that serve to arouse the child and energize its evasive maneuver. These emotions can seem overwhelming to an infant and prompt a demand for the collapse of the pretend space and the reestablishment of a reassuring executive space. Since the construction of the blend is typically a collaborative endeavor between the caregiver and the infant, this collapse requires that the caregiver cease the production of the threatening activators. If the activators continue to be delivered

even after the child has signaled that she is anxious, this implicitly signals the child is not in charge of the pedagogical situation, which would be predicted to increase her distress. The knowledge that the pretend space can be collapsed on command is a vital factor in making the child feel secure enough to play.

In this section, we have argued that the cognitive design of pretense must meet both a simulation requirement and a source-monitoring requirement. The mental and physical simulation constructed in chase play, we propose, is organized by the single-scope conceptual integration of the relevant affordances in the perceptual input and the corresponding definitions in the predator schema. This blend must be powerful enough to arouse the inferences of the predator schema yet not so powerful that it overwhelms the source-monitoring system. This latter, we propose, involves maintaining a concurrent executive space that tracks the canonical interpretation of the environment. Even as the pretend space is experienced as inherently attractive and enjoyable, it remains closely dependent on the continued presence of suitable conditions in the executive space. Minor disturbances in the executive space typically lead to the immediate collapse of the pretend space. These processes are largely unconscious and indeed cognitively impenetrable; pretense in classic chase play can be and typically is handled without mental imagery, without consciousness of the purpose of the activity, and without an explicit awareness that the activity is a form of pretense.

7. Role Play

Already in classic chase, there is a chaser and a fleer and these roles frequently get reversed during play. Barrett (1999) posits perspective-shifting as a basic design feature of the human predator-prey schema. In the present hypothesis, chase play involves the creation of counterfactual blended mental spaces that trigger inferences from the predator-prey schema, generating a mental and behavioral simulation of a predator-prey interaction. This cognitive machinery, which we propose may have evolved to train predator evasion, is in effect also a machinery for modeling mental states, not only incidentally but as part of its biological function. The individual who adopts the role of the chaser does so by simulating a generic predator's intentions and desires, communicated through such

activators as self-handicapped stalking, running, clawing, grabbing, and biting. We have no evidence, however, that the purpose of this activity is to model other minds. The mental states pretended by the chaser and the fleer alike are generic and do not appear to have a referential function. The key generic construct is that of the monster: when children are asked whom they are running from, they very often reply "the monster." This mental representation, we suggest, springs from or is shaped to elicit the predator schema.

In what we term role play proper in the context of chase play, the child imagines that she or someone else is an animal. Even very young children may pretend to be lions or cheetahs and growl and claw in the air. A 2.11-year-old girl names every chaser, even those that do not know they are supposedly chasing her, "the big bad wolf." This cognitive act depends on the ability to recall memories into waking consciousness and to create a double-scope conceptual integration (Fauconnier & Turner, in press) between the perception, the mental image, and the predator schema. Our hypothesis is agnostic on the origin of these capacities; they are simply enlisted in pretend play. By pretending to be a lion, the child is able to associate a suite of intentions and behaviors with a particular role. We hypothesize that the primary purpose of role play is not to improve on the child's existing models of animal behavior, but to explore his own possibility spaces in an expanded form of self-construction. A role allows the child to access aspects of himself that are similar to the known or frequently merely imagined characteristics of a certain animal, thus expanding his available set of strategies.

In narrative chase, the roles assumed by the children are further elaborated into identities with individual memories. Desire is not simply hunger, for instance, but includes the history of not having eaten for a week. Early narrative play is solitary or parallel; around the age of four, children begin to be able to synchronize their pretend scenarios. They enrich their games with the collaborative use of mental imagery derived from personal experience or frequently from culturally transmitted sources such as mass media. Such coordinated games can go on for long periods of time and involve large numbers of players. The older 4-year-olds in our study often play a game of their own invention called "cheetah." As cheetahs, they are a family complete with parents, brothers, sisters, and

a baby-sitter. They all live either on the playset or in a tunnel and growl and prowl around. The cheetahs are not chasers, however; they are fleers pursued by a generic monster (Owens et al., under submission). Other favorite predators in this sample include wolves, dinosaurs, triceratops, and t-rex. The fact that narrative chase invariably elaborates chase play with mental imagery of predators lends support to the interpretation that classic chase play is implicitly about predator evasion, even if the imagery is absent.

In cognitive terms, role play relies on the construction of a *virtual agent*. The executive identity of the child is constructed in part on the basis of personal memories of goals, resources, past achievements, and future obstacles. Role play requires that the child be in a situation where these executive memories do not have to be active; only if the conditions are right will the executive space be placed a state of suspended animation, thus freeing up the necessary cognitive resources to construct a rich pretend space. When the executive agent memories are quiescent, the memories that enable the construction of the role can take their place and in this way take over control of thinking, emotion, gestures, and actions. This virtual agent acts in a narrative pretend space, exploring vast possibility spaces of attitudes, emotions, actions, and social relations that the child could not otherwise access. During this imaginative immersion, as in simpler forms of pretense, the pretend space remains dependent on the suspended executive space, which must track — perhaps imperfectly, relying on reduced resources — the canonical interpretation of the environment and ensures conditions remain suitable for play.

8. Structural Learning

In the previous sections, we have argued that chase play provides a favorable and low-cost opportunity for searching the possibility space of evasive action, for locating new and effective strategies, and for gaining experience in these under safe conditions. When children acquire a new skill, whether it be a motor skill or a cognitive skill, this opens up a new possibility space of behavior. Only a small fraction of this theoretical space can be realized in the executive mode: the child may lack the necessary resources, the activity may be dangerous, or it may involve a course of action that creates irreversible and undesirable consequences. Pretense, we

propose, is designed to allow the exploration of these possibility spaces in the organizational mode. The goal of this search is to discover new strategies of action that may be effective in achieving an executive task. As Nichols and Stich note, "the behavior that is seen in pretend play is motivated not from a 'pretend desire', but from a real desire to act in a way that fits the description being constructed in the Possible World Box" (p. 115). Pretend play functions as thought experiments in Sheperd's (1990) sense of the term — as simulations that access the mind's inference systems.

The motivational system of the organizational mode makes the exploration of such possible strategies inherently rewarding. This motivational system has a complex relation to the motivational systems of the executive mode. Pinker (1997) has proposed we enjoy fictional narratives because we enjoy life (p. 539) — that is to say, there is only one motivational system. However, this is not borne out by the evidence from chase play. In the executive mode, for instance, it is not fun to be chased by a lion or to eat your own children, and your children will not find either prospect enjoyable. In the organizational mode, in contrast, pretending to engage in these behaviors can be extremely enjoyable. At the same time, in both modes it is enjoyable to evade capture and to escape being eaten. This is precisely the expected design from an adaptationist perspective. On the one hand, the physical and mental simulation of dangerous activities should be encouraged, even if they are unpleasant in reality; on the other, the selection of strategies should be regulated by goals from the executive mode.

The proposed purpose of chase play, both of the classic and the narrative varieties, is to explore possibility spaces of action to locate potentially useful strategies for attaining executive goals. The simplest design of this evolved pedagogy involves unconscious and cognitively impenetrable forms of learning, what we propose to term *structural learning*. The acquisition of a new strategy is predicted to take place largely in procedural memory. To the extent that explicit memories, semantic and episodic, are formed, these would not be expected to be central to the biological function of the activity. In narrative play, consciousness is occupied by the visual imagery that participates in the conceptual blend driving the game and the play sequence may lead to the formation of new explicit memories. However, we see no more evidence in this activity than

in classic chase of the participants having an awareness of *why* they are playing. The answer that it is fun is intuitively felt to be unproblematically adequate. Using a model developed by Siegler (1996), we propose that structural learning operates by altering the weightings assigned to the probability of success of a certain strategy and to the confidence threshold that it can be carried out successfully.

Assigning appropriate probability weightings to strategies is not a trivial matter. A recent newswire recounts how a four-year-old Turkish boy jumped from the seventh floor of a building in Mersin, miraculously suffering only a broken leg. In the hospital, little Ferhat explained why he jumped: "I am a Pokémon and I flew like one" (AFP, 2000). This bald claim suggests that the boy is confusing the character he imagines to be — his virtual agent — with the one he really is. Yet this literal interpretation is unlikely to be correct. While in the hospital, he is already playing with a Pokémon toy; it is not at all plausible that he is unable to tell the categorical difference between the toy and himself. We suggest Ferhat is not making a source-monitoring error but a mistake in structural learning. He finds it deeply rewarding, for reasons it does not occur to him to question or contemplate, to explore the possibility spaces opened to him by the Pokémon figures and cartoons. He is understandably attracted to the locomotor strategy of flying — such an attraction need not be considered inherently unreasonable; it was shared by successful inventors such as Leonardo da Vinci. His confidence threshold for attempting the strategy of plunging himself into the air unaided, however, has been set far too low. Perhaps because he "always watches Pokémon cartoons on television," as his mother reports, he lacks elementary self-knowledge. Like don Quixote, he is a victim of his own imaginative immersion. Pretense, we suggest, evolved to enhance self-construction; its motivational structures have made possible a market in entertainment that targets the thrill without delivering the benefits.

9. Summary and Outlook

In this paper, we have presented a highly specified adaptationist model of pretense based on observational data from chase play in early childhood. We propose that processes of natural variation and selection have resulted in biological adaptations for taking advantage of features of the

environment that are irrelevant for the biological function of an adaptation but helpful for its construction. Chase play, we suggest, may have evolved in early mammals as a way to train predator evasion skills, favored by the capacity to acquire and perfect strategies and the low marginal cost of motor activities. It involves an elementary form of pretense that makes use of cheap and plentiful resources as affordances to construct a pedagogically appropriate simulation of situations that are rare, dangerous, and expensive. This simulation is experienced as intrinsically rewarding; boredom is an evolved function that acts to signal the pedagogical situation is no longer satisfactory, while the thrill of play signals optimal learning conditions. Chase play is guided by a single-scope conceptual integration of perceptual input and a preexisting predator schema. This blend must be sufficiently realistic to activate the inferences of the predator schema. Representational abuse is prevented by maintaining a distinct and concurrent executive space; the pretend space is sustained only as long as a satisfactory condition exists in the executive space. In narrative chase, affordances of personal memories are enlisted in the organizational mode to assist in the construction of pedagogically appropriate pretend spaces. A double-scope conceptual blend is created that selectively draws from memory, from perception, and from the predator schema. The activities organized by the blend are experienced as intrinsically enjoyable. The biological purpose of the game is structural learning; that is to say, the exploration of possibility spaces to develop potentially viable strategies of action. Pretend play changes the probability weightings assigned to the successful performance and outcome of a certain strategy.

The hypothesis that we have presented in this paper represents work in progress. Multiple dimensions of the organizational-mode hypothesis await further data collection and experimental testing. Following Bohm and Peat (1987), we suggest a new theory should be both nurtured and critiqued (pp. 58-60). On the one hand, by applying the model to a range of phenomena that involve pretense, we can gain a sense of its explanatory and predictive powers. On the other, we are continuing to collect data from children's play and working on designing experimental tests of various components of the model. The organizational-mode hypothesis as a whole is falsifiable: if it should turn out, for instance, that play consistently delivers

no performance benefit along the dimensions we have proposed, the model must be considered disproven.

While work continues on various aspects of the hypothesis, we suggest that the proposed design of the elementary forms of pretense that we have examined in this article meets the proposed minimal criteria for an adequate theory of entertainment, even as a great number of questions still need to be investigated. The model accounts for the basic facts: that entertainment is fun, that we get imaginatively and emotionally involved, and that it has a tacit pedagogical effect. The reason entertainment is enjoyable is that it taps into a cognitive adaptation with a distinct motivational system. The imaginative and emotional involvement is necessary for structural learning; it is made possible by the construction of a virtual agent within a mental pretend space. Entertainment has a tacit pedagogical effect because this is the biological function of pretend play. The ability of the organizational-mode hypothesis to account for the basic and otherwise paradoxical features of entertainment may be characterized as promising, warranting further work.

A challenge that must be met by an application of a theory of pretend play to entertainment is the transition from an enacted to an imaginatively projected participation. Narrative chase play utilizes the affordances of personal memories in conjunction with perceptions and physical actions to create pedagogical situations that are experienced as fun. These games are collaborative and participatory, they involve the mutual recognition of virtual agents, and they are enacted physically, using one's own body as well as suitable props. Sociocultural entertainment, whether in the form of a theatrical performance, an oral recital, a novel read silently, a movie showing, or a television broadcast, typically removes the person who is being entertained from a physically active position to the relaxed immobility of an audience or reader. The cognitive capacities that make this transition possible are poorly understood and the organizational-mode hypothesis is silent on the issue. Basic capacities for imitative learning and empathy are presumably involved; more speculatively, mirror neurons, which fire both when you perform an activity and when you see it performed, may play a role (Ramachandran, 2000; Arbib & Rizzolatti, 1997). The fact remains that people are able to create virtual agents that are associated with someone else's body, and even to simulate this other

body on the basis of narrated or read words. These are remarkable if familiar abilities. If adaptations for pretend play structure the nature of entertainment, the motivational system that evolved for enacted play must be capable of being accessed in purely mental simulations. We see no principled objections to this proposal. A related prediction is that complex cultural technologies of entertainment, such as printed novels, television, movies, and computer games, are deliberately designed to evoke the organizational mode. The possibly maladaptive dimensions of this process, as well as its psychological and cultural effects, go beyond the scope of this paper.

To sum up, the notion of an evolved pedagogy matters for two central reasons. First, it suggests that evolution has designed a cognitive adaptation for utilizing the environment creatively to construct appropriate learning situations, guided by boredom and that peculiar reward of pretend play, thrill. Sociocultural forms of pretend play, such as mass media entertainment, may tap into this ancient system, targeting a motivational system that is calibrated for an environment long since gone. Secondly, it suggests that the learning processes that are involved are largely unconscious and may be cognitively impenetrable. Even when we engage in activities simply because we find them entertaining, we are likely to be engaged in an evolved form of unconscious learning. These entailments of the model have broad consequences for our understanding of culture, for instance in the areas of children and television, mass entertainment, and political propaganda, not only in the present, but also in a historical perspective.

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