Introduction to Cognitive Science



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Cyborg: human-technology mixtures.

This can include not only commonly-used pieces of technology such as phones, computers, the Internet, and so on, but also artifacts that may not popularly be considered technology; for example, **pen** and **paper**, and **speech** and **Language**.

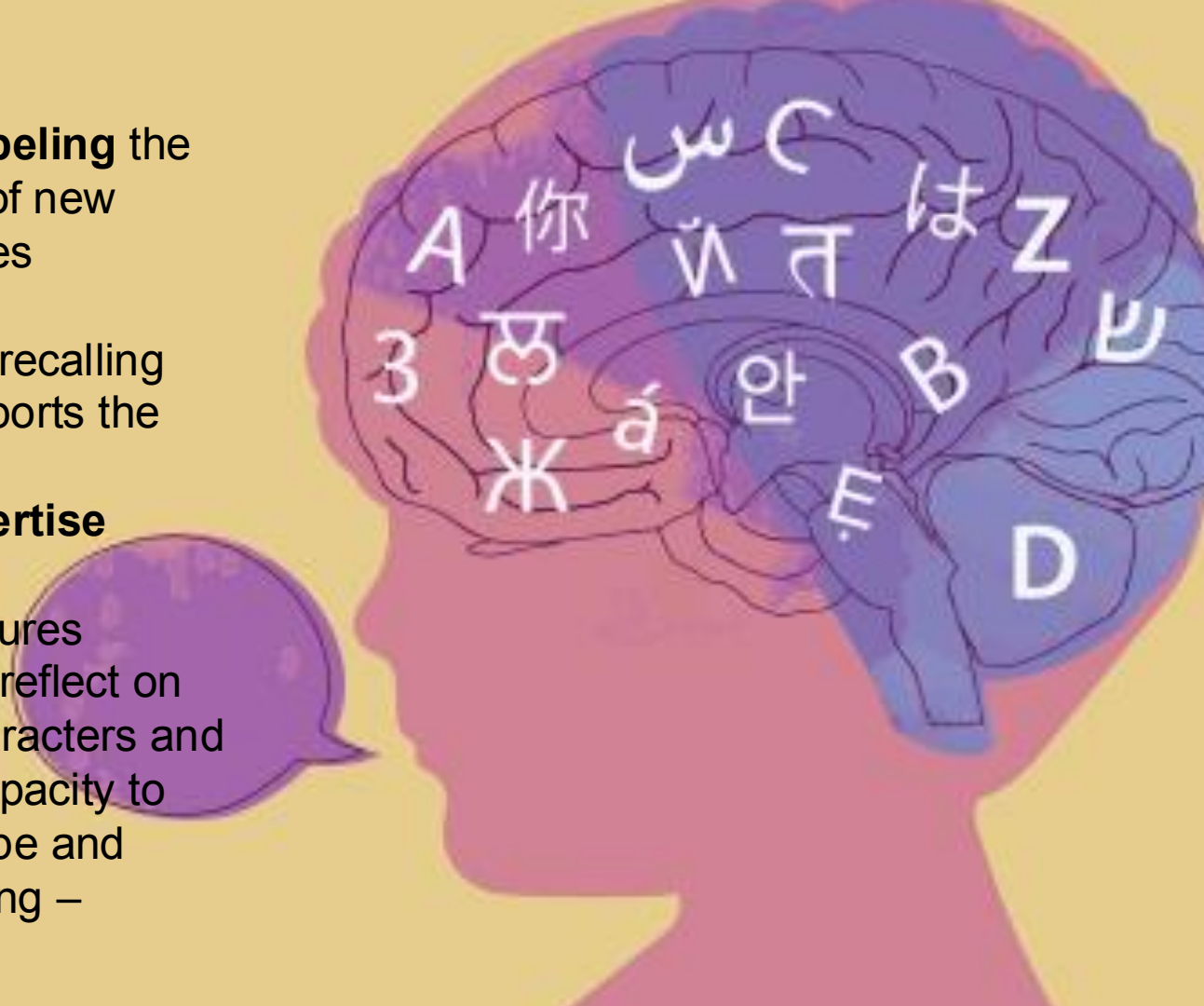
When augmented with these technologies and connected in communication with people in other times and places**, a person becomes capable of more than they were before.**



First, the simple act of **labeling** the world opens up a variety of new computational opportunities

Second, encountering or recalling structured sentences supports the development of otherwise unattainable kinds of **expertise**

And **third**, linguistic structures contribute to our ability to reflect on our own thoughts and characters and our limited but genuine capacity to control and guide the shape and contents of our own thinking – **thinking about thinking**.




LABLES AND
AUGMENTED
REALITY

Symbolic Tools and Decision-Making

The material symbols, by being simple and stripped of most treat-signifying physical cues, allow the chimps to sidestep the capture of their own behavior by ecologically specific, fast-and-frugal subroutines.

The material symbol here acts as a manipulable and, in some sense, a merely “shallowly interpreted” (Clowes 2007) stand-in, able to loosen the bonds between perception and action





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POINTING AT SMALLER FOOD AMOUNTS IN AN ANALOGUE OF BOYSEN AND BERNTSON'S (1995) PROCEDURE

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Boysen and Berntson (1995) showed that apes could not learn to point to a small amount of candy in order to get a larger amount when pointing to the larger amount was reinforced by receipt of the alternate, smaller amount. They explained this result as an unlearned predisposition to reach for the larger of two visible food alternatives. In the present study, 2 chimpanzees were tested under the first condition. A monkey chose between one raisin held in one hand by the experimenter and four raisins held in the other hand. If a monkey pointed at four raisins, it received one. If it pointed at one, it received four. Over ten 20-trial sessions, no monkey learned to point at the one-raisin alternative, a result similar to that of Boysen and Berntson. In the second condition, pointing at one raisin still produced four; however, pointing at four raisins now produced no reinforcement. In five 20-trial sessions, all monkeys learned to point at one raisin in order to get four. This finding demonstrates that at least in monkeys there is no predisposition to reach for higher value foods that cannot be readily overridden by reinforcement contingencies, and casts doubt on Boysen and Berntson's claim to have demonstrated such a process in apes.

Key words: choice, maximizing, differential reinforcement, monkeys

In the first condition of an experiment by Boysen and Berntson (1995; also see Boysen, Berntson, Hannan, & Cacioppo, 1996), each of 2 chimpanzees (the selectors) viewed two arrays of candy that differed in size. If a selector pointed at the larger array, it was given the smaller array as its reinforcer; and the larger array was given to a 2nd chimpanzee (the observer) present in the room. Boysen and Berntson found that in eight 12-trial sessions, neither ape learned when it was the selector to point to the smaller array of candy in order to receive the larger array. In the second condition of their experiment, 1 ape no longer chose by pointing at a candy array. Instead, the number of candies in each array was written as a numeral on a card and the cards were shown to the selector ape. Now the ape learned to point to the smaller value numeral so that it, rather than the observer ape, got the larger amount of candy.

Boysen and Berntson (1995) explained the results of these two conditions in terms of the opposed action of two processes: a perceptual process that hindered mastery of this task and a cognitive process that aided task mastery. The perceptual process was posited as an unlearned predisposition to reach for the higher value of two visible food alternatives. The primacy of this predisposition was reflected in the selector apes' failure to learn to point to the lower value food alternative in the first condition of their experiment. The cognitive process, defined as learning the response–reinforcer optimizing contingency of pointing to the small array in order to get the large-array reinforcer, was thought to be operative in the first condition of the experiment; however, this learned relation was overridden by the more powerful unlearned, perceptual predisposition to point at higher value food sources. As evidence for this claim, Boysen and Berntson noted the rapidity with which the selector ape learned in the second condition to point to the smaller of two numbers written on cards when they served as the discriminative stimuli. In their view, the removal of the perceptual predisposition in the second condition by using numerals rather than food arrays enabled the previously learned association between pointing to the smaller food array and receiving the larger reinforcer to emerge.

The present report hypothesizes that Boy-

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Language-Naive Chimpanzees (*Pan troglodytes*) Judge Relations Between Relations in a Conceptual Matching-to-Sample Task

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Three chimpanzees with a history of conditional and numeric token training spontaneously matched relations between relations under conditions of nondifferential reinforcement. Heretofore, this conceptual ability was demonstrated only in language-trained chimpanzees. The performance levels of the language-naive animals in this study, however, were equivalent to those of a 4th animal—Sarah—whose history included language training and analogical problem solving. There was no evidence that associative factors mediated successful performance in any of the animals. Prior claims of a profound disparity between language-trained and language-naive chimpanzees apparently can be attributed to prior experience with arbitrary tokens consistently associated with abstract relations and not language per se.

Early reports by some investigators indicated that language-trained chimpanzees differed profoundly in their problem-solving skills from chimpanzees who had not had such training (D. Premack, 1983a, 1983b, 1984, 1986; Savage-Rumbaugh, 1986). Language-trained chimpanzees solved conceptual problems that language-naive chimpanzees failed. D. Premack's language-trained animals, for example, reportedly were superior to the language-naive animals on problems that required reasoning about relations between relations but that could not be solved merely on the basis of correspondence of physical features.

The discrepancy between language-trained and language-naive chimpanzees reported by D. Premack was based originally on the performances of seven African-born chimpanzees raised from infancy by human caregivers; three of the seven had received language training and four had not. Premack argued that the disparity in performance between these two groups of animals on such tasks could not be attributed to either age differences or their relative test sophistication (cf. D. Premack, 1984). Rather this profound disparity could be attributed only to whether or not an animal had received language training as originally described by D. Premack (1976). Short strings of rule-governed plastic words formed the physical basis of this language, which the chimpanzees used in both comprehension and production. See D. Premack and Premack (1994) for a summary of the procedure and D. Premack (1976) and A. J. Premack and Premack (1972) for extended examples.

One such task that differentiated between language-trained and language-naive chimpanzees in D. Premack's research program was a modified version of an analogy problem called conceptual matching-to-sample. Given AA as sample, for example, the correct response is to choose a BB rather than an EF alternative. Given CD as sample, the correct alternative is EF and not BB. Each letter within a pair refers here, and throughout this article, to a discrete object. Hence, an AA sample might consist of a pair of physically identical cups and BB to a pair of identical shoes. CD and EF might refer to pairs of nonidentical objects consisting, respectively, of a bottle top paired with a clothespin and a pen paired with a padlock.

Because the individual objects used to construct the sample and alternatives are physically different, successful matching cannot be based on the correspondence of physical features. Instead, successful performance of a conceptual matching problem must be based on the correspondence of two abstract relations. In this case, an animal is required to judge one pair of identical objects as instantiating the *same* within-pair relationship as another pair of identical objects. Likewise, the animal has to judge one pair of nonidentical objects as instantiating the *same* within-pair relationship as another pair of nonidentical objects (see Thompson & Oden, 1996).

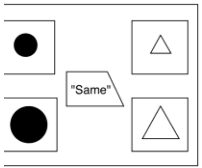
It is clear from D. Premack's early discussions (1983a, 1983b, 1984, 1986) that he considered prior practice with linguistic strings per se as necessary if a chimpanzee were to

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Ohio State University Laboratory Animal Center is fully accredited by the American Association for Laboratory Animal Care.

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Abstract Relations and Problem-Solving

"This is a nice concrete example of what may well be a very general effect (see Clark 1998b and Dennett 1993). Once fluent in the use of tags, complex properties and relations in the perceptual array are, in effect, artificially reconstituted as simple inspectable wholes."

It is intuitive that once descriptive complexity is thus reduced, processes of selective attention, and of action control, can operate on elements of a scene that were previously too "unmarked" to define such operations over. Experience with tags and labels may be a cheap way of achieving a similar result.





Researchers have described the intelligent use of space in just these terms.

Example: you group your groceries in one bag and mine in another, you place washed vegetables in one location and unwashed ones in another.

The effect is to use spatial organization to simplify problem solving by using spatial proximity to reduce descriptive complexity.

It is intuitive that once descriptive complexity is thus reduced, processes of selective attention, and of action control, can operate on elements of a scene that were previously too “unmarked” to define such operations over.

Experience with tags and labels may be a cheap way of achieving a similar result.







Another example: A skilled bartender combines biological recall and the physical arrangement of differently shaped glasses to solve the cocktail bar problem

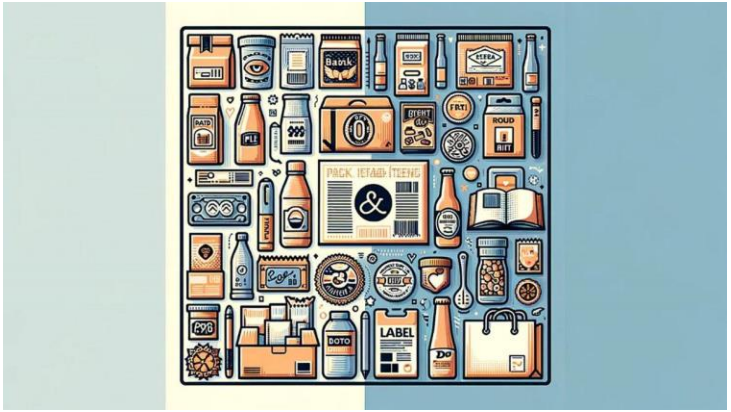
Now picture the young brain, learning to solve problems in an environment packed with pen, paper, PC, and so on. That brain may develop problem-solving strategies that factor in these props just as the bartender's brain factors in the availability of differently shaped glasses to reduce memory load.

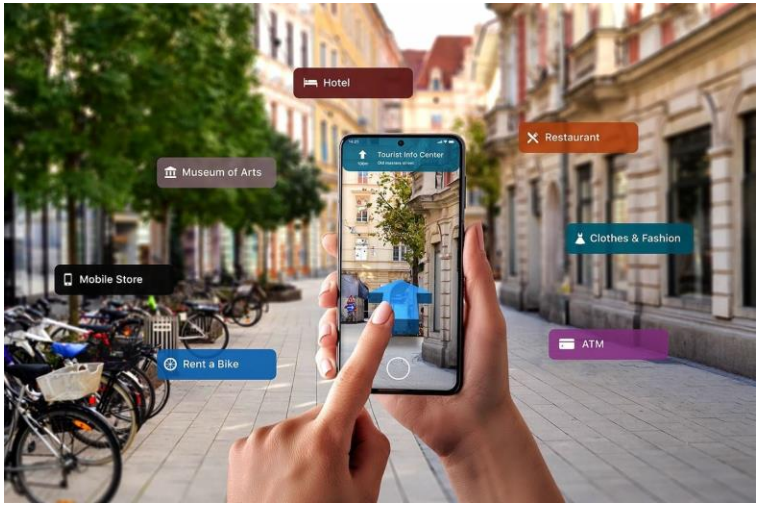
What this suggests... is that young brains may even develop a kind of **cortical *architecture* especially suited** to promoting a symbiotic problem-solving regime, in which neural subsystems, pen, paper, and PC-based operations are equal partners performing complementary and delicately orchestrated operations.

Simple labeling functions as a kind of **augmented reality trick** by means of which we cheaply and open-endedly project new groupings and structures onto a perceived scene.

Linguistic labels, on this view, are tools for grouping and in this sense act much like real spatial reorganization. But in addition (and unlike mere physical groupings), they add **new "virtual" items** (the recalled labels themselves) to the scene.

In this way, experience with tags and labels **warps and reconfigures the problem spaces** for the cognitive engine.






SCULPTING
ATTENTION
WITH LANGUAGE

Language plays a crucial role in directing and refining attention, allowing humans to focus on relevant aspects of a task or environment



“One question I ask myself a lot that I don't hear others use very often is "what should I be trying to do right now?" Answers can be something like "develop my pieces," "get castled," or "create a passed pawn." Of course, lots of answers are possible, but asking myself this simple question has helped me so many times I just always myself this question and try to answer it correctly almost every move.”

“I always liked the “CCPM” acronym I was taught as a kid - checks, captures, piece attacks, mate threats.”

Language does not merely reflect cognition but actively shapes it, enhancing the precision and efficiency of skilled performance.



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Self-Talk and Sports Performance: A Meta-Analysis

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Affiliations + expand

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Research article

The Effects of Self-Talk on Shooting Athletes' Motivation

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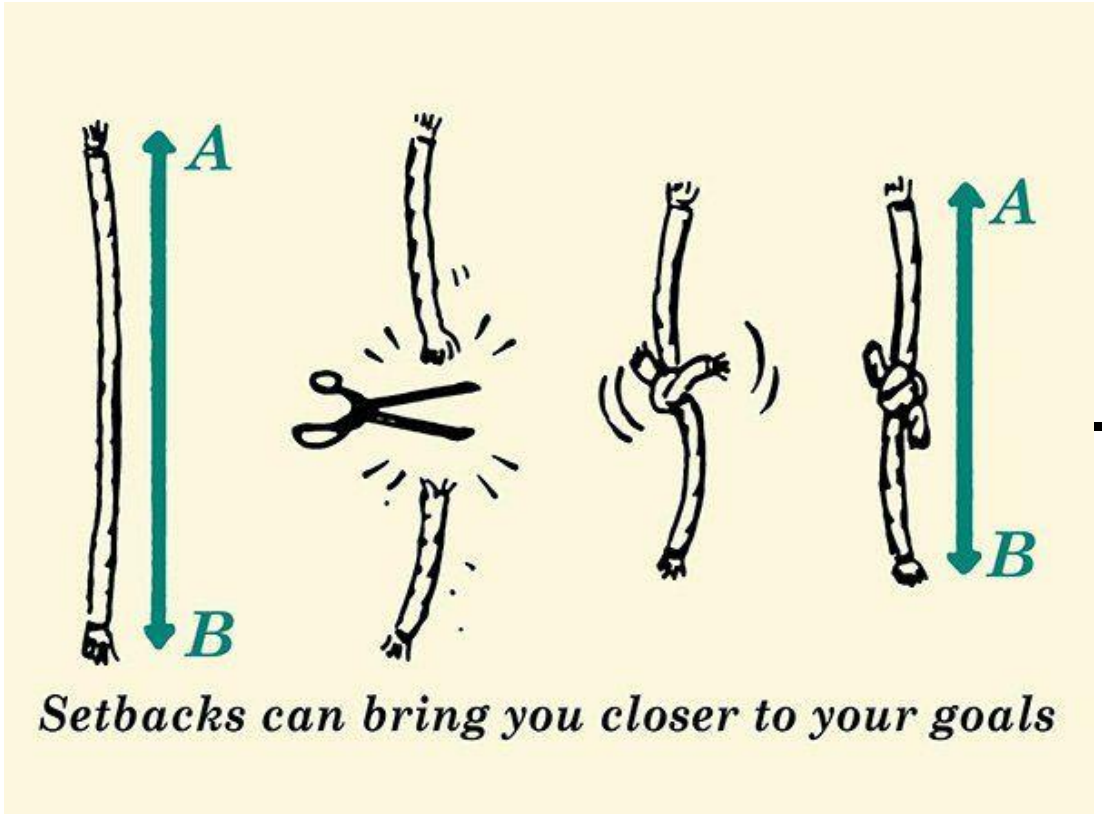




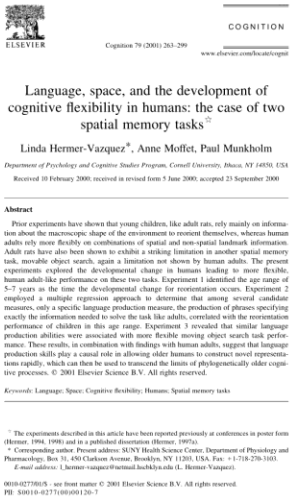
Be grateful to everyone.
All dharma agrees at one point.
Always maintain only a joyful mind.
Abandon any hope of fruition
Don’t be so predictable.




Lojong


A
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Setbacks can bring you closer to your goals

Attention to Complex Cues: Language helps individuals combine multiple sensory cues into coherent solutions.



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Language, space, and the development of cognitive flexibility in humans: the case of two spatial memory tasks☆

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Abstract

Prior experiments have shown that young children, like adult rats, rely mainly on information about the macroscopic shape of the environment to reorient themselves, whereas human adults rely more flexibly on combinations of spatial and non-spatial landmark information. Adult rats have also been shown to exhibit a striking limitation in another spatial memory task, movable object search, again a limitation not shown by human adults. The present experiments explored the developmental change in humans leading to more flexible, human adult-like performance on these two tasks. Experiment 1 identified the age range of 5–7 years as the time the developmental change for reorientation occurs. Experiment 2 employed a multiple regression approach to determine that among several candidate measures, only a specific language production measure, the production of phrases specifying exactly the information needed to solve the task like adults, correlated with the reorientation performance of children in this age range. Experiment 3 revealed that similar language production abilities were associated with more flexible moving object search task performance. These results, in combination with findings with human adults, suggest that language production skills play a causal role in allowing older humans to construct novel representations rapidly, which can then be used to transcend the limits of phylogenetically older cognitive processes. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Language; Space; Cognitive flexibility; Humans; Spatial memory tasks

☆ The experiments described in this article have been reported previously at conferences in poster form (Hermer, 1994, 1998) and in a published dissertation (Hermer, 1997a).

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Attention to a complex conjoined cues requires the retrieval of at least some of the relevant lexical items.



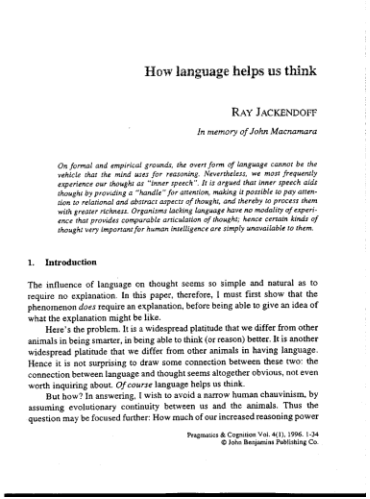
THINKING
ABOUT
THINKING

One of the most profound roles of language is its ability to enable **second-order thinking** - reflecting on and evaluating one's own thoughts. This capacity is foundational to human self-awareness and creativity.

Examples would include recognizing a flaw in our own plan or argument and dedicating further cognitive efforts to fixing it; reflecting on the unreliability of our own initial judgments in certain types of situations and proceeding with special caution as a result; coming to see why we reached a particular conclusion by appreciating the logical transitions in our own thought; thinking about the conditions under which we think best and trying to bring them about.







How language helps us think

RAY JACKENDOFF

In memory of John Macnamara

On formal and empirical grounds, the overt form of language cannot be the vehicle that the mind uses for reasoning. Nevertheless, we most frequently experience our thoughts as "inner speech". It is argued that inner speech aids thought by providing a "handle" for attention, making it possible to pay attention to relational and abstract aspects of thought, and thereby to process them with greater richness. Organisms lacking language have no modality of experience that provides comparable articulation of thought; hence certain kinds of thought very important for human intelligence are simply unavailable to them.

1. **Introduction**

The influence of language on thought seems so simple and natural as to require no explanation. In this paper, therefore, I must first show that the phenomenon *does* require an explanation, before being able to give an idea of what the explanation might be like.

Here's the problem. It is a widespread platitude that we differ from other animals in being smarter, in being able to think (or reason) better. It is another widespread platitude that we differ from other animals in having language. Hence it is not surprising to draw some connection between these two: the connection between language and thought seems altogether obvious, not even worth inquiring about. *Of course* language helps us think.

But how? In answering, I wish to avoid a narrow human chauvinism, by assuming evolutionary continuity between us and the animals. Thus the question may be focused further: How much of our increased reasoning power

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Mental rehearsal of sentences may be the primary means by which our **own thoughts** are able to **become objects** of further attention and reflection.

It is because we can think about our own thinking that we can **actively structure our world** in ways designed to promote, support, and extend our own cognitive achievements.

This process also feeds itself, as when the arrival of *written text* and notation allowed us to begin to fix ever more complex and extended sequences of thought and reason as objects for further scrutiny and attention.

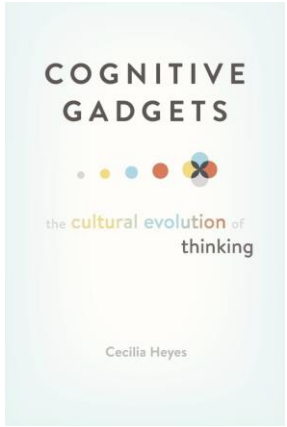
As soon as we formulate a thought in words (or on paper), it becomes an object for both **ourselves** and for **others**.

As an object, it is **the kind of thing we can have thoughts about**. In creating the object we need have no thoughts about thoughts—but once it is there, the opportunity immediately exists to attend to it as an object in its own right.

The process of linguistic formulation thus creates the stable structure to which subsequent thinkings attach.







Thanks!



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