"If you've ever wondered why you are who you are, *A Brief History of the Mind* is a good place to start."
—*Seattle Times*

WILLIAM H. CALVIN
author of
A BRAIN FOR ALL SEASONS
winner of the Phi Beta Kappa Book Prize

A BRIEF HISTORY OF THE MIND

From Apes to Intellect and Beyond

A BRIEF HISTORY OF THE MIND

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Adding more meat to the diet fueled the first Out of Africa

Food preparation likely began, maybe even cooking the savory stew. By 1.7 million years ago, *Homo erectus* had spread out of Africa into the grasslands of Asia and was eating a lot of meat. Accurate throwing is a difficult task for the brain. You can't rely on progress reports as you launch (your nerves are too slow). Without timely feedback, you have to make the perfect plan as you "get set"—and there are a million ways to get it wrong, any one of which will cause dinner to run away. So better short-term planning has an immediate payoff. Perhaps that improved their planning for other occasions as well.

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Here we are coming up on the last few minutes of the up-from-the-apes movie, and our vaunted intelligence still hasn't made its first appearance.

Our ancestors were *Homo sapiens* for 100,000 years but, despite the big brain, they were not "behaviorally modern" *Homo sapiens sapiens.* Simple forms of protostructure such as framing and "theory of mind" were likely present, and perhaps the protolanguage like that of modern two-year-olds. Clearly, brain size wasn't sufficient to produce spectacular results. It must have taken something more.

8 Structured Thought Finally Appears 83

The curb-cut principle and emerging higher intellectual function

In saying "I think I saw him leave to go home," you are nesting three sentences inside a fourth. Other aspects of thought are structured too: multistage planning, games with rules that constrain possible moves, chains of logic, structured music. This structured suite likely aided the giant step up to the modern mind. Did it take another genetic change to become behaviorally modern, or was accumulating culture alone able to trigger the boom by giving babies enough structured stuff to hear so that they softwired their brains earlier? And so excelled as adults?

9 From Africa to Everywhere 107

Was the still-full-of-bugs prototype what spread around the world?

A period between 60,000 to 40,000 years ago looks like the probable time of migration of modern humans into the more exotic parts of Eurasia. And it looks as if they became behaviorally modern in important respects not long before leaving Africa. The lack of time to "debug" the new abilities, before the rough-around-the-edges prototype expanded out of Africa, might be thought of as the first worldwide distribution of crash-prone software.

10 How Creativity Manages the Mixups 127

Higher intellectual function and the search for coherence

We have a fascination with discovering hidden order, with imagining how things hang together. And the problem with creativity is not in putting together novel mixtures—a little confusion may suffice—but in managing the incoherence. Things often don't hang together properly—as in our nighttime dreams, full of people, places, and occasions that don't fit together very well. What sort of on-the-fly process does it take to convert such an incoherent mix into a coherent compound, whether it be an on-target movement program or a novel sentence to speak aloud?

11 Civilizing Ourselves 139

From planting to writing to mind medicine

Once agriculture allowed towns and specialized occupations to develop by 6,000 years ago (the last few seconds of the movie), writing developed from tax accounting about 5,000 years ago. Education now helps us to deal with our fallible minds, to "unlearn" our intuitive but erroneous Aristotelian physics, our intuitive biology of vital essences, and our intuitive notions of engineering that make Darwinian evolution so difficult to comprehend. Medicine now calms the voices and delusions, dampens the obsessions and compulsions, and lifts the depressions. In addition to patching us up, might mind medicine eventually "improve" us?

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The moderns somehow got their act together

For fans of how and why questions, a brief summary of the most recent Major Transition in evolution. There are a half-dozen candidates so far for the transition to behaviorally modern *Homo sapiens sapiens.* All may be essential but not sufficient by themselves. The question is not when the last stone is added to the archway but which has a growth curve that becomes steeper and steeper, building on itself. The EvoDevo candidate, those precocious kids soft-wiring their brains earlier to become more capable adults, could double and redouble the percentage of syntax users in only a few generations.

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Inventing new levels of organization on the fly

As an example of four levels, *fleece* is organized into *yarn*, which is woven into *cloth*, which can be arranged into *clothing*. As we advance beyond the one-word level of language after the morning cup of coffee, we begin talking about relationships ("This is bigger than that"). With a second cup, we can advance another level to analogies ("Bigger is better"). Poets have to compare candidate metaphors, however, requiring all manner of superstitious practices in order to shore up their mental house of cards and stabilize a new level.

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A combustible mixture of ignorance and power?

Where does mind go from here, its powers extended by science-enhanced education and new tools—but with its slowly evolving gut instincts still firmly anchored to the ice ages? We will likely shift mental gears again, into juggling

more concepts simultaneously and making decisions even faster—but the faster you go, the more danger of spinning out of control. Ethics, morals, a sense of "what's right" are possible only because of a human level of ability to speculate about the future and modify our possible actions accordingly. But science increasingly serves as our "headlights," and we are "out driving" them, going faster than we can react effectively.

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To Ingrith Deyrup-Olsen, Beatrice Bruteau,
and five of my other informal sounding boards:

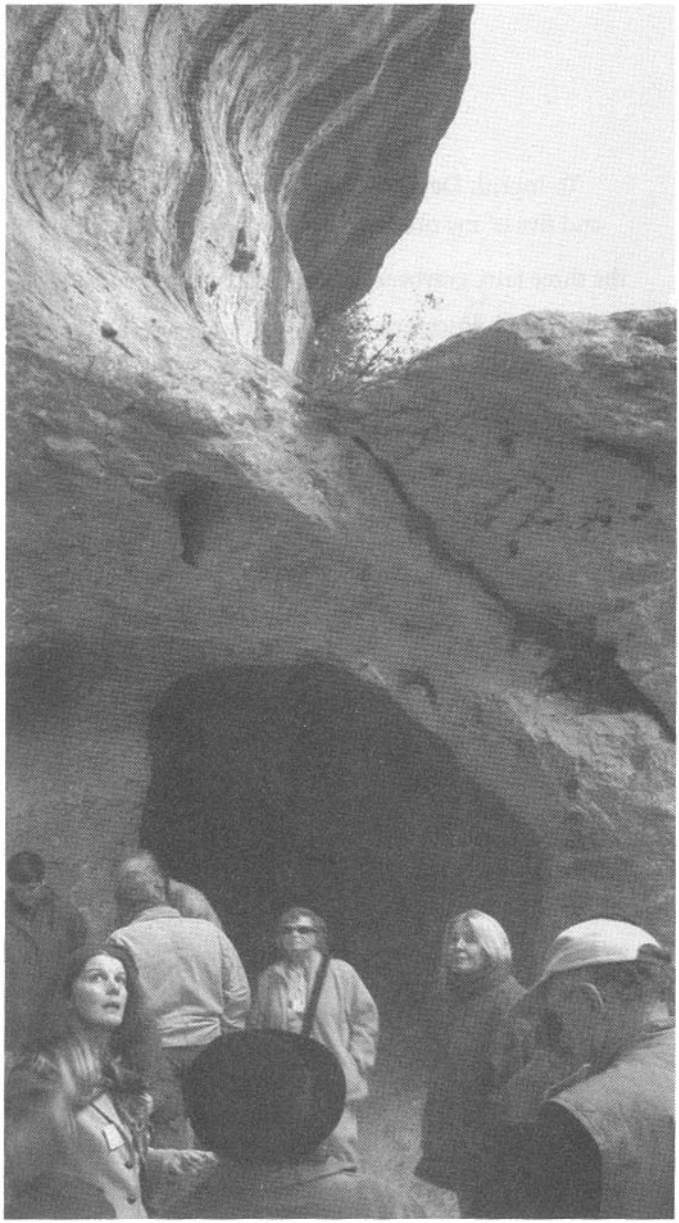
the three faux graybeards, and the expatriate cousin,

the neuropsychophilosophers of the psychiatry conference room,

the catalysts of the faculty club,

the surrogates of the think tank,

and those who gather in Jonas' basement boardroom.



The view from the community hearth outside the ceremonial cave?
(Grotte de Font de Gaume, France)

Preface

> *[History] is concerned not with events but with processes. Processes are things which do not begin and end but which turn into one another.*
>
> —R. G. COLLINGWOOD, 1939

THERE IS SOMETHING ABOUT a big campfire. Small cooking hearths are very useful but, beginning about 120,000 years ago in South Africa, the archaeologists start finding them supplemented by a bigger hearth. Psychologically, it's very attractive—a community bonfire pulls in people from all round the camp.

Back then, did someone tell origin stories around the campfire? That date, in the middle of the prior warm period in the ice ages, is an enigmatic date, as you'll discover about halfway through my origin story. *Homo sapiens* was around by then—they looked a lot like us, big brains and all—but behaviorally they weren't yet us, the innovative species known as *Homo sapiens sapiens*, a people not doubly wise so much as far more creative. It wasn't until about 50,000 years ago that they were finally doing things that cause us to say, "They must have thought a lot like we do." At that point, they surely appreciated campfire storytelling.

"Can you tell the story of the world in an evening around the campfire, the way an old-fashioned shaman used to do?" This was the challenge that the historian David Fromkin took up in writing his short book, *The Way of the World.* It mostly focused, as historians do, on the time scale of civilizations, going back perhaps 6,000 years. There are other admirable short histories which have inspired me, such as Stephen Hawking's *A Brief History of Time*, on the cosmological time scale of the 13 billion years that began with the Big Bang.

My origin story starts at 7 million years ago, so as to cover the time since we emerged from the great apes. To understand the emergence of mind—and particularly the higher aspects of consciousness that so set us apart from the rest of the animal kingdom—we need to understand what the great apes are capable of. And what they don't do. That will help us appreciate what happened in ape-to-human brain evolution since we last shared a common ancestor with the chimpanzees and bonobos of Africa.

It is just in the last 1 percent of that up-from-the-apes period that human creativity and technological capabilities have really blossomed. It's been called "The Mind's Big Bang." In our usual expansive sense of "mind," the history of the mind is surprisingly brief, certainly when compared with the long increase in brain size and the halting march of toolmaking. What came before was not, as we usually assume, a series of increasing approximations to the modern mind. So what set the stage for this creative explosion?

The modern mind of *Homo sapiens sapiens* is so startling, when seen against its evolutionary background, that it is worth the effort to tell

the up-from-the-apes story in a space short enough so that all the intermediate stages will linger together in the reader's working memory, reverberating off one another, creating a living contrast that might help illuminate mind's future.

THERE are many ways to write a book like this, depending on the author's viewpoint. We all tend to deal with the same set of facts, but our intellectual backgrounds and interests differ. Most people writing on the subject were trained in anthropology, linguistics, psychology, or evolutionary biology.

I tend to look at the problem from the standpoint of a neurobiologist, always trying to figure out how nerve cells can analyze the world, make sensible plans for movement, and manage those interneurons that convert thought into action. This is the brain mechanic's time scale of *how*. I was driven to looking into the evolutionary setup for *why* things work the way they presently do. And, since I try to deal with brain circuitry for language and creative plans, I was looking for insights from the comparison of human brains to those of our closest cousins that lack these behaviors. I tend to be impressed by self-organization, emergent properties of neural circuitry, and fast tracks in evolution. For better or worse, this book reflects those issues more than would be found in most books on human evolution. Read widely.

Like most brain researchers, I am inconsistent in using the term 'mind.' Yes, the brain does it all. It is something like the software-hardware distinction—but we are really dealing with the advanced products here, higher intellectual function, and 'mind' is the term that gets across the complexities. This is not a brief history of the brain.

WE tend to see ourselves as the narrator of a life story, always situated at a crossroads between past and future, swimming in speculation. We can construct alternative explanations for how we got where we are, emphasizing one aspect or another as a path. Looking

ahead, we imagine various trajectories. We refine our guesses, editing out the nonsense, and achieve a clearer glimpse of our crossroad choices.

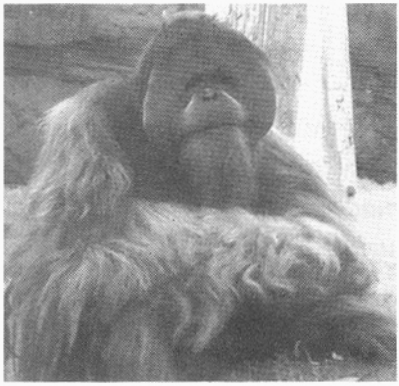
Because our less imaginative ancestors couldn't think about the future in much detail, they were trapped in a here-and-now existence. They could anticipate routine happenings (like meals), but not in our extended sense of speculation and worry. No "what if" and "why me?" They were conscious in the sense of choosing between alternative courses of action, but with their unstructured type of mental life, you couldn't narrate a life story or conceive of dying someday. Without creative intelligence, there's no crossroad and no end of the road.

I intend this brief history of the mind to itself be a vista from a crossroads, looking back at simpler versions of mental life, taking stock of what we have now, and then speculating about mind's future. For we are at a crossroads in another sense, that of a frontier where the rules are about to change, where mind shifts gears again.

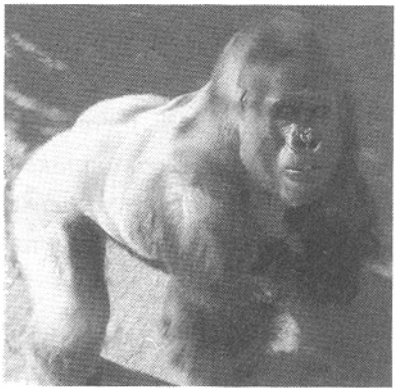
That's my brief history (you'll have to provide your own campfire). Instead of starting with a big bang, I lead up to one—and then look beyond, to contemplate mind's next advances.

The more we learn about what we are, the more options we will discern about what to try to become. Americans have long honored the "self-made man," but now that we are actually learning enough to be able to remake ourselves into something new, many flinch. Many would apparently rather bumble around with their eyes closed, trusting in tradition, than look around to see what's about to happen. Yes, it is unnerving; yes, it can be scary. After all, there are entirely new mistakes we are now empowered to make for the first time. But it's the beginning of a great new adventure for our knowing species. And it's much more exciting, as well as safer, if we open our eyes.

—DANIEL C. DENNETT, *FREEDOM EVOLVES*, 2003



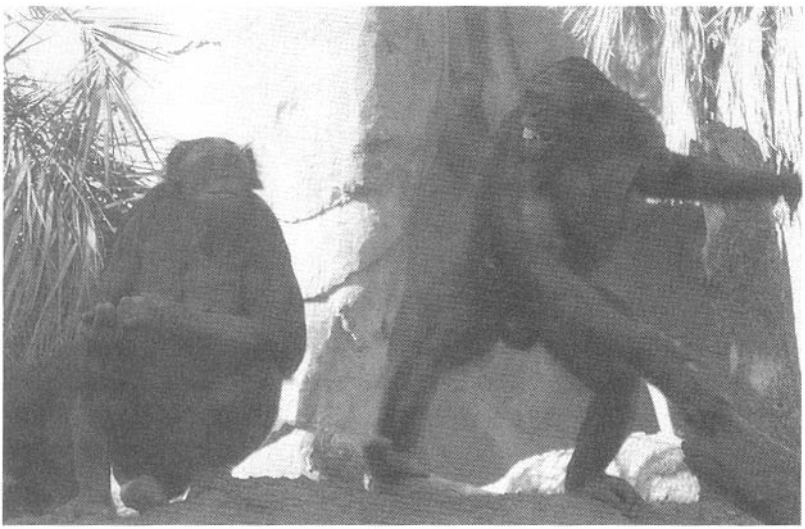
The Closest Cousins



Above: Orangutan (Borneo, also Indonesia)

Right: Gorilla (Central Africa)

Below: Bonobos (shown here; left bank of the Congo) are more lightly built than the otherwise similar chimpanzees (not shown; found in East, Central, and West Africa).



Some Stage-setting Perspective

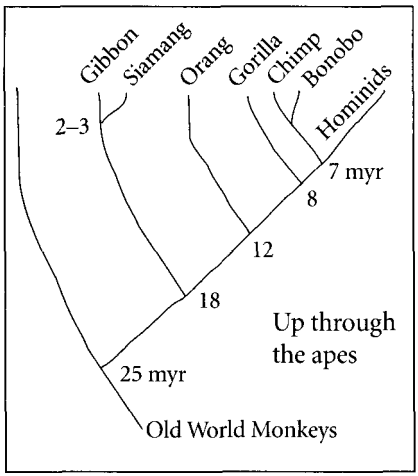
IF YOU HAVE TROUBLE with the names, just remember that they nest inside one another: **Animals** > **mammals** > **primates** > **monkeys** > **apes** > **hominids** > **us**.

While **animals** have been around perhaps 800 million years, **mammals** are seen only in the last 200 million years or so. **Primates** evolved from the mammals more than 60 million years ago. Living examples of the early small-brained prosimian forms include tree shrews, lemurs, the slow loris, and the galagos.

Monkeys evolved 40 million years ago from the prosimians. Some of the Old World monkeys lost their tails to become **apes** about 25 million years ago. The ape brain is about twice the size of a monkey brain; apes also have more versatile shoulder joints. The lesser apes, the gibbon and the somewhat larger siamang, are examples of the early apes.

The extant great apes are the orangutan (with whom we shared a common ancestor about 12 million years ago), the gorilla (about 8 to 10 million years ago) and the chimpanzee and bonobo (with whom we shared a common ancestor about 6 or 7 million years ago). They all inhabit forests, though chimps can sometimes be found in the more open woodlands.

Hominids (hominins in new-speak) are all the species between that last common ancestor and us humans. They are upright in posture,



live in the woodlands between forests and grasslands, and have lost the big canine teeth of the apes. But brain size doesn't change much until 2.5 million years ago with the earliest *Homo* species, and that's about when sharp stone toolmaking starts. By *Homo erectus* at 1.8 million years ago, they were eating a lot of meat and were probably inhabiting the grasslands and no longer nesting in trees.

For this brief history of the mind, I will start about 7 million years ago when we shared a common ancestor with the chimp and the bonobo (the misnamed "pygmy chimp" of central Congo), the two great apes with which we have the most in common. The width of the Congo River has kept bonobos isolated for the last several million years from the common chimpanzees, which extend from the East African Rift Valley in Uganda all the way to Senegal in westernmost Africa. Behaviorally, bonobos and chimps have different styles, each of which give us some clues as to what that common ancestor (call it *Pan prior*) might have been thinking, just 7 million years back.

A BRIEF HISTORY OF THE MIND

The bonobo is overthrowing established notions about where we came from and what our behavior potential is. . . . Even though the bonobo is not our ancestor, but perhaps a rather specialized relative, its female-centered, nonbelligerent society is putting question marks all over the hypothesized evolutionary map of our species. Who could have imagined a close relative of ours in which female alliances intimidate males, sexual behavior is as rich as ours, different groups do not fight but mingle, mothers take on a central role, and the greatest intellectual achievement is not tool use but sensitivity to others?

—FRANS DE WAAL, 1997

1

When Chimpanzees Think

The way we were, 7 million years ago?

WHAT IS IT LIKE, to be a chimpanzee? Are they us, just without language and metaphor? Maybe, as cartoonists suggest, they even talk silently to themselves? (Probably not.)

When we don't understand something like the weather or an animal's mind, we attempt an analogy to something we do know—such as our own familiar mental states or social strategies. Sometimes this works, and sometimes it doesn't. If we don't understand what causes the rain, we may fall back on our knowledge of human social strategy—and assume that a person is in charge of the rain, a person who can be influenced with flattery or gifts or begging. (Sometimes it happens to rain afterwards, and you are persuaded that you were successful.)

And so it is natural enough to suppose that our pets can think. Our pets certainly display emotions, and it is reasonable to assume they have feelings (unexpressed emotions). They certainly have purposeful