A New Theory of Mind:

The Theory of Narrative Thought

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By

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With Byron L. Bissell

Commentary by James A. Wise

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Dedicated to our endlessly patient wives.

“A scientist’s job is to tell interesting stories.”

—Ward Edwards

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PREFACE

In a previous book (Beach, 2010), which was a run-up to this one, I introduced the Theory of Narrative Thought and explored its implications for decision making. In this book, my colleagues and I extend the 2010 discussion by advancing three propositions. The first proposition, echoing the 2010 book, is that narrative thinking is the "natural" mode of human thought. The second proposition is that the "urge" to think narratively reflects known neurological processes that format selected neural events in a narrative form, i.e. a rudimentary story. The third proposition is that although narrative thinking is a product of evolution, it enables humans to transcend some of their evolutionary limits, making it possible for them to actively shape the physical environment by anticipating and shaping the events that impact that environment. Underlying these three propositions is the observation that the course of the Human Experiment has been twofold: evolving the ability to meet environmental demands and evolving the ability to modify those demands. The former has shaped our physical characteristics, including our neurology, and the latter has shaped how we use those characteristics to create more supportive, more comfortable environments.

These three propositions form the backbone of our attempts to address the task we have set ourselves (indeed, the task facing cognitive science in general), which is to fill the gap between the realm of neural activity and the realm of subjective experience and action. That is, neuroscience provides increasingly better knowledge about how the nervous system works, including how the brain functions. And the outcome of what the nervous system and the brain do is revealed in our own and the everyday lives of those around us—the ways in which we cope with the demands of our environment and the ways in which we shape the environment to our advantage. The task is to bridge the gap.

At the moment, the greatest effort to bridge the gap is invested in trying to build from the bottom up, from neurophysiology to experience. And a great deal is being learned. For example, the 2014 Nobel Prize in physiology was awarded for discovery of "place cells" in the entorhinal cortex of the brain and "grid cells" in the hippocampus that together enable the brain to form a map of surrounding space that supports spatial navigation. As valuable as this "building upward" strategy is, however, it ultimately may not be as successful as its proponents hope. The problem lies in that last little bit, where neural activity in the brain is transformed into the conscious experience that each of us has of our past, of our present, and of our expectations for the future. The theory described in these pages is an attempt to address that last little bit.

In what follows, Chapter 1 will briefly sketch the historical development of modern cognitive science, from “mind” as the determinant and directive of human thinking to a more nuanced view heavily based on neurophysiological and behavioral research. Chapter 2 will describe the five key cognitive systems that research has shown to be the foundation of human thinking. Chapter 3 will describe the physiological bases of narrative thinking, proto-narratives created by specialized subsystems of the brain. Chapter 4 will describe the nature of narratives and explain the difference between chronicle narratives and procedural narratives. Chapter 5 will describe where the narrator’s concept of “I” comes from. Chapter 6 will describe how errors are introduced into narratives, both through the natural limitations of everyday narrative thinking and through the actions of other people. Chapter 7 will describe how narrative thinking results in actions that manage the future by influencing the ongoing course of events in an attempt to ensure that the future, when it arrives, is desirable (where desirable means that it conforms to the narrator’s values and preferences). Chapter 8 will describe narrative-based decision making, again turning on values and preferences. Chapter 9 will describe shared narratives, and the implications of sharing, as well as how specialized acquired narratives extend human cognitive abilities and, in doing so, allow human cognition to work beyond its inherent limitations. Chapter 10 will describe how people deal with the omnipresence and demandingness of narratives. Chapter 11 will summarize the Theory of Narrative Thinking and examine its implications for the age-old concept of mind.

This book has three contributors, each of whom brought particular strengths to the project. I (Lee Beach) brought the Theory of Narrative Thought and more than 15 years of thinking about its implications—plus the previous 30 years of thinking and research that led up to the Theory. I am the author of the main body of the book and am solely responsible for its flaws. Byron Bissell brought his critical abilities as well as his interest in the neurological foundations of thinking and made numerous suggestions about things to be considered as I was writing. And James Wise wrote commentaries on all but the final chapter as a way of connecting the theory to a broader range of topics than I could conveniently cover in the text as well as to topics with which I am unfamiliar.

Our format is rather strange because it reflects how the book developed. Byron and I often have lunch together, during which narrative thinking often is discussed. We toyed with the idea of collaborating; we are both retired and it seemed like an attractive pastime. After we began, I mentioned in an e-mail to Jim what we were doing. Jim had read my 2010 book on narrative thought and his return e-mail was full of enthusiastic linking of narrative to other things, things about which Byron and I knew little. His e-mail, and those that followed, inspired us to ask him to write commentaries on the chapters. Our agreement was that he could write whatever he wanted and neither Byron nor I would censor, interfere, or be offended.

My collaborators have strengths quite different from my own. Byron is hardheaded and always wants to know what an idea is "good for," which sometimes gives me pain but keeps things grounded. He acted as the official sounding board, resident skeptic, and really, really picky editor and proofreader. His comments generally began with, "Yeah, but what about….?" Jim has one of most wide-ranging intellects I've ever encountered, specializing in knowledge that, to me, seems both obscure and exotic. But, the result is that his take on things is always intriguing and thought provoking—just the thing for commentaries. I thank both of them for the opportunity to work with them.

There are three others to whom thanks are due. The first is Professor Walter R. Fisher, whose book, *Human Communication as a Narration: Toward a Philosophy of Reason, Value, and Action* (1987), introduced the idea of narration as a mode of thought, particularly in communications. This is the foundation of the Theory of Narrative Thought, in which narrative becomes the mode of thought for all situations, not just communication.

The second person to thank is Professor Jerome Bruner, whose book, *Acts of Meaning* (1990), introduced the differentiation between narratives and what he called "paradigms." Paradigms are a general way of thinking about something or doing something. In my 2010 book, I changed Bruner's differentiation a bit; narrative became the generic name for both chronicular narratives (stories about what has happened, is happening, and will happen) and paradigmatic narratives (stories about how to do things). In the present book, we simplified these terms to chronicle narratives and procedural narratives. Nonetheless, Bruner's differentiation is fundamental because it is the key to understanding how narratives contribute to humans taking control of their own destinies by managing the future.

The third person to thank is Professor Michael S. Gazzaniga, whose 1989 article, *Organization of the Human Brain*, and 2011 book, *Who's in*

Charge? provide evidence for subsystems of the brain imposing order upon incoming perceptual events. As he has demonstrated, there exists a subsystem in the left hemisphere, probably enhanced by a similar subsystem in the right hemisphere, which imposes a story-like structure on these events. It may, of course, turn out that these subsystems are less specialized than they presently appear or that more is involved than is currently appreciated. However that may be, the credibility of the Theory of Narrative Thought does not depend upon what is now presumed to be the case; it can adapt to whatever is discovered in the future.

A word about our writing style. We want the experience of reading this book to focus on the ideas, not the mechanics of presentation. To this end, we have tried to be as informal as possible, using contractions and personal pronouns throughout; we find the stiffness of formal scientific and technical discourse to be profoundly dull. For this same reason, we have kept the book short. The ideas are straightforward and, once stated, don't need a lot of explanation. And, we've kept citations in the text to a minimum, but have listed them by chapter in Further Reading at the end of the book.

Readers of my 2010 book will note similarities between it and this one. This is in part necessary because the topic is the same in both and, as I said above, that book was the run-up to this one. As a result, for this book I adapted some of the material from the previous book, for which I hold the copyright.

Finally, as you might expect, we have constructed a narrative about you, the reader. Perhaps inaccurate, it at least focused my attention as we wrote. We see you as having just obtained a copy of this book, rushing home, putting out the cat, turning off your cellphone, unplugging the landline, retreating to your comfortable oak-paneled study, pouring yourself a glass of something soothing, and sitting down for an hour or two of mental stimulation. You may not be convinced by what we have to say, but we think you will at least find it interesting—and then……….who knows?

Lee Roy Beach
Tucson, Arizona

PART I:

FUNDAMENTALS

CHAPTER ONE

MIND

Certainly since the ancient Greeks, and no doubt well before, people have tried to understand thought and action. For most of this time, the simple answer was that everything originated with, and was executed by, the 'mind.' Mind was viewed in a variety of ways, but most people saw it as a special faculty, usually related to the soul, separate from, but linked to, the physical body. It embodied and controlled thought and it instigated and guided action.

This conception of mind-as-executive works well enough until you examine it critically. For example, if the mind is running everything, what is running the mind? If mind is separate from the body, how does it influence action? If it isn't separate from the body, what is it? Is it the brain or is it something separate? And, even if you could answer these questions, the big question remains; how does the mind create unitary experience from everything that is going on around and inside of you?

For the most part, it wasn't until the advent of modern science that the shortcomings of mind became apparent. In the 18th century, scientists set about discovering how the brain is constructed and the sense organs work. At first, this didn't have much impact on the ubiquity of mind as an explanation, but as research progressed, executive mind, as an explanatory concept, became increasingly tenuous. Which raised the question, "If not mind, then what?"

For our purposes, the tale begins in the 19th century, when two Germans, a physician-physiologist named Ernst Weber (1795-1878) and a physicist-physiologist named Gustav Fechner (1801-1887) devised methods to study how perception changes as a function of changes in sensory stimulation. In a nutshell, they found that as the strength of a stimulus (e.g., a sound) increased, the conscious experience (loudness) did not increase commensurately. In fact, as the energy in the stimulus increases, you have to jack it up more and more for the listener to be able to detect that it has changed at all. For example, in a quiet room the additional sound of a dropped pin is easily detected but in the front row at a rock concert you might not hear a helicopter land on the roof. This finding is true for a variety of different stimuli/experiences. Fechner's general formulation of his own and Weber's findings is called the Weber/Fechner Law.

In retrospect, Weber's and Fechner's big contribution was not their law *per se*. Rather, it was their demonstration that it is possible to map the correspondence between the external world of noise and light and heat and weight and all the rest with the internal world of conscious experience. This gave rise to a field of study, called psychophysics, which became foundational for the evolving new discipline of psychology and eventually was usefully applied in fields such as sound systems, audiology, and optometry as well as in the design of control systems and a host of other applications.

Psychophysics and related lines of research on perception were taken up by other scientists throughout Europe and soon appeared in the United States. The celebrated Harvard philosopher, William James (1842-1910), who was also a physician and a physiologist, returned from studying in Germany to establish the first psychological laboratory in North America. In 1890, he wrote the first American textbook in psychology, using the new scientific viewpoint.

Another step in the movement away from mind-as-executive was the work of the Russian physiologist Ivan Pavlov (1849-1936), who studied how expectations arise and how actions derive from them, although he probably wouldn't have put it like that. You perhaps recall his experiment in which a bell that was rung before a dog was fed came to itself elicit the dog's reflexive anticipatory salivation, which previously had occurred only in the presence of food. Even if you are not familiar with the experiment, you are familiar with the phenomenon; if you have a cat or dog, the sound of the can opener brings them running, licking their chops in anticipation of something to eat. Pavlov described salivation in response to the bell, as *conditional* upon the previous paring of the bell and food—the idea is that because the bell and the food were always paired, the dog came to anticipate food when the bell rang and began to salivate in preparation for eating. [Sidelight: When his work was translated from Russian to English, for some unknown reason *conditional* was replaced by *conditioned*, and the term stuck; we now speak of conditioned behavior rather than conditional behavior and we refer to the behavior itself as a conditioned reflex.] The formal title for Pavlov's discovery is *classical conditioning*, and it too became foundational for the new scientific psychology.

While Weber, Fechner, and, somewhat later, Pavlov were doing their research, other scholars took a different tack by using trained "introspectionists"—people who were adept at analyzing their conscious experience and describing its various nuances. This way of studying experience, together with other trends, evolved into a new way of thinking about mental events. One famous figure in this endeavor was the Austrian physician and brain specialist Sigmund Freud (1856-1939), whose psychoanalytic theory shaped how the general public thought and talked about, thinking and action throughout most of the 20th century. Freudian theory gave rise to psychiatry as a profession and psychotherapy as a therapeutic method.

With time, introspection and related tools, as well as psychoanalytic theory, came into disrepute because they lacked scientific rigor. By then, however, the timeworn concept of "the mind" had already begun to change. Now it was viewed, not as a *thing* but as the sum total of the various cognitive functions that research was beginning to uncover. But, many faulted even this new use of the word.

The First Cognitive Revolution

Misgivings about mind, even in its tamer form, gave rise to what can be called the first cognitive revolution. It was a revolution because it was so extreme; it addressed the problem of mind by simply eliminating it from the discussion. This move reflected the early rumblings of what would, in the 1920's, become Logical Positivism, a branch of analytic philosophy that asserts that a concept is meaningful only if propositions about it can be objectively verified. Because there appeared to be no way to objectively verify propositions about the mind, especially in its role as executive, it was deemed a useless concept—as were any concepts that smacked of mind, such as consciousness or thought.

Therefore, the first cognitive revolution was an attempt to construct a psychology of action without recourse to mind or anything related to it. The revolution's program was clearly stated in an influential article written in 1913 by an American, John Watson (1878-1958), one of a new breed of scientists whose degrees were in the new discipline of psychology rather than medicine, physiology or philosophy. Watson's article declared that psychology "…is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent on the readiness with which they lend themselves to interpretation in terms of consciousness."

Watson's article came to be called "The Behaviorist Manifesto," and it launched a new movement called Behaviorism. The building blocks of this new science were Pavlov's "*classical conditioning*," the signature experiment of which was described above, and, later, B.F. Skinner's (1904-1990) "*operant conditioning*."

Skinner's signature experiment was a food-deprived rat in a barren box that had a bar protruding from one wall. If the rat accidently touched the bar, a pellet of food dropped into a little bowl below the bar. Then, as the experiment progressed, the rat didn't get fed until it actually grasped the bar and pushed it down. After a few (sometimes, quite a few) exploratory trials, most rats learned to operate the bar to get the food. The stimulus was the box and its bar, the response was the bar-press, the thing that was learned was called the operant response, and the process was called operant conditioning. It was, in fact, the basis of almost all animal training long before Professor Skinner came along, but his research explored every aspect of it—what happened if the bar-press only resulted in food part of the time. Or what happened if there was a delay. Or how long would the rat continue to press the bar when food stopped altogether. And so on.

Just as classical conditioning was regarded as the prototype for all forms of anticipatory learning, operant conditioning was regarded as the prototype for all forms of task learning. The apparently precise, mechanistic nature of these two kinds of conditioning, along with the absence of anything mental about them made them attractive to Behaviorism. Thus began the Behaviorist Experiment, the attempt to construct a comprehensive science of human behavior solely in terms of these two kinds of conditioning.

The Behaviorist Experiment prevailed in English-speaking countries, for the most part, from its inception in 1913 through the 1950's. But, things were very different in much of Europe, particularly Austria and Germany. There, consciousness and conscious experience remained the topic of study, building upon the early research on the relationships between sensory stimulation and conscious experience. This culminated in a movement known as Gestalt Psychology (which also became the name of a form of psychotherapy in the 1970's, but that's not what we're talking about here). The word "gestalt" came from the observation, in 1890 by an Austrian researcher named Christian von Ehrenfels, that when a melody is transposed, every sound is changed but we still recognize it as the same melody. He called the perceptually unchanged melody a *Gestaltqualität*, or "form quality" that is subjectively constant despite physical transformation. Others noted that the same sort of constancy occurs, for example, when you perceive a table top to remain rectangular as you walk around it, even though the shape of its image on the retina of your eye is never a rectangle, it is a trapezoid that changes as you move. Similarly, even though the retinal image changes considerably, an object is perceived to remain unchanged under variations in illumination; the light is seen as changing and the object is seen as constant rather than being seen as a series of different lighter or darker objects. And, when an object moves away from you, its image on your retina gets smaller and smaller. But you never see it as a series of smaller and smaller objects, you see it as a solid object that retains its size as its distance increases.

These and similar phenomena were investigated by a great number of European investigators. Out of this came recognition of the difference between sensory perception, of the variety studied by Weber and Fechner, and object perception. The latter demonstrates that our conscious experience of the world around us is not a direct representation of its physical properties. Instead, our brains meld the basic perceptions of those properties into a much more elaborate and meaningful experience of the objects around us. Therefore, conscious experience cannot be simply ignored, as the Behaviorists tried to do.

Gestalt Psychology was imported to the English-speaking countries in the 1940's when German and Austrian researchers fled the Nazis at the beginning of World War II. Even at that, Gestalt Psychology, and similar views, had comparatively little impact on Behaviorism until, in the 1960's, when Behaviorism began to die of its own weight. It required impossibly convoluted explanations to account for complex animal and human behavior strictly in terms of classical and operant conditioning; they were entirely too simplistic and mechanistic to do the job. And its attempts to explain thought (which everyone knew existed even if most Behaviorists chose to ignore it) were never entirely convincing. But, about the time that the Behaviorist Experiment had run its course, something new came along to prompt a second cognitive revolution that refocused on thinking, if not on consciousness *per se*.

The Second Cognitive Revolution

It is difficult for humans to think clearly about their own thinking. After all, nowhere else in science is the object of study itself doing the studying. Perhaps for this reason there has been a tendency to resort to helpful metaphors and analogies, often drawn from the larger culture. For example, although he probably didn't realize it (which has a certain irony), the metaphor underlying Sigmund Freud's psychoanalytic theory was a familiar technology of his time, the steam engine. The id boils away, building up steam that threatens to blow the top off the superego, and the ego provides a safety valve by directing the pent-up energy toward less hazardous ends. Behaviorism's metaphor derived from a familiar technology of its era, the telephone. Learning was represented as building (presumably neural) connections between stimuli and responses, analogues to a telephone switchboard operator connecting those who call with those who answer.

The familiar technology of the 1950's and early '60's, the newly invented computer, provided a metaphor for psychologists who were wary of Freudian vagaries and weary of Behaviorist absolutes. The pivotal feature was that computers "process" coded "information" using programs made up of specific rules that, when executed in proper sequence, allowed the computer to perform tasks that previously had been the exclusive preserve of the mind. Moreover, the rules in these programs were more sophisticated than classical and operant conditioning and became increasingly complex as computer technology grew. The computer metaphor was invaluable in shaping modern cognitive psychology. Indeed, much of the work that continues today owes its existence to the computer metaphor and frequently is couched in terms that harken back to the metaphor. Indeed, even in common parlance, people less frequently speak of being "conditioned" to do this or that and more frequently speak of being "programmed" to do this or that. (Curiously, both phrases have sinister overtones, like you're being manipulated in some Machiavellian way.)

With time, however, the computer metaphor has itself become somewhat obsolete. This is largely because of its necessary emphasis upon orderly information processing to the exclusion of less orderly information meaning. This emphasis never quite satisfied anyone who was aware of the vagaries, subtleties, and wonder of their own and others' thinking. This unease, along with developments in other fields such as linguistics and social psychology, has given birth to a third cognitive revolution. The new revolution focuses, not on elegant, contentless systems for the processing of "information" in the generic sense, but on how humans use information in an attempt to understand the very specific meanings and implications of the events that are at the core of their conscious experience and how they act in light of these meanings and implications.

The Third Cognitive Revolution

We are in the midst of the third revolution. Allied disciplines, particularly linguistics and philosophy, and new ways of studying cognitive functioning, particularly in the neurosciences, have joined forces with cognitive psychology to form a new discipline called cognitive science. A strength of this new discipline is the synergy created by the diverse views and skills brought to it by scientists from different fields. This has resulted in new and more sophisticated ways of framing questions, particularly in terms of brain function. Indeed, "the brain" has replaced "the mind" as the ultimate explanation of almost everything psychological.

It has long been clear that consciousness is dependent upon the brain. But it is only recently that the old, reductionist approach to studying both the brain and consciousness has given way to greater appreciation of the complexity of both of them. The current view is that consciousness is an *emergent property* of the nervous system, primarily the brain. Emergence is an established concept in both science and philosophy, with subtleties that go beyond our present needs. The basic idea is that a property of a superordinate system is a function of the properties of its subordinate systems. If the subordinate systems contribute *independently (i.e., additively)* to the property of the superordinate system, the latter property is called a *resultant property*. If the subordinate systems' contributions are *interdependent (i.e., interactively, multiplicatively)*, the property of the superordinate system is called an *emergent property*. Because resultant properties are simple, additive, combinations of the independent contributions of subordinate systems, they tend to resemble those contributions. Because emergent properties are complicated, multiplicative, combinations of the interdependent contributions of subordinate systems—indeed there may be second order, third order, etc., interdependencies—they tend not to resemble those contributions. In fact, an emergent property may be so different from its contributing subsystems as to be of an entirely different order. (Emergence is a very useful concept, but it must be used carefully because not everything we don't understand is a property of an emergent system. In what follows, we will use the concept of emergence only twice, emergent consciousness, as discussed here, and emergent meaning in language, discussed in the next chapter.)

It is old news to say that consciousness is dependent upon the brain, but to say that it is an emergent property of the brain recasts the proposition. First of all, it helps us understand why conscious experience has been so hard to understand. It is not a simple, straightforward resultant property of the brain. It is a complicated emergent property of a multitude of complex interactions among the brain's many subsystems, which makes it very difficult to tie directly to those subsystems. Second, emergence helps us understand why consciousness is qualitatively different from the underlying brain functions that give rise to it. Moreover, it helps us understand why it is inappropriate to explain away conscious and everything related to it as simply "what the brain does." Third, emergence helps us think more clearly about how to study consciousness.

The strategy for studying resultant properties is essentially reductionist. This means that the resultant property is assumed to be a function of the additive effects of contributing brain subsystems and the research strategy is to examine the relative contribution of each subsystem. This simple approach doesn't work for emergent properties. Here the complex interactions among the subsystems and their contributions produce something qualitatively different. This means that in the process of emergence transforms the products of the subsystems into something different from themselves.

In principle, even emergent properties can be traced to their origins. However, in the case of the brain, a great deal more has to be known about both the subsystems and their interactions before it will be possible to account for their various contributions to emerging consciousness. Until this knowledge is available, if ever, a different approach must be taken. In this approach, subordinate subsystems are identified and their contributions acknowledged, but the specifics about how these contributions combine is temporarily glossed over. Thus, we can study the structure and function of perception or memory without completely specifying the underlying neural processes and all of the interactions involved. If we know something about the brain functions and interactions, great. But if we don't, inquiry need not simply come to a halt until we do.

In this spirit, in the next chapter I will describe five cognitive functions that are the products of five subsystems of the brain but that have been studied both together with and somewhat independently of the underlying neurology. These subsystems are perception, memory, imagination, reasoning, and language. A great deal is known about the neurological underpinnings of each of these, some more than others, and that knowledge is invaluable. But we can discuss them in and of themselves and we can discuss their contributions to superordinate consciousness and conscious experience.

Before we move on, we need to clarify the terms we will be using because they are used in everyday parlance in ways that are insufficiently precise for our purposes. In what follows, we will use "*consciousness*" to refer to the aforementioned emergent property of the brain, which is qualitatively different from the brain functions that underlie it. The word "*unconsciousness*" is the absence of consciousness due to trauma, drugs, illness, etc. The "*content*" of consciousness derives, for the most part, from perception, one of the five brain subsystems to be discussed in the next chapter. Relevant content is the stuff of *conscious experience*, which is a refinement of emergent consciousness. Irrelevant content lies in the shadows, largely nonexistent to conscious experience unless it is especially intrusive; loud, bright, abrupt, and so on. (*The* unconscious is largely a matter of memory, not consciousness).

Moment by moment, new content is entering consciousness and old content expires as life goes on. The result is that conscious experience is in constant flux. Why, then, isn't conscious experience simply a jumble. What gives it the meaningful structure with which each of us is familiar? Foreshadowing of what is to come in Chapter 3, the answer is that a subsystem in the left hemisphere of the brain imposes structure on the content of consciousness. The structure is called "*narrative*" and as newer content enters consciousness, the narrative changes to take it into account (see Chapter 4). In short, narrative is the substance of conscious experience.

The Theory of Narrative Thought views the neural activity of the brain as the support system for, but qualitatively different from, consciousness and conscious experience. The brain is seen as composed of subsystems, some of which, acting in concert, give rise to emergent consciousness. Other subsystems are seen as contributing content to consciousness and others structure the content in narrative form. It is here that emergence is evidenced; the currency of the brain, neural activity, is transformed into the currency of conscious experience, narrative. It also is here that the insufficiency of a theory couched solely in terms of brain functioning becomes clear. Because brain functioning and consciousness are qualitatively different, an encompassing theory must treat them as such and explore the implications.

Commentary for Chapter 1

So, given what we now know about the (albeit condensed) history of ‘mind’ and the modern approach to ‘consciousness’, let’s expand our thinking a bit.

Consider this little thought experiment that was first proposed by the psychiatrist and systems theorist, Dr. Gregory Bateson. Imagine a blind man walking down a city street, his cane thrust out before him. He swings the cane through an arc, tapping the sidewalk as he progresses.

Now, in this example, where does the mind, the consciousness, of the blind man begin and where does it end? Is mind in his motor cortex, which sends the signal to swing the cane? Is it in the interstitial neurons synapse in his neck, which sends the neural signal down his arm? Is it in the motor neurons and muscles in his fingers, which grip the handle of the cane? Is it in the tip of the cane, which taps the sidewalk? Or does it even extend to the surface of the environment the cane impacts?

Actually none of these is where mind resides—or, rather, they all are but that is only half the story. We can think of the first half as starting with an intentional neural signal originating in the man’s cortex that then travels down his arm, through his hand and fingers, down the cane, into the tip. But then the second half begins as it returns through parallel pathways with signals about the environment that the tip encountered, traveling upward to the cortex; whereupon of course the blind man’s path is modified appropriately. So where does the man’s mind reside? Bateson’s answer, and mine, is that it resides in the entire loop from the cortex to the cane tip, into the environment, and back again.

Generalizing this to every interaction with the environment leads to the conclusion that the brain is in the head, but *the mind is in the loops.* And the loops entail a lot more than just cortex or even subcortical and bodily connections, because the loops extend out into the environment, the physical properties of which are transduced into mechanical and then neural signals that return to the brain.

Lest you think this is only a contrived thought experiment, let me assure you it has practical consequences. Failure to understand these consequences cost the City of Seattle a great deal of money when it first installed bus signs on its downtown streets. The signs were at eye level across a curbside portion of the sidewalk and supported by two slender rectangular posts at either end. Unfortunately, the distance between the posts was about the same as the distance that blind persons were taught to swing their cane tips as they walked down the sidewalk. As a result, cane tips sometimes passed between the posts without detecting them, leading the cane's owners to walk headlong into the signs! This prompted the city to add expensive horizontal rods between the end posts; at exactly the height the blind swing their canes. This added component allowed the perceptual control loop to be completed so the person could avoid the sign.

This was a lesson expensively learned, but it was followed by another that was, in principle, almost exactly the same. Around the same time the bus signs were being installed, curbs were being cut to install short ramps for wheelchairs, in accord with the then-new American Disability Act. This was great for wheelchair users but unfortunate for blind people. The blind detect that the sidewalk is ending at an intersection by the drop-off of the curb from the sidewalk level to the street level. After the curbs were cut, removing the drop-off, blind people began walking out in front of traffic. The remedy now was to crosshatch the surface of the short ramp area where the curb had been cut; a change in texture that could be detected by a cane tip. Cross-hatching has become standard throughout America, so when you see it you'll know why it is there—because mind is in the loops. In this case, critical way-finding loops for specific sensory limited individuals.

So mind is *embodied* in brains, muscles and fingertips, and even *embedded* in the cane those fingers grasp, and then even further to include the textures of the physical environment the cane tip encounters. This recognition, that mind need not only be constructed of 'mind stuff', but may also include our body's musculature and other seemingly irrelevant processes, is a (relatively) new view of our psychological reality called "embodiment." In short, what affects and engages our state of mind is not constrained to the brain, or even the nervous system itself. It is in all the feedback loops from body functions and activities that intersect with neural processes, and can reach all the way up to narrative thought.

To show this in the context of this example, let's consider where the blind man is going and why. He isn't just walking down the street. His journey has purpose. He is going to the grocery store to buy some food because an old college chum of his that he's just reconnected with is coming over for dinner. And as he walks, he recalls the times they had together, remembers his friend's favorite foods, and perhaps even adjusts his route to check out an old haunt of theirs from long ago, guiding his way with sounds, smells, and haptic feedback returning from his cane. Does this sound more like narrative thinking now? If it does, then where did the narrative end, somewhere between his memories, plans, and expectations, and where did simple way-finding begin?

As we shall see in subsequent commentaries, the answers to these questions reveal not only the purpose of narrative thinking and of the mind, but how and why it got that way. The important point for the moment, though, is that while narrative thinking may have its locus of control in specialized cortical circuits of the left hemisphere, this does not imply that it is confined to or ends there.

This commentary is meant to emphasize that the modern theory of mind or consciousness is not bound by the physical limits of our brains or even our bodies. It incorporates the information loops that our homeostasis, our senses, and our current purposes all provide. These need to be distilled and integrated into a coherent; enduring representation of the world and its inhabitants we encounter and act upon. And that is where narrative comes in. If mind is in the loops, then narrative must be too, but the critical distinction is where those loops coalesce, and why and how they got there in the first place.

CHAPTER TWO

COGNITIVE ABILITIES

The long history of psychological and neurological research described in the previous chapter has identified the subsystems of the brain that support the five cognitive abilities which underlie thinking as we normally experience it:

- *Memory*; the ability to retain and retrieve knowledge.
- *Perception*; the ability to combine current sensory knowledge and knowledge from memory to produce an understanding of the present.
- *Imagination*; the ability to use knowledge about the past and present to set expectations for the future.
- *Reasoning*; the ability to use causal and evaluative rules to make sense of experience and shape decisions about the future.
- *Language;* the ability to acquire and use symbol systems to communicate to oneself and others about the past, present, and expected future.

The first four of these abilities provide answers to the fundamental questions that are the essence of everyday thinking: Memory = what led up to this moment? Perception = what is happening now? Imagination = what can be expected to happen in the future? Reasoning = is the expected future desirable and, if not, what can be done to make it so? The answers to the four questions comprise a story that is rooted in the past, includes the present, and extends into the future which will be shaped, at least in part, by purposeful action.

Note that it is this story, formally called a *narrative*, that structures the relevant content of consciousness and gives order and direction to conscious experience that without it might otherwise be a jumble of messages from the subsystems of the brain that support each of the first four abilities listed above. Research strongly suggests that the story itself is constructed, wholly or in part, by a specialized subsystem in the left hemisphere of the brain called the *interpreter*.

We'll talk about this brain research in subsequent chapters. But for the moment let us focus upon the story, the narrative, and upon the fifth cognitive ability, language. Encoding the narrative in language translates it from raw experience into a structured form that permits more precise thinking about it and enables us to communicate with others about it. It is this precision that allows humans to address complex problems and it is this communicability that allows us to share knowledge, to establish social ties, and to collaborate, which have contributed to our astonishing success as a species.

Memory

Cognitive scientists have determined that memory as a whole can be divided into immediate memory and retentive memory. Retentive memory can in turn be divided into procedural memory and declarative memory. And, declarative memory can be further divided into episodic memory and semantic memory. Each of these divisions represents a difference in the kind of stored information. That is:

- Immediate memory—the present.
- Retentive memory—the past.
  - Procedural memory--skills.
  - Declarative memory—information.
    - Episodic memory—specific information.
    - Semantic memory—general information.

Immediate memory is closely related to focus of attention. It can be thought of as a limited-capacity buffer that holds information about that infinitesimal instant that is "now" and the brief time preceding it. As time progresses, "now" is merely a flickering moment that is immediately replaced by a new "now." The new "now" is then replaced by another "now" and then another, and so on. Although each "now" actually lasts only a moment, immediate memory extends that moment by retaining a few the "nows" that came before it. The result is a brief interval that you experience as "the present."

Because time doesn't stand still, the older (by milliseconds) information in immediate memory is pushed out as new information comes in. Normally this older information moves to retentive memory and is experienced as something that already has happened, although very recently. However, you can retain older information in immediate memory by focusing your attention on it. An example is when you repeat a telephone number over and over to yourself until you have successfully made the call. The mechanism by which this is done is called *working memory*, which bridges between immediate memory and retentive memory—between the present and the past. In doing so, working memory melds information from your past with what is contained in the brief interval you experience as the present, which gives extension and meaning to what is happening to you.

Retentive memory contains the things you have learned, either from past experience or by instruction. It consists of procedural memories and declarative memories.

Procedural memory contains skills; how to use a screwdriver, operate a computer, drive a car, read a map, handle a knife and fork, and all the other skills one acquires in the course of being alive and to which one pays little conscious thought once they are well learned. Procedural memories run the gamut from basic motor skills, such as writing with a pen or pencil, to abstract intellectual skills, such as doing long division or algebra.

Declarative memory contains specific episodes that you have experienced and narratives that link multiple episodes into a cohesive, meaningful story.

Episodic memory contains information about specific persons, objects, and events ("this cow is") as well as the times, places, and emotions associated with them. They are the episodes discussed earlier—the sorts of things you can recount to someone else as an incident you experienced or that you can see clearly in your "mind's eye" when you try to remember what happened.

Semantic memory contains your general knowledge ("all cows are").

The general idea is that things that are happening "now" constitute your immediate/working memory. Then the memories are copied to your episodic memory where they are stored as facts about specific incidents—episodes. After a time in episodic memory they are copied to your semantic memory, although the parts of them that involve skills are also copied into your procedural memory to add to your store of skills.

Perception

As we saw in the previous chapter, psychology was born 200 years ago with the advent of research on sensory perception. Building on this, the Gestalt psychologists demonstrated that even the most rudimentary perceptions are not solely the result of physical stimulation. Even basic perceptual experiences, simply the presence or absence of some low intensity sound for example, are colored by memory, largely in the form of expectations based on past experience. Perhaps with the exception of fetuses or newborn babies, humans never have a pure, unalloyed sensory experience. With the help of memory, a sensory experience is about something other than itself. A sound is the sound of something, a color is the color of something, a smell is the smell of something, a taste is the taste of something, and so on.

It turns out that your brain is wired to create higher-level perceptions (the "somethings" in the previous paragraph) from lower level sensory perceptions. Although infants may do so, you never experience a face as simply a big oval adorned with little ovals; you see a face. And, with a little more help from memory, you may recognize it as the face of a friend. Moreover you see your friend's face whether you view it full on, from the side, from below, up-side-down, in person or in a photograph.

In addition to the perception of objects, you have the ability to perceive events. Events can be defined as the interactions among objects (including people). Of course, complex events like an election or a war are not examples of perception in the sense I am using the term. But there are simple events that you perceive quite readily and that you do not have to think about to understand. Consider a famous experiment performed in the mid-1940's by a Belgian psychologist, Albert Michotte (1861-1965). In the modern version of his experiment, people are asked to watch a display of diodes that are tightly packed in rows and columns in a slot that is three inches high and two feet long. To start, some of the diodes are lighted, creating a solid block of blue light that is three inches high and four inches long located about half way along the length of the slot. Additional diodes are lighted, creating another three inch by four inch solid block of light, but this one is red and is located at the far left end of the slot. By rapidly and repeatedly turning off a column of diodes on this red block's left edge while simultaneously turning on a column on its right edge, the block can be made to appear to move quickly to the right along the slot, stopping when its right edge abuts the left edge of the blue block. An instant after the red block stops, the blue block is made to appear to move quickly to the right and then disappear from the end of the slot.

When shown this display, everyone perceives the same thing: the red block "hit" the blue block and knocked it out the end of the slot. Which is to say, the groups of lights are seen as *objects* (red and blue blocks) which are participants in an *event* (movement leading to hitting resulting in knocking). But, of course, as tends to be the case in psychology experiments, all is not as it appears. The blocks are not objects, they are merely light displays. They do not actually move and the red one didn't actually knock the blue one to the end of the slot. The illusion of movement was caused by the columns of the diodes going on and off and the illusion of "objectness" was caused by making the constituents of the blocks all appear to move at the same time, which mimics what happens when you watch a real object move.

There are many variations of this experiment; if the red block appears to pause after touching the blue block, it looks like the red one "launched" the blue block. If the red block touches the blue block and they move together to the end of the slot, it looks like the red box is "pushing" the blue box. Everyone reports that the perception of the event, whether it be "hit," "launched," or "pushed," is both immediate and compelling. In short, they perceive the sequence of lights as an event in which one lighted object *causes* the action of the second object.

Every TV show is an example of both object and event perception. Like the diodes in the previous example, movement on TV is produced by fooling your event-perception system. The pictures on the TV screen, for instance, are produced by patterns of dots of colored light. To produce the perception of movement, some dots of light go off and others go on, resulting in a succession of very short-lived pictures, each slightly different from the one that proceeded it. Your event-perception system turns this succession of images into the motion of the objects on the screen.

What is more, you not only perceive the patterns of dots as people and objects, you also perceive them to have the attributes of people and objects with which you are familiar. You attribute motives to them, motives that cause their actions. You attribute emotions to them, emotions that reflect their reactions to what is going on. In the case of TV, all of this is illusory; the dots on the screen aren't people or objects and they don't have motives or emotions. But, in real life, the sensory experiences you have are indeed about real people, objects, motives, and emotions. The perceptual system that makes TV possible is the same one you use every day to figure out what is going on around you.

The general idea is that sensory events are combined by your brain into perceptions of objects and events. Primary among the events is causal perception; an event in which the action of an object is perceived to cause the action of another object. As we shall see, these perceived objects and events, and the causal relations among them, are the elements around which narratives are woven and are the focus of conscious experience.