ON BEING CERTAIN

Believing You Are Right Even When You're Not

ROBERT A. BURTON, M.D.

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YOU RECOGNIZE WHEN YOU KNOW SOMETHING FOR CERTAIN, RIGHT? You "know" the sky is blue, or that the traffic light has turned green, or where you were on the morning of September 11, 2001—you know these things because, well, you just do.

In *On Being Certain,* neurologist Robert Burton challenges the notions of how we think about what we know. He shows that the feeling of certainty we have when we *know* something comes from sources beyond our control and knowledge. In fact, certainty is a mental sensation, rather than evidence of fact. Because this *feeling of knowing* seems like confirmation of knowledge, we tend to think of it as a product of reason. But an increasing body of evidence suggests that feelings such as certainty stem from primitive areas of the brain and are independent of active, conscious reflection and reasoning. The feeling of knowing happens to us; we cannot make it happen.

Bringing together cutting-edge neuroscience, experimental data, and fascinating anecdotes, Robert Burton explores the inconsistent and

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sometimes paradoxical relationship between our thoughts and what we actually know. Provocative and groundbreaking, *On Being Certain* will challenge what you know (or *think* you know) about the mind, knowledge, and reason.

JUDITH PIETOROMARTIRE

ROBERT A. BURTON, M.D., graduated from Yale University and the University of California, San Francisco, medical school, where he also completed his neurology residency. At age thirty-three, he was appointed chief of the Division of Neurology at Mt. Zion–UCSF Hospital, where he subsequently became associate chief of the Department of Neurosciences. Dr. Burton's non-neurology writing career includes three critically acclaimed novels. He lives in Sausalito, California. Visit his Web site at www.rburton.com.

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PRAISE FOR
ON BEING CERTAIN

"What do we do when we recognize that a false certainty feels the same as certainty about the sky being blue? A lesser guide might get bogged down in nail-biting doubts about the limits of knowledge. Yet Burton not only makes clear the fascinating beauty of this tangled terrain, he also brings us out to the other side with a clearer sense of how to navigate. It's a lovely piece of work; I'm all but certain you'll like it." **—David Dobbs, author of *Reef Madness: Charles Darwin, Alexander Agassiz, and the Meaning of Coral***

"Burton has a great talent for combining wit and insight in a way both palatable and profound." **—Johanna Shapiro, Ph.D., professor of family medicine at U.C. Irvine School of Medicine**

"A new way of looking at knowledge that merits close reading by scientists and general readers alike." ***—Kirkus Reviews***

"This could be one of the most important books of the year. With so much riding on 'certainty' and so little known about how people actually reach a state of certainty about anything, some plain speaking from a knowledgeable neuroscientist is called for. If Gladwell's *Blink* was fascinating but largely anecdotal, Burton's book drills down to the real science behind snap judgments and other decision making." **—Howard Rheingold, futurist and author of *Smart Mobs***

"A fascinating read. Burton's engaging prose takes us into the deepest corners of our subconscious, making us question our most solid contentions. Nobody who reads this book will walk away from it and say 'I know this for sure' ever again." **—Sylvia Pagán Westphal, science reporter, *The Wall Street Journal***

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Also by Robert A. Burton, M.D.

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for Adrianne

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Preface

CERTAINTY IS EVERYWHERE. FUNDAMENTALISM IS IN FULL bloom. Legions of authorities cloaked in total conviction tell us why we should invade country X, ban *The Adventures of Huckleberry Finn* in schools, or eat stewed tomatoes; how much brain damage is necessary to justify a plea of diminished capacity; the precise moment when a sperm and an egg must be treated as a human being; and why the stock market will eventually revert to historical returns. A public change of mind is national news.

But why? Is this simply a matter of stubbornness, arrogance, and/or misguided thinking, or is the problem more deeply rooted in brain biology? Since my early days in neurology training, I have been puzzled by this most basic of cognitive problems: What does it mean to be convinced? At first glance, this question might sound foolish. You study the evidence, weigh the pros and cons, and make a decision. If the evidence is strong enough, you are convinced that there is no other reasonable answer. Your resulting

sense of certainty feels like the only logical and justifiable conclusion to a conscious and deliberate line of reasoning.

But modern biology is pointing in a different direction. Consider for a moment an acutely delusional schizophrenic patient telling you with absolute certainty that three-legged Martians are secretly tapping his phone and monitoring his thoughts. The patient is utterly convinced of the "realness" of the Martians; he "knows" that they exist even if we can't see them. And he is surprised that we aren't convinced. Given what we now know about the biology of schizophrenia, we recognize that the patient's brain chemistry has gone amok, resulting in wildly implausible thoughts that can't be "talked away" with logic and contrary evidence. We accept that his false sense of conviction has arisen out of a disturbed neurochemistry.

It is through extreme examples of brain malfunction that neurologists painstakingly explore how the brain works under normal circumstances. For example, most readers will be familiar with the case of Phineas Gage, the Vermont laborer whose skull and frontal region of the brain were pierced with an iron bar during an 1848 railroad construction accident.[1] Miraculously, he lived, but with a dramatically altered personality. By gathering together information from family, friends, and employers, his physicians were able to piece together one of the earliest accurate descriptions of how the frontal lobe affects behavior.

Back to the pesky Martians. If Phineas Gage's posttraumatic personality change led to a better understanding of normal frontal lobe functions, is the schizophrenic's certainty that the Martians are listening to his thoughts a clue as to the origins of our sense of conviction? What is this patient telling us about the brain's ability to create the unshakable belief that what we feel that we know is,

in fact, unequivocally correct? Are certainty and conviction purely deliberate, logical, and conscious choices, or not what they appear?

For me, the evidence is overwhelming; the answer is startling and counterintuitive, yet unavoidable. The revolutionary premise at the heart of this book is:

> Despite how certainty feels, it is neither a conscious choice nor even a thought process. Certainty and similar states of "knowing what we know" arise out of involuntary brain mechanisms that, like love or anger, function independently of reason.

To dispel the myth that we "know what we know" by conscious deliberation, the first section of the book will show how the brain creates the involuntary sensation of "knowing" and how this sensation is affected by everything from genetic predispositions to perceptual illusions common to all bodily sensations. Then we can see how this nonreasoned *feeling of knowing* is at the heart of many seemingly irresolvable modern dilemmas.

I am a neurologist with a novelist's sensibility. Though I have tried to make this book as accurate as possible, there will be many areas of controversy and frank disagreement. My goal is not to defend each argument against all criticism, but rather to generate a discussion about the nature and limitations of how we know what we know. To keep the book from being too dense or riddled with jargon, I have relegated more technical details, explanations, most personal digressions, and bibliography to the endnotes.

I must also confess to an underlying agenda: A stance of absolute certainty that precludes consideration of alternative opinions has always struck me as fundamentally wrong. But such accusations

are meaningless without the backing of hard science. So I have set out to provide a scientific basis for challenging our belief in certainty. An unavoidable side effect: The scientific evidence will also show the limits of scientific inquiry. But in pointing out the biological limits of reason, including scientific thought, I'm not making the case that all ideas are equal or that scientific method is mere illusion. I do not wish to give ammunition to the legions of true believers who transform blind faith into evidence for creationism, alien abduction, or Aryan supremacy. The purpose is not to destroy the foundations of science, but only to point out the inherent limitations of the questions that science asks and the answers it provides.

My goal is to strip away the power of certainty by exposing its involuntary neurological roots. If science can shame us into questioning the nature of conviction, we might develop some degree of tolerance and an increased willingness to consider alternative ideas—from opposing religious or scientific views to contrary opinions at the dinner table.

A personal note: The schema that I am about to present has given me an unintended new way of seeing common problems. It isn't that I think about each issue and how it relates to neurobiology. Rather, the very notion of how we know—and even how we ask questions—has shaped how I feel and respond to everything from the daily news to pillow talk with my wife to age-old philosophical questions. The sense of an inner quiet born of acknowledging my limitations has been extraordinary; I would like to share this with you.

On Being
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The Feeling of Knowing

I AM STUCK IN AN OBLIGATORY NEIGHBORHOOD COCKTAIL party during the first week of the U.S. invasion of Iraq. A middle-aged, pin-striped lawyer announces that he'd love to be in the front lines when the troops reach Baghdad. "Door-to-door fighting," he says, puffing up his chest. He says he's certain he could shoot an Iraqi soldier, although he's never been in a conflict bigger than a schoolyard brawl.

"I don't know," I say. "I'd have trouble shooting some young kid who was being forced to fight."

"Not me. We're down to dog-eat-dog."

He nods at his frowning wife, who's anti-invasion. "All's fair in love and war." Then back to me. "You're not one of those peacenik softies, are you?"

"It wouldn't bother you to kill someone?"

"Not a bit."

"You're sure?"

"Absolutely."

He's a neighbor and I can't escape. So I tell him one of my father's favorite self-mocking stories.

During the 1930s and '40s, my father had a pharmacy in one of the tougher areas of San Francisco. He kept a small revolver hidden beneath the back cash register. One night, a man approached, pulled out a knife, and demanded all the money in the register. My father reached under the counter, grabbed his gun, and aimed it at the robber.

"Drop it," the robber said, his knife at my father's throat. "You're not going to shoot me, but I *will* kill you."

For a moment it was a Hollywood standoff, *mano a mano*. Then my father put down his gun, emptied out the register, and handed over the money.

"What's your point?" the lawyer asks. "Your father should have shot him."

"Just the obvious," I say. "You don't always know what you're going to do until you're in the moment."

"Sure you do. I know with absolute certainty that I'd shoot anyone who was threatening me."

"No chance of any hesitation?"

"None at all. I know myself. I know what I would do. End of discussion."

MY MIND REELS with seemingly impossible questions. What kind of knowledge is "I know myself and what I would do"? Is it a conscious decision based upon deep self-contemplation or is it a "gut feeling"? But what is a gut feeling—an unconscious decision, a mood or emotion, an ill-defined but clearly recognizable mental state, or a combination of all these ingredients? If we are to

understand how we know what we know, we first need some ground rules, including a general classification of mental states that create our sense of knowledge about our knowledge.

For simplicity, I have chosen to lump together the closely allied feelings of certainty, rightness, conviction, and correctness under the all-inclusive term, the *feeling of knowing*. Whether or not these are separate sensations or merely shades or degrees of a common feeling isn't important. What they do share is a common quality: Each is a form of metaknowledge—knowledge about our knowledge—that qualifies or colors our thoughts, imbuing them with a sense of rightness or wrongness. When focusing on the phenomenology (how these sensations *feel*), I've chosen to use the term the *feeling of knowing* (in italics). However, when talking about the underlying science, I'll use *knowing* (in italics). Later I will expand this category to include feelings of familiarity and realness—qualities that enhance our sense of correctness.

EVERYONE IS FAMILIAR with the most commonly recognized *feeling of knowing*. When asked a question, you feel strongly that you know an answer that you cannot immediately recall. Psychologists refer to this hard-to-describe but easily recognizable feeling as a tip-of-the-tongue sensation. The frequent accompanying comment as you scan your mental Rolodex for the forgotten name or phone number: "I know it, but I just can't think of it." In this example, you are aware of knowing something, without knowing what this sense of knowing refers to.

Anyone who's been frustrated with a difficult math problem has appreciated the delicious moment of relief when an incomprehensible equation suddenly *makes sense*. We "see the light." This *aha* is a notification from a subterranean portion of our

mind, an involuntary all-clear signal that we have grasped the heart of a problem. It isn't just that we can solve the problem; we also "know" that we understand it.

Most *feelings of knowing* are far less dramatic. We don't ordinarily sense them as spontaneous emotions or moods like love or happiness; rather they feel like thoughts—elements of a correct line of reasoning. We learn to add 2+2. Our teacher tells us that 4 is the correct answer. Yes, we hear a portion of our mind say. Something within us tells us that we "know" that our answer is correct. At this simplest level of understanding, there are two components to our understanding—the knowledge that 2+2=4, and the judgment or assessment of this understanding. We know that our understanding that 2+2=4 is itself correct.

The *feeling of knowing* is also commonly recognized by its absence. Most of us are all too familiar with the frustration of being able to operate a computer without having any "sense" of how the computer really works. Or learning physics despite having no "feeling" for the rightness of what you've learned. I can fix a frayed electrical cord, yet am puzzled by the very essence of electricity. I can pick up iron filings with a magnet without having the slightest sense of what magnetism "is."

At a deeper level, most of us have agonized over those sickening "crises of faith" when firmly held personal beliefs are suddenly stripped of a visceral sense of correctness, rightness, or meaning. Our most considered beliefs suddenly don't "feel right." Similarly, most of us have been shocked to hear that a close friend or relative has died unexpectedly, and yet we "feel" that he is still alive. Such upsetting news often takes time to "sink in." This disbelief associated with hearing about a death is an example of the sometimes complete disassociation between intellectual and felt knowledge.

To begin our discussion of the *feeling of knowing*, read the following excerpt at normal speed. Don't skim, give up halfway through, or skip to the explanation. Because this experience can't be duplicated once you know the explanation, take a moment to ask yourself how you feel about the paragraph. After reading the clarifying word, reread the paragraph. As you do so, please pay close attention to the shifts in your mental state and your feeling about the paragraph.

> A newspaper is better than a magazine. A seashore is a better place than the street. At first it is better to run than to walk. You may have to try several times. It takes some skill, but it is easy to learn. Even young children can enjoy it. Once successful, complications are minimal. Birds seldom get too close. Rain, however, soaks in very fast. Too many people doing the same thing can also cause problems. One needs lots of room. If there are no complications, it can be very peaceful. A rock will serve as an anchor. If things break loose from it, however, you will not get a second chance.

Is this paragraph comprehensible or meaningless? Feel your mind sort through potential explanations. Now watch what happens with the presentation of a single word: kite. As you reread the paragraph, feel the prior discomfort of something amiss shifting to a pleasing sense of rightness. Everything fits; every sentence works and has meaning. Reread the paragraph again; it is impossible to regain the sense of not understanding. In an instant, without due conscious deliberation, the paragraph has been irreversibly infused with a *feeling of knowing*.

Try to imagine other interpretations for the paragraph. Suppose

I tell you that this is a collaborative poem written by a third-grade class, or a collage of strung-together fortune cookie quotes. Your mind balks. The presence of this *feeling of knowing* makes contemplating alternatives physically difficult.

Each of us probably read the paragraph somewhat differently, but certain features seem universal. After seeing the word *kite*, we quickly go back and reread the paragraph, testing the sentences against this new piece of information. At some point, we are convinced. But when and how?

The kite paragraph raises several questions central to our understanding of how we "know" something. Though each will be discussed at greater length in subsequent chapters, here's a sneak preview.

- Did you consciously "decide" that *kite* was the correct explanation for the paragraph, or did this decision occur involuntarily, outside of conscious awareness?
- What brain mechanism(s) created the shift from not knowing to *knowing*?
- When did this shift take place? (Did you know that the explanation was correct before, during, or after you reread the paragraph?)
- After rereading the paragraph, are you able to consciously separate out the *feeling of knowing* that *kite* is the correct answer from a reasoned understanding that the answer is correct?
- Are you sure that *kite* is the correct answer? If so, how do you know?