Resistance to Belief Change: Limits of Learning

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"Joe Lao draws from a remarkably broad array of sources in psychology and philosophy to carefully address one of the most critical questions of today: How do we know what to believe?"

—**Deanna Kuhn**, *Professor of Psychology and Education at Teachers College, Columbia University, USA*

RESISTANCE TO BELIEF CHANGE

This book examines the human proclivity to resist changing our beliefs. Drawing on psychological, neurological, and philosophical research, and integrating topics as wide ranging as emotion, cognition, social (and physical) context, and learning theory, Lao and Young explore why this resistance to change impedes our learning and progression. They also suggest that failure to adapt our beliefs to available and informed evidence can incur costs that may be seen in personal growth, politics, science, law, medicine, education, and business.

Resistance to Belief Change explores the various manifestations of resistance, including overt, discursive, and especially inertial forms of resistance. As well as the influential factors that can impact upon them, the book also examines how the self-directed learner, as well as teachers, may structure the learning experience to overcome resistance and facilitate progressive and adaptive learning.

Lao and Young find that the impediments to learning and resistance to change are far more prevalent and costly than previously suggested in research, and so this book will be of interest to a range of people in cognitive development, social psychology, and clinical and educational psychology.

Joseph R. Lao earned his Ph.D. in the field of cognitive development from Teachers College, Columbia University. As an Adjunct Associate Professor of Psychology and Education at Teachers College, and a full-time Senior Lecturer at Hunter College, in the City University of New York, and elsewhere, Dr. Lao has taught undergraduate and graduate courses in Experimental Psychology, Human Development, Learning, and Cognitive Development for more than 20 years.

Jason Young earned his Ph.D. in social psychology from the University of Minnesota. As a full-time Associate Professor at Hunter College, in the City University of New York, and elsewhere, Professor Young has taught undergraduate and graduate courses in social psychology over the past 30 years, including Introduction to Social Psychology, Research Methods in Social Psychology, the Psychology of Prediction, and The Psychology of Attitudes and Persuasion.

RESISTANCE TO BELIEF CHANGE

Limits of Learning

Joseph R. Lao and Jason Young

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This book is dedicated
by Joseph Lao to Deborah Lao, his wife, and
by Jason Young to his students and colleagues who have
helped to highlight the strengths
and challenges posed by resistance.

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PREFACE

The genesis of this book extends back more than 20 years, to when Joseph Lao was a doctoral student studying cognitive development at Teachers College. It was difficult to understand how some people could be confronted with credible evidence and not accept it, while others accepted that same evidence willingly. The confusion was compounded by the reading of Thomas Kuhn's book *The Structure of Scientific Revolutions*, and even more by the investigation of attitude change, in which people sometimes displayed the seemingly perverse boomerang effect, in which they interpreted evidence that supports a proposition in a way that enabled them to become more opposed to that proposition. Some of this confusion was channeled into a masters thesis at Teachers College on inertial effects, but that only served to whet the appetite, as it was clear that there is much more to this phenomenon.

Unfortunately, full-time work on a doctoral dissertation and the need to earn a living reduced the available time and cognitive resources to return to this issue. It was not until I obtained tenure as a senior lecturer and was granted a one-year sabbatical by Hunter College that conditions were once again favorable to return to this topic. One of the conditions for that sabbatical was that I focus on a problem in learning or education.

At about the same time, I had occasional exchanges of ideas with social psychology professor Jason Young at Hunter College about people's tendency to resist change. It was an area of mutual interest that neither of us had time to explore the way we wanted. But when my application for sabbatical was approved I approached Jason about the possibility of collaborating on this book, and a mutually beneficial partnership was born.

Since then, Jason and I have had many fascinating, yet frustratingly short, conversations about the topics contained in this book. We each see the phenomena

outlined here a little differently, with me coming from a cognitive development perspective and Jason coming from a social psychology perspective.

We would like to thank several people for their invaluable assistance with this book. First, there is Paul Dukes at Routledge. He was the first to recognize the importance of our idea and invite us to sign a contract with Routledge to produce this book. Also, Eleanor Reedy has been a constant and constructive steward of this project on behalf of Routledge for more than a year. Her positive feedback, editorial insights, and constant encouragement during that time are more appreciated than can easily be expressed in words.

We also wish to thank Martin Chodorow, a professor of cognitive development at Hunter College for his illuminating feedback regarding early chapters of this book. And we are extremely grateful to Valerie Khait for her constructive feedback on an earlier version of this book. We are especially grateful for her willingness to review the manuscript with a short timeline, and for reminding us that not everyone is an academician, resulting in a much broader appeal for this book than would otherwise have been the case.

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THE NATURE OF BELIEFS

Have you ever been in a discussion with somebody who refused to admit they were wrong? Did you feel frustrated when they seemed to listen to what you believed to be common sense yet failed to see things as "clearly" as you? And did your voices and emotions escalate as you tried everything you could think of to persuade them, perhaps for their own good, of the error of their ways? Have you noticed how hard it is to convince people they are wrong when they are angry? Alternatively, have you ever encountered a student who seemed as bright as anybody else in the class but who just seemed so turned off to the subject that they didn't learn the material? Or, have you ever noticed how hard it can be to change religion, political affiliation, or habitual patterns of behavior? Perhaps you even know somebody who has admitted their current behaviors are maladaptive and yet failed to change.

If these experiences sound familiar then this book may help illuminate the mystery of why people hold on to beliefs, even when they no longer seem to reflect reality or serve their original purpose. That is because this book provides an analysis of what we believe to be a pervasive human problem, our tendency to resist changing our views, or behaviors, even when change is in our own best interest.

To a great extent, this book is about our inherent, often inertial, inflexibility. It is intended not as yet another "Ain't we awful" excoriation of human weakness and fallibility, but rather as an examination of an overlooked and deeply underestimated common human tendency that has both positive and negative consequences. If we consider nothing more than the contribution of resistance to human conflict it becomes clear that resistance to change is at the same time one of the most natural of all human tendencies and one of the greatest threats to the advancement (if not the survival) of mankind (e.g., see Turiel, 2003). The

implications of this phenomenon extend beyond whether we shift from pro to con, or back again, on the issues of our day. Of far deeper significance is the fact that our resistance to change may constitute a significant limitation to our ability to learn new information, and therefore to grow. This places resistance at the very core of cognitive development and personal growth. In effect, it makes resistance a bottleneck for healthy human development. After all, if we cannot, or will not, change then we cannot grow. And so, the study of the underlying causes and mechanisms of resistance is simultaneously the study of the limits of learning. In this sense, this book is one response to the question, "What are the limits of human learning?" Therefore, our intent is not so much to criticize and ridicule as to explore a common problem and offer some possible solutions.

Because we believe resistance is a pervasive human tendency, we will offer examples from a broad range of human activities. Accordingly, this book attempts to integrate research across a broad range of domains, both within and outside of psychology.[1]

Embedded within the general question of why we resist change are a multitude of specific issues that need to be defined as we search for the answers. For instance, why should we even bother to study this problem? What is it that we resist changing? What kinds of situations, emotional states, or individual personal traits arouse a resistance response? What are the environmental factors that engender, exacerbate, or ameliorate resistance? And then there are the "how" questions. In particular, how do these factors work to trigger resistance? This is closely related with questions about the mechanisms that mediate resistance. Finally, there are questions about when resistance is warranted, or counterproductive, and what we should do about it.

These questions will be addressed in the following chapters. But a more fundamental question concerns the unit of measurement. In most of the coming discussion, the basic unit of measure will be the belief. In general, there exists a correspondence between the nature of a belief and the ways in which we resist changing that belief. Therefore, we should begin by examining some of the general characteristics of beliefs. Many of these characteristics will be revisited later as part of a more detailed discussion of the factors and mechanisms involved in resistance.

The Nature of Beliefs

Definition of Belief

Over the years epistemologists and psychologists have explored the nature and origins of knowledge from many different perspectives (e.g., Gardenfors, 1988; Piaget, 1970), with most of their findings also applying to beliefs. Although this has increased our understanding of knowledge it has also raised a problem in that many different ways of conceptualizing knowledge (and therefore beliefs)

are now available. This then marks one of the first major forks in our road, for the types of problems and solutions we are able to address are limited by the way in which we conceptualize knowledge and beliefs. For our purposes, beliefs will be construed as propositions (whether explicitly stated or implicitly inferred) which the possessor thinks are true. Note that, for the purpose of qualifying as a belief, it does not matter whether the proposition is actually true. It doesn't even matter whether the proposition is rational. All that is necessary for a proposition to qualify as a belief is for its possessor to think it is true.

Beliefs and Knowledge

This way of defining beliefs raises a question about the differences between suspicions, beliefs, and knowledge. Perhaps the best way of distinguishing between these is by thinking of them as different points along a continuum of certainty. Suspicions may be thought of as beliefs about which we have a low degree of certainty. For instance, we may possess some evidence to believe they are true yet not enough to provide a satisfactory degree of certainty. This may occur when somebody tells us something new that contradicts our other beliefs. Or, we may be in the early stages of forming a belief about some phenomenon, so that we have either unclearly formulated the belief or have not yet begun amassing either confirming or disconfirming evidence. A real-life example of this was Copernicus' early suspicion that the earth orbited the sun; after his research, a firmer belief that this was correct; and, presently, the commonly accepted fact-as-knowledge that this is true.

Beliefs may be thought of as propositions about which we have amassed sufficient evidence to lead us to achieve some self-satisfying level of certainty they are true. The source, quality, and weight of evidence which is necessary to reach a sufficient level of certainty to enable a proposition to qualify as a belief will vary from one person (and situation) to another. The source of that belief-supporting evidence may be the physical world, one's parents or other care givers (e.g., teachers, relatives), one's peers, one's self, or other parts of society (see Urie Bronfenbrenner, 1989 for an interesting discussion of different levels of social influence). The perceived quality of that evidence will vary with the types of sources presenting it. And the weight assigned to any given piece of evidence will also vary with the perceived credibility of the sources, along with one's willingness and ability to consider the evidence presented.

Knowledge is typically defined as justified true belief. In practice, beliefs may qualify as knowledge when we hold them with a high degree of certainty (Hawthorne et al., 2016; Rott, 2001). As with other beliefs, this depends on the amount and type of evidence that has been amassed, and on the weight assigned to that evidence. Likewise, that evidence may derive from any of various levels of internal or external influence (cf., Bronfenbrenner, 1989). Moreover, the degree of proof which is considered minimal to qualify a proposition as

knowledge will vary from one person to another. Some people will set very stringent standards (e.g., scientists working in their domain of specialization) while others may set more casual standards (e.g., children listening to gossip). Still others may not make meaningful distinctions between such things as suspicions, beliefs, and knowledge. What is important for them may be simply that they think something is true (or untrue).

One further distinction may be offered between knowledge and beliefs. The former may be said to entail logical necessity while the latter does not. For instance, Renee Descartes (1637/1998) is famous, in part, for this claim, "I think, therefore I am." It seems logically necessary that if one is capable of producing thoughts then one must exist. And so, one may be said to "know" such things as that one exists.

Characteristics of Beliefs

Correspondence With Reality

Beliefs are our own private mental representations of reality. Although they are real in the sense that they reflect our current interpretation of the world, they are not the reality they are supposed to represent. When you look at a person who is 6 feet tall, your mental representation of that person is not that person. It is an image created by your brain, using input from your eyes and incorporating some of your beliefs and expectations. In addition, your mental representation of that person is not an exact copy of that person. For instance, the physical image of that person in your brain is only a few inches tall, not 6 feet. And many of the unimportant details (such as the number of wrinkles in their shoes) are omitted from your mental representation, partly for the sake of convenience, but also to reduce the mental load.

Despite these minor deviations from the reality they represent, one of the most valuable characteristics of beliefs is their correspondence with reality. The more accurately a belief represents reality (i.e., in the sense of being a true proposition) the more useful, and valuable, that belief can be. It is the truthfulness of our beliefs that enables us to use them as aids to better adapt to the world around (and within) us. The more truthful a belief actually is, the more effectively it enables us to interact with our environment. The less truthful a belief actually is the less effectively it enables us to successfully adapt to our environment. If you accurately believe that no cars are approaching an intersection, then you will be able to safely walk across the street. But if you inaccurately believe that no cars are approaching that intersection, then when you try to cross the street, you may be seriously injured. In this case, the accuracy of the beliefs you hold about the immediate environment has direct implications for your physical safety.

One of the distinctions that can be made about beliefs concerns whether they correspond with physical reality or subjective reality (cf Piaget, 1985). Objective beliefs represent physical reality more or less literally. Typically, they constitute an inferred relation between stimuli. For instance, we believe a ball is hard, or soft, or round, or flat, etc. This type of belief is objective in the sense that there exists a tangible physical reality to which the belief may be compared. Moreover, other people may inspect that same tangible reality and draw their own (hopefully similar) conclusions. In other words, objective beliefs are about "outwardly observable" information. Both the (ongoing) availability of physical evidence and the enhanced possibility of social feedback this affords have implications for the resistance of such beliefs to change.

In addition to corresponding with physical reality, our beliefs also need to correspond with subjective reality. Subjective beliefs refer to either private (i.e., in the sense of not being publicly observable) experience or private values. They refer to subjective states, relative judgments, or what is desirable.[2] Thus, the statement, "The wall is blue" would refer to (and presumably be supported by) physical reality while the statements, "That blue wall makes me sad," "I feel happy," and "I believe Mrs. Smith is a wonderful person" refer to subjective beliefs.

Note that both objective and subjective beliefs should correspond with physical reality, in the sense, for example, that there is some physical evidence that leads us to believe that Mrs. Smith is a wonderful person. Even a statement about one's own happiness may correspond with physical evidence, such as a particular sensation, smiling, or having a gleam in one's eye. For this reason, physical evidence usually carries more weight than subjective evidence as support for beliefs. We will see throughout this book that the evidence supporting a belief serves as a major factor in the stability of that belief, for better or worse.

Organization

There exists considerable evidence to support the claim that beliefs do not exist in isolation from each other. It has been adequately demonstrated that beliefs are like social animals in that they "travel in packs." Beliefs that have common elements tend to be more closely related to each other, both psychologically and physically, than beliefs that share no common elements. For instance, our beliefs about the current President of the United States are more closely related to each other than they are to our beliefs about how trains work. Our beliefs typically exist in networks of related beliefs (cf. Dalege et al., 2016; Judd et al., 1991; Leone, 1989), or what Jean Piaget referred to as "schemas." These schemas may be described as our own private "mental maps" regarding different aspects of reality. For instance, most people have a scheme for parents. This

may include beliefs about the characteristics our parents possess, as well as their typical nurturing behaviors.

Three important properties of this organization are coherence, centrality, and embeddedness.

Coherence. Coherence refers to the degree of consistency within a belief as well as between a belief and other available information (see also Piaget, 1952). A belief is internally coherent when it is free of internal contradiction. It is externally coherent when it is consistent with external information, i.e., either the physical world or other beliefs (cf Sternberg, 1997). And, finally, it includes consistency with social feedback. Each of these has implications for the ability of a belief to endure, since each provides justification for the belief.

Centrality. One of the ways in which beliefs are hierarchically organized concerns how central a role they play in our life. As noted by several eminent psychologists (e.g., Bem, 1970; Rokeach, 1960), central beliefs play a prominent role in our life, while peripheral beliefs play only a superficial, or peripheral, role. In general, central beliefs include those basic or essential beliefs that are at the core of a person's belief system. In a sense, these are the beliefs that comprise the foundation and inner framework of a person's belief system, and determine the person's basic orientation toward the world. Included among our central beliefs are many of our political and religious beliefs and the beliefs that our sensory information is reliable, that the world is OK (or not OK), and that people are generally to be (or not to be) trusted. Many beliefs about the nature of physical reality also fall under this category (Rokeach, 1960), as well as beliefs about our own identity (e.g., self-worth, self-efficacy, etc.).

Central beliefs are generally acquired early in life. Although they may arise from one particularly poignant experience, it is more common that central beliefs are built from repeated experiences across a broad range of contexts (Bem, 1970). As a result of their early acquisition and repeated reinforcement, these beliefs are not only accepted as true but are often even thought to be beyond critical scrutiny (Rokeach, 1960). In many cases we may find that "our most fundamental primitive beliefs are so taken for granted that we are apt not to notice that we hold them at all" (Bem, 1970, p. 5).

In addition, our central beliefs are the basic assumptions upon which many of our other beliefs are constructed. They serve as initial premises for many other beliefs, but they serve as conclusions in very few other beliefs (Bem, 1970). This property of central beliefs has two interesting consequences. First, in theory, if we know enough about a person's central beliefs we should be able to construct a much broader network of their beliefs, based on the rational assumption that the person will also hold other beliefs that may be logically inferred by using their central beliefs as starting points (Rokeach, 1960). This would not be possible if we used peripheral beliefs as the starting point. Second, the process of

using some beliefs as premises (as in a syllogism) to derive other beliefs allows for the construction of a multilevel, hierarchical network of beliefs.

At the other end of the central-peripheral belief continuum are those beliefs that are of relatively little importance for our other beliefs or our orientation to the world. These may be relatively irrelevant, innocuous, observations. For instance, the belief that your mother is/was a good person may be a central belief, while the belief that she was wearing black shoes the last time you saw her would be a peripheral belief. Alternatively, peripheral beliefs may be inferences drawn from (more) central beliefs. If I believe that Mrs. Smith is a wonderful person, I might infer that she tends to smile a lot, thereby forming a peripheral belief.

While challenging a person's central beliefs may arouse great anxiety, challenging their peripheral beliefs generally elicits a less intense emotional reaction. It is easy to imagine alternatives to peripheral beliefs, and that would likely not be upsetting (Bem, 1970). In light of this we find that central beliefs (which we care more about and which are more interconnected within our mind) are more resistant to change than peripheral beliefs (which we care relatively less about and which have fewer, if any, connections with other beliefs in our mind).[3]

Embeddedness and Entrenchment. One characteristic feature of the "interrelatedness" of beliefs that affects resistance is embeddedness. Embeddedness refers to the extent to which a belief is interconnected with (and sometimes dependent upon) other beliefs. Of particular interest here is the tendency of beliefs to bolster one another. They may provide mutual support in the form of their interdependence and consistency. If we believe Mrs. Smith is a wonderful person, then believing that she likes to smile, that she donates her time and money to charity, and that she likes children will all help establish and support the former belief.

While embeddedness is an important common property of beliefs, it has another side. The mutual support of embeddedness can make each individual belief additionally resistant to disconfirming evidence, a property known as entrenchment. This is particularly true of central beliefs, as the extent to which a belief is embedded is strongly related to the centrality of that belief. For instance, if Mrs. Smith has a central belief that she is a good person, it is likely that this belief is supported by a lifetime of evidence and many related beliefs, even if she is deluded (cf Bartolotti and Broome, 2008). If she yells at a child, this would seem to contradict, and potentially disconfirm, her belief that she is a good person. However, that belief may be sufficiently supported by her other beliefs about herself (and the evidence that gives rise to those other beliefs) that yelling at a child a single time does little to weaken her belief that she is a good person. Embeddedness, therefore, refers to the interconnectedness of beliefs, while entrenchment refers to the fixedness of beliefs. This is a highly important

characteristic of belief systems, both as a distinguishing characteristic of individuals and for its role in resistance.

Types of Beliefs

There are many different types of beliefs, depending largely on the type of target they represent. These include concrete, abstract, metacognitive, and subjective beliefs. Beliefs about physical reality are typically referred to as concrete (or objective) beliefs (Piaget, 1985). Ideally, concrete beliefs are closely related to the way the world appears to our senses. Statements such as, "The sky is blue," "John is 6 feet tall," and "Birds have wings" are all examples of concrete beliefs. These beliefs are the easiest of all beliefs to confirm with physical reality.

Abstract beliefs are beliefs that refer to things that cannot be directly physically observed, but that may be inferred from physical evidence. For instance, the claim that "John is intelligent" refers to an abstract property, intelligence. Although we may infer from his patterns of behavior that John is, in fact, intelligent, we can never directly see his intelligence itself. We can only see physical behaviors that we judge to be consistent, or inconsistent, with intelligence.

Metacognitive beliefs are beliefs about beliefs and thinking (cf, Kuhn, 2001). This includes beliefs about what we believe, beliefs about how strongly we hold any given belief, and beliefs (or self-assessments) about whether we can solve a given problem. One particularly important type of metacognitive belief is our epistemic standards. As Piaget (1985) has noted, the beliefs constituting our epistemic standards may be about either the ways in which our beliefs relate to reality (e.g., how they should be derived) or about how new beliefs do, or should, fit in with our existing beliefs. Such "meta-beliefs" are especially important when it comes to understanding resistance. These beliefs dictate both the models we follow in formulating our beliefs and the standards we must meet if we are to conclude that our own beliefs are either true or rational (e.g., see Gardenfors, 1988; Kuhn, 2001). If one's epistemic standards are faulty, it greatly increases the risk that person will form beliefs that are irrational, or inconsistent with available evidence. It also reduces the probability that person will change their existing beliefs in response to disconfirming evidence.

Subjective beliefs are beliefs that are based on one's own internal, personal frame of reference. Admittedly, all beliefs are subjective to some extent, but subjective beliefs draw at least as much support from inner reality as external reality. For instance, one type of subjective belief refers to one's estimation of his or her current mood. That is, you may believe you are calm right now, or happy, etc. Another type of subject belief pertains to relative judgments. For instance, one may judge that the movie they saw last night was very long, especially if it was boring.

An especially important type of subjective belief refers to what is desirable. Our subjective values are associated with beliefs about what is important. This

includes our preferences, priorities, and how we think things should be. If John values honesty, he will believe honesty is desirable, and he will prioritize honesty over less desirable qualities. Similarly, our moral values may be defined as how we believe people should treat each other. Also falling under this heading are our attitudes. Our attitudes may be defined as cognitive, emotional, and behavioral dispositions to react in a certain way to people, conditions, or events. These dispositions, however, are generally correlated with our beliefs.[4] For instance, if John opposes capital punishment, he is likely to hold beliefs such as that it is ineffective, cruel, or barbaric.

Subjective beliefs differ from some of the other types of beliefs not only because they may be less directly dependent on physical reality, but also because they are simultaneously embedded in cognitive, emotional, and possibly social frameworks. They may also be correlated with our central beliefs. As a result, such beliefs may derive support from a multitude of sources. This makes them more entrenched, and particularly resistant to change, than other types of belief, though they may change in response to experience (Kuhn and Lao, 1996; Lao, 1999).

Dispositions Toward Beliefs

In addition to the different types of beliefs we hold, another factor that influences our willingness, or ability, to change a belief is our dispositions toward that belief. This includes the extent to which we are aware of that belief, how certain we are that it is true, and its importance to us.

Awareness

Although most beliefs are accessible to conscious awareness, we possess some beliefs that we are not aware of. Indeed, as much as we like to think we know ourselves well, we occasionally surprise even ourselves, either by articulating beliefs we did not realize we held, or by engaging in behaviors that are consistent with such a belief, in contradiction with what we say we believe. This sometimes produces confusion, as we tell people we believe one thing, but they infer that we really believe something else, based on our behaviors, body language, or tone of voice. As a result, we may sometimes verbally object to believing something that we nevertheless communicate nonverbally. This is sometimes seen in people who are racist or homophobic but who do not consciously acknowledge it.

Superficially, it seems absurd to claim that a person may hold a belief of which they are unaware. After all, if you ask any person of normal intelligence whether they believe proposition X is true they are generally able to respond "yes" or "no." However, beliefs are not always so clear. No clear line exists (i.e., in real life as opposed to logic or the English dictionary) between belief and nonbelief.

For instance, any given person may either believe or disbelieve in (the truth of) proposition X. Alternatively, that same person may neither believe nor disbelieve in that same proposition, i.e., they may not have a clear belief one way or another about X. At some point in time that person may become aware of evidence that supports that proposition. Although one might expect this new evidence to influence the probability that X will be believed (especially if it is diagnostic), it is also possible that the person who encounters the evidence has insufficient interest in X to even exert the effort necessary to formulate a belief in X. Similar outcomes could occur if the person has insufficient confidence in the new evidence (or its bearer), or if they consider the evidence insufficiently informative to cause a formulation or change of belief, i.e., from nonbelief to belief. Or, the person may suspend belief in X pending the acquisition of additional evidence. For instance, if I don't know Mrs. Smith and I hear someone claim that she is a wonderful person, I may choose to neither believe nor disbelieve the claim, especially if I don't know the claimant. If I don't expect to ever meet Mrs. Smith, I may choose to stay in this state indefinitely. Alternatively, I may choose to tentatively accept the claim as true (perhaps even unconsciously), with a low level of confidence, pending the acquisition of more information. If I would like to know more I might ask, "Why do you say Mrs. Smith is a wonderful person?" Or, I may choose to personally interact with Mrs. Smith to learn more about her. The precise point at which we become consciously aware of a belief depends on a variety of factors, and it is not always clear what these are, or when they occur, even to their owner.

In addition, as Gardenfors (1988, p. 23) has noted, "One must distinguish between the acceptance of a sentence from the awareness of this acceptance." Many times we hold firm beliefs without even being aware that we hold those beliefs. For instance, new parents sometimes surprise themselves when they hear themselves telling their children the same things their parents used to say. A common reaction might be, "I can't believe I said that. I'm turning into my mother." Most likely they harbored the belief for some time without being aware of it.

Psychologists distinguish between those beliefs of which we are consciously aware from those of which we are not by referring to the former as explicit beliefs and the latter as implicit beliefs. As Harman (1986) has noted, explicit beliefs are available for conscious inspection. They generally involve an explicit conscious representation and may be (more or less) easily expressed in verbal terms.

Although implicit beliefs share the characteristic of being relatively unavailable in conscious expression and representation, they may take several forms. First, they may constitute basic assumptions we take so for granted that we do not generally give them conscious expression. Such implicit beliefs include the assumption that our senses are currently providing accurate information. Second, we may have insufficient clarity to articulate the belief, as when we describe them as gut feelings, or intuitions. Third, implicit beliefs may consist of (logical) conclusions that may be arrived at by reasoning from existing beliefs. This

type of belief might include the beliefs that the sun will rise tomorrow, and that the earth will not explode in the next 10 minutes. Many of our expectations fall under this category. A fourth type of implicit belief consists of repressed beliefs, which we may withhold from conscious scrutiny. Often such beliefs may be acted upon unconsciously before they can be represented consciously. For example, one may believe picnics are messy affairs as a means to mask one's embarrassment over being afraid of possible encounters with ants and other outdoor insects.

It should also be noted that implicit beliefs may become explicit. That is to say, we may exert the type of effort necessary to become aware of a belief that was previously implicit. This may be done through personal reflection upon our beliefs, assumptions, inclinations, etc. . . . It may be accomplished by studying our own physical behavior (e.g., via memory or videotape). Or it may be accomplished with the assistance of input from an outside observer.

One of the reasons awareness of a belief is so important is that it is related to our ability to scrutinize and alter that belief. Although we do not have to be consciously aware of a belief in order for it to change, conscious awareness makes it easier for us to explicitly evaluate its correspondence with reality and other beliefs. In addition, when we encounter new evidence, conscious awareness makes it easier to evaluate its correspondence with an existing belief. As a result, explicit beliefs tend to be less resistant to change than implicit beliefs.

Certainty

Beliefs also differ in the degree of certainty we have about them. In general, beliefs that are consistent with a greater amount of information tend to engender a greater degree of certainty than beliefs that are consistent with less information. However, just as with emotional investments, this is an idiosyncratic thing. For many people, it may suffice for only a small amount of supporting evidence to be available for them to have great certainty in their beliefs (Weinstock, 1999). For others (such as scientists or skeptics), even large amounts of evidence may be insufficient to produce a feeling of certainty (cf. Schmid-Petri, 2017). For instance, Weinstock (1999) found that some jurors quickly jumped to a firm verdict on the basis of only partial evidence while others reached only tentative verdicts on the basis of all the evidence presented. In addition, some of the jurors seemed highly certain while others were less certain about the verdicts they reached based on the same evidence. Other factors playing a role in certainty include prior experience with the subject and the perceived value of the information used to judge how certain one feels.

Importance

In addition to awareness and certainty, beliefs differ in how important they are to us. This is true in at least two different ways. First, as noted above, central

beliefs tend to be more important to us than peripheral beliefs. That is, the more central a belief is, the more different inferences and beliefs depend on that belief. This makes important beliefs more resistant to change than unimportant beliefs. Second, some beliefs are more important to us emotionally than other beliefs. That is, we may be more emotionally attached to some beliefs than others. For most of us, it is more important to believe we are rational people than it is to believe there are nine planets in our solar system. Most of us will go to greater lengths to retain the former than the latter. As we will see in Chapters 4 and 5, the stronger the emotional attachment we have toward a belief the harder it is to change that belief.

One important point to consider here is whether importance should be attributed to beliefs or, instead, to the states of affairs that are the targets of beliefs. It might be argued, for instance, that it is not the belief that you are a good person that is important, it's being a good person. Although this is generally true, there are also instances when a belief is so important to us that it may become divorced from reality. For instance, while being a good person may not actually be important to Mr. Smith, it may be important to his self-esteem that he believe he is a good person. Mr. Smith may therefore engage in behaviors that are bad while preserving his belief (e.g., through rationalization or self-delusion) that he is a good person.

Functions of Beliefs

Beliefs Circumscribe Reality

Many of the reasons resistance is important stem from the functions of our beliefs. A common assumption of constructivist psychologists is that our beliefs determine our reality (e.g., Piaget, 1954; Snyder, 1984). The truth of this claim is evident in several ways. First, our beliefs constitute the subjective psychological embodiment of the characteristics we, and the universe, are thought to possess. Bem (1970, p. 5) has observed, "Collectively, a man's beliefs compose his understanding of himself and his environment." Second, our beliefs serve as lenses through which we view the world. The characteristics and categories ensconced in our beliefs are the ones we seek and detect in the world. Third, things and events that we do not believe often escape our detection (consider Wayne Dyer's (2001) book, *You'll See It When You Believe It* or Einstein's famous quote, "It is the theory that determines what we can observe" (1926). Thus, beliefs serve a central role in the construction of reality as we know it. And anything that influences our beliefs has the potential to significantly influence how we see the world.

Beliefs Generate Expectations

Part of the importance of our beliefs comes from their role in generating expectations about what is to come. Although most organisms have inherited inborn

reflexive reactions to particular environmental stimuli, humans tend to outgrow most such responses during the first few months of life (cf Santrock, 2014). Unlike many other organisms, humans learn to predict the occurrence of stimuli and accumulate a repertoire of available responses that are expected to be suitable to various situations. Citing the work of George and Handlon (1957) Rokeach (1960, pp. 402–403) describes beliefs by saying, "In everyday terms, they are those stored memories whose contents specify for the organism what may be expected to happen." Piaget (1985, pp. 29–30) made a related point when he stated, "Anticipations depend on indexes announcing what is to come." These "indexes," which we call beliefs, consist of learned associations between events that enable people to predict the occurrence of one event from the occurrence of a preceding event.

Beliefs Guide Behavior

The importance of beliefs (and therefore of resistance) lies also in that they serve as guides to behavior. When one's beliefs are accurate they provide useful information that enables their possessor to achieve various ends. If we believe the actions we select will each produce a particular consequence then we may use that information to select those actions that lead to the consequences we expect to be most favorable. In this sense, our beliefs constitute the seeds of our actions, and different beliefs yield different actions. This is probably the basis of the biblical admonition, "As a man thinketh in his heart so is he." It is also probably what James Allen (1989, pp. 11–12) had in mind when he wrote, "As the plant springs from, and could not be without, the seed, so every act of man springs from the hidden seeds of thought, and could not have appeared without them."

At the same time, the explanations, expectations, and options available to us at any given time are limited by the repetoire of beliefs we possess. As a result, our beliefs constitute a limiting factor in determining not only our perceptions of reality but also the resources available to us throughout our lives. In this sense, our beliefs are simultaneously the fruit and jailers of our thought, making options available and setting limits on our interaction with the world, much as genotypes are associated with a reaction range limiting the phenotypes that are possible. Piaget (1985, p. 28) referred to this as the "norm of accommodations."

Beliefs and Learning

Acquisition and Formation of Beliefs

Learning is best defined as the process by which one acquires information. However, a moment of reflection should confirm that learning is simultaneously the process by which beliefs are formed. That is, as we acquire new

information, we are, in effect, forming beliefs about the nature of the world around and/or within us. When a child learns that if he lets go of a ball it will fall to the ground, he is simultaneously forming a belief about what will happen when he lets go of the ball. This is true whether the information is acquired by instruction, imitation, or discovery. In all the different forms of learning the process of learning has not been completed until the individual forms a belief about the nature of reality. In this sense, learning is not technically the acquisition of information but rather the formation of beliefs. That is, the information is not "acquired" until the belief has been formed.

Deletion of Beliefs

Another way in which learning occurs is through the deletion of existing information/beliefs. For many centuries it was believed that the earth is flat. However, as additional information became available it became clear that the earth is not flat, and so the belief that it is had to be deleted, if we were going to preserve consistency between our beliefs and the available evidence.

Modification of Beliefs

Learning may also consist of the modification of existing beliefs. In this case, information has still been acquired, but the new information does not cause the formation of a new belief or deletion of an old belief. For instance, if one believes that all objects will fall to the ground when they are released, and then releases a helium-filled balloon, the original belief will be proven to be an overgeneralization. At that point, it may be modified to something like, "Most objects fall to the ground when they are released," or "All objects that are heavier than air will fall to the ground when released." This enables us to maintain much of the original belief and thereby preserve the information it contains.

Embedding/Disembedding of Beliefs

In addition to the formation and modification of beliefs they may also become more, or less, embedded within a network of existing beliefs. For instance, if you believe people are basically good, and then witness your cousin engage in an altruistic act, it may enable you to form the belief that that cousin is basically good. It may also bolster your belief that people are basically good. The new evidence serves to further embed your belief about your cousin in the larger network of beliefs about the goodness of people. On the other hand, if you have already formed the belief that your cousin is good, and then witness your cousin perform an act that is bad, it may weaken your belief that your cousin is good. It may also weaken your larger belief that people are good, though perhaps not to the point of causing you to eradicate either belief.

It should be clear by now that beliefs play a central role in the affairs of mankind. They circumscribe our reality, determine our expectations, and guide our behavior. With the exception of our reflexes and vital functions, there is hardly any aspect of human behavior that is unaffected by our beliefs. This means that any general proclivities that influence the development of our beliefs have the potential to influence our behavior. It is a central contention of this book that the proclivity to resist changing our beliefs may serve as an ever present impediment to adapting to new information, and, therefore, to growth. Of course, not everything that interferes with learning is resistance. There are many other possible impediments, including distraction, disability, poor diet, and even bad advice. And the consequences of failing to adapt our beliefs to reality may not be entirely undesirable, as benefits of pragmatic concerns may outweigh the costs of inflexibility. Nonetheless, resistance remains one of the least understood bottlenecks of learning. Let us, therefore, begin to examine resistance more carefully.

Notes

1. Although this is necessary to convey the breadth of the tendency toward resistance, it makes it necessary to concede two important points at the outset. First, it is readily acknowledged that by using such a broad range of exemplars the authors risk obfuscating important differences in the way we think in, and about, different domains and contexts. It is hoped that the patient reader will tolerate the comparison of psychological apples and oranges in an effort to discover common underlying characteristics. Second, it is conceded that coverage of these various domains may be uneven, and perhaps at times so thin as to boarder on over generalization. This is partly due to the paucity of available scientific evidence and partly also to a relative paucity of our own available temporal and physical resources. In such areas the available evidence will be construed as suggestive rather than definitive, and so acknowledged to be subject to possible disconfirmation through further research.
2. It may be claimed that all beliefs are subjective in the sense that they exist in the mind of the individual. However, we are calling beliefs objective if they pertain to external (i.e., tangible, or publicly observable and verifiable) reality and subjective if they either pertain to our internal state (e.g., our emotional state) or are descriptions of external physical reality that are strongly influenced by our internal state.
3. Note that this idea relates closely to the social judgment theory by Sherif and Hovland (1981).
4. In many models, beliefs constitute the cognitive component of attitude and may or may not be consistent with one's emotional reactions toward something. I may believe I am a brave person, yet I feel fear when confronted by an emergency situation, and may even shy away from helping if my fear is great enough, but in most cases one's beliefs, emotions, and actions are consistent with each other.

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When considering the relationship between learning and existing beliefs, it appears that our existing beliefs may limit our ability to learn by triggering mechanisms that restrict the range of new (especially incompatible) beliefs we are willing to entertain. For many reasons, new information that challenges our existing beliefs is treated differently from similar new information that is compatible with our existing beliefs (e.g., Lord et al., 1979). Thus, what we already believe exerts a powerful influence on how we interact with new information and, thereby, on our probability of not only accepting new information but even of noticing such information. In other words, what we already believe makes it relatively easy to acquire some new (compatible) beliefs and relatively more difficult to acquire other new (incompatible) beliefs. In addition, this general tendency is reinforced by emotional, social, and even physical factors. These limiting influences have some benefits, but may also prove deleterious when the new alternative is superior to our existing beliefs.

As suggested above, the purpose of this book is to improve our understanding of learning by taking a fresh look at how prior knowledge influences our learning, and by implication, the effectiveness of learning systems. In the chapters to follow, the phenomenon of resistance will be explored across several domains, though the paucity of available empirical research will render some of our conclusions more suggestive than definitive.

Before we continue, we should note that we are not claiming that inertia explains all misunderstanding and inability. These are frequently caused by a lack of information, or an inadequate perspective, and may often be easily remedied by learning new facts, or altering our interpretive framework. Nonetheless, some misunderstanding and inability are caused by inertia and so we wish to examine the role of inertia in some detail.

Note

1. Of course, each of these can be subdivided considerably. For instance, cognition subsumes memory, analysis, creativity, synthesis of information, problem solving, decision making, etc. . . . Emotions include joy, sadness, surprise, and a large number of specific affective reactions and motivations. Our physical capabilities include a practically unlimited number of voluntary and involuntary, homeostatic and homeorhetic, adaptive and sometimes not so adaptive capabilities. And there are different types of social influences, such as those coming from parents, teachers, and friends, and strangers that affect our ability and willingness to change our beliefs and learn.

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information and detecting erroneous beliefs. And yet, we all hold some false belief, even highly intelligent trained experts. Part of the answer may lie in the observation offered by Nisbett and Ross (1980, p. 192): "Peoples tendencies to persevere in their beliefs are so striking as to raise the possibility that such perseverance serves goals that may be more fundamental than holding correct views of particular issues."[2] Perhaps the logic of reason is not the only logic at work here. Perhaps resistance to changing our beliefs (and the resulting limitations to learning) is a multidimensional phenomenon. Perhaps we should also consider the "logics" of emotions, social contexts, and even physics, and the diverse mechanisms within each by which beliefs are preserved in the face of disconfirming evidence, even as we acknowledge interactions between domains.

Fourth, the broad range of conditions under which resistance occurs suggests that it may offer a useful new perspective for understanding many diverse human tendencies that have been acknowledged for centuries but have not heretofore been considered related. Perhaps resistance offers a way to integrate many disparate psychological phenomena within a unifying framework that incorporates some existing theories as special cases within a broader explanation of human learning, growth, and development.

Fifth, although some benefits may accrue from simply identifying the mechanisms of resistance, still greater benefits may be gained by using that knowledge to facilitate adaptation. For instance, because adaptation is a broader goal that requires successful learning to achieve, it is clear that learning plays a central role in successful adaptation. This suggests that part of the importance of understanding the role of resistance lies in the possibility of using this information to design learning systems that overcome resistance and enable the learner to achieve desired levels of competence, perhaps at a much faster rate than by using traditional systems. This also relates to a broad range of questions about the best way to prepare teachers and nurture successful educational reform. Despite the investments of many very bright minds and a great deal of money, there appears to be no consensus about the causes of school failure or the solutions, even as too many students fall through the cracks of our educational systems. Perhaps a careful examination of resistance will help.

Notes

1. Jean Piaget's (1954) book, *The Construction of Reality in the Child*, provides interesting insights into this process of construction.
2. Also see Haselton and Buss'(2000) article about error management theory, for a discussion of how preserving some errors may have survival value.

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many exceptions should I offer you before you are absolutely convinced you are right?" The obvious fact is, of course, that exceptions do not prove the rule. In science, it is precisely the discovery of exceptions that disproves accepted theories (see Thomas Kuhn, 1970 and Popper, 2002). However, this is a handy response that serves to deflect from the acknowledgement of evidence that disconfirms our trusted beliefs.

What is particularly troublesome about such forms of discounting as trivialization and subtyping is that we may oppose any discrepant information that comes our way by these methods. As Kunda and Oleson (1995) noted, it is nearly always possible to find some piece of information that enables us to determine that the deviant evidence is somehow atypical, and therefore presumably nonrepresentative, of the more general population.

Notes

1. Two interesting exceptions to this claim are habituation, in which we decrease a response to a repeatedly, or persistently, presented stimulus, and dishabituation, in which habituation is followed by an increase in response when the stimulus is changed. However, experiments on these phenomena typically have one stimulus as the focus of attention. In everyday life this is unlikely to occur with the numerous stimuli that fall outside of our central focus. Unless they are important, they are usually processed automatically.
2. It should be noted that recency effects have also been detected, in which more recently receive information may exert a greater influence than earlier received information (e.g., Cromwell, 1950; Hogarth and Einhorn, 1992).

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> land. This divorce between man and his life, the actor and his setting, is properly the feeling of absurdity.
>
> *(Camus, 1991, p. 6)*

One of the problems with religious beliefs, however, is that it is difficult to support them with empirical evidence. As a result, many people claim that their belief in God is based on faith. This is a curious phenomenon in which the standards used to bolster our beliefs about everyday reality (e.g., "I'll believe it when I see it") are loosened, or replaced by more lenient standards ("The Lord works in mysterious ways"), as evidence and logic give way to faith as the criteria of belief. But faith provides a poor epistemic foundation for our convictions about the origins and safety of the universe. As a result, many people are insecure about their religious beliefs. This is manifested in many different ways. For some people it plays out as a need to have their religious views confirmed by others, either by affiliating with people who share their beliefs, or by converting others to their views. This allows our religious beliefs to be reinforced by significant others. But the possession by others of different religious beliefs than ours is sometimes taken as a threat to our understanding of how the universe works, and therefore our security. Perhaps this is why some people are so sensitive to challenges to their religious beliefs. We already fear these beliefs cannot withstand a strong challenge on logical or empirical grounds, but there is so much to lose. As a result, religious beliefs resist disconfirmation through physical evidence.

But it's more than that. We also often find evidence of approval and opposition modes in religion. In general, we tend to approve of people and events surrounding our own personal religion. For example, we display the halo effect when we assume that God is benevolent and that he is looking out for us. Any claim that God is not benevolent may be met with the response that he only hurts wrongdoers. Also, those who share our religious beliefs are often perceived as fellow chosen ones. They are given the benefit of the doubt more readily than others, who, in turn, are assumed to not understand, or not be enlightened. On the other hand, we tend to oppose religions and their followers, who disagree with our own religious views. For example, we tend to display the horn effect when we demonize the disbelievers (e.g., as heathens) and assume that they will suffer eternal damnation in hell for their blasphemy. And when many people enter into religious debates, they display evidence of polarization, as attacks by the other side are sometimes interpreted as attempts by the devil to undermine our faith in God, evincing yet stronger evidence of faith.

Notes

1. This does not mean that we cannot recall events that are inconsistent with our current emotional state, only that it is easier to recall emotion-consistent experiences than emotion-inconsistent experiences.

2. These findings are generally consistent with Jonathan Haidt's (2013) idea that passion uses logic for its own ends.
3. We readily acknowledge that this way of describing emotional reactions is overly simplified, yet we believe the benefits of doing so outweigh the risks.
4. Of course, this is not to deny that we may simultaneously feel an urge to both approach and avoid a given stimulus, only to note that the most general emotional evaluations are these. More complex evaluations are possible as we consider multiple perspectives, or dimensions, of the same stimulus.
5. Note, however, that open and closed mindedness are not the same as agreement and disagreement, as one may be open minded and still disagree with a specific claim or closed minded and still agree.

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test. But even scientists may disagree about the precise definition of the word "intelligence." And what if I am not referring to the type of intelligence that most intelligence tests measure? What if I mean that I think he is emotionally intelligent? And what if we don't happen to have an emotional intelligence test handy, or he doesn't take it? It is hard to find reliable evidence to confirm or disconfirm this claim. On the other hand, it may be easy to find anecdotal evidence on both sides of this claim. As a result, such abstract claims are difficult to disconfirm and so tend to persevere in the face of evidence that some people might consider objective. More generally, as a belief becomes more abstract, the amount and type of evidence necessary to confirm or disconfirm it may increase as may the number of ways in which some of the evidence may be interpreted.

Notes

1. This information also includes statements made by other people, such as parents or teachers.
2. Note that we do not have to form such a commitment, and often do not, explicitly, until forced by circumstances to do so (Everett, 2018). For example, there are some claims toward which we may be neutral, perhaps because we have insufficient information. And, there are some claims toward which we may be inclined to agree or disagree, but have insufficient evidence or reason to form a commitment.
3. This is a bit misleading. Punishment may also help one form, and support, the belief that a particular course of action is undesirable, since it produces negative consequences.

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be a few years before he can understand such abstract concepts, about himself or anyone else. In this case, his beliefs are held in place by a knowledge system that lacks the necessary information to incorporate abstract concepts, or make compatible changes. The demands on the child's existing knowledge are too great for the child to handle.

A related problem is what is referred to as the Dunning-Kruger effect. This refers to the inability of novices to correct their mistakes because they don't have the knowledge or skills shared by experts to either recognize their mistakes or to make the needed corrections. It is difficult to correct false beliefs when we lack the knowledge, or perspective, to recognize our own faults and limitations.

All of these reasons, and many others, impair our ability to learn. On the other hand, this is one place where other people may be helpful. We will return to some of these issues in Chapters 10 and 11.

Notes

1. Some people also talk about subschemas, such as one's knowledge about algebra, geometry, and trigonometry within math.
2. Other terms that are used to describe these systems include heuristic and systematic (Chaiken et al., 1989), fast and slow thinking (Kahneman, 2011), Type 1 and Type 2 (Stanovich, 2010), and System 1 and System 2 (Kahneman, 2011), and peripheral and central systems (Petty and Caciopo, 1986).
3. The following discussion assumes that a central goal of cognitive development is the acquisition and retention of true beliefs. While this perspective accurately characterizes our views, as individuals, teachers, and scientists, the reality is that there are many occasions in which this does not hold. That is, there are many circumstances in which we employ automatic thought processes because a high degree of certainty about our beliefs may not be worth the effort to attain. For example, it is not important enough to most people to know which is the best toothpaste to conduct independent scientific research, or even conduct a thorough review of the literature. Many of us choose a brand of toothpaste based on the word of our dentist, parent, or best friend. Under those conditions, we may feel sufficiently comfortable with incorrect beliefs to preserve them for an entire lifetime, with little regard for their accuracy. In addition, we may harbor beliefs that are discrepant with available evidence if we are gaining sufficient compensatory advantages. For example, hedonic interests may supersede epistemic interests.
4. Although we believe the search for, and evaluation of, evidence are governed primarily by controlled processes, the reality is that these processes are also affected by automatic and inertial processes, such as anchoring effects. As a result, the reader will find some correspondence between the ideas discussed here and those discussed earlier in the chapter.
5. Most of the evidence for excitatory and inhibitory attentional processes comes from the study of visual attention. Although our views are consistent with this body of research we acknowledge that much of what follows is speculative.

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physical change, and therefore must be overcome in order to revise our beliefs and reform our behavior.

Of course, this does not mean that our neural structures and pathways are fixed. Considerable research evidence shows that our synapses and neurons do change in response to the "external perturbations" induced by interacting with the world (Dudai, 2004; Greenough et al., 2002; Vetere, et al., 2011). We observed above that learning is mediated by modifications of synaptic connections in response to experience. Thus, cognition might be described as simply using existing neural structures while learning may be described as the modification of those structures (Kandel et al., 2013, Kosko, 1993). And learning occurs frequently. It is thus more appropriate to say that beliefs (and thought processes), and the neural structures and pathways that mediate them, tend to persevere unless they are modified by learning, where the effects of learning may be detected at the neural level.

This raises one final issue regarding biological resistance to belief change. Inertial resistance to belief change is likely neither intentional nor conscious. We don't plan to be "lazy." When we experience resistance at the neural level our simultaneous conscious reaction may simply be that the new information that is discrepant with our preexisting beliefs "does not compute." It doesn't make sense because our existing neural structures and pathways are inconsistent with the new information. It doesn't fit within our existing framework. In order to accommodate the discrepant new information, we may have to do some rewiring. But this frequently requires the allocation of conscious resources and deliberate, controlled thinking. Most of the time we can reconcile the discrepancies if only we are willing to make the necessary investment of thought and energy. For some people, or for most of us when the subject matter is insufficiently interesting, this is too much like work. The great effort needed to change isn't always worth it.

On the other hand, most of us have experienced occasional moments of enlightenment, in which we suddenly realize something important for the first time. This experience is sometimes summarized by the exclamation, "Aha!" This can be a groundbreaking, earth-shattering realization that changes everything we think is true. But now, the laziness is replaced by surging energy as the excitement of our realization inspires thought about related issues and beliefs. Under such conditions, our reaction to disconfirming a primitive belief may not be the fear suggested above, but rather fascination, as we feel that "now it all makes sense," and we establish a more powerful, and more stable, equilibrium than before.

Notes

1. It is ironic that we can "see" our own beliefs but not the neural structures that mediate them, while scientists can "see" our neural structures but not the beliefs they mediate.

2. What follows is not a complete list of our biological needs but rather a sample of some of the needs we think are most related to the resistance of our beliefs to change.
3. Suicide and self-sacrifice are notable exceptions.
4. It is also possible for neurons to decrease their sensitivity to incoming signals, through a process called "long-term depression."
5. Still another possibility is that there are no doxastic neural structures that have a different form than memories. Since beliefs are neither sensory nor motor experiences, they may be encoded in a different format neurologically than either of these. Perhaps beliefs are encoded neurologically as inferences made about our experiences, producing a different type of neural imprint than sensations or motor activities.
6. Additional processes that may contribute to belief anchoring may include long-term desensitization (the process by which connections between contiguous neurons are weakened) and dendritic arborization (the process by which neurons sprout more branches).
7. Not all studies of learning suffer from this specific limitation. Some studies examine neural processes associated with learning a skill in the fMRI machine and then have participants practice that skill outside the machine for a period of time, before coming back to have their brain activity measured by the fMRI machine at a future date (e.g., Lehericy et al., 2005).
8. We are deliberately neglecting the spiritual level.
9. The obvious exceptions are those involving learning, in which presumably we alter the available pathways. We will discuss this below.
10. The astute reader may object that his particular conceptualization of the physical relationship between stimuli and responses appears to suffer from the same limitation as traditional theories of operant conditioning in its implication that only preexisting responses are available for use. There is some truth to the contention that preexisting responses are the most likely candidates for selection in the current situation. This is especially true in the "routine" situations that make up the bulk of our experience. Even in novel situation, however, we tend to first try those responses that have proven effective in the past and appear to offer promise in the present. In the majority of cases, we do not go beyond the repertoire of responses that we already have available. Whether this is due to efficiency or laziness, it is an example of the inertia effect.

    However, there is nothing in our description of neural pathways that precludes the learning of novel responses. It must be acknowledged, however, that (responses encoded in) existing neural pathways may serve to both facilitate and constrain the learning of new alternatives. Facilitative effects derive from the fact that existing pathways/responses may serve as resources to be used in the acquisition (e.g., via instruction, etc.) or construction of new/novel responses. On the other hand, constraining effects derive from the possible limitations in the availability of neural substrates to mediate the acquisition or construction of a suitable novel response. Stated more prosaically, the problem is a little like having enough parts (and possibly the directions) to build a new car.

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every one of our beliefs. On the other hand, that inaccuracy can sometimes be fatal. And so, we have to find that balance that makes us comfortable. Yes, we can establish standards for rational beliefs, and rational belief change, but at the end of the day we must each find our own balance between epistemic benefits and pragmatic costs.

Notes

1. In the following discussion, we will use the term "survival" to include both survival and happiness. We acknowledge that they are not strictly the same thing. However, they share the property of being rational targets of human behavior.
2. Although we are not aware of any empirical research on this, indirect support for this idea has been reported with respect to the origination, survival, and decline of memes (Dawkins, 1989; Kelly, 1994). According to the Merriam-Webster Dictionary (2018), memes are "an idea, behavior, style, or usage that spreads from person to person within a culture." Dawkins (1989) and Kelly (1994) have argued that memes follow Darwinian principles of evolution, including the survival of the fittest and the tendency to become extinct under certain conditions. Although not all memes are beliefs, the fate of memes suggests that the same principles may apply to beliefs.
3. The astute reader may note the irony that many of these standards have been discussed in prior chapters, as factors that contribute to our resistance to belief change. Insofar as our epistemic standards serve as criteria for deciding if a proposition is true, then any proposition that satisfies these standards is switched over from possibility to truth, thereby invoking the defensive and inertial mechanisms discussed above. Nonetheless, we believe the epistemic and pragmatic value gained by satisfying these standards both outweigh and increase the risks of resistance to change.
4. Note that we are not claiming that in order for a belief to be true it must bear a one to one correspondence with reality. All of our beliefs would fail by that metric. Instead, we are suggesting that in order to qualify as true the mental representations constituting our inner reality must correspond in some meaningful way with our (outer) reality.
5. One notable exception to this tendency is when a person has a high need for cognitive consistency. Such people are more willing to invest the time and effort to achieve cognitive consistency than the rest of us because it is more important for them to have beliefs that are consistent with each other.
6. Recall that in Chapter 7 we referred to this as a form of resistance.

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In most programs of study, the learner must pass a final test in order to be formally acknowledged as an expert. An example of such a test in academia is the doctoral dissertation defense. This is a sort of interview in which experts in the field test the learner's knowledge and competence. In carpentry, the test may entail building a room. In plumbing, the test might entail refurbishing a set of pipes. Whatever the subject and form of the test, it presents an opportunity for the learner to display his competence to other experts. It is rare for unreasonable student resistance to survive this process. Most erroneous views will have been rooted out by the problem solving process, the mentor, other members on the testing committee, or the evidence itself. If all goes well, and the student successfully defends his work, he is admitted to the highest ranks of expertise in his field.

Perhaps most importantly of all, expertise training prepares students to engage in "objective" self-directed learning. Ideally, it helps the learner understand what types of evidence are most probative and how to obtain and interpret that type of evidence. It prepares the learner to notice details that novices tend to miss, and interpret those details accurately, as part of a coherent framework, relatively free of bias. It helps him recognize and overcome flaws in reasoning that produce and support biased interpretations of evidence, whether they occur in the service of cognitive, social, or emotional biases. And it prepares him to learn through collaborative interactions, with awareness of the biases of others and the ability to think openly, yet critically, about their beliefs and claims.

Finally, we should note that becoming an expert does not completely eradicate bias, even in one's domain of expertise. We noted previously that even experts may disagree about what is important and how to interpret evidence. We also noted that sometimes people with different perspectives are both correct. In politics, for example, we in America have Republicans and Democrats. To some extent, these are associated with different world views. Under such conditions, it may not be realistic to think we can win them over by "educating" them about the realities of life. Under such conditions, it may be best to engage in constructive dialogue and search for common ground, especially when joined in a search for solutions to pressing problems.

Notes

1. We are not referring to students suffering from learning disabilities, though we hope our ideas are helpful with those students.
2. Most educators would also include among the goals of education the enculturation of children to the norms of their society.
3. Many of these are also characteristics of the development of expertise (Ericsson and Charness, 1994; Sternberg, 1998).
4. Zander and Zander (2002) observe that a similar effect may be obtained in a personal conversation by informing the other person that you value his view, even if it differs from your own.
5. Rogoff (1990) calls this an "apprenticeship in thinking."

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