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The General Nature of Human Cognition and Learning: Probably Not Quite What You Think It Is

We human beings are hardly alone in our ability to learn from our experiences. Even snails and earthworms can acquire and remember new behaviors as their environmental circumstances change, and many mammals and birds can learn new skills simply by observing and modeling what their human or nonhuman companions do.[1] Yet as members of the species *homo sapiens* – Latin for "wise man" or "wise human" – we have several capabilities that far exceed those of our fellow residents on Planet Earth.

Key among our exceptional talents is an ability to communicate with one another using a grammatically complex and very flexible *language*. Our language provides a critical means through which we learn from other people's experiences and guidance. For example, if you want to fix a broken bicycle or bake chocolate chip cookies, you can ask other people – or read books or websites that other people have written – to guide you through the process. In addition, as you'll discover in Chapter 3, language also provides an important resource for *thinking* about our experiences.

Another thing that sets us apart is the fact that virtually all of us humans live within a certain *culture* that not only helps us learn new things but also serves as a repository of what we have collectively learned as a group.[2] Consider our many books, museums, universities, and Internet websites; all of these serve as shared "memories" of what various civilizations have learned over the ages.

Finally, much more so than is true for any other species, we human beings can *self-reflect* about the things we have learned and about our thoughts in general.[3] For example, we can mull over and evaluate our own and other people's ideas about, say, social or political issues, and we can integrate the many tidbits of information we've obtained from various

sources to draw conclusions, speculate about implications, and solve new problems.

Such mental self-reflection is known as *metacognition*, a topic we'll explore in depth in Chapter 7. But in fact, this entire book is the result of countless researchers' attempts to reflect on and try to explain the nature of human thinking and learning. In this short book, we can only skim the surface of what has become a complex, multifaceted, exponentially increasing field of scientific inquiry. Nevertheless, as your author, I'm hoping that by the end of the book, you'll have a better understanding of how we humans think about, learn, and remember aspects of our day-to-day experiences – and why we often *don't* think about, learn, and remember them. I'm hoping, too, that you'll be able to apply your new knowledge both in your own future learning activities and also in your efforts to help others learn effectively – whether such efforts be in a role as parent, teacher, workplace supervisor, journalist, website designer, or general member of our society and culture.

WHAT WE USUALLY *DON'T* AND *CAN'T* DO WHEN WE THINK AND LEARN

In my own experiences as a psychologist, teacher, parent, friend, consultant, and citizen, I've found that many people have significant misconceptions about what our minds can do for us. I'll be presenting common misconceptions throughout the book – 28 of them altogether – and again in the Appendix that immediately follows Chapter 10. For now, I want to alert you to three especially pervasive ones.

> Misconception #1: That our minds mentally record every piece of information we encounter

Many people mistakenly believe that somehow we absorb and mentally "keep" everything we see and hear. But as you'll see in upcoming chapters, and especially in Chapter 4, we really don't have the hardware and software to save every tidbit that comes our way. Much as we might like them to be, our minds aren't video cameras or audio recorders. Ultimately, we probably capture only a tiny fraction of the environmental stimuli that bombard us at every waking moment.

> Misconception #2: That our minds record information exactly as we receive it

Quite the opposite is true. Right from the get-go, we humans mentally *do* something with much of the information we get: Our minds change and condense it in ways that enable us to remember it more effectively. Thus, we should never assume that our recollections of information and events are accurate ones. Nor should we assume that other people's recollections are accurate, no matter how confidently and self-assuredly those individuals describe the "facts" of the matter.

> Misconception #3: That occasional forgetfulness is a sign that something is wrong with our mental hardware

No, not at all. Some absent-mindedness is perfectly normal in people of all ages. Usually the problem isn't one of forgetting something altogether, but rather of failing to remember it *when we need it* – for example, completely forgetting about errands we've wanted to complete or appointments we've made for later in the day.

Chronic forgetfulness can sometimes indicate significant mental impairment or decline. But especially if we lead complicated lives with many distractions, virtually all of us occasionally forget something we've really wanted to remember. I'll talk more about this problem, including strategies for addressing it, in Chapter 6.

WHAT WE TYPICALLY *DO* DO WHEN WE THINK AND LEARN

Over our long history of evolving to become the species *homo sapiens*, we have ingeniously adapted to the limitations of our biology-based mental equipment. Two general principles characterize key strategies we use to make the most of our experiences. First, *we summarize and try to organize the information we obtain from our environment*. We seem to be predisposed to find patterns and consistencies in what we observe. This inclination toward identifying regularities in our world appears quite early in life, and it's undoubtedly a central reason why we acquire language as quickly and easily as we do.[4]

To see this summarizing/organizing principle in action, look at Figure 1.1. I doubt very much that you see only black marks scattered randomly about. Instead, you probably see several rows of circles, and you probably also see the larger circles forming two diagonal lines that crisscross each other in the middle. Perceiving all of these things – the circles, the rows, the diagonal lines, and the crisscross – reflects your own mental efforts to organize what you're looking at.

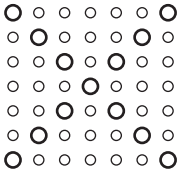

FIGURE 1.1. What do you see here?

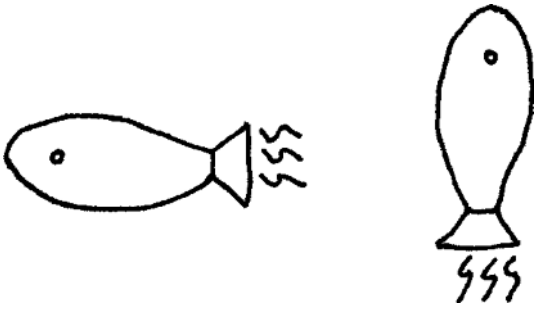

FIGURE 1.2. Here are two views of the same object. What might this object be?

I'm guessing that, in addition, you see the letter *X* in Figure 1.1, which illustrates a second general principle: *We try to impose meaning on the information we obtain*. As a rule, we humans seem determined to make some sort of sense of our experiences. At our very core, we are meaning makers. To see what I mean, look at Figure 1.2, which shows the same object in two orientations, one being a 90-degree rotation of the other. What is this object? Give it a label of some sort.

If you focus your attention on the left-hand version of the object, you might think that it's a fish or submarine going through water. If, instead, you look more closely at the right-hand version, you might perhaps think that it's a rocket ship launching into space. In each of these cases, you might interpret the three squiggly lines as indicating some sort of *movement* of the object. Alternatively, you might think of the squiggly lines in the right-hand version as reflecting the movement of *air* – perhaps as a vacuum cleaner sucks up dirt from a carpet. The object isn't necessarily a fish, submarine, rocket, or vacuum cleaner, of course; it could be something else altogether, or it could be just a collection of black marks that have no meaning whatsoever.

Sometimes most of us can agree on the meanings we attach to certain objects or events. For example, if we see objects of a particular shape moving in a particular way in a lake or river, we might all agree that those objects are "fish." And we'd probably all agree that we're looking at a "vacuum cleaner" if the object makes an irritating noise and if a person is moving it slowly and systematically across a carpet.

On other occasions, we might have trouble reaching consensus about what something means. For instance, people's body language can be notoriously ambiguous and hard to interpret with certainty. What does it mean when a person *smiles* at you? Is the person simply feeling happy? offering a gesture of friendship? feeling smug about winning a highly competitive event? trying to manipulate you in some way? It could be any of these things.

EMPIRICAL AND THEORETICAL BASES FOR THE BOOK

As I continue to talk about human cognition and learning in the pages ahead, I'll be basing my statements on research findings in psychology, neuroscience, and such related fields as neuropsychology and the learning sciences. (These fields overlap considerably, with various theorists often disagreeing about where one field ends and another begins.) Although I'll occasionally be able to describe specific processes that occur in the brain, for the most part I'll be relying on studies of observable, measureable human behaviors. Such is the nature of psychological inquiry: to observe what people *do* and then draw reasonable inferences about how people *think*.

If you have some background in psychology, you may notice that I don't cite my sources in parentheses within the text. Thus, I don't use the writing style that the American Psychological Association (APA) recommends. Instead, I cite my sources in "Endnotes" sections at the end of each chapter. My reasoning for this departure from APA format is simple: Lists of many names and dates within a paragraph can be quite a distraction for readers whose primary goal is to *understand* what I'm saying. By all means, please make use of the sources I cite in the endnotes to learn more about particular points I make in the book.

DEFINING BASIC TERMS

Before we go any further, you and I need to be on the same page regarding the meanings of certain words. Following are a few terms that are central to the entire book.

First, consider the title of this first chapter: "The General Nature of Human Cognition and Learning." Psychologists often use the term **cognition** to encompass all the internal mental processes that occur in our heads as we go through our daily lives. Many psychologists also make an implicit distinction between *brain* and *mind*. The **brain**, of course, is our basic thinking hardware; it provides the neurological underpinnings for everything we do mentally. By the term **mind**, psychologists are often referring to *psychological* phenomena either in addition to or instead of *physiological* phenomena. For example, the concept of mind encompasses the many memories we experience, the many mental strategies we use to help us learn and remember things more effectively, and our general awareness of ourselves as thinking, remembering, and forgetting individuals.

Is the mind nothing more than a collection of brain-based processes – that is, are mind and brain one and the same – or do our minds also involve processes that in some way transcend our physical brains? And what about our general awareness of ourselves as thinkers – that is, our consciousness? Such existential questions are likely to remain unresolved for the foreseeable future.[5] Thus, I'll largely ignore them in this book, although I'll touch briefly on the concept of consciousness in Chapter 4.

Two other key concepts are *learning* and *memory*. For purposes of this book, the word **learning** refers to a long-term change in mental representations or associations as a result of experience. Three parts of this definition are important to note. First, learning involves a *long-term change*: It has an impact for quite a while, although not necessarily forever. Second, learning involves a change in *mental representations or associations*; in other words, it's an internal, mind- or brain-based phenomenon.[6] And third, learning is a *result of experience*; it isn't a change due to, say, mood swings, fatigue, mind-altering substances, or the onset of mental illness.

Meanwhile, the word **memory** can be used in either of two ways. In some instances it refers to a general ability to retain information or skills over a lengthy period. In other cases it refers to a specific "location" where ideas and skills are saved – for example, in "working memory" or

"long-term memory." Keep in mind, however, that these supposed "locations" aren't really discrete parts of our brains; rather, they're psychologists' labels for different components of our complex memory system (more about this point as well in Chapter 4).

BEING STRATEGIC

Our brains don't come with owners' manuals. And without such manuals, most of us tend to be quite naive and ill-informed in our approaches to new learning and teaching situations. The next two misconceptions illustrate the problem:

> Misconception #4: That we intuitively know how we can best learn and remember something new
>
> Misconception #5: That we intuitively know how we can most effectively teach other people new knowledge and skills

Sadly, many people of all ages think that the best way to learn a new fact is simply to repeat it over and over. And some teachers seem to emphasize drill-and-practice exercises in their instructional methods. As you'll see in the discussion of automaticity in Chapter 5, repetition and drill-and-practice do have their place, but as a general rule they're *not* terribly effective ways to either learn or teach new knowledge and skills.

By and large, effective learning and effective teaching require conscious, intentional, planful *strategies*. Sometimes we develop such strategies on our own, but we typically do so only after we've undergone a fair amount of trial and error with relatively mindless approaches. Fortunately, with appropriate guidance and support from others, we can acquire many good strategies, the result being that we become far more successful and efficient learners and teachers. In other words, we can greatly enhance our own and others' brainpower.

Consistent with my optimism about what we *can* do if we use the right strategies, each chapter in this book has a "Being Strategic" section that includes both (a) self-strategies for enhancing thinking and learning in your own everyday life and (b) formal and informal instructional strategies for enhancing thinking and learning in other people. Those other people might be students (if you're a teacher), employees (if you're a boss or supervisor), or readers of your work (if you're a writer or Internet blogger). I'll often use the word *students* in my instructional strategies, but I urge you

to interpret the word quite loosely to encompass virtually anyone who might benefit from your guidance and support.

At this point in the book, we haven't yet delved into the nitty-gritties of human cognition. Even so, we can derive a few implications from the ideas and principles we've discussed so far.

Enhancing Your Own Thinking and Learning in Everyday Life

- **Self-Strategy 1.1: Be realistic about how much you can learn and remember in any given time period**. You will never remember everything you see and hear. Don't even try. However, you might find some comfort in the fact that if you become a more strategic learner, you can enhance your memory quite a bit.
- **Self-Strategy 1.2: Focus on making reasonable sense of various information and events you encounter**. Remember, we humans are predisposed to find meanings in the things we see and hear. For the most part, your meaning-making tendencies will work to your advantage, although they'll sometimes lead you astray – a problem I'll discuss in greater depth in Chapters 3 and 8.
- **Self-Strategy 1.3: Look for patterns in what you observe**. On average, organizing what you see and hear can help you remember it better. There's an important caveat here: To the extent that you organize it incorrectly – perhaps by lumping two or more very different entities into a single category that doesn't accurately represent them, or perhaps by identifying a cause-and-effect relationship that doesn't really exist – your understanding of a situation might be way off the mark. Chapter 8 will address this problem as well.
- **Self-Strategy 1.4: Never trust your memory to be a complete, accurate record of your experiences**. No matter how convinced you are that you saw an event unfold in a particular way or that you heard somebody make a particular statement, your memory might not be a good representation of what actually happened. If you want to remember something accurately, it's best to rely on an external record of the event – say, by taking notes in a lecture class or making a video or audio recording of an important interview or other conversation.

Enhancing Other People's Thinking and Learning in Instructional Settings

- **Instructional Strategy 1.1: Help people find productive meanings in what they see and hear**. Especially when people are novices in a particular activity or subject area, they don't always know how to make reasonable sense of what they're observing. One way to help them make better sense is to draw their attention to noteworthy aspects of a situation. For example, if you're using a map of Europe to teach high school students about Napoleon Bonaparte's rise to power in the late 1700s and early 1800s, you might point out how controlling certain rivers, ports, and other locations on the map were critical for Napoleon's conquests. And if you're coaching a soccer team (this would be a "football" team if you were anywhere other than in the United States or Canada), you might draw team members' attention to the footwork techniques that professional players use to keep the ball away from their opponents. Another way to help people in their sense making is to attach meaningful labels to what they're observing – for instance, by explaining how people's experiences on some amusement-park rides illustrate *centrifugal force* or by identifying various trees on a nature walk as being either *deciduous* or *evergreen*.
- **Instructional Strategy 1.2: Provide one or more organizational structures to help people make sense of new information and synthesize it into larger, more integrated understandings**. For example, if you were to introduce a visitor to a large city you know well, you might (in New York) provide a simple map of key subway lines in downtown Manhattan or (in Boston) explain how streets in one popular part of the city are labeled alphabetically from east to west – first Arlington and then Berkeley, Clarendon, and so on up to Hereford. And as a 60-something woman who has been at the receiving end of piano lessons this year, I've been quite grateful for the many times my teacher has pointed out certain repetitive patterns in what have initially struck me as arbitrary series of notes on the page.
- **Instructional Strategy 1.3: Foster meaning making not only in how you teach others but also in how you assess their final knowledge and achievements**. If you currently teach or plan to teach in a formal educational setting, you should keep in mind that students are apt to focus their efforts on mastering the things they expect you to test them on. For example, if you tell students that you want them to *understand* a topic but then give them a hastily constructed exam that requires

word-for-word recall of specific, unrelated facts, they'll quickly figure out that they can get the best grades if they devote their studying efforts more to rote memorization than to genuine meaning making. You must think of any quizzes, exams, and other assessment methods you use as being *integral parts* of your instruction – not as separate, unrelated activities – because they'll give students clear messages about what things are most important for them to learn and remember.

NOTES

1. Aplin et al., 2015; Datta, 1962; de Waal, 2016; Heyes & Galef, 1996; Samarova et al., 2005.
2. Some research has detected primitive forms of a "culture" in certain other species as well (e.g., see Aplin et al., 2015; Boesch, 2012), but nothing that approaches the sophistication of human cultures.
3. For examples of self-reflection in other animals, see Foote & Crystal, 2007; Kornell, 2009.
4. Chomsky, 2006; Dewar & Xu, 2010; Mandler, 2007; Quinn, 2007.
5. For varying perspectives, see Dehaene, 2007; Fernández-Espejo et al., 2011; Kaku, 2014; G. A. Miller, 2010; Paller, Voss, & Westerberg, 2009; Siegel, 2012.
6. If you have a background in psychology, you might realize that this part of the definition conflicts with traditional behaviorists' view of learning, which involves a change in observable behavior rather than a change in a mental entity.