TEACHING *that* STICKS

Chip Heath & Dan Heath

"Teaching that Sticks" is an article written by Chip Heath and Dan Heath, the authors of the book *Made to Stick: Why Some Ideas Survive and Others Die*, published by Random House in January 2007.

Some of the material in this article comes from *Made to Stick*.

This edition of "Teaching that Sticks" was published on November 6, 2007.

TEACHING THAT STICKS

So a friend of a friend of ours, who's a frequent business traveler, was returning recently from a meeting with clients, and he stopped into the airport bar. What happened next surprised him: An attractive woman approached him and offered to buy him a drink. He said sure. She returned with two drinks, he took a sip of his, and ... that's the last thing he remembered.

Until he woke up in a bathtub full of ice. With his kidneys missing.

Rough day.

You've probably heard this urban legend about "kidney thieves." It's an absurd idea. You'll probably meet someone, at some point in your life, who swears it happened to their friend's cousin, but it didn't. It's 100% urban legend. Yet everyone seems to know it—even in other languages and other cultures. It's an idea that has stuck.

A sticky idea is an idea that's understood, that's remembered, and that changes something (opinions, behaviors, values). As a teacher, you're on the front lines of stickiness. Every single day, you've got to wake up in the morning and go make ideas stick. And let's face it, this is no easy mission. Few students burst into the classroom, giddy with anticipation, ready for the latest lesson on punctuation, polynomials, or pilgrims.

So, given the difficulty of your mission, and the importance of it, it's annoying that dumb ideas (like the kidney thieves legend) seem to stick so effortlessly. What's even more irritating is that urban legends don't have any resources behind them. There's no textbook budget, lesson plan, or training program for an urban legend. Nor are there any *people* behind them! They stick on their own merits. There's just something about the way these ideas are constructed that makes them "naturally sticky."

And it's not just sleazy ideas that stick naturally, it's a whole world of other ideas: proverbs ("A bird in hand...") and fables ("The Tortoise and the Hare") and conspiracy theories (black helicopters) and religious stories (the Good Samaritan) and fad diets (Atkins) and scientific ideas (relativity). Some of these ideas are profound, some are ridiculous, but they all stick. Why? What links them?

The two of us—Chip and Dan Heath, we're brothers and now co-authors—have been studying successful ideas like these for years, trying to reverse engineer them. What we've found in our research is that these ideas share common traits. You can actually spot the same trait in a successful conspiracy theory that you can spot in a successful history lesson. The content is vastly different, but the "idea design" is similar.

We've discovered 6 traits that make ideas stickier. A sticky idea is:

1. Simple
2. Unexpected
3. Concrete
4. Credible
5. Emotional
6. Story

We wrote a book about these 6 traits called *Made to Stick: Why Some Ideas Survive and Others Die*. In this article, we'll give you an overview of the 6 traits and how they apply to teaching. (If you like this guide, it's pretty clear you'll like the book, which goes into much more depth on these topics.)

Here's the good news about stickiness: This isn't just interesting trivia about how the world of ideas works. Rather, it's a playbook. There are very practical ways that you can make your teaching stickier. For instance, every Earth Science class has a lesson on the Earth's magnetic field. But one teacher decided to add a bit of mystery. She asked the students: "Did you know that if you'd been holding a compass 25,000 years ago, and you were walking 'North' according to the compass, you'd be headed straight for the South Pole?" That's an example of a "curiosity gap," a technique we'll discuss in the Unexpected section.

We hope to inspire you in this article by telling stories of teachers who made their lessons stick, and we'll show you how to apply the same principles to your own lessons. Regardless of your level of "natural creativity," we'll show you how a little focused effort can make almost any idea stickier. And a sticky idea is one that's more likely to make a difference.

There are very practical ways that you can make your teaching stickier.

SIMPLE

Journalists use a model of writing called the "inverted pyramid," which demands that the most important news be put in the first paragraph, and then, with each successive paragraph, the news value declines. One result of this is that it's easy to cut down a news article, if you need the space: You just lop off paragraphs from the bottom, since by definition they're the least important.

The hard part about writing using inverted-pyramid style is that it *forces you to prioritize*. As a journalist, you've got scads of information at your disposal, but you've got to winnow it down to the few pieces of information that deserve to be featured in the first paragraph.

This process of prioritization is the heart of simplicity. It's what we call "finding the core." Simplicity doesn't mean dumbing down, it means choosing. Some concepts are more critical than others. And as the teacher, you're the only one who can make that determination.

Andrew Carl Singer teaches a class on digital signal processing at the University of Illinois at Urbana-Champaign. It's a complex subject, and it's easy to get lost in the mathematics. So he works hard to find the core of his class. He said:

When a student from the University of Illinois interviews at a company and says "I took digital signal processing from Prof. Singer," what are the 3 things that they need to know to both get the job and make the University of Illinois proud to have this graduate working in this field? By focusing on the core ideas of the course, I whittled away the extraneous details that basically served to separate the A+++ students from the A++ students, but largely fell on deaf ears on the rest of the class.

Students need to understand what a mathematical model for a signal is, what happens when it is sampled, understand the concept of analog and digital frequency and how they are related, understand what happened when the digital signal is processed (in time and frequency) and what happens when this signal is then reintroduced to the analog world, through a digital-to-analog converter.

This set of core ideas can be visualized in a picture, where the signals that touch the world, say a musical recording, are sampled and become a digital file, this digital file is manipulated, and then the file is played out through a D/A converter. By showing this to the class at the beginning of the term and referring back to this example, I found I could keep the class on track to the core messages I wanted them to learn. I also focused on this core message when deciding what material to keep in the course and what should be left out.

So identifying your core message involves tough choices: What's in and what's out? Once you've decided what's "in," how do you communicate it as simply as possible?

Try the following exercise for some inspiration. Here are the rules: Spend 10-15 seconds, no more, studying the letters below. Then, look away from this article, pull out a sheet of paper, and write down as many letters as you can remember. Spoiler alert: Don't move on to the next page until you've finished the exercise.

J FKFB INAT OUP SNA SAI RS

If you're like most people, you probably remembered about 7-10 letters. That's not much information.

Now try the exercise again. There's a twist this time. We haven't changed the letters or the sequence. All we have done is change the way the letters are grouped. Once again, study the letters for 10-15 seconds, then click away and test your recall.

JFK FBI NATO UPS NASA IRS

Chances are, you did much better the second time. In Round 1, you were trying to remember raw data: 20 random letters. Round 2 was easier because you were simply highlighting 6 concepts you already knew: John F. Kennedy, the FBI, the North Atlantic Treaty Organization, UPS, NASA, the IRS.

This exercise shows us how we can communicate a lot of information in compact fashion: By anchoring the information in what students already know. Teachers use this principle of anchoring constantly. For instance, take the classic Bohr model of an atom. Teachers explain it by saying, "Electrons orbit the nucleus the way that planets orbit the sun." Because the concept is anchored in something students already know—the solar system—they can gain some quick intuition about a difficult concept. *It's like the solar system but on a microscopic level*.

Eric Beasley, a 3rd grade teacher in Sherwood, Oregon, was struggling with how to communicate the concept of an "onomatopoeia." The dictionary definition is: "The formation of a word by imitation of a sound made by or associated with its referent." Well, that's ridiculous. No 3rd grader will understand that. What knowledge do they have that you can anchor in?

You can anchor in examples, obviously: Boom. Cuckoo. Sizzle. And Beasley took it a step further, showing clips of old Batman shows where the Dynamic Duo are fighting goofy-looking villains. With each punch thrown by the masked crusaders comes a fresh onomatopoeia: "KAZAM!" "POW!" Beasley said it was a home run in class.

Analogies work well because of their built-in anchors. A math teacher in Washington DC told her class: "Polynomials are mathematical Legos," emphasizing the way that polynomials can be snapped together in various configurations.

A high school teacher in South Africa named Bjorn Holdt, who teaches a Java programming class, was having a hard time communicating the concept of "variables." So he came up with an analogy: "Variables are just like cups. They are containers that hold some information." Each student was given a different type of cup. Glass mugs were only able to store numbers. Beer mugs were only allowed to store text. Coffee mugs were only allowed to store "true" and "false". Contents were never allowed to be mixed—for instance, you couldn't put a number in a coffee mug (which modeled what's called "type-safe programming"). Holdt reported that, by using this analogy, students understood the concept of a "variable" more quickly and retained it longer—he said he was frequently able to untangle misunderstandings by explaining things in terms of the coffee cup or glass mug.

Simplicity makes ideas stick by keeping them lean and focused. The model of a simple idea is not a sound bite, it's the Golden Rule—a one-sentence idea that's sufficiently profound that you could spend a lifetime living up to it.

More on Simplicity from the book *Made to Stick*

- How to use "generative analogies"—analogies that are so useful that they can actually become a platform for new thinking (pages 60-62)
- How economics, physics, and other subjects slowly build up complexity by using "schemas" (pages 53-57)

UNEXPECTED

Robert Cialdini, a social psychologist at Arizona State University, wanted to find a more compelling way to talk about science in his writing and in his classes. So, in search of inspiration, he went to the library and read a slew of articles in which scientists were writing for nonscientists. He picked out the most interesting articles and then tried to figure out what made them succeed.

He found one striking consistency: The good articles used mysteries. One article began this way: "How can we account for what is perhaps the most spectacular planetary feature in our solar system, the rings of Saturn? There's nothing else like them. What are the rings of Saturn made of anyway?"

The answer unfolded like the plot of a mystery. The teams of scientists pursued promising leads, they hit dead ends, they chased clues. Eventually, after many months of effort, there was a breakthrough. Cialdini says, "Do you know what the answer was at the end of 20 pages? Dust. Dust. Actually, ice-covered dust, which accounts for some of the confusion. Now, I don't care about dust, and the makeup of the rings of Saturn is entirely irrelevant to my life. But that writer had me turning pages like a speed-reader."

Piquing curiosity is the holy grail of teaching. Cialdini said, "You've heard of the famous *Ah ha!* experience, right? Well, the *Ah ha!* experience is much more satisfying when it's preceded by the *Huh?* experience."

So how do you create the "Huh?" experience with your students? George Loewenstein, a behavioral economist, says that curiosity arises when we feel a gap in our knowledge. Loewenstein argues that gaps cause pain. When we want to know something but don't, it's like having an itch we need to scratch. To take away the pain, we need to fill the knowledge gap. We sit patiently through bad movies, even though they may be painful to watch, because it's too painful not to know how they end.

Movies cause us to ask, *What will happen?* Mystery novels cause us to ask, *Who did it?* Sports contests cause us to ask, *Who will win?* Crossword puzzles cause us to ask, *What is a 6-letter word for psychiatrist?* Pokemon cards cause kids to wonder, *Which characters am I missing?*

One important implication of the "gap theory" is that we need to *open* gaps before we *close* them. Our tendency is to tell students the facts. First, though, they must realize they *need* them.

The trick for convincing students they need our message, according to Loewenstein, is to first highlight some specific knowledge they are missing. You can pose a question or puzzle that confronts them with a gap in their knowledge: One recent book had a curiosity gap as its title: "Why do men have nipples?" A science teacher in Colorado asked his students: "Have you ever noticed that, in the winter, your car tires look a little flat? So where did the air go?" The book Freakonomics makes brilliant use of curiosity gaps: "Why do so many drug dealers live with their moms?" [There is a more extended discussion of curiosity gaps in Made to Stick on pages 84-90.]

Another technique is to force students to make a prediction. Eric Mazur, a physics professor at Harvard, came up with a pedagogical innovation known as "concept testing." Every so often in his classes, Mazur will pose a conceptual question and then ask students to vote publicly on the answer. The simple act of committing to an answer makes students more engaged and more curious about the outcome. This is exactly what Crowe did in asking his students, "What will my picture look like?" (He was actually creating two knowledge gaps—"what will the picture look like?" and "was I right?")

Unexpected ideas, by opening a knowledge gap, tease and flirt. They mark a big red X on something that needs to be discovered but don't necessarily tell you how to get there.

More on Unexpectedness from the book *Made to Stick*

- How the producer of ABC's Wide World of Sports figured out a way to spark the curiosity of football fans in games where their teams weren't playing and they had nothing at stake (pages 90-93)
- How Nora Ephron's journalism teacher managed to shatter and rebuild his students' image of journalism in a simple 30-minute exercise (pages 75-76)

CONCRETE

In math, students often struggle with the notion of a "function." What exactly is a function, and what is meant by its strange "f(x)" notation, which looks like nothing else that students have seen before?

It seems so abstract, so mysterious. So a math teacher at the Loudoun Academy of Science, Diana Virgo, gives students a more real-world experience with functions. She brings a bunch of chirping crickets into the classroom and poses a question: What do you think will happen to the crickets' chirping as the temperature changes? Will it get faster or slower as the air heats up? And might the crickets' reaction be so predictable that we can actually create a function that *predicts* how fast they'll chirp? Our function would be a like a little machine: You feed in a temperature (say, 85 degrees), and out pops the rate of chirping (say, 60 chirps per minute).

So the class runs the experiment: The crickets chirp. The students count the chirps. Virgo changes the temperature. The crickets, undoubtedly puzzled by the weather, chirp differently. The students count again. And soon the class has gathered a bunch of data that can be plugged into a software package, which generates the predictive function. It turns out that the hotter it is, the faster the crickets chirp—and it's predictable! Suddenly, the importance of a function makes sense—it's been grounded in reality. Students have personally experienced the entire context—where functions come from, how they're constructed, and how they can be used. (As a side note, Virgo also warns her students that human judgment is always indispensable. For instance, if you plug into the function the temperature "1000 degrees," it'll predict a really really fast rate of chirping! Sadly, though, at 1000 degrees, crickets don't chirp at all…)

The cricket function is an example of making a concept concrete—avoiding abstraction and conceptual language and grounding an idea in sensory reality. It's the difference between reading about a wine ("bold but balanced") and tasting it. In our book, we discuss what we call the "Velcro Theory of Memory" (extended discussion on pages 109-111). In brief, this concept says that the more sensory "hooks" we can put into an idea, the better it will stick.

An 8th-grade teacher named Sabrina Richardson helped students "see" punctuation by using macaroni. Richardson described her exercise:

> The students were given cards with sentences printed on them that were missing punctuation like quotation marks, periods, exclamation points, commas, apostrophes. The students were divided into groups of two and three and were given baggies that contained elbow macaroni, small macaroni shells, and ritoni. The students were asked to place the pieces of macaroni in the correct place in the sentence. For example, they were given the sentence:
>
> Jackie shouted Gwen come back here
>
> The students had to use the elbow macaroni as commas and quotation marks, the ritoni and small macaroni shell together as an exclamation point, and a small macaroni shell as a period. I knew that a lot of my students were confused about whether the comma went inside or outside the quotation marks, so this gave my visual learners and really all of my students a chance to "see" the correct way to punctuate quotations. Once they were finished, they knew the sentence would read: Jackie shouted, "Gwen, come back here!"

Concreteness etches ideas into our brain—think of how much easier it is to remember a song than a credit card number—even though a song contains much more data!

One of the most striking examples of concreteness in the history of education comes from an elementary school teacher named Jane Elliott, who entered her third-grade classroom on April 5, 1968, the day after Martin Luther King, Jr. was murdered. She found herself trying to explain his assassination. In the all-white town of Riceville, Iowa, students were familiar with King but could not understand who would want him dead, or why.

Elliott said, "I knew it was time to deal with this in a concrete way, because we'd *talked* about discrimination since the first day of school. But the shooting of Martin Luther King, one of our 'Heroes of the Month' two months earlier, couldn't be explained to little third-graders in Riceville, Iowa."

She came to class the next day with a plan. She aimed to make prejudice tangible to her students. At the start of class, she divided the students into two groups: brown-eyed kids and blue-eyed kids. She made a shocking announcement: Brown-eyed kids were superior to blue-eyed kids—"They're the better people in this room."

The groups were separated: Blue-eyed kids were forced to sit at the back of the classroom. Brown-eyed kids were told they were smarter. They were given extra time at recess. The blue-eyed kids had to wear special collars, so that everyone would know their eye color from a distance. The two groups were not allowed to mix at recess.

Elliott was shocked to see how quickly the class transformed. "I watched those kids turn into nasty, vicious, discriminating third-graders … it was ghastly." Friendships seem to dissolve instantly, as brown-eyed kids taunted their blue-eyed former friends. One brown-eyed student asked Elliott how she could be teacher "if you've got dem blue eyes."

At the start of the next class day, Elliott walked in and announced that she had been wrong. It was actually the *brown-eyed* children who were inferior. This reversal of fortune was embraced instantly. A shout of glee went up from the blue-eyed kids as they ran to place their collars on their lesser brown-eyed counterparts.

On the day when they were in the inferior group, students described themselves as sad, bad, stupid, and mean. "When we were down," said one boy, his voice cracking, "it felt like everything bad was happening to us." When they were on top, the students felt happy, good, and smart.

Even their performance on academic tasks changed. One of the reading exercises was a phonics card pack that the kids were supposed to go through as quickly as possible. The first day, when the blue-eyed kids were on the bottom, it took them 5.5 minutes. On the second day, when they were on top, it took 2.5 minutes. "Why couldn't you go this fast yesterday?" asked Elliott. One blue-eyed girl said, "We had those collars on…" Another student chimed in, "We couldn't stop thinking about those collars."

Elliott's simulation made prejudice concrete—brutally concrete. It also had an enduring impact on students' lives. Experiments ten and twenty years afterward showed that Elliott's students were significantly less prejudiced than peers who had not been through the exercise.

Elliott's simulation was life-altering. But the use of concreteness need not be so dramatic. Any lesson can be made more concrete, and the sensory nature of concrete ideas helps to bind them to memory.

More on Concreteness from the book *Made to Stick*

- The surprising truth about math instruction in Asian countries—could it actually be more creative than the average American classroom? (pages 104-106)
- Why it feels different to use different kinds of memory—for instance, to think of the Mona Lisa versus the taste of watermelon versus the capital of Kansas. (pages 109-111)

CREDIBLE

Amy Hyett, an American Literature teacher at Brookline High School in Boston, teaches a unit on Transcendentalism. She says when students read Thoreau, and they learn how much time he spent alone in the wilderness, they have a common reaction: Er, why would he do that? So, in the spirit of building empathy, she gives them an unorthodox assignment: Spend 30 minutes alone in nature. No cell phone. No iPod. No pet companions. No Gameboy. Just you and the great outdoors.

Hyett says, "It's quite amazing, because almost every student has a moving and illuminating experience. They are surprised by how much the experience moves them. Even the most skeptical students come away with a deeper understanding of transcendentalism and nature."

For an idea to stick, it needs to be credible. YouTube-era students don't find it credible that hanging out outside, for a long period of time, alone, could be conducive to great thinking. So how do you combat their skepticism? You let them see for themselves. It's like a taste test for ideas.

This is what we call a testable credential. A classic example of a testable credential is the question: Are you better off now than you were four years ago? Ronald Reagan famously posed this question to the audience during his 1980 presidential debate with Jimmy Carter. Reagan could have focused on statistics—the high inflation rate, the loss of jobs, the rising interest rates. But instead of selling his case, he deferred to his audience. A testable credential, then, essentially outsources the credibility of an idea to the audience. [Testable credentials can also, unfortunately, help to propagate sleazy ideas, such as the longstanding (false) rumor that Snapple supports the KKK, which gained strength because of certain "secret marks" on the Snapple labels. See pages 157-158.]

Sometimes you have to see something, or experience it, to believe it. For instance, you might not believe that adding Mentos candy to a 2-liter bottle of soda would cause a volcanic eruption that sends soda spewing 10-15 feet from the bottle. But you'd believe it if you saw it. (In the meantime, just Google it for a laugh.) Lots of science lab experiments operate on this principle—*see for yourself*. (Notice too that labs are pedagogically useful for other reasons: They are often Unexpected—"Look, the chemicals turn bright blue when mixed!" And they are always Concrete—instead of talking about a phenomenon, you're seeing it or producing it.)

Another technique for making ideas credible is to use statistics—but perhaps not in the way you'd expect. It's difficult to make a statistic stick. Numbers tend to slide easily in one ear and out the other. The relationships that statistics illustrate, on the other hand, can be immensely sticky.

For instance, here are two statistics: Bottled water costs about 8.4 cents per ounce. Municipal water in San Francisco costs about 0.0022 cents per ounce. When you read those two statistics, what you take away is this: Wow, there's a big difference there. Bottled water costs a lot more than municipal water! But our brains aren't very good at intuiting much more than that. For instance, your brain would have had an identical response if the numbers had been 6.8 and 0.0877—wow, there's a big difference there! That's a problem, though, because there's a difference of 50 times between those two pairs!

The writer Charles Fishman, in a magazine article about the bottled water industry, figured out a brilliant way to make this statistic come alive. Here's what he wrote: "In San Francisco, the municipal water comes from inside Yosemite National Park. It's so good the EPA doesn't require San Francisco to filter it. If you bought and drank a bottle of Evian, you could refill that bottle once a day for 10 years, 5 months, and 21 days with San Francisco tap water before that water would cost $1.35." Now your brain can begin to apprehend the full scale of the difference between these numbers—it's not a big difference, it's a gargantuan difference! It's a 10-and-a-half-year's-worth-of-refilling-a-water-bottle difference.

The trick with using statistics, then, is to focus on the relationship, not the number. Here's another example of this technique as used by Tony Pratt, a 4th-grade teacher in the New Orleans Recovery School District. He said he was teaching the basics of probability, and as an example, he told his students they had a really, really small probability of winning the lottery. The odds are 1 in millions. But again, this statistic is so big that it fuzzes our brains. Our brains can't easily distinguish between "1 in millions" and "1 in tens of thousands," even though there's an enormous gap there! So the teacher grounded the probability in a relationship. He said: You're more likely to be struck by lightning than to win the lottery. That amazed the students—it gave them an intuition for just how rare it is to win. In fact, several of them rushed home to tell their family members.

One student, Jarred, relayed his story, "I saw my uncle buying lottery tickets last night. I told him that he was more likely to be struck by lightning than he was to win the lottery and that buying lottery tickets was a bad idea because of probability."

"What did he say?"

"He told me to get the F out of his face."

I guess we should admit it: Sticky ideas won't win over *everyone*…

More on Credibility from the book *Made to Stick*

- How the NBA used a shocking testable credential to get its rookie players to take the risk of AIDS seriously (pages 162-163)
- Why a medical internist had to chug a glass of harmful bacteria to get his colleagues to believe his idea, which later won a Nobel Prize— (pages 130-132)
- How to use the "human scale principle" to make numbers more intuitive (pages 143-146)

THE CURSE OF KNOWLEDGE

So wait a minute. We claim using the principles of stickiness is easy. And most of the principles seem relatively common-sensical. So why aren't we deluged with brilliantly-designed sticky ideas? Why don't most 35 year-olds remember anything about their literature or chemistry classes?

Sadly, there is a villain in our story. The villain is a natural psychological tendency that consistently confounds our ability to create ideas using these principles. It's called the Curse of Knowledge. (We will capitalize the phrase to give it the drama we think it deserves.)

In 1990, Elizabeth Newton earned a Ph.D. in psychology at Stanford by studying a simple game where she assigned people to one of two roles: "tappers" or "listeners." Tappers received a list of 25 well-known songs, such as "Happy Birthday to You" and "The Star-Spangled Banner." Each tapper was asked to pick a song and tap out the rhythm to a listener (by knocking on a table). The listener's job was to guess the song, based on the rhythm being tapped. (By the way, this experiment is fun to try at home if there is a good "listener" candidate nearby.)

The listener's job in this game is quite difficult. Over the course of Newton's experiment, 120 songs were tapped out. Listeners guessed only 2.5% of the songs—3 songs out of 120.

But here's what made the result worthy of a dissertation in psychology. Before the listeners guessed the name of the song, Newton asked the tappers to predict the odds that the listeners would guess correctly. They predicted that the odds were 50%.

The tappers got their message across 1 time in 40, but they thought they were getting their message across 1 time in 2. Why?

When a tapper taps, she is *hearing the song in her head*. Go ahead and try it for yourself—tap out "The Star Spangled Banner." It is impossible to avoid hearing the tune playing along in your head. Meanwhile, the listeners can't hear that tune—all they can hear are a bunch of disconnected taps like a kind of bizarre Morse Code.

In the experiment, tappers are flabbergasted at how hard the listeners seem to be working to pick up the tune. *Isn't the song obvious?* The tappers' expressions, when a listener guesses "Happy Birthday to You" for "The Star-Spangled Banner," are priceless. *How could you be so stupid?*

It's hard to be a tapper. The problem is that tappers have been given knowledge (the song title) that makes it impossible for them to imagine what it is like to *lack* that knowledge. When they are tapping, they can't imagine what it is like for the listeners to hear isolated taps rather than a song. This is the Curse of Knowledge. Once we know something, we find it hard to imagine what it was like not to know it. Our knowledge has "cursed" us. And it becomes difficult for us to share our knowledge with others, because we can't readily re-create the state of mind of our listeners.

The tapper/listener experiment is reenacted every day across the world. The tappers and listeners are CEOs and frontline employees, politicians and voters, marketers and customers, writers and readers. And, last but not least: Teachers and students. All of these groups rely on ongoing communication, but they suffer from enormous information imbalances, just like the tappers and listeners. When a math teacher unveils "functions" or an English teacher talks about "graceful prose," there is a tune playing in their heads that the students can't hear.

It's a hard problem to avoid—every year, you walk into class with another year's worth of mental refinement under your belt. You've taught the same concepts every year, and every year your understanding gets sharper, your sophistication gets deeper. If you're a biology teacher, you simply can't imagine anymore what it's like to hear the word "mitosis" for the first time, or to lack the knowledge that the body is composed of cells. You can't unlearn what you already know. There are, in fact, only two ways to beat the Curse of Knowledge reliably. The first is not to learn anything. The second is to take your ideas and transform them.

Stickiness is a second language. When you open your mouth and communicate, without thinking about what's coming out of your mouth, you're speaking your native language: Expertese. But students don't speak Expertese. They do speak Sticky, though. Everyone speaks Sticky. In some sense, it's the universal language. The grammar of stickiness—simplicity, storytelling, learning through the senses—enables anyone to understand the ideas being communicated.

EMOTION

Bart Millar, an American History teacher at Lincoln High School in Portland, Oregon, was having a hard time getting his students to care about the Civil War. "We talked about the weaponry, the tactics, the strategy, and so on. The students were respectful, but not much beyond that," he said.

Determined to do better, he went to the National Archives website and downloaded photos of battlefield surgeons and their surgical tents. He presented them to the class and asked them to imagine the sounds of war (the explosions, the rustle of uniforms, the occasional eerie quiet) and the smells of war (dust, gunpowder, blood, excrement). [This is a brilliant use of Concreteness, by the way.] But he had one more surprise in store for the students.

On the side of the room was a table covered by a tarp. Millar whisked away the tarp to reveal: 2 stopwatches, 2 thick-looking bones, and 2 handsaws. The bones were cow legs procured from a local butcher that approximated the weight and thickness of a human femur. Two student volunteers were asked each to play the role of a battlefield surgeon, forced to amputate a soldier's leg in hope of saving his life. Their mission: Saw thru the bone forcefully and quickly—after all, at the time there was very little anesthesia.

Millar says, "The entire lesson only took about 15 minutes, but 10 years later, students who stop in to say hi still talk about that lesson." And it's not hard to see why: He found a way to make students care, to give them a peek into the brutal realities of war.

That's what Emotion does for an idea—it makes people care. It makes people *feel something*. In some science departments, during the lesson on "lab safety," the instructor will do something shocking: They'll take some of the acid that the students will be handling and use it to dissolve a cow eyeball. A lot of students shudder when they see the demonstration. They *feel* something. (It should also be noted that some students, mostly male, think it is "cool.") Lab safety "dos and don'ts" don't grab you in the gut, but a dissolving eyeball sure does.

The Civil War simulation tapped into students' empathy and horror, and the lab safety demo tapped into disgust and fear. But more positive emotions can build student's engagement, too. For instance, many an algebra teacher has heard the question, "Why do we need to learn this?"

Let's compare and contrast two responses to this question. The first comes from a 1993 conference on "Algebra for All." The participants laid out a series of responses to the question, "Why study algebra?" Here are two of them:

- Algebra provides procedures for manipulating symbols to allow for understanding of the world around us.
- Algebra provides a vehicle for understanding our world through mathematical models.

So are you fired up to learn algebra? This is the Curse of Knowledge in action. The phrase "procedures for manipulating symbols" makes perfect sense to experts and no sense at all to students. It certainly doesn't provide a motivational answer to the question, "Why study this?"

A different approach was taken by a 9th-grade algebra teacher named Dean Sherman. He said his students would constantly ask him, "When are we ever going to need this?" He said that, at first, he'd search for a real-world rationale for everything he taught. Then, it dawned on him that he had missed the point.

Now he tells his students: "Never. You will never use this." Then he points out that people don't lift weights so they'll be prepared should, one day, somebody knock them over on the street and trap them under a barbell. "You lift weights so that you can knock over a defensive lineman, or carry your groceries or lift your grandchildren without being sore the next day. You do math exercises so that you can improve your ability to think logically, so that you can be a better lawyer, doctor, architect, prison warden or parent. MATH IS MENTAL WEIGHT TRAINING. It is a means to an end, (for most people), not an end in itself."

Let's unpack this ingenious response. Note that it's Simple because of its analogy comparing algebra to weightlifting. It's unexpected by virtue of the surprising first line, "Never. You will never use this." It's Concrete because Sherman provides specific occasions that can be visualized: knocking over a defensive lineman, being a better prison warden. And it's Emotional because it appeals to students' aspirations: This subject can make you a better doctor, lawyer, or parent.

And that's the role of Emotion in making ideas sticky: To transform the idea from something that's analytical or abstract or theoretical and make it hit us in the gut (or the heart).

More on Emotion from the book *Made to Stick*

- Why the term "sportsmanship" has become so weak and watered-down—and how one group of coaches is turning it around (pages 174-177)
- How the state of Texas managed to decrease littering by 72% in 5 years by tapping into something that was important to young, truck-driving guys (pages 195-199)
- Why voters consistently vote against their personal self-interest, and why this finding should transform the way we communicate (pages 187-191)

STORY

Have you ever noticed, when you teach, that the moment you start sharing a personal story with the class, they instantly snap to attention? Students seem to have Story Radar. For that matter, so do the rest of us. Some of the stickiest ideas in the world are stories. Aesop's fables have endured for about 2,500 years, and they will easily survive another 2,500. The world's religions are built on powerful stories. Our culture is defined by the stories we tell—in movies, in books, in the media. Human beings just have a natural affinity for stories. Stories are the currency of our thoughts.

None of this is a surprise to you. Teachers understand the value of stories. But there are two things that might surprise you: *what kind* of stories work so well, and *why* they work so well.

The first surprise concerns what kinds of stories are effective in making ideas stick. The answer is this: Virtually any kind. The stories don't have to be dramatic, they don't have to be captivating, and they don't have to be entertaining. The story form does most of the heavy lifting—even a boring story will be stickier than a set of facts. And that's comforting to a lot of us who don't consider ourselves great storytellers or dramatists. Woody Allen said, "Ninety percent of life is just showing up," and that seems to be true of storytelling. Ninety percent of the value is just *trying*.

If ever there was a subject ill-suited for storytelling, it's accounting. Yet two college professors at Georgia State University rewrote their intro accounting course and put a story at the center. The story concerned a new business launched by two imaginary college sophomores, Kris and Sandy at LeGrande State University.

Kris and Sandy had an idea for a new product called Safe Night Out (SNO), a device targeted at parents with teenagers who were old enough to drive. Installed in the teenager's car, the device would record the route and speed of the car. For the first time, parents could confirm that their car was being driven responsibly.

At this point, you—a student in introductory accounting—become part of the story. Kris and Sandy are your friends and they hear you're taking an accounting class. They need your help. They ask: Is our business idea feasible? How many units would we have to sell to pay for our tuition? You are given guidance on how to track down the costs of the relevant materials (GPS receivers, storage hardware) and partnerships (how much it would cost to sell it on eBay?).

Difficult accounting concepts—such as when to recognize revenue or how to compute current assets—could be *hung* on the structure of the story, the way that ornaments are hung on a tree. A Christmas tree ornament has a specific location—it's on a certain branch, near other ornaments. And concepts that are taught within a story structure naturally receive a "location" that makes them easier to retain—for instance, you might remember cash flow management originated on the branch of the story in which Kris and Sandy were growing so fast that they actually ran out of operating cash.

Did the story-based course work? In the next accounting course—taken an average of two years later—the first section of the course built heavily on the concepts that students were supposed to have learned in introductory accounting. Students who had worked through the case study scored noticeably higher on this first exam. In fact, the difference in scores was particularly dramatic for students with a C-average overall. They scored, on average, 12 points higher—more than a letter grade. And, remember, this is two years after the case study ended. And remember also that this wasn't a very exciting story! No child will ever beg to be told the story of Kris and Sandy's startup business. The story form did the heavy lifting.

The second surprise about stories is *why* stories, even boring stories, are so sticky. The answer starts with some fascinating research done on "mental simulation." Brain scans show that when people *imagine* a flashing light they activate the visual area of the brain; when they *imagine* someone tapping on their skin they activate tactile areas of the brain. The activity of mental simulation is not limited to the insides of our heads. People who imagine words that start with "b" or "p" can't resist subtle lip movements, and people who imagine looking at the Eiffel Tower can't resist moving their eyes upward. Mental simulation can even alter visceral physical responses: When people drink water but imagine it is lemon juice, they salivate more. Even more surprisingly, when people drink lemon juice but imagine it is water, they salivate less.

Mental simulation can also build skills. A review of 35 studies featuring over 3,214 participants showed that mental practice alone—sitting quietly, without moving, and picturing yourself performing a task successfully from start to finish—improves performance significantly. The results were borne out over a large number of tasks: Mental simulation helped people weld better and throw darts better. Trombonists improved their playing and competitive figure-skaters improved their skating. Not surprisingly, mental practice is more effective when a task involves more mental activity (e.g., trombone playing) as opposed to physical activity (e.g., balancing), but the magnitude of gains from mental practice is large on average: Overall, mental practice alone produced about *two-thirds of the benefits of actual physical practice*.

The takeaway is simple: Mental simulation is not as good as actually doing something—but it's the next best thing. And, to circle back to the world of sticky ideas, what we're suggesting is that the right kind of story is, effectively, a simulation. Stories are like flight simulators for the brain.

When you tell a story about Queen Nefertiti, students are flight-simulating. They're imagining that it would be like to be her, to have lived in the era when she lived. And that flight simulation makes the idea sticky.

More on Stories from the book *Made to Stick*

- An extended discussion of the value of mental simulation and why it works (pages 207-217)
- An explanation of the three kinds of stories—all easy to spot and tell—that are effective at inspiring people (pages 224-231)

WHAT STICKS

Making ideas stickier is not hard to do. It just takes a bit of time and focus. The six principles of stickiness that we've discussed can be used as a checklist—imagine the checklist written on a Post-It note, to the side of your desk as you plan out a lesson. "Okay, for tomorrow's lesson I've got to compare sedimentary and igneous rock. How can I make this Simple? Do students have some knowledge I can anchor in? How can I make it Concrete? Can I get a sample of the kinds of rock to show them? Can I show them photos? How can I tell a Story? Can I find a story of an archaeologist who used knowledge of the rock layers to solve an interesting problem?" You get the idea.

A group of teachers at the Loudon Academy of Science—Linda Gulden, Jennifer Lynn, and Dan Crowe—did exactly this in planning their oceanography unit. They put a lot of energy into revamping the unit, because they weren't happy with how it had gone in the years past. Here's a paraphrase of the new and improved lesson plan for the unit:

> In the first class in the unit, we start with a mystery: Let's say you put a message in a bottle, drive out to the coast, and throw it as far as you can into the ocean. Where will the bottle end up? We let students make their guesses. ("The waves will bring it right back to shore." "It'll end up in Antarctica." "It'll sink." Etc.) But we don't give an answer (since there isn't a clear answer).
>
> Then we began to explore this same mystery in a more dramatic form. We'll have students read a wonderful article from Harper's magazine. What happened is this: In January 1992, somewhere in the Pacific Ocean, a cargo ship hit a severe storm and lost a con-

tainer overboard which held 7,200 packages of plastic toys, including thousands of rubber duckies. Years later, we know where many of these rubber duckies ended up. In fact, many of them ended up on the same beach! By tracing the paths that these duckies swam, we learn a lot about the way ocean currents work.

Next, we let the kids do some hands-on experimentation. We'll set up tanks of water with different salinities and different temperatures, and let them see how those variables change the water current. In essence, we are letting them create their own ocean currents.

Finally, we'll pivot to the critical role that oceans play with global climate. We'll start by asking them: What determines the weather of a city, like New York City? Inevitably, students say it depends on the latitude of the city – the closer to the equator the city is, the warmer it is, and the closer to the poles it is, the colder it is. There is much truth to that, but there are huge discrepancies: For instance, New York City and Madrid are at roughly the same latitude. Yet it snows every winter in NYC and it doesn't snow in Madrid. What's the difference? That paves our way to talk about the way that ocean currents influence climate.

In closing, notice that all of the elements of sticky ideas are involved here.

- **Simple**: Anchoring in students' knowledge of weather (New York vs. Madrid).
- **Unexpected**: Where will the bottle end up? Where did the duckies end up?
- **Concrete**: The message in a bottle, the rubber duckies, the hands-on tanks of water, the mention of specific cities.
- **Credible**: See for yourself, using this tank, how temperature affects water current.
- **Emotional**: Think of the hope and mystery and anxiety involved with tossing an important message into the sea and wondering where it will go.
- **Story**: The tale of thousands rubber duckies that fell overboard—and the journey they took around the world.

Our hats are off to these teachers. And we hope you'll be motivated by their work, and the work of the other teachers we've cited. We hope we've inspired you to try something new, and if you do, we'd love to hear about it. May your ideas stick!

- Chip & Dan

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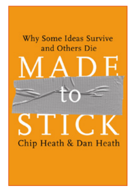

If you liked this article, you'll like our book, *Made to Stick*. At roughly 10x the length of this article, we were able to cover many more concepts, in more depth, than we could here. Made to Stick is available via your local bookseller (Barnes & Noble, Borders, Waldenbooks) and more immediately via Amazon.com, where it is only $16.47.

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