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[TITLE]:
Why Having Too Little Means So Much

Introduction, Chapter 1 and Chapter 2

Sendhil Mullainathan
&
Eldar Shafir

Introduction

If ants are such busy workers, how come they find time to go to all the picnics?
Marie Dressler

We wrote this book because we were too busy not to. Sendhil was grumbling to Eldar. He had more to dos than time to do them in. Deadlines had matured from "overdue" to "offensively late." Meetings had been accidentally double-booked, sheepishly rescheduled, and in a few ugly situations forgotten. His cell phone blinked aggressively, a threatening reminder of unheard voice mails. His car registration sticker had expired. He could picture his mother's hurt face at not getting even an occasional call. And things were getting worse. That presentation two connecting flights away seemed like a good idea six months ago. Not so much now. Falling behind turned into a vicious cycle. Re-registering the car was now one more thing to do. One email asked if he would come give a talk. His tardy response meant a guilty acceptance and one more commitment. The past-due pile of life was growing dangerously close to toppling.

The irony of spending time lamenting the lack of time was not lost on Eldar. It was only partly lost on Sendhil who, undeterred, described his plan for getting out.

He would first stem the tide. Old obligations would need to be fulfilled, but new ones could be avoided. He would say no to anything new. He would prevent further delays on old projects by working meticulously to finish them. Eventually this austerity would pay off. The to-do pile would shrink to a manageable level. Only then would he even think about new projects. And of course he would be more prudent going forward. "Yes" would be rare and uttered only after careful scrutiny. It would not be easy, but it was necessary. Having made the plan felt good. Of course it did. As Voltaire noted long ago, "Illusion is the first of all pleasures."

A week later, another call from Sendhil: Two colleagues were putting together a book on the lives of low-income Americans, and they wanted us to write a chapter on the

psychology of decision-making. “This is a great opportunity. We should do it!” said Sendhil. His voice, Eldar recalls, lacked even a trace of irony.

Predictably, the chapter was “too good to pass up,” and we agreed to do it. Just as predictably, it was a mistake, written in a rush and behind schedule. Unpredictably, it was a worthwhile mistake, creating an unexpected connection that eventually led to this book.

Here is an excerpt from our background notes for that chapter:

Shawn, an office manager in Cleveland, was struggling to make ends meet. He was late on a bunch of bills. His credit cards were maxed out. His paycheck ran out quickly. As he said, “There is always more month than money.” The other day, he accidentally bounced a check after over estimating the money in his account; he had forgotten a $22 purchase. Every phone call made him tense: another creditor calling to “remind” him? Being out of money was also affecting his personal life. Sometimes at dinner he would put in less than his fair share because he was short. His friends understood, but it didn’t feel good.

And there was no end in sight. He had bought a Blu-ray player on credit, with no payments for the first six months. That was five months ago. How would he pay this extra bill next month? Already, more and more money went to paying off old debts. The bounced check had a hefty overdraft charge. The late bills meant late fees. His finances were a mess. He was in the deep end of the debt pool and barely staying afloat.

Shawn, like many people in his situation, got financial advice from many sources, all of it pretty similar:

Don’t sink any deeper. Stop borrowing. Cut your spending to the minimum. Some expenses may be tough to cut, but you’ll have to learn how. Pay off your old debts as quickly as possible. Eventually, with no new debts, your payments will become manageable. After this, remain vigilant so as not to fall back in. Spend and borrow wisely. Avoid unaffordable luxuries. If you must borrow, be clear about what it

takes to pay it back.

This advice worked better in theory than in practice for Shawn. Resisting temptation is hard. Resisting all temptations was even harder. A leather jacket he had coveted went on sale at a great price. Skimping on his daughters' birthday felt less prudent as the day got closer. There were too many ways to spend more than he planned. Shawn eventually sank back into the debt pool.

It did not take long for us to notice the resemblance between Sendhil's and Shawn's behavior. Missed deadlines are a lot like overdue bills. Double-booked meetings (committing time you do not have) are a lot like bounced checks (spending money you do not have). The busier you are, the greater the need to say no. The more indebted you are, the greater the need to not buy. Plans to escape sound reasonable but prove hard to implement. They require constant vigilance—about what to buy or what to agree to do. When vigilance flags—the slightest temptation in time or in money—you sink deeper. Shawn ended up stuck with accumulating debt. Sendhil ended up stuck under mounting commitments.

This resemblance is striking because the circumstances are so different. We normally think of time management and money management as distinct problems. The consequences to failing are different: bad time management leads to embarrassment or poor job performance; bad money management leads to fees or eviction. The cultural contexts are different: falling behind and missing a deadline means one thing to a busy professional; falling behind and missing a debt payment means something else to an urban low-wage worker. The surroundings differ. The education levels differ. Even the aspirations can differ. Yet despite these differences, the end behavior was remarkably similar.

Sendhil and Shawn did have one thing in common: both were feeling scarcity. Sendhil felt harried and Shawn felt cash-strapped. By scarcity we mean this subjective sense of having more wants than resources to fulfill them. Of course, we would all like to own a Ferrari, or a house on the French Riviera, or get a six month vacation from work. But

a feeling of scarcity is distinct from the finiteness of resources that all of us, however rich or leisurely, always face. It is about more immediate wants that require fulfillment. Physical limits—the money in our savings account, the debts we owe, the tasks we must complete—contribute to scarcity as we define it. But so do other factors, such as your perception of your must-dos and must-haves. Just as how cold you feel depends both on absolute temperature as well as your own private metabolism. Scarcity, in our definition, is the feeling of having less than you want. What is striking about this feeling is that it is both universal and limited. It is universal in the sense that we have all experienced resource scarcity. As a dieter, you will have felt you had access to fewer calories than you would have liked. If ever you were lonely, it felt like you had fewer friends than you wished for. And similarly when you were strapped for time or for money. But the feeling is also limited: we all have been free of it on some resource at least some of the time. Even the poorest or the busiest might have felt content at some point with the friends they have. And no matter how busy you are there's always the occasional leisurely Sunday.

Now, if Shawn and Sendhil had in common this experience of scarcity, could that explain their behavior? Could it be that scarcity led Sendhil and Shawn to behave in such similar ways? Might scarcity have its own inner logic, creating a particular mindset? Or, put another way, could a deeper theory of scarcity help explain why Shawn and Sendhil made similar mistakes and why they stayed stuck with their scarcity?

We had to figure out where this idea led. We were too busy not to.

Scarcity Captures the Mind

Our newfound interest in scarcity led us to a remarkable study from over half a century ago. The authors of that study did not think of themselves as studying scarcity - they were interested in starvation. It was toward the end of World War II, and the Allies has just realized they had a problem. As they advanced into German-occupied territories, they knew they would encounter great numbers of people at the edge of starvation. The problem was not food; the Americans and British had enough to feed the prisoners of war and the civilians they were liberating. Their problem was more technical. How do you

begin feeding people who had been at the edge of starvation for so long? Should they be given full meals? Should they be allowed to eat as much as they want? Or should you start by underfeeding them and slowly increase their intake? What was the safest way to bring people back from the edge of starvation?

The experts at the time had few answers. So a team at the University of Minnesota conducted an experiment to find out. Understanding how to feed people, though, requires first starving them. The experiment started with healthy, male volunteers in a controlled environment where their calories were reduced until they were subsisting on just enough food so as not to permanently harm themselves, but not much more. After a few months of this, the real experiment began: find out how their bodies responded to different feeding regimens. Not an easy experiment to be a subject in, but this was "the Good War" and conscientious objectors who did not go to the front were willing to do their part.

The thirty-six subjects in the study were housed in a dormitory and carefully monitored, with every behavior observed and noted. Though the researchers cared most about the feeding part of the study, they also measured the impact of starvation. Much of what happens to starving bodies is quite graphic. Subjects lost so much fat on the butt that sitting became painful: the men had to use pillows. Actual weight loss was complicated by edema—the men accumulated as much as fourteen pounds of extra fluid due to starvation. Their metabolism slowed down by 40 percent. They lost strength and endurance. As one subject put it, "I notice the weakness in my arms when I wash my hair in the shower; they become completely fatigued in the course of this simple operation."

Not only did their bodies weaken; their minds changed as well. As Sharman Apt Russell describes a lunch scene in her book *Hunger:*

> *The men became impatient waiting in line if the service was slow. They were possessive about their food. Some hunched over their trays using their arms to protect their meal. Mostly they were silent, with the concentration that eating deserved…Dislikes for certain foods, such as rutabagas, disappeared. All food was eaten to the last bite. Then they licked their plates.*

This is largely what you might expect of people who are starving. But some mental changes they showed were more unexpected:

> *Obsessions developed around cookbooks and menus from local restaurants. Some men could spend hours comparing the prices of fruits and vegetables from one newspaper to the next. Some planned now to go into agriculture. They dreamed of new careers as restaurant owners…..They lost their will for academic problems and became far more interested in cookbooks…When they went to the movies, only the scenes with food held their interest.*

They were focused on food. Of course if you are starving, this is to be expected; getting more food should be a priority. But their minds focused in a way that transcended practical benefits. The delusions of starting a restaurant, comparing food prices, and researching cookbooks will not alleviate hunger. If anything all this thinking about food—almost a fixation—surely heightened the pain of hunger. They did not choose this. They did not decide to look at the food in a movie rather than follow the plot. They did not choose to put food on top of their mind. Instead, hunger captured their thinking and their attention. These behaviors were only a footnote in the Minnesota study, not at all what the researchers were interested in. To us, they foreshadow the main story.

Scarcity captures the mind. Just as the starving subjects had food on top of their mind, when we experience scarcity of any kind, we become absorbed by it. The mind orients automatically, powerfully, toward unfulfilled needs. For the hungry that need is food. For the busy it might be a project that needs to be finished. For the cash-strapped it might be this month's rent payment; For the lonely a lack of companionship. Scarcity is more than just the displeasure of having very little. It changes how we think. It imposes itself on our minds.

Top of Mind

This is a lot to infer from just one study. Starvation is an extreme case: it involves scarcity but it also involves many other physiological changes. The study had only thirty-six subjects. The data consisted largely of the mutterings of hungry men, no hard numbers.

But many other, more precise studies have shown the same results. Not only that, they give a window into exactly how scarcity captures the mind.

One recent study asked subjects to come to a lab around lunchtime, not having eaten for three to four hours. Half of these hungry subjects were sent out to grab lunch, the others weren't. So half were hungry and half were sated. Their task in the study was simple: Watch a screen. A word will flash. Identify that word. So, for example, TAKE might flash and the subjects would have to decide whether they just saw TAKE or RAKE. This seems a trivial task and it would have been except that everything happened quickly. Very quickly. The word itself flashes for 33 milliseconds -- that is 1/30 of a second.

Now you might think that the hungry subjects might do worse at this task, tired and unfocused from their hunger. In this study, though, they did as well as the sated subjects. Except in one case. The hungry did much *better* on food-related words. They were much more likely to accurately detect the word CAKE. Tasks such as these are designed to tell us what is on top of someone's mind. When a concept occupies our thoughts, we see words related to it more quickly. So when the hungry recognize CAKE more quickly, we see directly that food is on top of their minds. Here we do not rely on odd behaviors such as leafing through cookbooks or plans of being a restaurateur to infer their fixation. The speed and accuracy of their responses directly show us that scarcity has captured the hungry subject's mind.

And it does so on a subconscious level. The tiny timescales in this task—outcomes measured in milliseconds—were devised to observe fast processes, fast enough to remain beyond conscious control. We now know enough about the brain to know what these time scales mean. Complex higher-order calculations require more than 300 milliseconds. Faster responses rely on more automatic subconscious processes. So when the hungry recognize CAKE more quickly, it is not because they *choose* to focus more on this word. All this happens faster than they could choose to do anything. This is why we use the word "capture" when describing how scarcity focuses the mind.

This phenomenon is not specific to hunger. One study finds that when subjects are thirsty, they are much quicker (again at the level of tens of milliseconds) to recognize the word WATER. In all these cases, scarcity operates unconsciously. It captures attention whether the mind's owner wishes it or not.

Now, both thirst and hunger are physical cravings. Other, less visceral forms of scarcity also capture the mind. In one study, children were asked to estimate from memory, by adjusting a physical device, the size of regular U.S. coins—from a penny to a half dollar. The coins "looked" largest to the poorer children, who significantly over-estimated the size of the coins. The most valuable coins—the quarter and half dollar—were the most distorted. Just as food captures the focus of the hungry, the coins captured the focus of poor children. The increased focus made these coins "look" bigger. Now, it's possible that poor children are simply unskilled at remembering size. So the researchers had the kids estimate sizes with the coins in front of them, an even simpler task. In fact, the poor children made even *bigger* errors with the coins in front of them. The real coins drew even more focus than did the abstract ones in memory. (And, by the way, with no coins around, the kids were highly accurate at estimating similarly sized cardboard disks.)

The capture of attention can alter experience. During brief and highly focused events, such as car accidents and robberies, for example, the increased engagement of attention brings about what researchers have called a "subjective expansion of time," a feeling that such events last longer, precisely because of the greater amount of information that is processed. Similarly, scarcity's capture of attention affects not only what we see or how fast we see it but also how we interpret the world. One study of people who reported feeling lonely flashed pictures of faces for one second and asked subjects to describe what emotion was being expressed. Were the faces conveying anger, fear, happiness, or sadness? This simple task measures a key social skill: the ability to understand what others are feeling. Remarkably, the lonely do *better* at this task. You might have thought they would do worse -- after all, their loneliness might imply social ineptitude or inexperience. But this superior performance makes sense with the psychology of scarcity. It is just what you would predict if the lonely focus on their own form of scarcity, on managing social contacts.

They ought to be particularly attuned to reading emotions.

This implies that the lonely should also show greater recall for social information. One study asked people to read from someone's diary and to form an impression of the writer. Later they were asked to recall details from the diary entries. The lonely did about as well as the non-lonely. Except in one case: they were much better at remembering the entries that involved social content, such as interactions with others.

The authors of this study relay an anecdote that nicely summarizes how loneliness changes focus: Bradley Smith, unlucky in love and lacking close friends, finds his perception changes after a divorce.

> *Suddenly, Bradley cannot escape noticing connections between people—couples and families—in exquisite and painful detail. At one time or another, Bradley's plight may have befallen most of us. Perhaps, similar to Bradley, a romantic relationship ends, and you find yourself noticing lovers holding hands in the park. Or your first days in a new school or job place you in a world of strangers, in which each smile, scowl, or glance in your direction assumes added significance.*

Bradley, you might say, is the social equivalent of the starving men, leafing through his own cookbooks.

The Original Science of Scarcity

You can't have everything. Where would you put it?
Steven Wright

When we told an economist colleague that we were working on scarcity he remarked, "There is already a science of scarcity. You might have heard of it. It's called economics." He was right, of course. Economics begins by highlighting issues of scarcity, in a different sense than we do. It emphasizes physical limits - it points out that all resources are finite. If you spend money on a new coat, you have less money for a dinner out. If the government spends money on an experimental procedure for prostate cancer, there is less

money for highway safety. A surprising number of discussions overlook this simple but important observation (an oversight that our theory helps explain).

Economics analyzes how people and society manage physical scarcity. It looks at wheat happens when people do the best they can, constrained by the social institutions and the markets they are part of. This approach has proven insightful. For example, it shows that physical scarcity responds to prices, sometimes in unexpected ways. European paleontologists in nineteenth-century China learned this the hard way. Seeking to acquire scarce dinosaur bones, they paid villagers for bone fragments. The result? Supply responded. More bone fragments. When peasants found bones they would smash them to increase the number of pieces they could sell. Not quite what the paleontologists were hoping for.

Other disciplines also touch on scarcity: sociology, psychology, anthropology, neuroscientists, psychiatrists, and even marketers all are interested in this age-old problem. The prevailing view is that we are less happy when we have less than what we want. The poorer we are, the less nice things we can afford—be it a house in a good school district or salt and sugar to flavor our food. The busier we are, the less leisure time we can enjoy—be it watching television or spending time with our families. The fewer calories we can afford, the fewer foods we can savor. And so on. Having less is unpleasant. And it can have repercussions, for example, on health, safety, or education. Scarcity leads to dissatisfaction and struggle.

While certainly true, we think this misses something critical - it overlooks how scarcity affects the mind. When scarcity captures attention, it changes how we operate—whether it is at the level of milliseconds, hours, or days and weeks. By staying top of mind, it affects what we notice, how we weigh our choices, how we deliberate and ultimately what we decide. When we function under scarcity, we represent, manage, and deal with problems differently. Some fields have studied mindsets created by particular instances of scarcity: how dieting affects mood, or how a particular cultural context might affect the attitudes of the local poor. We are arguing something much more universal: Scarcity, in every form, creates a similar kind of mindset. And this mindset can help us understand

many of the behaviors and the consequences of scarcity.

We find, for example, that it was not a coincidence that Sendhil and Shawn both fell in and stayed in a trap. One of the remarkable facts about scarcity, we will argue, is that in many circumstances it creates behaviors that further perpetuate scarcity. Scarcity often creates a trap, a precarious and messy context, much like Sendhil's near-toppling past-due pile, or Shawn's patchwork of finances. We will also show, however, that this trap is not unavoidable. Because it is the result of behavior and the environment, changes to how we structure the environment can ameliorate the potential to avoid or get out of scarcity traps.

Furthermore, many of Sendhil and Shawn's behaviors are representative of the scarcity mindset. The challenges of sticking to a plan, whether by resisting a new leather jacket or a new project, the forgetfulness (a car-registration, or a past-due bill), and the cognitive slips—the mis-estimated bank account balance or the mishandled invitation -- are all features of the psychology of scarcity. In fact they follow from one of our main findings. We will show how scarcity makes us measurably more impulsive, and less intelligent. It lowers what is perhaps the most central component of intelligent behavior, namely, our fluid intelligence, and it diminishes our capacity for what psychologists call executive control.

The scarcity mindset sheds light on some important problems. It sheds light on the persistent difficulties of having constantly to budget your finances. It explains why the busy stay busy, and why diets often fail. It suggests a surprising reason why the lonely stay lonely, finding it hard to make friends. And perhaps most importantly, it provides a new perspective on the age-old problem of poverty, quite distinct from existing views. In all these cases, our perspective is different because our approach is distinct. To understand these problems, existing theories turn to culture, personality, preferences, or institutions. What attitudes do the indebted have toward money and credit? What are the work habits of the overly busy? What cultural norms and constructed preferences guide the food choices of the obese?

All these, we suggest, may provide important explanations, but there is something

much more fundamental: Many of these problems can be understood through the scarcity mindset. This is not to say that culture, economic forces, and personality do not matter. They surely do. But scarcity has its own logic, one that operates on top of these forces. This is also not to say that all forms of scarcity are equally deleterious: most of us would rather be terribly busy than profoundly poor. But understanding a common mechanism can be powerful. The structure of human memory, for example, is responsible for phenomena that range from common forgetfulness to Alzheimer's disease. Similarly we will argue that the scarcity mindset underlies a common set of processes and behaviors, even if the consequences may differ.

As you may have already gathered, this book describes a "science in the making". Like any science, we will state hypotheses, present evidence, and consider alternatives. At the same time, we have worked hard to make the technical material easily accessible to the interested reader. To bring the ideas alive and render them intuitive, we use many anecdotes and vignettes. These, of course, are never meant as proof - the proof will be in the evidence we present. And the evidence will take many forms — lab experiments, qualitative research, quantitative survey data, and field experiments.

The book, in one sense, is written for the "expert". But because there are no experts (yet!) in the science of scarcity, everyone in invited to join. The work is very much "in the making," in that the material is new and different. We present data that we collected (with our co-authors) to understand the scarcity mindset, and we describe original experiments, run in university laboratories and in train stations, in sugar cane fields in India, and in soup kitchens in urban United States.. We also re-visit previous studies (such as the hunger study above) and re-interpret them in a way that the original authors probably did not anticipate.

Finally, the book is "in the making" in another sense. We think we have accumulated enough evidence to suggest that our hypothesis deserves serious consideration. And it appears to be relevant to a wide range of problems, from dieting, being lonely, and multitasking under time pressure, to feeling financially budgeted in these times of

increasing economic hardship, and to being truly poor. At the same time, these are early days for this new way of thinking (which we hope is exciting to you), and there are many more implications to be derived, magnitudes to be understood, and consequences to be unraveled.

This book suggests a fundamentally new way of thinking about age-old problems. The multitude of evidence suggests this new perspective ought to be taken seriously. But it is not the final word. There is much more to be done, and in that sense, our book is an invitation. It offers you a front row seat to the first act of a process of discovery.

Chapter 1
Focusing, Tunneling, and Neglect

Hobbes: *"Do you have an idea for your story yet?"*
Calvin: *"You can't just turn on creativity like a faucet. You have to be in the right mood."*
Hobbes: *"What mood would that be?"*
Calvin: *"Last minute Panic."*

-*Calvin and Hobbes,* Bill Watterson

One evening not long ago we went to a vegetarian restaurant called Dirt Candy, its name coming from the owner-chef Amanda Cohen's belief that vegetables are "candy" from the earth. The restaurant was known for a particular dish—the crispy tofu with broccoli served with an orange sauce—that all the reviewers raved about. They were right to rave. It was delicious, the table favorite.

Our visit was well timed. We learned the next day that Amanda Cohen was to appear on *Iron Chef*, a popular TV show, in which chefs compete by preparing a three-course meal under great time pressure. At the beginning of the show, they learn the surprise ingredient that must be used in every course and have a few hours to design and cook the dishes. The show is extremely popular with aspiring cooks, food connoisseurs, and people who just like looking at food. And Cohen got fantastically lucky on the show: her surprise ingredient was broccoli! Naturally, she prepared her signature dish, the one we had just eaten. And of course the judges loved it.

But Cohen didn't get lucky in the way we thought. The surprise ingredient, the broccoli, did not allow her to showcase a dish already in her repertoire. Quite the opposite. Episodes are filmed a year in advance. The surprise broccoli ingredient was what led her to create that dish in the first place. As she puts it, "The Crispy Tofu that's on the menu now was created for *Iron Chef*." This kind of "luck," if one can call it that, is even more remarkable. Here was an expert who had spent years perfecting her craft, yet one of her best dishes was created in a couple of hours.

Of course, this dish was not created from scratch. Creative bursts like this build on months and years of prior experience and hard work. Then scarcity focuses all that effort in a productive way. Imagine working on a presentation that you need to deliver at a business meeting. In the days leading up to it, you work hard but you vacillate. All the ideas may be there, but tough choices still need to be made on how to put everything together. Once the deadline looms, though, there is no more time for dawdling. Scarcity forces these choices. Abstractions become concrete output. Without this last push, you may be creative without producing a final product. Cohen had several secret ingredients of her own going into her appearance on *Iron Chef*: ideas she had been playing with for months or even years. But these ideas fleeted while Cohen was busy dealing with other aspects of her life, like running a restaurant. Scarcity did not create them. Instead it pushed her to bring the ingredients together into one dish, the best dish she could make at that time.

We often associate scarcity with its most dire consequences: the poor mired deep in debt or the busy perpetually behind on their work. Amanda Cohen's experience, on the other hand, illustrates another side of scarcity, a side that, due to scarcity's many tribulations, can easily go undetected: sometimes scarcity makes us more effective. We all have had experiences where we did remarkable things when we had less, when we felt constrained. Because she was keenly aware of the lack of time, Amanda Cohen focused on pulling everything from her bag of tricks into one great dish. In our theory, when scarcity captures the mind, it focuses our attention on using what we have most effectively. While it may have severe repercussions down the road, it can be highly effective locally. This suggests that to understand why scarcity eventually ends in failure, we must first articulate how scarcity can help us succeed.

Getting the most out of what you have

Some of us hate meetings. Connie Gersick, a Professor of Organizational Behavior, has made a living out of studying them. She has conducted numerous detailed qualitative studies to understand how they unfold, how the pattern of work and conversation changes over the course of a meeting. She has studied every kind of meeting—meetings between students and meetings between managers, meetings intended to weigh options to produce

a decision and meetings intended to brainstorm to produce something more tangible like a sales pitch. These meetings could not be more distinct. But in one way -- which we have all experienced -- they were all the same. They all began unfocused. The discussions abstract or tangential; conversations meandered, sometimes far off topic. Simple points would be made in lengthy ways. Disagreements would be aired but often with little resolution. Time would be spent on irrelevant details.

But then, halfway through the meeting, things would change. There was, as Gersick calls it, a *midcourse correction.* The group realized time was running out and became "serious." As she puts it, "The midpoint of their task was the start of a `major jump in progress' when the [group] became concerned about the deadline and their progress so far. [At this point] they settled into a…phase of working together [with] a sudden increase of energy to complete their task." They hammer out disagreements, concentrate on the essential details, and leave the rest aside. The second half of the meeting produces more tangible progress.

The midcourse correction illustrates how scarcity of time creates focus. It happens even when we are working alone. Picture yourself writing a book. Imagine that the chapter you are working on is due in a couple of weeks. You sit down to write. After a few sentences you remember an email that needs attention. When you open your inbox, you notice a few others that deserve a response. Before you know it, half an hour has passed and you're still doing email. Knowing you need to write, you return to your few meager sentences. A bit later, you suddenly catch yourself. While sitting at the computer "writing," your mind has been wandering. How long have you been sitting there thinking about whether you should have pizza for lunch, when was the last time you had your cholesterol checked, and whether you updated your life insurance policy to your new address? How long have you been drifting from thought to vaguely related thought? Luckily it is nearly time for lunch and you decide to pack off a bit early. As you finish the lunch with the friend you haven't seen in weeks, you linger over coffee—after all, you have a couple of weeks for that chapter. And so the day continues: you manage to get in a little bit of writing, but far less than you had hoped.

Now imagine the same situation, only the chapter is due in a couple of days, not weeks. This time when you sit down to write, you do so with a sense of urgency. When your colleague's email comes to mind, you press on rather than get distracted. And best of all, you may be so focused the email may not even cross your mind. This time, your mind does not wander to lunch, cholesterol checks, or life insurance policies. While at lunch with your friend (assuming you didn't cancel, or forget), you do not linger for coffee—the chapter and the deadline are right there with you at the restaurant. By day's end this focus pays off: you manage to write a significant chunk of the chapter.

Psychologists have studied the impact of deadlines in more controlled experiments. In one study, undergraduates were paid to proofread three essays and were given three weeks to complete the task. Their pay depended on how many errors they found and on finishing on time—they had to turn in all the essays by the third week. In a nice twist, the researchers created a second group with more scarcity: they had to turn in one proofread essay every week. This group faced much tighter deadlines. The result? The group with tighter deadlines did better: they were late less often (although they had more deadlines to miss), they found more typos and they earned more money.

Deadlines do not just mean greater productivity. Second semester college seniors, for example, also face a deadline: they have very few weeks left at school. This is a deadline for enjoying the last days of college life. A study by Psychology Professor Jamie Kurtz looked at how seniors managed this deadline. She started the study six weeks from graduation. Six weeks is far enough away that the end of college may not yet have fully registered, yet it is short enough that it can be made to feel quite close. For half the students, Kurtz framed the deadline as imminent (only so many hours left!) and for the others she framed it as far off (a portion of the year left). The result? Changing perceived scarcity changed the students' behavior. When they felt they had little time left, they tried to get more out of every day. They spent more time engaging in activities, soaking in the last of their college years. They also reported being happier—presumably enjoying more of what the college had to offer.

This impact of time scarcity has been observed in many disparate fields. In large-scale marketing experiments, some customers are mailed a coupon with an expiration date, while others are mailed a similar coupon that does not expire. Those with no expiration date have much more time to use the coupon. Yet most studies find that they avail themselves of the coupon less often. The expiration date focuses people and leads them to use the coupon more effectively. In another domain, organizational researchers find that sales-people work hardest in the last weeks (or days) of a sales cycle. In a study we ran, we found that data-entry workers worked the hardest as payday got closer.

The British journalist Max Hastings in his book on Churchill's "Finest Years," notes, "An Englishman's mind works best when it is almost too late." Everyone who has ever worked on a deadline (and who hasn't?) may feel like an Englishman. Deadlines are effective precisely because they create scarcity and focus the mind. Just as hunger led food to be top of mind, a deadline leads the current task to be top of mind. Whether it is the few minutes left in a meeting or a few weeks left in college, the deadline looms large. We put more time into the task. Distractions are less tempting. The deadline engulfs your thoughts, and overwhelms other demands: you do not linger at lunch when the book is due soon, you do not waste time on tangents when the meeting is about to end and you do not waste your college days when you are about to graduate. When time is short, you get more out of it, be it work or pleasure. We call this the *focus dividend*—the positive outcome of scarcity capturing the mind.

The Focus Dividend

Of course, the focus dividend should not just be about deadlines. Any kind of scarcity ought to focus us and in the right circumstances yield benefits. In our own lives, we have all found ourselves being more vigilant about the toothpaste and using it more effectively as the tube starts to run empty. In a box of expensive chocolates, we savor (and hoard) the last ones. We run around on the last days of a vacation to see every site. We write more carefully, and to our surprise often better, when we have a tight word limit.

This breadth of application—the idea that this applies all kinds of scarcity—is a strength. It is also a challenge. How can one study an effect that spans so many contexts?

Psychology professor Anuj Shah, a collaborator of ours, had an insight about how to arrive at conclusions that are more universally applicable. If our theory applies to all kinds of scarcity—not just money or time—it should even apply to artificial scarcity. Anuj suggested we create scarcity in the lab and see its effects in controlled conditions. In effect, he was following on a long tradition in the social sciences. The lab has proven a powerful context in which to understand important social issues—conformity, obedience, strategic interaction, helping behavior and even crime. By examining how people behave under conditions that are more controlled than the world typically allows, lab experiments can better explore mechanisms of thought and action. Anuj was hoping to do this for scarcity.

To do this, Anuj created a video game, based on *Angry Birds,* which he called *Angry Blueberries*. In this game, players shoot blueberries at waffles using a virtual slingshot, deciding how far back to pull the sling and at what angle. The blueberries fly across the screen, caroming off of objects and "destroying" all the waffles they hit. It is a game of aim, precision and physics. You must guess the trajectories and estimate how the blueberries will bounce.

In the study, subjects play twenty rounds, earning points that translate to prizes. In each round they receive another set of blueberries. They can shoot all the blueberries they have or they can bank some for use in future rounds. If they end the twenty rounds with blueberries saved up, they can play more rounds and continue accumulating points as long as they have blueberries left. In this game, blueberries determine one's wealth. More blueberries mean more shots, which means more points and a better prize. Anuj therefore created blueberry scarcity. He made some subjects blueberry rich (they were given six blueberries per round) and others blueberry poor (given only three per round).

So how do they do? Of course, the rich score more points. They have more blueberries to shoot with. But looked at another way, the poor do better: they are more accurate with their shots. This is not some magical improvement in visual acuity. The poor take more time on each shot (there is no limit on how long they could take). They aim more carefully. They have fewer shots, so they were more judicious. The rich on the other hand just let the blueberries fly. It is not that the rich, simply because they had more rounds, got

bored and decided to spend less time on the task. Nor is that they became fatigued. Even on the first shots they are already less focused and less careful than the poor. We would say the improved accuracy of the blueberry poor is a focus dividend.

In a way it is surprising that blueberry scarcity had effects similar to those observed with deadlines—time scarcity. Having few blueberries in a video game bears little resemblance to having only a few minutes left in a meeting or only a few hours to finish a project. Focusing on each shot, how far back to pull the sling, and when to release bears little resemblance to the complex choices that determine conversation and pace at work. We have stripped the world of all its complexity, all except for scarcity, and yet the same behavior emerges. These initial blueberry results illustrate that—whatever else may happen in the world—scarcity by itself can create a focus dividend.

The observed effects of scarcity in controlled conditions show one more thing. In the real world, the poor and the rich differ in so many ways. Their diverse backgrounds and experiences lead them to have different personalities, different abilities, health, and preferences. Those who find themselves working at the last minute under deadline may simply be different people. When they are seen to behave differently, scarcity could be one reason, but so could any of several other differences. In *Angry Blueberries,* a coin flip determined who was "rich" (in blueberries) and who was "poor." Now, if they are seen to behave differently, it cannot be attributed to any systematic inherent personal differences; it must be due to the one thing that distinguishes between them: their blueberry scarcity. By creating scarcity in the lab in this way, we can untangle scarcity from the knots that usually surround it. We know that scarcity itself must be the reason.

The focus dividend—whether the increased effectiveness due to deadlines or the improved productivity of the blueberry poor—comes from our core mechanism: scarcity captures the mind. The word "capture" here is essential. We already saw how scarcity grabs attention at a level below conscious control. It is a level of focus beyond what we could consciously choose. A dividend that comes from a focusing act that would be hard to fake. Just as we cannot effectively tickle ourselves, it is exceedingly difficult to fool ourselves into working harder by pretending we have a deadline. A fake deadline will never

capture our mind the way an actual deadline does. Here, again, the game provides a suggestive glimpse. The rich in *Angry Blueberries*, for example, could have employed a strategy that simulates being poor. They could have used only three shots each round (like the poor) and saved the rest. This would have led them to play twice as many rounds as the "truly" poor, and thus allowed them to earn twice as many points. In actuality, the blueberry-rich do not earn anywhere near twice as much in the course of each game. (Or if the rich simply didn't want to spend so much time on the task, they could have played fewer rounds overall and stopped early). Of course, the players may not have realized this strategy. But we would argue that even if they had, it would not have helped. It is very hard to fake scarcity. The scarcity dividend happens because scarcity imposes itself on us, capturing our attention against all else. An imaginary deadline will be just that, imagined. It is why the impending deadline lets us avoid distractions and temptations so readily. It actively pushes away distractions and temptations.

The focus dividend also shows that scarcity captures attention at many time scales. We saw in the Introduction that scarcity captures attention at the level of milliseconds (the time it took the hungry to recognize the word CAKE). In the present examples we see it operate at slower timescales. We see it at the scale of minutes—aiming blueberries—and of days and weeks—college seniors getting the most of their time before graduation. Putting all these together, we see how scarcity captures the mind, both subconsciously as well as when we act more deliberately. As psychologist Danny Kahneman would say, scarcity captures the mind both when thinking fast and when thinking slow.

Tunneling

A Tragic Consequence

At 10 pm on April 23, 2005, Brian Hunton of the Amarillo Fire Department received what was to be his last call.

Some calls turn out to be false alarms. Some—like this burning house on South Polk Street—turn out to be all too real. Not knowing which is which, firefighters take each one seriously. Each alarm creates a literal fire drill: firefighters must go from a relaxed evening

at the firehouse to being at the fire scene. Not only must they get there quickly, but they must arrive in full gear and fully prepared. They rehearse and optimize each step. They even train getting dressed quickly. All this pays off. Within *one minute* of the call, Hunton and the rest of the crew were fully loaded on the truck, their pants, jackets, hoods, gloves, helmets, and boots already on.

Those outside the firefighting community are surprised by how Hunton died. He did not die because of burns from the fire. Nor did he die from smoke inhalation or from building collapse. In fact, Hunton never made it to the fire. As the fire truck raced to South Polk Street, it took a sharp turn. Going around a corner at full speed, the left rear door swung open. Hunton came tumbling out and his head struck the pavement. The massive force of the strike caused serious trauma to the head, from which he died two days later.

Hunton's death is tragic because it could have been prevented. If he had been wearing seat belt when the door accidentally swung open, he might have been rattled but he would have been safe.

Hunton's death is particularly tragic because it is not unique. Some estimates place vehicle accidents as the second leading cause of firefighter deaths, after heart attacks. Between 1984 and 2000, motor vehicle collisions accounted for between 20 and 25 percent of firefighter fatalities. In 79 percent of these cases the firefighters were not wearing a seat belt. Though one cannot know for sure, it stands to reason that simply buckling up could have saved many of these lives.

Firefighters know these statistics. They learn them in safety classes. Hunton, for one, had graduated from a safety class the year before. "I don't know of a firefighter who doesn't wear his or her seat belt when driving a personal vehicle," wrote Charlie Dickinson, Deputy Administrator of the U.S. Fire Administration in 2007. "I don't know of a firefighter who doesn't also insist family members buckle up as well. Why is it then that firefighters lose their lives being thrown from fire apparatus?"

Rushing to a call, firefighters confront time scarcity. Not only must they get on the truck and to the fire quickly, but a lot of preparation also needs to take place by the time

they arrive at the fire. They strategize en route. They use an onboard computer display to study the structure and layout of the burning building. They decide on their entry and exit strategies. They calculate the amount of hose they will need. All this must be done in the brief time it takes to get to the fire. And firefighters are terrific at managing this scarcity. They get to the distant fires in minutes. They reap a big focus dividend. But this dividend comes at a cost.

When we focus on one thing we must neglect something else. We've all had the experience of being so engrossed in a book or a TV show that we failed to register a question from a friend sitting next to us. The power of focus is the power to shut things out. Instead of saying scarcity "focuses" we could just as easily say scarcity causes us to *tunnel*.

By tunneling, we mean a single-minded focus, in this case on managing scarcity. While we are focused on scarcity, thoughts and considerations unrelated to addressing it recede in our minds: they are less available; they lay outside the tunnel. The name is meant to evoke tunnel vision, the narrowing of the visual field in which objects inside the tunnel come into sharper focus while rendering us blind to everything peripheral, on the outside. By tunneling, we mean the cognitive equivalent of this visual experience. .

Firefighters, it turns out, do not just focus on getting to the fire prepared and on time - they tunnel on it. Unrelated considerations—in this case the seat belt—get neglected. Of course, there might be other reasons firefighters do not wear seat belts. But a seat belt that never crosses your mind cannot be buckled. And there is nothing unique about firefighters when it comes to tunneling. Many men tunnel when their wives enter labor, focused intently on getting to the hospital as fast as they can. As they speed down the highway, they neglect the probability of an accident, putting themselves and their family at risk. The poor tunnel on making that rent payment and the busy tunnel on making the project deadline; they neglect everything else. "Focus" is a positive. "Tunneling" is not. The benefits of focusing come at a cost: of all those things we neglect while managing scarcity.

The Process of Neglect

Imagine that one morning you skip your regular gym session to get some work done. We could say you tunneled on your work and neglected the gym. Although we could just as easily say that you had only so many hours that morning and that your work was more important. What exactly does it mean to neglect in a world where we can never have, or do, all we would like? Something must always be given up. How is neglect different from any other tradeoff?

The difference is that neglect refers not to whether the right choice was made, but to *how* the choice was made. Think about how you might "choose" not to go to the gym on that busy day? Perhaps you made a reasoned tradeoff. You calculated how often you've been to the gym recently. You weighed the benefits of one more visit against the immediate needs of your project and decided to skip. Or perhaps, when you are busily working against an upcoming deadline, the gym never even crossed your mind. You wake up with the project on the top of your mind. And even if the gym crosses your mind, you think primarily not of its advantages, but of all the ways in which it is an impediment to finishing your project. This is what we mean by neglect: not the validity but the process of choice. We neglect because when we tunnel, we shut out other considerations. We do not actively decide to ignore these other things, we simply fail to consider them fully.

To understand the process of tunneling it helps to better understand the mechanism by which things come or fail to come to mind. Try this simple task: list as many white things as you can. Go ahead and give it a try. To make things easier, we will give you a couple of obvious ones to start you off. Take a minute and see what other white things you can name.

Snow	Milk			

How many could you name? Was it harder than you thought it would be?

Research shows that there is one way to make this task easier for you—and that is *not* to give you "milk" and "snow". In experiments, people given these "helpers" name fewer total items, even counting the freebies.

This perverse outcome is a consequence of a basic feature of the mind, what psychologists call inhibition. Once the link between "white" and "milk" is activated in your mind, each time that you think, "things that are white," that activated link draws you right back to "milk" (and activates it further). As a consequence, all other things white are inhibited, made harder to reach. You draw a blank. (Even thinking of examples for this paragraph proved hard). "Milk" is such a canonically white object that, once activated, it crowds out any others. And this is a general feature of mental focus. Inhibition is what happens when you are angry with someone, and it is harder to remember their good features: the focus the annoying features inhibits positive memories.

The mind does not inhibit just words or memories. In one study, subjects were asked to write down a personal goal, an attribute that describes a trait (e.g., "popular" or "successful") that they would like to attain. Half were asked to list a personally important goal. Others are just asked to merely list some goal. Following this, just as in our little milk experiment above, both groups were asked to list as many goals as they could. Starting off with an important goal led to 30 percent fewer goals being named. Just as "milk" tends to shuts out other white objects, activating an important goal shuts off competing goals. Focusing on something that matters to you makes you less able to think about other things you care about. Psychologists call this *goal inhibition*.

Goal inhibition helps understand tunneling. By capturing our attention, scarcity creates a powerful goal and in the process inhibits others. The fireman has one goal: get to the fire quickly and prepared. Other things do not enter his mind. This can be good: his mind is free from thoughts about dinner or retirement savings, focusing instead on the upcoming fire. But it can also be bad. Things unrelated to that goal (such as the seat belt) will not cross his mind; and even if they do, more urgent concerns drown them out. The husband driving his pregnant wife to the hospital has one goal. Other goals—be a safe

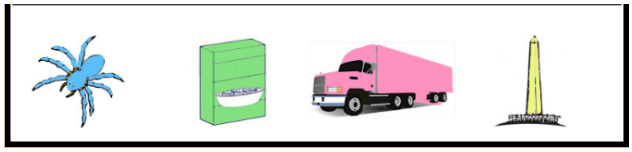
driver, avoid speeding tickets—all get inhibited. It is in this sense that the seat belt and the risk of an accident get neglected.

Inhibition is not merely bad - it also happens to be a primary reason for the focus dividend. Inhibiting distractions allows you to focus. In our earlier example, why were we so productive working on the chapter when facing a deadline? Because we were less distracted. The colleague's email does not come to mind, or is easily dismissed. And goal inhibition is why we were less distracted. The primary goal—finish the chapter—captured our mind. It inhibited all those distractions that create procrastination—email, a short video game, that phone call that ought to be made, a light snack. But it is a two-way street: it also inhibited other, important considerations.

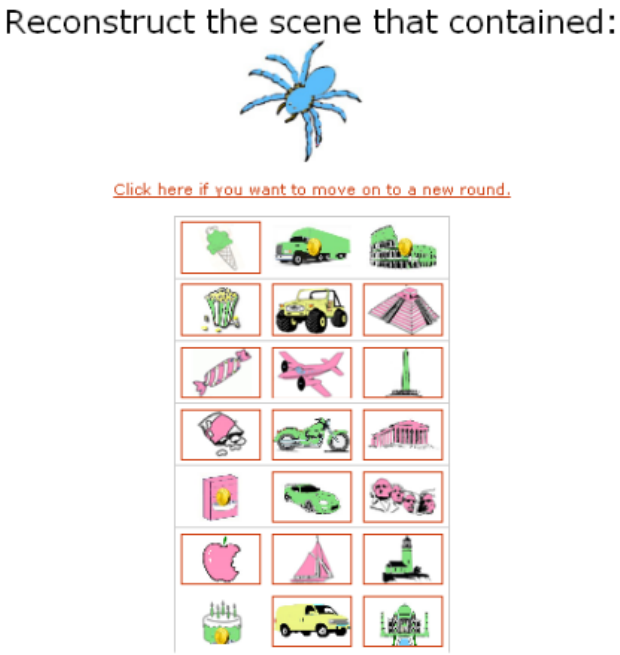
We focus and tunnel, attend and neglect for the same reason: things outside the tunnel get inhibited. When we worked on a deadline, skipping the gym might or might not have made sense. We just didn't think (or think enough) about it that way when we decided to forego the gym for the deadline. Our mind was not on that subtle cost-benefit problem; it was on the deadline. Considerations that fall within the tunnel get careful scrutiny. Considerations that fall outside the tunnel are neglected, both when it makes sense and when it does not. Think of an air traffic controller who manages several planes in the air. When two planes are on a collision course, that's where she focuses. At that moment, she neglects not only her lunch plans and her retirement savings, but also the other planes that are under her control.

The Neglect Tax

To test for neglect, we wanted a behavior that would be hard to reconcile with making a reasoned tradeoff. If scarcity-induced neglect is insensitive to the weighing of costs and benefits, we ought to see scarcity creating neglect even when it is detrimental to the person's outcomes. To test for this, we went back to our method from the last chapter: we created scarcity in the lab. In this experiment, our colleague Anuj Shah gave participants simple memory tasks, each containing four items, such as this one:



Subjects memorized these pictures and were later asked to reconstruct them. They were given one of the four items and asked to recall the other three. For example, after seeing the picture above they might be asked:



Subjects had to retrieve from memory which of the other objects – a food, a vehicle, and a monument -- went along with the spider in the original picture. They got points for correct responses, and they could take as long as they wanted. There was no time scarcity. But there was "guess scarcity." They only had a fixed number of guesses they were allowed to make. As before, we create the guess poor and the guess rich.

To study neglect, we added a wrinkle. We had participants play two such games side by side. They were given two pictures to memorize and to reconstruct. And we made them poor (few guesses) in one game and rich (many guesses) in the other. So they experienced scarcity in trying to reconstruct one picture but not the other. Their total earnings

depended on their performance on both games: they had to maximize total points earned. Think of it as having two projects, one with a deadline tomorrow and the other a week later.

Consistent with the focus dividend, people were more effective guessers on the picture they were poor on. But they also neglected: they gave less attention to the other picture. And this neglect was not efficient. They performed so much worse on the neglected picture that they earned, overall, fewer points than subjects who were poor on *both pictures*. They earned less even though they had more total guesses. A scarcity of guesses in both games meant they could not neglect either one; whereas abundance in one game led them to neglect that game in favor of the one they felt poor on. And they over-focused. Had the shift in focus to the poor game been deliberate, they would not have taken it to such an extreme. Clearly they did not gauge the costs and benefits of tunneling. They simply tunneled, and in this environment it hurt them.

We call the consequences of neglect, the *tunneling tax*. Naturally, whether this tax dominates the focus dividend or not is a matter of context and of payoffs. Change the game a bit and the dividend wins out. The point of the study was not to show that neglect always leads to a bad outcome. Rather, what the study shows is that cost-benefit considerations do not determine whether we tunnel. Scarcity captures our minds automatically. It leads us to focus and neglect beyond what a calculus of costs and benefits might warrant.

The Tunneling Tax

> *I took a speed-reading course and read 'War and Peace' in twenty minutes. It involved Russia.*
>
> -Woody Allen

To see how the tunneling tax might play itself out in the world, here are a few examples. First, some advice from the *Wall Street Journal* on how to save money:

> *OK. So you want to save an extra $10,000 by next Thanksgiving. How can you do it? You've heard the usual finger-wagging frugality lessons over and over.*

*And you already do the obvious things, like cutting back on lattes**, raising your insurance deductibles** and steering clear of expensive stores.*

Is raising deductibles a good idea? Even, or perhaps especially, for someone on a tight budget, this is a hard question to answer. It depends on a great many things, such as your chance of an accident, the cost of repair, or how much you use your car. After all, someone with very little money will also have very little money to pay the deductible in case of an accident. But these considerations get neglected: how to pay for repairs in case the car breaks down falls outside the tunnel. A reasoned choice about the deductible would trade off these considerations. But within the tunnel of making ends meet, all that is seen is a way to save some money (like cutting back on lattes, or on movies).

When facing time scarcity, a common way we neglect is by multi-tasking. We might check email while "listening in" on a conference call; or squeeze in a bit more email on the cell phone over dinner. All this comes at a cost: missing something on the call or at dinner, or writing a sloppy email. These costs are notorious when we drive. When you think about the multitasking driver, you think of cell phones. Indeed, studies have shown that talking on a (non hand-held) cell phone while you drive can be worse than driving at above legal alcohol levels. But you might also want to think about that driver eating a sandwich. Studies show that eating while driving can be an even bigger danger. And a very common practice: one study found that 70 percent of Americans squeeze in eating while they drive. Eating while driving saves you a bit of time, but it risks an accident. It also risks staining your upholstery, and it increases your chances of a different kind of spare tire: people eat more calories when they are distracted, such as when they drive.

In all these cases, we neglect the potential costs of compromising in order to manage many needs under a tight budget, be they insurance, email, or a meal. At other times we neglect by just cutting things out. When we are busy with a pressing project we skimp on time with our family, put off getting our finances in order, or defer a regular medical checkup. When you are extremely rushed for time, it is easier to say, "I can spend time with the kids next week," rather than "Actually, the kids really need me. When exactly will I

really have time next?" Things outside the tunnel are harder to see clearly, easier to undervalue, and more likely to get left out.

People short on money cut "unnecessary" expenses. But what appears unnecessary in the tunnel may not always be the least valuable. Researchers in poor countries have found it hard to get poor farmers to take-up many kinds of insurance, from health insurance to crop insurance. Rainfall insurance, for example, would protect these farmers from the havoc that low (or very heavy) rainfall could do to their livelihood. Even with extremely large subsidies, most do not insure (in some cases below ten percent of farmers). The same is true of health insurance. When asked why they are unisured, the poor often report they cannot afford insurance. This is ironic since you could say the exact opposite: that they cannot afford *not* to be insured. We would argue that insurance is a casualty of neglect. To a farmer who is struggling to find enough money for food and vital expenses this month, the threat of low rainfall or medical expenses next season seems abstract. And it falls clearly outside the tunnel. Insurance does not deal with any of the needs—food, rent, school fees—that are pressing against the mind right now. Instead, it exacerbates them - one more strain on a strained budget.

Companies are not immune to the psychology of scarcity. For example, during lean times, many firms slash their marketing budgets. Some experts believe that this is not a sound business decision. As one adviser for small businesses puts it:

> *In lean times, many small businesses make the mistake of cutting their marketing budget to the bone or even eliminating it entirely. But lean times are exactly the times your small business most needs marketing. Consumers are restless and looking to make changes in their buying decisions. You need to help them find your products and services and choose them rather than others by getting your name out there. So don't quit marketing. In fact, if possible, step up your marketing efforts.*

Settling this debate—whether cutting marketing during recessions is efficient—would require a great deal of empirical work. What we can say is that marketing expenses

look a lot like the kind of thing you would neglect in the tunnel, when focused on trimming your budget this quarter. Marketing—like the insurance policy for the poor—has a cost that falls smack inside the tunnel while its benefits fall outside.

In many of these examples, one could fairly question whether neglect in fact led to a bad outcome. How do we know that the time saved eating while driving is not worth the increased accident risk? It is often a challenge to decide whether neglect was wrong in any particular case. If focusing on a deadline, you neglect your kids, was that a bad choice? Who is to say? It depends on the consequences of performing poorly at work, the impact of your absence on your children, and even what you want out of life. An outside observer would need to struggle to disentangle these considerations. But by exposing *how* neglect happens, the scarcity mindset can shed light on the issue even without settling these debates.

It tells us, for example, that we should be cautious about inferring preferences from behavior. We might see the busy person neglect their children and conclude they do not care as much about their kids as they do about their work. But that ain't necessarily so. Any more than we should conclude the farmer doesn't care much about the loss of his crop to the rains. The busy person may be tunneling. They may value their time with the children greatly, but the project they are rushing to finish pushes all that outside the tunnel. They may look back over the weeks, months or years and report a great deal of anguish about not spending more time with the children. In our theory, this is genuine anguish. It is not mere compliance with a social norm ("yes, yes, I agree I should have spent more time with my children"). It is also a predictable disappointment, an entirely foreseeable consequence of tunneling. Projects must be finished now; the children will be there tomorrow. Looking back at how our time or money were spent during moments of scarcity, we are bound to be disappointed. Immediate scarcity looms large and important things unrelated to it will be neglected. When we experience scarcity again and again, as the perpetually busy do, these omissions can add up. Which should not be confused with a lack of interest. After all, the person themselves regret it.

There is a whimsical saying that no one on their deathbed ever regrets not spending more time at the office. The psychology of scarcity lends this a rather serious meaning.

Interestingly, understanding the way we tunnel and neglect can improve our ability to manage and deal with tunneling, as we will see in Chapter 7. If neglect were merely the result of careful tradeoffs, there would not be much that could be done. But since neglect—as we define it—is a more specific process, we can do much more with an eye towards changing the dynamics of neglect. We may not need to look back and regret those things we did not do during times of scarcity: by changing the environment to accommodate tunneling, we may be able to derive some of the focusing dividend while managing to avoid predictable mistakes.

Chapter 2
The Bandwidth Tax

Here are three vignettes about scarcity:

Suddenly every hour counts. One of your biggest clients informs you they want to take their business elsewhere. They will listen to one last pitch on why they should stay. Tomorrow. You cancel all your meetings. You put off all other tasks. You pour all your time into the pitch. One appointment though cannot be avoided. Your daughter has her city championship softball game tonight. For a moment you even consider skipping that but your better side (barely) wins out: surely her pitches tonight feel as important to her as your sales pitch tomorrow feels to you. On the way to the game, your daughter realizes she forgot her lucky charm. You snap at her before turning around to pick it up. By the time you have regained your composure it's too late. She was already nervous for the game and you made her more nervous. Something fun has become tension-filled. At the game, you can't enjoy yourself. Your mind keeps turning to that presentation, not that you can work on it now -- you just can't focus on the game. You're distracted, and when your daughter occasionally catches a glimpse of you, you know she knows it. Lucky for you, her team wins and the jubilation helps cover your mistakes. But certainly your performance that evening would not put you in any parenting Hall of Fame.

John has an exam tomorrow. He is putting himself through college. Though his parents saved for all their kids' college, they did not save enough. They never dreamed tuitions would rise so much. As the last of four kids, by the time John's turn came around, the savings was meager and tuition was even higher. Still he chose to go to a more prestigious but more expensive college. If he was going to invest in his degree, he might as well invest in the one that would be worth the most. He patched together student loans, the college's financial aid and scholarships. It was messy but somehow he made it work. It always seemed like a good choice. Until now. Two scholarships that were to be automatically renewed suddenly evaporated. The foundations that

give them were hit hard by the recession and forced to cut back. How would he make tuition for next semester? It was due in less than a month. Would the bank give him another student loan? Could he afford it? He could borrow from his aunt and uncle; his father would hate it but did he have a choice? Should he just transfer back to the local college? John just can't focus. He keeps thinking about what to do. Preoccupied, he misses a study group meeting that he wanted—needed—to attend. This was no time to take the exam but he had no choice. When the day arrives, he tries to focus but his mind keeps going elsewhere. He misses some easy questions, and is doubly upset at the end of the day. Not only is he struggling with tuition, he is annoyed at his abysmal performance on the exam.

A manager of a fast-food burger shop laments his trouble with his (low-wage) employees. "They are just so unreliable," he says. Much of his effort goes into cajoling them into being better with the customers. "Customer service means just that. Put on a smile. Be friendly. When the customer talks to you, make small talk. When the customers is a jerk, don't get snippy. It's your job to be polite." The rest of his time goes dealing with careless mistakes. "When someone says they want medium fries, how hard is it to push the button for fries?" He is clearly frustrated with his workers. "Maybe it's that these guys just don't care. Maybe it's the education in this country. Maybe it's the way they were raised. Whatever it is, I'm the one who has to deal with it," he says.

These vignettes are not about over-borrowing or under-saving, or about mismanaging a scarce resource at all. Instead, there is carelessness: forgetting the fries or the study group. There is impulsiveness: snapping at your daughter or at a rude customer. There is mindlessness: failing to focus on the exam or on your daughter's game. These pressures, and failures, are different than those we discussed earlier. The failures here are different than what we have discussed so far. These are not the busy mismanaging their time or the financially strapped mismanaging their money.

These failures happen in the rest of life. They are about what happens in all those moments when you are *trying* to focus on something other than your scarcity. We catch the harried

executive not when he is putting together his sales pitch, but when his taking time off to be a parent. We catch the student not when he is trying to make ends meet but when is trying to focus on his exam. We catch the low-income worker not when they are about to take a payday loan but when they are at work serving customers.

This chapter makes a bold claim. Because human attentional resources are severely limited, focusing on scarcity in one walk of life can lead to failure in others. It changes the very fabric of who we are and how we appear to be: we end up dumber, more impulsive and careless. Scarcity doesn't just change how we manage our limited resources. If these stories are to be believed, our fixation on scarcity affects how we behave everywhere - it makes for ineffective employees, weak students and bad parents. We call this the *bandwidth tax,* and this chapter is devoted to it.

Its Loud in Here (or Passing Trains)

Imagine sitting in an office located near the train tracks. Trains rattle by several times an hour. The trains are not deafening. They do not disrupt conversation. In principle they are not loud enough to prevent you from working. But, of course, they do. As you try to concentrate, the sound of a passing train pulls you away from what you were doing. The interruption itself is brief, but its effect lasts longer. You need time to refocus. You may have lost your thread of thought. Worse, just when you have settled back in, another train appears on the tracks.

This description mirrors the conditions of a school in New Haven that was located next to some loud train tacks. To measure the impact of this noise on students, two researchers made a clever observation. Only one side of the school faced the tracks so the students in those classrooms were particularly exposed to the noise but similar in other regards. They found a striking difference between the two sides of the school. Sixth graders on the train side were a full year behind the students on the quieter side. Further evidence came when the city, prompted by this study, installed noise pads. The researchers found that this erased the difference: now students on both sides of the building performed the same. A whole host of studies have now shown that noise can hurt concentration and performance. Even if the impact of noise does not surprise you, the size of the impact (a full school year

level at 6th grade) should. In fact, these results mirror many laboratory studies that have documented the powerful effects of even slight distraction.

Picture yourself now working in a pleasant, quiet office: no disruptions; no trains. Instead, you are struggling with your mortgage: freelance work is hard to come by, and your spouse and you are living a two-earner life with only one and quarter earners. You sit down to focus on your work. Soon your mind is wandering. "Should we sell the second car?" "Should we take another loan?" Suddenly, that quiet office is not so quiet anymore. These noisy trains of thought are every bit as hard to ignore. They arrive at even greater regularity every bit as uninvited. But these trains pull you on board. "Should we sell the second car?" leads to "That would raise some money but it would make the logistics so much harder, just when I need to be working as hard as I can. We don't want to risk the one steady job we do have." You can ride these trains of thought for some time before you break free and return to focusing on your task. Though this room seems quiet, it is full of disruptions. But these disruptions come from within.

This is how scarcity taxes bandwidth. The things that distract us, that occupy our mind, need not come from outside us. We generate them for ourselves. These distractions can disrupt more than a physical train. These trains of thought rumble with personal relevance. The mortgage distraction lingers because it matters. It is not a passing nuisance but an intensely personal concern. Scarcity captures the mind. When we are trying to focus on something else, this capture becomes a hindrance. And the more you try to focus, the greater the hindrance becomes. It keeps pulling us away from what we are trying to do. Just like an external noise that distracts us from thinking clearly, scarcity is a persistent generator of *internal* disruption.

The notion of an "internal disruption" is commonplace in the cognitive sciences and in neuroscience. A great many studies have documented the profound impact of internal thoughts -- merely rehearsing a sequence of numbers in your head -- on general cognitive function. And years of lab studies compounded by fMRI evidence have taught us a lot about how the brain focuses and is disrupted. One common distinction is between "top-down" processing, where the mind is directed by our conscious choice of what to focus on, and

"bottom-up" processing, where attention is captured by one stimulus or another in ways that we find hard to control. We saw this in the opening chapter, when food related words captured the attention of the hungry. You know the feeling well, from any time a quick movement or sound captured your attention away from what you were doing. A particularly interesting form of distraction, one that requires no "real" distractors at all, is mind wondering. Without us realizing it, the brain's resting state -- the default network -- tends to pull us away from what we were doing. True to its name, this happens without our conscious input, when our mind "wonders." So while, thankfully, we are often able to direct our brain's activity, at other times we really lose that control. Interestingly, and unfortunately for the kids in the school near the trains, the ability to remain focused in the presence of bottom-up distractors depends also on how much work the brain is doing, on how "loaded" it is. Behavioral and neuroimaging studies have shown that distraction along with brain activity related to the presence of distractors increase when load is high.

Now think about scarcity. We have seen how scarcity captures our attention. As a bottom-up process, it too—like trains or sudden noises—can pull us away even when we are trying to focus elsewhere. This is our hypothesis: scarcity creates its own distractions. An early study tested this idea by giving subjects a simple enough task: "push a button when you see a red dot on the screen. Sometimes, just before the dot appeared another picture would flash on the screen. For non-dieters, this picture had no effect on whether people saw the dot. For dieters, in contrast, something interesting happened but only with pictures of food (say cake). Flashing the picture of cake reduced dieters' chance of seeing the red dot after: it was as if the cake "blinded" them. Of course they were not physically blinded; they were just mentally distracted. Psychologists call this an "attentional blink." The picture of the cake was long gone, but it had made the dieters' mind "blink". The cake made them think about food, so that their mind was elsewhere when the dot appeared. All of this happens in a fraction of a second, too quick to control. Too quick to even be aware of. The title of the study says it best: "All I saw was the cake".

An attentional blink occurs only briefly, but the distracting effects of scarcity, we suspected, would be more powerful, last significantly longer than mere "blinks". To test this, we ran a study with Chris Bryan, where we gave subjects word searches such as this one:



Subjects searched for the highlighted word (STREET in this case). When they found and clicked it, a new grid appeared and they would look for the next word.

A second group of subjects was given the same task but with slightly different words. For example:



The even numbered words are the same for both groups. The odd numbered words were neutral words for the first group but tempting ones for the second: STREET became CAKE, PICTURE became DONUT, and so on. We then looked at how long it took participants to find the same words, those they had in common, the even-numbered neutral ones.

For most subjects, changing the odd-numbered words had no effect. Not so for dieters. Dieters took 30% longer to find CLOUD after they had just searched for DONUT. Dieters were not slow overall—they found CLOUD just as quickly as non-dieters when it was preceded by PICTURE. The DONUT was the problem. What is happening here is clear. It is a version of what psychologists call proactive interference. The mention of a donut brings it top of mind. The non-dieter searches for it, finds it, and moves on. The dieter, in contrast, finds it hard to move on. Even while searching for the next word, for CLOUD, that donut is still there, tugging away, every bit as disruptive as a passing train. It is harder to find the CLOUD with a donut lingering.

<Paragraph Option A>: Surely you've experienced something similar. You have an afternoon meeting. Someone (thinking they are being nice!) has brought a plate of cookies. They are not right in front of you or you would have stood no chance. But they are too close for comfort. You resist taking a cookie and the meeting starts. About ten minutes in, you realize you've only processed half of what was said. That makes sense. Only half of your mind was on the meeting. The other half was with the cookies. "Should I have a cookie? I did have a healthy lunch. I deserve it. But why not keep the streak going? I probably shouldn't."

<Paragraph Option B> Surely you've experienced something similar. If not with food, perhaps it happened with time. You are heroically juggling your busy life, when out of the blue comes an irresistible invitation. A friend's surprise birthday party, in San Francisco. You're excited, and you'd love to go. But then the complications raise their ugly head. Your boss is away, and it's a week before the board meeting. Not to mention that your in laws are in town, and you promised your husband you'd be there. But invitations like this don't come very often. Could you spend a day with the in laws and then go? Maybe convince your boss to prepare for the board meeting in advance? As you consider the possibilities from every direction, you are heavily distracted from your meeting right now. That invitation is your donut.

The Bandwidth Tax

Picture surfing the web on your laptop. On a reasonably fast computer, you easily go from page to page. But imagine now that there many other programs open in the background. You have some music playing, files downloading and a bunch of browser windows open. Suddenly you are crawling, not surfing, the web. These background programs are eating up processor cycles, leaving less process speed for browsing. Of course your processor is slowed down.

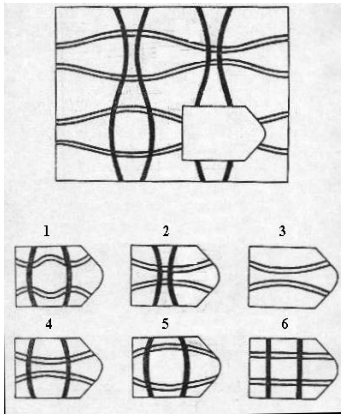
Now imagine you were sitting at that computer unaware of these other programs. As your browser crawls from page to page, you might draw the wrong conclusion. What a slow computer, you might think, confusing the processor loaded down by other tasks for one that is inherently slow. Scarcity does something similar to our mental processor. By constantly tugging at the mind, it leaves less "mind" for the task at hand. This leads us to the central hypothesis of this chapter: scarcity directly reduces *bandwidth*; not inherent capacity, but how much of that capacity is presently available for use.

We are using the term bandwidth as a placeholder for several more nuanced and carefully researched psychological constructs. We are in effect walking a fine line. As psychologists, we care about the distinctions, functional and otherwise, between the various constructs, and their corresponding brain function. And "bandwidth" is a generic term that obscures those distinctions. As social scientists interested in the effects of scarcity, however, we are willing to leave the fine distinctions alone. Much as one might refer to "democracy," or "subatomic particles," while avoiding the many finer distinctions that these afford. By way of compromise, we use the term bandwidth to refer to two broad and related components of mental function. The first might be broadly referred to as *cognitive capacity*. It refers to psychological mechanisms that underlie our ability to solve problems, retain information, engage in logical reasoning, and so on. Perhaps the most prominent in this category is fluid intelligence, the ability to think and reason abstractly and solve problems independent of any specific learning or experience. The second is *executive control,* which underlies our ability to manage our cognitive activities, including planning, attention, initiating and inhibiting actions, and controlling impulses. Much like a central processor, executive

control is essential to functioning well. It determines our ability to focus, to shift attention, to retain things in memory, to multi-task, to self-monitor. Both cognitive capacity and executive control are multifaceted and rich in nuance. In what follows we will combine them under the umbrella term *bandwidth*, as we try to explore the impact of scarcity on mental function. Or, to use our new terminology, as we look at how scarcity taxes bandwidth.

Raven's test

As explained above, a major component of bandwidth is cognitive capacity. And the most central feature of cognitive capacity is fluid intelligence. To test for the impact of scarcity on people's cognitive capacity, we resort to the most prominent and universally accepted measure of fluid intelligence, namely, the Raven's matrices test. For an example, look at the following and ask yourself which of options 1-6 fits in the missing space:



You may recognize this test from your school days. It is a common component of IQ tests. While IQ tests are complex and variegated, most agree that the Raven's Matrices is one of the most important and reliable components. Raven's requires no knowledge of world events and little formal study. It is the most common way that psychologists, educators, the military, etc., measure what is called fluid intelligence, the capacity to think logically, analyze and solve novel problems, independent of background knowledge. A mechanic reasoning about why an engine won't start uses both background automotive knowledge and reasoning skills. The same mechanic looking at a Raven's matrix is applying his

reasoning skills in a context in which he has no expertise — he's on par with a farmer in India. This has made Raven's particularly useful as a measure of general intelligence, one that supposedly transcends specific culture. Still, there are skeptics. Those who have familiarity with tests and test taking will surely perform better. Those who have taken geometry might do better. In fact, it is known that there are benefits to schooling -- kids with more years of school do better than those of equal age with fewer years. The debates about what IQ really measures persist even for fluid intelligence. Fortunately, these debates do not matter for our purposes. We will not be comparing fluid intelligence between one person and another, or from one culture to the next. We are interested in how scarcity affects the same person's cognitive capacity. It may strike you as odd that a person's "capacity" can be so easily affected, but that is precisely the point—we are used to thinking of cognitive capacity as fixed, when in fact it might change with circumstances.

To see the effect of scarcity on fluid intelligence, we ran some studies with our graduate student, Jiaying Zhao, where we gave people in a New Jersey mall the Raven's Matrices test. First, half the subjects were presented with simple hypothetical scenarios, such as this one:

> *Imagine that your car has some trouble, which requires a $300 service. Your auto insurance will cover half the cost. You need to decide whether to go ahead and get the car fixed, or take a chance and hope that it lasts for a while longer. How would you go about making such a decision? Financially, would it be an easy or a difficult decision for you to make?*

We then followed this question with a series of Ravens' matrices problems. Using self-reported household income we divided subjects, by median split, into rich and poor. In this set-up we found no statistically significant difference between the rich and poor mall-goers. Of course, there may been some difference but it was not big enough for us to detect in this sample. The rich and the poor looked equally smart.

For the remaining subjects, we ran the same study but with a slight twist. They were given this question instead (identical except that the $300 service was now $3000):

> *Imagine that your car has some trouble, which requires an **expensive $3,000 service**. Your auto insurance will cover half the cost. You need to decide whether to go ahead and get the car fixed, or take a chance and hope that it lasts for a while longer. How would you go about making such a decision? Financially, would it be an easy or a difficult decision for you to make?*

All we have done here is replace the $300 with $3000. Remarkably, this change affected the two groups differently. Coming up with a half of $300 or $3000 was easy for those who were well off. They could just pay out of savings or put it on a credit card. For the less well off, finding $150 for an important need was not too hard either. Not enough to make them think too much about scarcity and their own finances.

Not so for the $3,000 car expense: finding $1500 was going to be hard for those with low-incomes.. A 2011 study found that close to half of all Americans reported they would be unable to come up with $2,000 in 30 days even if they really needed it. Of course the question we gave our mall-goers was hypothetical. But it was realistic, and it likely got them thinking about their own money concerns. They may not have a broken car, but money scarcity meant they had monetary issues close to the top of mind. Once we tickled that part of the brain, the all too real non-hypothetical thinking about scarcity came spilling out. "Coming up with $1500 would be hard. My credit cards are maxed out. Already the minimum payment due is so large. How will I make the minimum payment this month? Can I afford to miss another payment? Should I take a payday loan this time instead?" A little tickle could raise a racket in the brain.

And this racket affected performance. The well-off subjects, with no racket, did just as well here as if they had seen the easy scenario. The poorer subjects, on the other hand, did significantly worse. A small tickle of scarcity and all of a sudden they looked significantly less intelligent. Preoccupied by scarcity, they had lower fluid intelligence scores.

We have run these studies numerous times now, always with the same results. This is not merely an artifact of the $3,000 being *mathematically* more challenging. When we ran non-financial problems we found absolutely no effect of giving similarly small versus large

numbers. The effect is specific to hard problems that are financial in nature (for the money poor). It is also not the result of a lack of motivation. In one replication of the study we paid people for every right answer on the Raven's test. Presumably the low-income have a *greater* incentive to do better: after all the money matters to them more. In fact, they did not do any better than before. They did just a tiny bit worse. Low-income participants who presumably could have used the extra pay left the mall with less money after having contemplated the harder scenarios, an effect that was absent for those financially more comfortable.

In all the replications, the effects were big. (If you're into formal statistics, they ranged between a Cohen's *d* of 0.88 and 0.94.) Here is a benchmark for you from a sleep study. The study examined the impact of sleep deprivation on Raven's performance. While the control subjects were in bed by 10:30pm, the experimental group was kept up all night -- playing cards, watching videos, having midnight snacks. They were totally deprived of sleep. In separate interviews, they reported being "sleepy" and "drowsy." And at 8am all subjects took a Raven's test. Not surprisingly, the sleep-deprived subjects did much worse. What is remarkable is that our effect was even bigger than this. Picture yourself after a night of no sleep. How smart do you feel? How sharp would you be? Simply reminding our poorer subjects of monetary concerns had a bigger effect on cognitive performance.

One of the oldest topics in social science is intelligence. And perhaps the touchiest data are the observed differences between poor and rich. For centuries (millennia!) scholars have disputed whether the poor and rich actually differ in inherent intelligence. Some have gone so far as to argue that the poor are poor *because* they are less intelligent. More recently, books such as *The Bell Curve* have resuscitated this debate.

The present results suggest a different look at this age-old question. Intelligence researchers usually evaluate the success of interventions by their implied impact on IQ. Has the intervention made people smarter, and by how much? To do that, they assume a normal distribution of IQ scores, with a mean of 100 and a standard deviation of 15 (don't worry at all if these terms don't mean much to you). If an intervention has an effect equivalent to 1/3 of a standard deviation, well, that effect corresponds to about 5 IQ points.

By that measure our effects correspond to between 13 and 14 IQ points! By most commonly used descriptive classifications of IQ, 13 points can move you from "average" to "superior" intelligence. Or, if you move in the other direction, losing 13 points can take you from "average" to "borderline retarded." It seems hard to take seriously purported *innate* differences between poor and rich when we find such large effects with our rather modest scarcity manipulation. In effect, these differences may be not between poor and rich *people.* Rather, any person whose bandwidth is taxed by poverty will appear less intelligent if you catch them at a time of concern.

This is key to our story. The poor looked just like the rich when the car cost little to fix, when scarcity had not been rendered salient. Clearly, this is not about inherent cognitive capacity. Just like the processor that is slowed down by too many applications, the poor here *appear* worse because part of their bandwidth is elsewhere.

Marshmallows

The second component of bandwidth is executive control. As discussed above, executive control is multi-faceted, so we begin by considering one the many important functions to which it contributes, namely, self control. In the late 1960s Walter Mischel and colleagues performed one of the most interesting (at the very least cutest) psychology experiments on impulsivity. His research staff would seat 4 to 5 year olds in a room and put in front of them a marshmallow. Some children would stare entranced at it, some would fidget with excitement; all of them wanted it. And they could have it. But, before they could eat it, they were told there was a catch. More of an opportunity really. The researcher was going to leave the room. And when he returned, if the child hadn't eaten the marshmallow, they would get a second marshmallow. The children were faced with one of the oldest problems known to man, what social scientist Thomas Schelling calls "The Intimate Contest for Self Command", the problem of self control.

Self control remains one of the more obscure parts of the study of psychology. We know many ingredients go into the manufacturing of self control. It depends on how we weigh the future. And we appear to do it inconsistently. Immediate rewards (a marshmallow now) are salient and receive a heavy weight. Rewards in the distant future (two

marshmallows later) are less salient and thus receive lower weight. So when we think about one versus two marshmallows both in the abstract and in the future, two is better than one. But when one marshmallow is right in front of us now, it suddenly beats two. Self control also depends on will power, a resource whose functioning we do not fully understand, but which is affected, among other things, by personality, fatigue, and attention.

Another major contributor to self control is executive control. We use executive control to direct attention, initiate an action, or to inhibit an intuitive response, resist an impulse. In fact, a less publicized but oft replicated part of Mischel's study is highly instructive here. The children who were most successful in resisting the marshmallow temptation did so by attending elsewhere. Instead of looking at and thinking about the marshmallow, they thought about other things. Instead of having to resist the desire, they simply arranged not to notice it. As Mischel put it, "Once you realize that will power is just a matter of learning how to control your attention and thoughts, you can really begin to increase it."

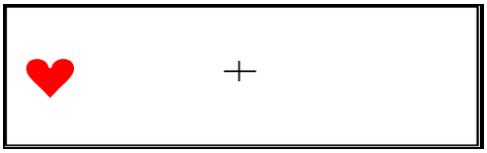
This provides a telling link between executive and self-control. Since executive control helps direct attention and control impulses, reduced executive function will hamper self-control. A number of experiments have vividly illustrated this connection. One experiment gave subjects a memory task. Some were asked to remember a 2-digit number; some were give a seven-digit number. Subjects were then led to a lobby where they would await further testing. In front of them in the waiting area were slices of cake and fruit. The real test was what they would choose while they waited, while rehearsing those numbers in their heads. Those whose minds were not terribly occupied by the 2 digit number chose the fruit salad most of the time. Those whose minds were busy rehearsing the seven-digit number chose the cake 50% more often. The cake is the impulsive choice. It requires conscious action to prevent the automatic choice. When our mental bandwidth is used on something else, like rehearsing digits, we have less capacity to prevent ourselves from eating cake.

In another study, white Australian students were served food, but in this case it was something they found revolting: a chicken foot cooked in a Chinese style that preserved the entire foot intact, claws included. The challenge for the subjects was that this was served by

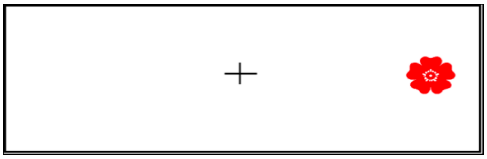
a Chinese experimenter, creating some pressure to act civilized. As in the cake study, some subjects' minds were loaded: they were asked to remember an 8-digit number. Those whose minds were not loaded managed to maintain composure, keeping their thoughts to themselves. Not the cognitively loaded subjects. They would blurt out rude comments, such as "this is bloody revolting" despite their best intentions.

Whether it is eating cake we would rather resist or saying things we do not mean to say, a tax on bandwidth makes it harder for us to control our impulses. And because scarcity taxes bandwidth, this suggests that scarcity not only can reduce fluid intelligence, it can also reduce self-control. Hence, the Australian student snaps at the Chinese experimenter, the executive consumed by the impending presentation snaps at his daughter, and the employee thinking about his unpaid bills snaps at a rude customer.

To further explore the notion that scarcity reduces executive control, we gave subjects at the New Jersey mall another task, one that directly tests their ability to inhibit automatic responses. Subjects would see pictures such as these:



or



in rapid succession on a computer screen. They placed the fingers of both hands on the keyboard, and their task was to press the same side as the heart and the *opposite* side of the flower. So if the heart appears on the right, you press right. And if the flower appears on the right, you press left.

The flower creates an automatic impulse that needs to be resisted: hitting the same side as the heart comes easy; hitting the opposite side of the flower is hard. Doing well requires over-riding your impulse to quickly hit the same side. The more executive control you have, the better you will do. This test measures how capable you are at inhibiting your first impulse in favor of a different response, be it resisting a cake, biting your tongue, or, in this case, resisting the flower.

Though this task tests executive control, quite different from fluid intelligence, the results were the same. After the financially easy questions, the poor and the well-off looked similar. They were able to control their impulses to the same degree - they made about the same number of errors. But the financially hard questions changed things dramatically for the poor. The well-off subjects continued to do just as well as if they had seen the easy scenario. They exhibited the same level of executive control. The poorer subjects, on the other hand, now did significantly worse. They were more impulsive, mistakenly hitting the same side as the flower more often. While they had hit the correct key 83% of the time in the context of the financially-easy scenarios, correct key presses went down to 63% in the context of scenarios that were financially more challenging. A small tickle of scarcity and subjects were suddenly more impulsive. Beyond fluid intelligence, scarcity appears to reduce executive control.

Harvests

The experiments above carefully measure fluid intelligence and executive control. Yet the way they manipulate scarcity is a bit artificial. They show how people respond when we trigger their keen awareness of scarcity. In the word search, the word DONUT triggers it. In the mall studies, it is an explicit (although hypothetical) question about financial hardship. Our interest, though, is in people's everyday lives, outside the confines of an experiment. Does scarcity tax people's cognitive resources even when there are no experimenters lurking in the mall to get them to think about it? Showing that it does is essential to our argument. Yet it is hard. We cannot simply look at how poor people compare to rich people in cognitive capacity or self-control. Too many other things -- health, friends, education -- differ between the rich and the poor for us to be able to attribute any observed differences

to scarcity. Such comparisons have been attempted endlessly with no obvious solution to the statistical problems that are inherent to such comparisons. How could we see the effect of scarcity free from all these intricacies?

It was around this time that we were doing field-work on farming in India with Anandi Mani, when we noticed something interesting. Farmers get their income in big lumps, all at once at harvest time. This means the farmer has a very different financial life than most workers, who get paid regularly (daily, weekly or maybe monthly). Instead, a farmer might get paid twice a year or sometimes even once a year. Now picture a farmer who gets paid in June. The next few months are quite good: he's got cash. But even if he's prudent and tries hard to smooth his spending over this period, in most cases, by the time next April or May roll around, he will be tight on cash. So the *same farmer* is rich in the months after harvest and poor in the months before harvest.

This was quite close to what we needed: we could examine the same farmer's psyche in the months before and the months after harvest. Instead of comparing rich and poor people, we'd be seeing how the same person behaves differently when tight for cash and when flush with cash. But there was one wrinkle. Might not harvest months be different? For example, festivals and weddings are common during harvest months—exactly because people are cash rich. So instead of seeing the effects of scarcity, we might just see the effects of parties.

To get around this, we used sugar cane farming, which has a peculiar feature. Sugar cane requires an enormous factory to crush the cane and extract the juice (which once evaporated forms sugar). The factories can only process so much and the crop can't sit after harvesting for long. So sugar cane is harvested over a four to five month window. In some areas it is harvested throughout the year. Neighboring plots will be on very different harvest cycles. One farmer may be harvesting while his neighbor to one side harvested several months ago and his other neighbor has months to go before harvesting. This rather obscure fact gave us the break we needed. We could now study the same farmers when they're poor and rich *and* know that there's nothing specific about the pre-harvest and

post-harvest calendar months. After all the same month was pre harvest for one farmer and post-harvest for her neighbor.

As we had hoped, the data showed that the farmers were more strapped for cash pre-harvest. For example 78% of them had pawned something in the month before harvest (and 99% of them took some sort of loan), but only 4% pawned something in the month after harvest (only 13% took any kind of loan). Before harvest, they were also 11% more likely to report having trouble coping with ordinary bills.

As in the mall, we again measured executive control and fluid intelligence. We gave the farmers a Raven's matrices task, and an executive control task (a number Stroop) similar to the heart-flower. Comparing the farmers before and after harvest, we found that on both tasks they did worse before the harvest. The same farmer fared worse on fluid intelligence and executive control when he was poor (pre-harvest) than when he was rich (post). Much like the subjects in the mall, the same person looked less intelligent and more impulsive when they were poor. Yet in this case it was not us who triggered scarcity-related thoughts or even tried to bring them to the surface. It was what was naturally on the farmers' minds when they were poor (the harvest money dissipated to a small amount) or when they were rich (still flush with cash from the harvest).

And again the magnitudes were large. They got about 18% more items correct on Raven's. Put in IQ terms, as in the mall study above, this would correspond to about 9 or 10 IQ points. Not as big as in the mall, but that is to be expected. After all, here we hadn't induced them to think about money. We simply measured their mental state at an arbitrarily selected point in time, their *latent* tendency to have their bandwidth taxed by scarcity. On the executive control (Stroop) task, they were 15% slower in responding and made 16% more errors, quite comparable to the lab. Had we met a farmer when he was poor, we would have been tempted to attribute his limited capacity to a personal trait. But we know from this study that this had little to do with his genuine capacity as a person. The very state of having less in the months before harvest made him perform less intelligently and show less cognitive control.

Before notching this as a victory, though, a few doors must be shut. We know scarcity (poverty) changes before and after harvest. But are there other things that change with it? And if so, might these be the driver of the psychic changes? Three alternatives stand out.

First, if the farmers are poorer pre-harvest, might they not be eating less? If so, is it such a surprise then to find that their cognitive function was also lower? Worse nutrition and simple hunger could leave anyone's brain in a weakened state. For our farmers, though, this was not the case. These farmers are not so poor that when they are short on cash, they are forced to cut back on food. They are better off than that. If anything they spent slightly less post-harvest: 4000Rs on food the month pre-harvest and nearly 3700Rs the month after harvest. We do see that they spend less but this does not translate to reduced calories or even to reduced spending on food more generally. They spend less on other things that matter. For example, you might give your cousin a smaller gift for his wedding. In a culture like India's, where gift giving is not simply a bonus but an obligation (a repayment of past gifts) such cut backs can be painful.

Second, might they not be working harder pre-harvest? Preparing for harvest is hard work and might leave farmers tired. Physical exhaustion could easily bring mental exhaustion. In fact, our surveys sufficiently preceded the physical harvest date (four weeks is a long time in agriculture) that preparation for harvest had not started in any serious way. Farmers were not working any more (or harder) in the pre-harvest week than in the post-harvest week.

Finally, harvest time is not only when you get your money, it's also when you find out how much you got. Farming is notoriously variable. Some harvests are bountiful, others meager. Could the simple anxiety of not knowing how much money will come in affect a farmer's mental state? Surely yes. For some crops, such as rice, this is a serious concern. But not so with sugar cane, because it grows like a tree. In fact almost all the crop growth has happened several months before harvest. The last months are just to increase the sugar content of the crop, not its volume. But this is the mill's problem: the farmers get paid solely on volume not on sugar content. The only reason farmers do not harvest earlier is that the sugar mill does not allow it. In short, several months ahead of time farmers have

an accurate understanding of how much they will get paid. They know as much before as they do after the harvest.

There are other minor quibbles we could discuss. But the bottom line is clear. Poverty *itself* taxes the mind. Even without an experimenter around to remind us of scarcity, poverty reduces fluid intelligence and executive-control. Returning to where we started, this suggests a major twist on the debate over the cognitive capacity of the poor. We would argue that the poor do have lower *effective* capacity. But this, we suggest, is not because they are less capable, but, rather, because part of their mind is captured by scarcity.

Other Forms of Scarcity

> *About that time, it occurred to me that I was succeeding in the world with only part of my brain engaged. While a tenth of it was devoted to school, a tenth devoted to my daughter, and perhaps another tenth devoted to family crises and illnesses, the other 70 percent of my mind was constantly focused on food – the calorie count of a grape, the filling bulk of popcorn, the clever use of water as a placebo. "How much farther," I thought, "can I go in the world if I use that 70 percent more wisely?"*
>
> *Natalie Kusz, The Fat Lady Sings*

We all understand that dieting can be hard: resisting tasty foods can be hard for all of us. These results, however, suggest that dieting makes it more difficult for other aspects of life. There is nothing specific to word searches when you are on a diet. Dieters, when doing anything, should find they have less mental resources because they are partly preoccupied with food. In fact, these results suggest something even more striking: we should find that dieters have fewer cognitive resources left.

In fact, this is what a variety of studies have shown. They have compared dieters to non-dieters on various cognitive measures, the kind that psychologists use to gauge effective cognitive capacity. Sometimes they compare restrained eaters to non-restrained eaters. Sometimes they compare the same person over time, during periods when they are dieting compared to periods when they are not. However they do it, they find the same effect. Across a variety of cognitive tests, they find that people simply do worse when they diet.

Better yet, when psychologists query the reason, they find a common pattern: concerns related to dieting are on top of mind for these dieters, and interfere with their performance.

These results do not appear to come from a simple lack of calories. Not surprisingly (since many of the attempt to diet fail), the effects appear even in cases where there is no weight loss. Furthermore, direct physiological measures show that nutritional deficiencies do not cause these cognitive impairments. Interestingly, one must distinguish restrained eating from being slim. Successful dieting can lead to weight loss. And recent data suggests a link between obesity and *worse* cognitive performance. Think of it this way—while losing weight you are preoccupied and face a bandwidth tax. But if you are able to settle into a new equilibrium, and find yourself no longer needing to restrain eating, then the bandwidth tax disappears. Of course one can poke holes in these data: dieters and non-dieters may differ for other reasons. More research will be needed to quantify the size of the bandwidth tax for dieters, but it is striking that the results around calorie scarcity mirror what we find using income.

And then there are the lonely. One study gave lonely and non-lonely subjects a different kind of bandwidth measure, a rather elegant procedure called a dichotic listening task. Subjects wear earphones, but what they hear are not the usual sounds of jazz or hip-hop. Instead each earpiece plays a different recording, typically speech. It's as if you had one person speaking to you in one ear and another person speaking to you in the other.

People in these studies are asked to attend to one ear and ignore the other.

This test relies on an interesting fact about the brain: brain lateralization. Most people are right-ear dominant for language, which means that verbal information presented to the right ear is easier for them to attend to. When given no instructions, they tend to focus on the voice presented to the right ear. In fact, when asked to track what was said in the right ear, the lonely and the non-lonely did equally well. In contrast, focusing on the non-dominant ear—the left ear—requires bandwidth. It requires executive control to override the natural proclivity to focus on the right, and instead to attend to the left. And now the lonely did significantly less well. They were less effective at overriding their natural urge,

less effective at tuning out the right ear and listening to the left. The lonely in other words showed impaired bandwidth—in this case, lesser executive control.

In other studies, they did something similar to what we did in the mall. They had subjects fill out what they thought were personality tests, and then, by random assignment, they gave these subjects feedback leading them to believe the tests clearly indicated they were going to be either socially well adjusted, or else very lonely. They randomly, and instantaneously, created perceived scarcity; led subjects to anticipate loneliness. After the information had sunk in, they gave subjects a Raven's test and they found that those who anticipated being lonely did much worse. In fact, when they placed subjects in the scanner, they saw that making people think they would be lonely reduced activation of the executive control areas of the brain. Finally, in a study, looking at impulse control, when subjects who anticipated being lonely were given the opportunity to taste chocolate chip cookies, they ate roughly twice as many. Consistent with this, research on the diets of older adults has found that those who feel lonely in their daily lives have a substantially higher consumption of fatty foods.

We can even look at purely artificial scarcity. Remember the Family Feud studies? Subjects there played a game where some were made poor (in seconds available) and others were made rich. We used those data to show how scarcity created borrowing—how the poor ended up borrowing too many seconds. Upon seeing the bandwidth results from the New Jersey mall and the harvests in India, we wondered whether the "poor" in Family Feud also had their bandwidth taxed. So after they finished playing, we gave them a test similar to the heart-flower task, and sure enough, as with the dieters, the poor, and the lonely, the Family Feud poor too exhibited reduced bandwidth.

Scarcity and Worry

Why do we focus on preoccupations unique to scarcity? Some might argue that everyone has worries. Imagine you had a difficult fight with your spouse this morning. You might not be very productive at work. You might look and act "dumber" that day. You might not bite your tongue when you should. Part of your bandwidth is being used up fussing, fretting,

and maybe fuming over the fight. You too would have less brain left for everything else. Under this view, everyone has concerns and needs that can tax the mind.

What then is so special about scarcity?

Scarcity, by definition, is when there is less than would be sufficient to satisfy your wants. It is, by its nature, a clustering of wants that are unfulfilled or hard to fulfill. Unlike a marital spat that can happen anywhere and to anyone, preoccupations with money and with time cluster around the poor and the busy. The poor must contend with not being able to buy some things they'd like to buy. The busy must contend with not being able to do some things they'd like to do. Scarcity predictably creates an *additional* load that happens on top of what other background concerns any one might feel. Everyone can be preoccupied. Both rich and poor can fight with their spouses; both rich and poor can be flustered by their bosses. Scarcity, however, creates an additional load. It consistently and predictably taxes bandwidth, and that is in addition to whatever other concerns the person might have. Thus, while some people who do not experience scarcity will be preoccupied occasionally, nearly everyone experiencing scarcity will be preoccupied.

This discussion raises another important question. In all this talk about scarcity, are we just referring to stress in a roundabout way? In everyday life, stress is used liberally, to mean many things. Scientifically, however, there has been considerable progress in the understanding of stress. We now have a firmer grasp of the biochemistry of the generalized stress response. We can even identify several of the molecules involved--glucocorticoids (such as cortisol), norepinephrine and serotonin—as well as some of their function. This knowledge allows us to more carefully consider whether stress is the biological mechanism by which scarcity affects the mind.

There is, even in our data, some reason to think that stress plays some role. Predictably, experiencing scarcity can be stressful. In the harvest study, for example, we found that post-harvest farmers were less 'stressed' than before harvest. Specifically, we found sizable reductions in heart rate variability, a frequently used measure of stress.

At the same time, stress is unlikely to be the primary driver of many of the effects we have observed. Some of the most important effects had to do with scarcity taxing what we have come to call bandwidth. Stress, in contrast, does not have these predictable effects. Some studies find that stress *heightens* working memory. Still other studies have found mixed evidence, including some indication that executive control might improve during periods of stress. Of course the chronic effects of stress are still different, but the effects of scarcity that we have studied are rather immediate: in the mall study, simply reminding people about their money had an almost instantaneous effect. And the Family Feud and Angry Blueberries studies not only produced immediate effects, but also were highly unlikely to have been terribly stressful. In addition, we have shown a particular pattern of improved performance (the focus dividend) and diminished performance (the bandwidth tax), a pattern that anxiety and stress alone cannot explain.

What the Bandwidth Tax Means

We have used a variety of abstract quantitative measures to illustrate the bandwidth tax, from flexible intelligence to executive control. In the rest of the book we will refer to this entire panoply of behaviors with the single phrase *bandwidth.* Bandwidth captures fundamental human capacities, and correlates with everything from intelligence and SAT performance to impulse control and success on diets. It measures our computational capacity, our ability to pay attention, make good decisions, to stick with our plans and to resist temptations.

The vignettes with which we opened this chapter seem quite obvious in light of the bandwidth tax. You wouldn't be surprised if the cashier hadn't heard the order of fries just when a train passed by. So you (and her manager) shouldn't be surprised if lost in thoughts of how to make rent this month, she also overlooks the order of fries. She is not being careless. She is preoccupied. Thoughts such as "Should I risk being late again on my credit card?" can be every bit as loud as a passing train. The manager with the impending sales pitch tries to focus on his daughter's game. Yet, before he knows it he finds himself ruminating on the impending sale pitch. The student tries to focus on the exam at hand but is constantly interrupted by the impending need to make tuition. Even smiling and being

pleasant is hard when your mind is taxed. The employee will snap at rude customers more often than she wants. The parent snaps at the child. A taxed bandwidth leads to carelessness. The student forgets his study group meeting. The employee rings up the wrong item.

The bandwidth tax changes us in surprising and powerful ways. It changes those parts of us -- our patience, tolerance, attention, dedication -- that usually fall under the umbrella of "personality" or "talent". So much of what we attribute to talent or personality is predicated on cognitive capacity and executive control. The manager looks to all the usual places to explain his employees' behavior—lack of skill, no motivation, too little education. And a taxed bandwidth can look just like one of those. The harried manager, when she snaps at her daughter, looks like a bad parent. But she is not unskilled or uncaring, just badly taxed. The student looks incapable or lazy having missed some easy questions. But perhaps he is not? His mind is merely preoccupied.

Yet our findings are not—and we cannot emphasize this enough—about inherent differences between people. We are very much not saying that poor *people* have less bandwidth. Quite the opposite. We are saying that all people, if they were poor, would have less effective bandwidth. The problem, clearly, is the context of scarcity, not the people who have the misfortune to experience it.

All this suggests that we ought to broaden our notion of scarcity. When we think of having very little (time, money, calories) we focus on the physical implications of scarcity: less time for fun or less money to spend. The bandwidth tax suggests there is another, perhaps more important shortfall. We must now get by with fewer mental resources. Scarcity doesn't just lead us to over-borrow or fail to invest. It leaves us handicapped in other aspects of our lives. It makes us dumber. It makes us more impulsive. We must get by with less fluid intelligence and with diminished executive control - making life that much harder.