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Sarah and James Bowdoin Speech **Revised**

Attention and the Life of the Brain

I'm honored to be speaking in front of you all today.

Here at Bowdoin I study Biology and Computer Science. When you slam those two things together, some really interesting stuff pops out. You can learn about quantitative models of behavior, or the ways proteins fold together. But a lot of what people are really interested in at this interface-- a lot of what people are really interested in, in general-- is human thought. I think almost everyone is fascinated by how and why we think our thoughts. I was lucky enough to take a course with Professor Eric Chown on just this topic, on "Cognitive Architectures." This was a Computer Science course rather than a Neuroscience or a Psychology course, and because of this it was mainly focused on the patterns of high-level systems that control the brain. We learned about the broad methods that humans, or other organisms, or maybe robots can use to face big challenges in the environment. Things like recognizing objects or navigating through a room. These are really hard problems to solve.

One major section of the course was focused on so-called "Executive Control." Most of the behaviors we all have a particular fondness for fall under this umbrella. Executive control allows us to solve complicated problems, or manage complex social interactions, and engage in conscious thought. These are the sorts of behaviors that most people consider eminently "human."

In the 1980s, psychologists Rachel and Stephen Kaplan at the University of Michigan thought very deeply about executive control, and developed what they called "Attention Restoration Theory." This is a theory in the scientific sense-- a rigorous framework that can be used to explain all sorts of empirical observations. There's a lot to this theory, but I want to start with the most important bit, with the big headline.

So here it is, in appropriate jargon: **Directed attention is a limited resource.**

With nothing to back it, that statement doesn't seem too interesting, so we should break it down a bit. To start us off we have to think about *effortless* attention. If a lion starts chasing you, you immediately snap to attention. If the lion keeps chasing you, it's not difficult to continue paying attention. Our fascination with objects and events that impact our survival is automatic and virtually limitless. This is an evolutionary arrangement-- one that helps us accomplish basic tasks as we try to survive and reproduce.

But most of what fills our modern lives, particularly our lives at a place like Bowdoin, are not things like lions or foraging for food. Much of our time is spent listening to lectures and studying deeply abstract concepts. Most of the rest of our time is spent managing our own behavior in front of hundreds of peers as we develop enormously complicated social networks. Learning abstract concepts and self-regulating our social environments are both key elements of executive control. Although humans are great at these kinds of tasks, we can't fall back on the same sorts of automatic, evolutionary responses, like when we're running away from lions. To control its own activity at higher levels, our brains need to appropriately time complex mechanisms of inhibition. These mechanisms allow for our conscious *attention*. This is what I mean by "directed" attention. And a big part of the Kaplans' (along with many others') work was showing that you can only direct your attention for so long. Your regulated focus runs down, sometimes very quickly. You can consider, as an easy example, how paying attention to a speech about Cognitive Science right now is taking *work*. Like any other currency, the neurological resource we use to do this work is finite.

So now we have a simple fact: the fact that our ability to learn, and our ability to maintain social relationships, rely on our finite capacity to stay focused.

We can consider a huge number of implications for this fact. We can start to get a better understanding of why college friendships are sometimes really hard. Our courses are a literal trade off with our social lives. Our capacity for self-regulation in relationships wears down over the semester, or over particularly hard stretches of the year, or when we're sick. This is not accusatory. The fact that we are fragile in this way is a lesson to be gentle with ourselves and with the ones we love, especially when things get difficult.

We can also think about our academic lives. We can understand why there are some essays we just can't bring ourselves to write. We can re-consider our struggles during midterms or finals-- this may be a more important lesson for the faculty in the room. A final exam isn't a capstone for the content of our thought. Students are being tested after their resources for directed attention have been run down over the course of the semester. These exams become simple trials to tests the depths of our pool of attention. Some faculty may actually perk up at the idea that they can test students at their worst. But to me, the ability to *just keep paying attention* is not a particularly interesting trait. But, through the structure of our courses, it ends up being the reason why most of us get to be here today.

So most importantly for today, we can understand why we are in this room and why others are not. Is it because of the pure content of our thought? In some cases this might be true. Most of the time, though, we can see how what we know about attention damages this ideal academic image. There are students who have gotten sick, or who

have family members who are sick. There are students worrying about money. There are female students, LGBT students, and students of color who are being burdened by the unique expectations we hoist upon them to constantly think about, and discuss, and organize discussions of race, and gender, and sexuality. Research by Steele and Arosen suggests that these groups also face “stereotype threat.” That is, they have knowledge of negative stereotypes and have to spend effort regulating their behavior in light of these stereotypes. I’m not just making a vague appeal to issues we know exist. These people aren’t just being robbed of time or energy. Their pool of directed attention-- their actual currency of learning and thought-- is being sapped. At the very least, it becomes harder for them to learn, and study, and take tests. There are people who are not in this room who should be in this room.

At this point I’m sounding pretty pessimistic. But remember that this is “Attention *Restoration* Theory,” which suggests a more positive outlook. Rachel and Stephen Kaplan were more interested in healing our bank of directed attention. It’s actually very easy. By our modern, almost capitalist sense of intellectual work, it’s probably the easiest thing in the world *because* it doesn’t require our mental effort. Our bodies are built to behave very well in specific, natural environments. As it turns out, more than absolutely anything else, we need time with nature to heal our attention spans. We need soft fascination with trees, and grass, and clouds. We need to see biodiversity and living landscapes. Natural things draw our attention in automatic, quiet ways, and allow us to replenish whatever biochemical currency lets us direct our focus. Even relaxed moments in our everyday, urban environments don’t do the same sort of good. We *need* the structure and slow movement of life. The natural world isn’t an arbitrary source of amusement. It’s the source of our recurring potential for thought.

We’ve just gone from directed attention, to our social lives, to our academic lives, to the natural world. This is to say we’ve ended up pretty far from the original headline about directed attention. I want to make just one final point about that transition. We can see how a whole universe of discourse emerges if we allow ourselves to talk at the level of the brain. If we try and consider the material basis of what’s going on, and follow the implications of actual facts. But we usually don’t. Consider, for a final moment, the intended prompt of this speech-- what was sent to students by the event’s organizers. To “celebrate the life of the mind and academic achievement.” We could have talked for hours about the achievements of the mind. Concepts would have slid out of the ether and, as soon as we were done with them, they would have returned there. There would be no mechanism, no function by which we could actually, *in reality*, understand the process of our thought. So I’d make a plea to everyone here to keep thinking about the “life of the brain.” We could help ourselves, and each other, feel better and think better.

Thank you.

