You Remember You

The Sum of Ourselves

Who are you? It is easy to identify *what* we are—this collection of muscle fibers, neural tissues, skeletal frameworks, this flesh and bone—but gleaning *who* we are is an elusive, mysterious, metamorphosing, and almost unfathomably-complex process of perpetual self-building that encompasses every moment of our conscious being.

And what is at the core of this self-building machinery? Memory. The remaining sum total of everything that you have ever seen or done, every experience your mind has consumed. And what are these memories really? Data. Ginormous, explosively and exponentially interconnected, magnificently vast piles of data.

I'm tempted to describe our data's vastness as *incomprehensible*, except that this is exactly what the human brain was built to do: comprehend that data. Not only comprehend it, but decide how and when to make use of it in our moment-to-moment decision-making process. And for consistency, we'll say yet again: that is the ultimate purpose of our consciousness—to make lots & lots of decisions, every second of every day.

In essence, much of our cerebral cortex functions as our brain's data storage system, our *hard drive*. And while humans have been working on computer hard drives for mere decades, the forces of the universe have spent several hundred million years perfecting the technology that is our lumpy, folded, gray matter. Which leads us to ask: what provocatively brilliant solutions has the universe stumbled upon during the evolution of the human brain's sophisticated data storage systems?

When we consider these storage systems of the mind, we are also necessarily considering the systems' handling of data retrieval, comparison, analysis and application (essentially, our *cognitive* processes). Thus, any full blueprint of this data-handling machinery must depict a complex, dynamic architecture capable of adapting to the myriad short- and long-term challenges the brain encounters.

Despite this architecture's complexity, by applying what we know about the brain and our own experiences, we can hypothesize a set of fundamental memory & cognitive systems & mechanics that can help to explain the inner workings of our brain's hard drive & our language-based cognition. Narrative Complexity seeks to do this by exploring how the brain stores & handles memories & thoughts in their most familiar and fundamental form: as narratives.

(There are, of course, other kinds of non-narrative “task-based” memories—those myriad, detailed & deeply-remembered motor scripts that we use to physically enact everything from walking & eating to hitting a baseball. But those kinds of learned physical scripts are stored in different ways & locations in our brain, and are handled by those more primitive & essentially *unconscious* mechanisms of our pre-human systems of mind—which we'll explore in our final essay.)

A Story From Your Life

The simplest way to view these narratively-based memory mechanics is in their natural habitat, to trace their workings within the environs of everyday experience. *You are running along a familiar trail in the woods, a route in which every dip & turn has already been memorized. Suddenly, you encounter a freshly-fallen tree crossing the path. It stops you in your tracks and requires careful negotiation.* This is important, relevant, novel & valid data (yes, there's that omni-present *Narrative Prioritizor Test* again). In other words, we should probably *remember* this.

Throughout the entire run, you've been taking in environmental data & matching it to previously recorded data about the path, using it to help guide your course and pace based on your resources and goals. But it's likely that on any particularly average day, your familiarity with the path combined with a preoccupation over other life-matters might lead your brain to neglect recording most of that non-novel environmental information while it focuses on processing internal dialogue narratives about those specific life-matters. In these cases, upon later recollection you will likely have a memory of what you thought about, but not the specific details of, say, the trail's dampness. (Unless that dampness, for example, made something along the path reflect in a unique or beautiful way, causing that momentary image to attach to any internal narrative in which your consciousness was engaged.)

This focus on life-matters dialogue, however, can be interrupted when you encounter something along your run like a suddenly-narratively-important fallen tree. Now the "story" of our trail run takes precedence over the domestic drama in our head. In essence, the vehicle carrying our life-matters has exited the internal dialogue highway, and the typically-low-priority vehicle transporting the story of our run has sped onto the main thoroughfare. And it is the stories that occupy this prestigious roadway of our consciousness that are candidates for actual recording in our brain's memory database.

For the same reasons that we can't focus our conscious awareness on *everything* in our purview, there is no way we could *remember* everything that happens around us. That's just way too much data. And it would be essentially useless, because if we're recording *everything* then we're likely not prioritizing *any* of it. Once we begin prioritizing, there's no need to record all of it—because we can discard what isn't important, which is a much more efficient way to handle data. As soon as we accept that our brains must prioritize information in order to make use of it, it seems we must accept the likelihood that it would make use of this prioritization in selecting what information it records. A similar “prioritization mechanic” also helps determine which of those temporarily-recorded memories survives long-term.

And we need look no further than our life experience to find abundant evidence of this. We are more prone to remember specifically important, relevant, novel & perceivably valid moments or narratives over those that we judge to be insignificant, irrelevant, redundant & apparently unreliable. *Of all the mornings you drove to work that month, the only one you remember was the morning when you ran the red light and almost got hit by another car.* This mechanic is so obvious, examples almost seem superfluous.

The method that our brain uses to encode data with and calculate this prioritization is the system explored in our second essay: emotions. When a thought & its correlating experience enter our subconscious for recording, association, and subsequent thought generation, they’re accompanied by the emotions generated when that thought parcel was first built. Those emotions were initially used to help guide the resultant actions and/or behavior. But once that's happened, these emotions serve their other purpose: to help encode & prioritize the newly-stored data & strengthen any associations it creates with other memory-stored data.

Of course, although these mechanisms work as a loop, the process can happen so quickly (in less than a second) and repeat with such extraordinary rapidity that it feels instantaneous to us. We can construct a thought parcel, then feel, perceive, store, associate, compare & evaluate its data seemingly all at once—running the loop of our consciousness in a snippet of time more mere than a moment. The deeper we dive into the mechanics of consciousness, the clearer the connections become between these nested systems of the mind—further revealing the elegant way in which all of its mechanisms are enacted and interwoven through our ever-efficient, perpetually-circumnavigating internal dialogue loop.

Memory Construction: Sentence-by-Sentence

So then, what really happens to this story after it makes its pass along the roadway of our consciousness and enters our data storage system? Essentially, that narrative information—the linguistic elements & syntax of that experience's correlating internal (or spoken) dialogue, plus the temporally-simultaneous, attention-defined associated environmental, physical & emotional data (sights, sounds, smells, tastes, sensations & feelings)—is recorded in our brain's neural network. More specifically, it's electrically and/or chemically imprinted onto those amazingly complex, interconnected, modularly-capable, differentially-associated, programmable & *re*-programmable neurons that compose the parts of our cerebral cortex that store data. In typical brains, these memory/data recording, recalling & associating mechanisms (our *parallel processing*) appear to primarily occur in our right hemisphere.

This is one of the areas where our model diverges from most current theories on memory management—because most suggest that memories are first stored & processed by the hippocampus before being transferred to long-term memory networks in the cortex. As we'll explain later—in our discussions of "short-term" & "working" memory—any kind of "intermediate" storage system would be an inefficient and ultimately *unnecessary* cognitive mechanism when viewed within the context of our model. As we'll also explain later, we hypothesize that the hippocampus clearly *does* have a specific & significant role in the formation & storage of new memories (as suggested by the unique memory deficits demonstrated by patients with damage to their hippocampus) but we propose that the primary memory data is initially encoded into the *cortex*—with the *aid* of the hippocampus.

And in 2017, researchers revealed the first evidence that mammalian brains do, indeed, encode new memories in the cortex at the same time that the hippocampus is handling these new memories [1] (thus contradicting previous models and, *theoretically*, supporting ours). Although our model *does* contradict the study's conclusions about how & when those cortex-based memories are used, I believe that's mostly because the study was done on *mice*—mammals who were among the *very first* creatures to employ cortex-based memories, and thus likely only present us with a highly *vestigial* view of humans' far-more-advanced modular memory systems.

The *experience* that is the source of this non-representational (aka, component-based & not truly *movie-like*) memory "recording" is what we perceive to be our true *in-the-moment* consciousness: the briefly-sustained, temporally-united experience of internal dialogue parcels combined with sensorially-perceived environmental & internal physical data that produces the *essence* of each moment's conscious experience. The locus of this process appears to be in the prefrontal cortex, but is, in total, a dynamically-constructed & ongoing effect of the simultaneous activation & integration of multiple distinct networks; this view mirrors the neural model of consciousness presented by Gerald Edelman's *Dynamic Core Hypothesis*. [2]

Since we've mentioned Edelman, I'll pause here to note that Edelman's & Tononi's *Universe of Consciousness: How Imagination Emerges from Matter* (Basic Books, 2000), Terrence Deacon's *Incomplete Nature: How Mind Emerged from Matter* (Norton, 2011) and Peter Ulric Tse's *The Neural Basis of Free Will: Criterial Causation* (MIT Press, 2013) together help provide a foundation for the neuroscience-based assumptions that underlie the mechanisms & systems I propose in this essay [3, 4]. Because I developed my initial hypothesis before actually *reading* those books (the latter two hadn't even been published yet) most of Narrative Complexity*'s* systems were not originally built upon the specific neural theories & mechanics that those books present.

My original proposition was that such neural mechanisms *must* be present (based on applying our theory to current knowledge of brain anatomy, behavior & evolution) in order for our model to function as theorized. And in the brief time since developing my initial hypothesis, Deacon & Tse have added to the neural evidence presented by Edelman —demonstrating that many of our theory's required mechanisms likely *do* exist within the human brain. In addition, the ideas in Douglas Hofstadter's *I Am a Strange Loop* (Basic Books, 2007) strengthen my conviction that a self-generating & self-sustaining looping stream of data (*language*) flows through & unites all those mechanisms in generating our consciousness.[5]

Nonetheless, our systems here will not be presented within the specific contexts of Hofstadter's, Edelman's, Deacon's or Tse's work (detailed explanations of which would make this essay lean too-heavily away from our *behaviorally-based* depiction of how these systems define human experience). Our goal here is to explain how the more general neural *capacities* & *abilities* that we hypothesize allow for the mechanisms that our model proposes (and anyone more interested in those *detailed explanations* that support those *capacities* & *abilities* is highly encouraged to read those four amazing & absolutely vital texts).

Swinging back around & returning to those actual *memory/data recording systems…* Current evidence also suggests that, in addition to our cortex-based memories, our amygdala is involved in storing & responding to specific kinds emotional memories [6] —primarily intense pain- & fear-based ones.[7] The amygdala's involvement in managing these kinds memories likely began in reptiles. Although our modern amygdala has its roots in the original vertebrate version (belonging to sharks & jawed fish) recent research has

shown that amniotes—reptiles & mammals —provide the first evidence of the amygdala developing sensory-associative regions. (Prior to reptiles the amygdala is limited to managing responses to internal data.)
In the view of Narrative Complexity, this amygdala-based memory is our most-ancient memory system, and might even be seen as an almost vestigial mechanism when compared to our other—primarily right-hemisphere-based—modern memory systems. This amygdala-based memory mechanism also appears to work essentially subconsciously & more reflexively than our primary memory system.

We can see this kind of subconscious operation in a famous century-old experiment by Édouard Claparède involving a woman who no longer had the ability to form new memories. Even though she could not remember meeting anyone new—no matter how often they would meet—in the experiment, she nonetheless recoiled from Claparède's attempted handshake the day after an encounter in which his handshake had included a painful prick. Not only did she not consciously recall the painful first encounter, she couldn't explain why she recoiled—to her it was simply a reflex.

As noted, research indicates that these specific kinds of reflexive pain- & fear-based memory responses are managed by the amygdala. Since our century-ago amnesiac's problem was in the formation of those new right-brain "conscious" memories, she still had the *reflex*, but not the *recollection*. It seems that the amygdala's was the first real memory system to evolve along the chordate pathway to the human brain. It was a kind of memory that allowed creatures to make use of unique remembered (& likely mostly pain-based) experiences long before the primary mechanisms of modern human consciousness (such as our cortex-based, right-brain memories) had begun to make their magic.

Returning to our primary, right-brain memory systems, as soon as a new parcel of internal dialogue (a sentence or phrase of a thought or an idea) is laid into the neural network—creating the foundation for a potential long-term memory—its component parts (specific words, images, emotions, etc.) build associations (synaptic pathways) to related, previously-recorded data. This data-pinging neurally connects the new potential memory to relevant (and ideally high-priority) stored data for current & future association and comparison. This data-pinging process also helps to produce the currently-percolating next thought, which will seek to use the highest-priority (most important, relevant, reliable) and/or most uniquely-applicable just-pinged data in constructing its next link in the ongoing narrative chain.

Link-by-link, our elements of daily experience—almost always set within or built around these narrative structures—sear themselves into our data-recording neurons, connecting these potential memories' modular elements in both a linear, syntactic, temporal fashion, and in an all-manner of all-angles vertical/diagonal, associative fashion. (Whether or not this potential memory becomes an *actual* memory partly depends upon the degree of *searing* when that narrative is laid into our neural network—something we'll explore in detail later.)

Who are you? In many very concrete ways you are simply & complicatedly a result of this process, a set of dynamic responses determined primarily by a lifelong chain of memories—a chain laid down one link, one moment at a time.

Our Outer Limits: Data Resolution
Although we've taken it for granted thus far, if we truly want to comprehend what's going on behind the veil of our consciousness—producing the many complicated facets of memory & cognition—we must genuinely consider the extraordinary *computational depth* of our mind's memory mechanisms.

The human brain is a massively powerful pattern association & comparison machine—subconsciously parsing a wide array of large & complex data patterns into their diversely modular components, then associating & comparing those components to related pattern data. The multitudinous elements and aspects of each self-contained memory-defining narrative pattern (and the attached environmental & associative data) are quickly examined & compared by our subconscious with a depth, detail & breadth that we are only minimally aware of consciously.

Generally speaking, we're only consciously aware of the emergent result & some feeling of the nuance behind these powerful calculations. But those flashes of neural activity—instantaneously circulating through the maze of memories & patterns, matching their ones and zeros against synaptically-connected stored data, and helping bring forth to the stage of our consciousness the thoughts we *perceive*—that perpetual lightning-storm in our brains goes primarily unnoticed by our conscious mind. Forever rapt by our moment-to-moment stories—which are the only things our minds were built to consciously comprehend—the whirring and sparking of the engine that builds those stories remains hidden in our neural silence.

Now that we have considered this, we must acknowledge an opposing truth: despite its deep & highly-complex ability to record & compare these memory-stored data patterns, the human brain is not *infinitely* powerful. This means, among other things, at some point its memory systems reach the limits of something we'll call *data resolution*.

One of Narrative Complexity's central hypotheses is that these neural networks that compose our memory databanks function primarily modularly. This goes back to our first essay's discussion of early animal brains representing ideas with one "word" (a singular neural component) that only & specifically means "I saw a red snake by the river this morning." In contrast, human brains employ a collection of individual words (modular neural components) that are combined to represent the same idea in several distinct, but malleable & independently-associative parts.

Basically, using a larger number of modular components to construct a full idea likely allows each component (and the full idea) to have greater *data resolution*—more capacity for informational detail—than when constructing the same idea using fewer (or a single) neural component(s). In essence, the latter method stuffs more items or pieces of data into its neural component(s), thus limiting the informational detail of this data.

Narrative Complexity further hypothesizes that the "skeleton" or framework around which all memories are built is language-based. In our theory, memories are narrative pattern-structures built from modular word-based elements—elements whose meaning & functionality (aka, their associative & generative cognitive capacities) are primarily defined by the words' broader symbolic content combined with their more specific linguistically-defined semantic content and syntactically-defined functional roles. Basically, these narratives that ultimately compose our recorded memories are built upon & around the words that we say to ourselves as the experiences occur (& the words we use when remembering or retelling the stories).

The modularization of these narrative parcels (a story, sentence, event sequence, etc.) that compose a memory is critical to data resolution. That's because our *memory modules* (those component parts of a narrative parcel) ultimately have a defined data capacity and a defined capacity for external associative connections. This is obvious because otherwise, the power of our memory & associative capabilities would essentially be infinite. Thus, as described earlier, the more individual pieces of data that are recorded onto one narratively-determined memory module, the lower the resolution of each piece of data's informational detail.

These *memory modules* are likely a collection of neurons arranged in (or a single neuron containing) a standard, defined structure that represents an individual memory module. We might imagine (to view the structure overly-rudimentarily, but in way that makes this concept easier to visualize) that our "short-term" memory's typical 5-7 item limit (which we'll discuss in a moment) is actually a reflection of the number of neurons that compose a standard memory-module structure.

It might seem *fundamentally odd* that our brain would pre-select a specific number of neurons to compose such a structure. This is because it makes our brain feel like a system designed by someone who contemplated choices: *"Hmm… how about we try using 6 neurons for a module. Create a model using those variables…"* But, in essence, this is what the process of evolution is doing. And at different points in evolution different "test-models" become stable for certain periods in a species. Very recent research, in fact, shows that our visual-spatial systems have made these kinds of oddly-specific-seeming *choices* in how it manages data. For example, it turns out that our brain spatially "grids" our world around us using *triangles*.[7] Why not *squares*? Or those awesomely-inter-connective *hexagons* that comprise all of the hippest board games today? Well, because that's what evolution has settled on in humans *for this cosmic moment*.

Similarly, somewhere amongst those evolutionary algorithms, our brain has arrived at some standard, pre-defined neural structure (limiting capacity & associations) for individual memory modules—which map to our use of syntax in narrative/prediction-construction. Basically, according to our theory, each individual module would correlate to (& contain) a single word or a small, limited group of words that make(s) up a specific syntactic element (e.g., subject, object or predicate, etc.).

One place where we can see this *memory-module-capacity-&-associations* mechanic at work is in the use of memory devices that aid in recalling data like lists. In my freshman year psychology lab, we did a simple short-term memory experiment. Or rather, *what is often mistakenly described as short-term memory*. As we'll make clear in this essay, in the view of Narrative Complexity there is no intermediate, quickly-disappearing "cache" of recently-consumed data—aka short-term or *working* memory. In our theory, the effects of short-term memory are explained entirely within one all-encompassing data-storage mechanism.

Which brings us back to that psych lab. Our instructor listed single-digit numbers out loud, and we were told to remember as many as we could in order. The experiment was meant to demonstrate our short-term memory's typically-limited capacity to contain a list of individual items. Much currently accepted theory suggests that a typical short-term memory has (as mentioned) a limit of 5–7 items—a theory that was reinforced that morning by almost all of the 15 or so students, most of whom recalled 5–7 items.

But one other student and I were able to remember a lot more, each of us recalling about 14 numbers. Both of us used simple memory devices to aid our recall. I—a devoted Chicago Bears fan—had gotten into the habit of pairing all numbers and remembering them according to a corresponding Bears player. Thus, I wasn't really remembering 14 individual items. I was still remembering essentially 7 individual items, but each was capable of associating itself with previously-recorded memory data that already contained a 2-digit numerical component.

Basically, I was maximizing the use of my memory module's limited data capacity by employing its items to access data stored outside of itself via associative connections. In the other students, the memory module containing the list used each of its (imagined) 5-7 neurons to record a number, and I used each of those neurons to record a name linked to already-stored data. This kind of memory device is often referred to as "chunking" data—which is a misleading label, because (as we'll show here) we're *always* "chunking" data in some fashion or another. (The other student, by the way, used a visual/tactile device imagining dialing numbers on a phone, which is another version of what I prefer to call *data maximization.*)

Now consider this memory challenge: recall the names of 20 people immediately after learning them. Again, most people would struggle to remember more than the list of 5-7 that seems to be the "item limit" of our brain's individual memory modules. And without the numerical component, my simple Bears device would not allow me to maximize my limited data-capacity here (*no "chunking"*). But a memory expert might create and tell themselves an internal story when learning the names. Immediately afterward, once they recall the first name & set the story in motion, the rest come tumbling forth.

In most people's minds, their basic narrative here is something like: "I am remembering a list…" or maybe a simple self-directive "Remember the names…" *Boom. You just lost the memory game.* The recall-resuscitating syntactic logic/structure of the narrative hits a dead end at the modular syntactic element: "a list" or "the names." That *list* or those *names* (whose occupation of a single module has been determined by how that linguistic element is being used in the narrative syntax) has now been deemed the dumping ground for all subsequent data that composes the list. In others words, the data capacity for the entire list has been limited to this single module, dooming the list to run out of space after it reaches the module's 5–7 item limit. Additionally, the data resolution of its items—which is essentially a result of the module's data & associative capacities being divided among those items—has also been reduced by stuffing the whole list into one memory module.

But the memory wizard has put the power of story to work. Not only have they turned the list of names into a modular narrative, but by devoting individual memory modules to each item (a result of the narrative syntax) they increase the capacity for each individual item's data resolution. Thus, in addition to being able to remember more names, they're also possibly able to remember a few specific details about each person in the list. (Another memory-enhancing technique—creating a visually-oriented "memory palace"—is essentially a spatially-based narrative, if you think of the individual rooms like "scenes" & the sequence/layout of the rooms like a story structure.)

When we try to remember something like a list, the way in which we *syntactically* (according to our narrative) construct or perceive that list helps determine how those pieces of data are modularized, and therefore how much data capacity & associative capacity is available to each syntactic element (& its components) for recording.

Instead of stuffing lots of data into individual modules (like those early brains) narrative helps us to make use of associative connections *between* memory-stored data modules. Basically, our brains are designed to follow everything that pops into our head with the compulsion to complete imperatives like *and then…*, *then why…* or *because…* in order to help build a cohesive story. (If you don't believe this, try talking to a 3-year-old, whose *imperatives* have just started to emerge.) And narratively logical construction (valid pattern-building) helps imprint a sequences in our memory.

Our brains work this way because these kinds of narratives are deemed *highly valid*—especially reliable as predictive patterns. In other words, this data is arranged in a way that adheres to learned rules of causality (rules that govern both linguistic & narrative syntax/prediction) and follows the contours of known, related & reliable patterns. These are the predictions that our consciousness was built to make in response to all of this incoming data. Inserting 20 names into a coherent & engaging narrative allows the brain to escape the limitations of an individual data module's defined storage capacity and make use of its more powerful & efficient narrative & associative abilities—to take full advantage of the human brain's magnificently-evolved neural modularity.

The Volume of the Voices

For me, one of the hardest truths to perceive when deciphering Narrative Complexity's explanation of consciousness & its attendant mechanisms: we're actually *always* talking to ourselves or someone else. Or we're fully engaged in *external* dialogue—someone else speaking, a movie, a book, *this essay*, etc.—which can essentially substitute for our own internal dialogue, an experience enhanced through empathy (discussed in my Story Theory essay).

It's true—we narrate *everything* in our minds. Even when you try to "catch yourself" not *thinking* internally, just listen—there you are talking to yourself about how you aren't thinking about anything. It's essentially impossible to "hear" yourself *not* thinking for more than a few moments (if that). Just try it. You can't. (Then *stop* trying, because it'll start to drive you nuts—trust me.)

I know what your internal dialogue is thinking right now: *what about meditation?* I've never been a Buddhist monk, so I can't speak to what internal dialogue manipulations they have either achieved or fooled themselves into believing they've achieved. But in your average, everyday, enlightenment-seeking, yoga-mat-toting suburbanite or city-dweller (which I *have* been on occasion) I can tell you what is likely common among all of *us*. Even if you are trying to think of *absolutely nothing*, your brain cannot comprehend the true *absence of everything*—at the very least your nothing is pure whiteness or grayness or blackness. And, like it or not, the "sight" of that color in your mind generates the related word—*your brain can't help itself*. Sure, "white" is a pretty vapid thought, but it's still *internal dialogue.*

(This is not to entirely *dismiss* the actual physical & mental benefits of meditation, which—without going into the matter too deeply—can ultimately result from quieting that cacophony of complex & often *stress-producing* internal dialogue by replacing it with a much more vapidly-serene, simple & purely-sensorially "experiential" internal expression of *white.*)

Despite its perpetual nature, some of this self-narration is built from such brief rote scripts and mundane elements (*It's darker. That's crooked. Where did I put that?*) that we likely barely *notice* the words spoken in our heads—either because the thought was experienced almost instantaneously and/or it was of such low priority that it was essentially a whisper along the roadway of our consciousness. And I mean *whisper* in an almost literal way—this is because internal dialogue appears to make use of our auditory cortex as it emerges in our consciousness (and dysfunction within this internal data exchange can result in auditory hallucinations [9]—essentially, falsely ascribing products of our internal dialogue to outside sources).

Thus, Narrative Complexity hypothesizes that these lowest priority thoughts are processed by our auditory cortex like an actual whisper. Obviously, there is no literal "volume" to this kind of internal dialogue experience, so what does this really mean neurally? Consider that in terms of processing external sound data, the auditory cortex produces different results within our consciousness mechanisms according to volume. Loud noises are more likely to garner our attention enough to spark & perpetuate their conscious contemplation than very quiet, hard-to-notice noises. (Which is likely why music provides a more emotionally intense & immersive experience when played *very loudly*—an experience that, admittedly, I have great personal affection for.) This kind of *differentiated attentional response* is essentially mimicked by low priority (internally "whispered") & high priority (internally "shouted") dialogue—which makes that louder/higher priority internal dialogue more likely to garner our attention enough to spark & perpetuate its conscious contemplation than quieter/lower priority internal dialogue.

In fact, the only reason that quiet, mundane, low priority thought even *reached* the conscious roadway is because our brain appears to grade narrative priority *on a curve*. This seems to be one of the effects of perpetually needing to narrate our lives. Something *always* has to be running along that roadway, so if *every* current potential narrative vehicle carries little weight, the heaviest of the little gets its chance to ride the open road. When it gets there, the scene is like 3 AM on a lost highway in the plains—so quiet that its wisp of a narrative almost gets noticed by you, but maybe not. Or at least not until you find your nearly-silent self in the open roadway and are prompted to ask: *what was I just thinking?* You might be prone to answer *nothing*. But that wouldn't quite be accurate—in truth, you were thinking *something*, but the thought was barely worth hearing. Or remembering.

There are actually some common techniques in which we naturally adjust this never-ending internal dialogue to help with memory-management. For example, when someone tells us to "hold that thought" we might instinctively try to *slow down the pace* of our internal dialogue or *repeat to ourselves* the thought we've been instructed to "hold." Both techniques are different ways to prevent ourselves from laying down new narrative parcels into our memory; this ensures that the "held" thought is the most-recent (thus, an easily-accessible) piece of data in our storage. Additionally, the latter technique (repeating) also helps to strengthen the data's imprint. (These memory imprinting mechanics will be discussed in detail in the next section.)

The mechanisms within our loop that permit some narratives threads to emerge in our conscious awareness while other (essentially simultaneous, but currently less-prestigious) potential narratives remain confined to our unaware subconscious is a concept that Narrative Complexity refers to as the "Diffuse Box of Consciousness." We'll explore in detail the workings of these mechanisms in our next essay (such as how those potential narratives subtly affect our behavior & decisions despite our conscious unawareness of them). In terms of our memory, the most significant result of this *Diffuse Box*: only the narrative threads that reach our actual consciousness can be seared as a memories.

And the threads that weave their way onto our conscious roadway essentially travel in one of two kinds of vehicles: "spoken" and "experienced" internal dialogue. As we just explained, those low-priority or instantly-fleeting conscious thoughts are not always "heard" by us word-for-word in the way that higher-priority or more-deliberate, focused internal dialogue is "spoken" inside our heads. Nonetheless, our speedy or prestige-challenged "experienced" internal dialogue is not totally invisible within our loop. Because the dialogue made it onto our conscious roadway, that word-based thought parcel still takes the narrative path into our subconscious processing—where it is weakly seared and meekly aids in building the subsequent thought. And its (likely short) existence as a potential memory is why this mundanity is still briefly available for immediate recollection in response to the sudden "*What was I just thinking?"* prompt. Of course, since this dull data is essentially the weakest form of a potential memory, it doesn't often linger for enough time *to be* remembered, thus leading it to be forever lost.

How to Make a Memory

Which brings us back to that matter of *potential* memories becoming *actual* memories. Even though we are always talking to ourselves, and those narratives become the foundation (or at least the starting point for the foundation) of long-term memories, we obviously do not remember every single sentence of internal dialogue.

In fact, you probably can't even recall most of what you said *out loud* during breakfast this morning. And yet, if one of those sentences was a response to your partner announcing "I'm pregnant," then it's likely those sentences and some of the moment's surrounding details would be well-remembered. *So how does that happen?* How does one set of sentences become a long-term memory while other dialogue is entirely lost? In the view of Narrative Complexity, the three key players in this mechanism are emotion, repeated recall & recentness.

As we've described, when any narrative parcel flows from our internal dialogue into our subconscious processing, that language-based pattern is seared into our data-storing neurons, becoming the foundation for a potential long-term memory. According to our theory, the degree of searing is mostly determined by the level of the specific emotions that came attached with the narrative parcel. Powerfully emotional narratives (like someone saying *You're pregnant!?*) are initially seared with commensurate power, while mundane narratives (like someone saying *I couldn't find my razor...)* are given a weak initial imprint. This immediately makes those higher-priority, more-powerful narratives stronger long-term memory candidates. In fact, they are already likely seared in a "semi-permanent" fashion—but whether or not that memory grows stronger (becomes "permanent" or much more likely to be recalled in the future) is primarily dependent on another of those key players: repeated recall.

This repeated recall is also essentially the only way that a mundane memory can become a long-term memory. This is because there is also that *third* key factor affecting our data's imprint strength: its *recentness*. Narrative Complexity hypothesizes that the most-weakly initially-imprinted potential memories have, essentially, a very short "half-life." In these cases, the only thing the memory has going for it is its *recentness*—once the memory is no longer recent, it's likely no longer there.

When a memory has enough emotional juice, it seems to immediately exceed that minimum level of searing below which a super-quick version of the memory-degradation countdown begins (thus placing the initially stronger memory into that "semi-permanent" state). But when a memory has none of that emotional juice and is seared only by the minimum level of neural energy provided by passing through our dialogue loop, that memory is immediately counting down to soon-to-be oblivion. If this data is not quickly accessed again, the strength of its imprint soon fades from the neurons. (Likely returning them to blankness—making them available for future re-use until something is more-strongly seared there or possibly, if they've been "re-used" multiple times and somehow degraded, allowing them to be discarded eventually & replaced with new neurons.)

This aforementioned "emotional juice" & "neural energy" might be described more accurately as electrical and/or chemical energy that accompanies a thought parcel (or is simultaneously present within those cognitive networks) as the parcel passes through the loop, and ultimately represents that parcel's initial *memory potential* when seared into the data-storage neurons. This searing only *allows* this data to be remembered (either temporarily or long-term) and thus merely makes it *available* for future recall. Whether or not this data is *likely* to be recalled (essentially, to become a stronger or permanent memory) is heavily dependent on the mechanisms of repeated recall.

Once a potential memory or semi-permanent memory is laid into our neurons, this likelihood of future recall is primarily determined according to the paths by which and how often that data can be reached via future pinging. Part of this "how often" is determined by searing factors like the initial emotional priority given to high-impact memories, whose powerful prestige can automatically make them generally more likely to be more frequently pulled from our data pile when related data enters the system. (Post Traumatic Stress Disorder is essentially this mechanic forced into overdrive by extreme memory data—a problem that's also likely worsened by those additional, powerful pain/fear-related amygdala-based memories of the trauma, which trigger essentially subconscious responses.)

Another part of this future-recall likelihood is determined by the associative neural pathways that might lead to that data. When a potential memory is first seared and creates synaptic pathways to other data, the number of associations and the kind of data with which it associates both affect future recall. If a potential or semi-permanent memory creates a lot of initial associations to other data & if that data is high-priority, with lots of its own pathways to other high-priority data—that's a best-case scenario. This memory's links to lots of information that's likely to be pinged makes the memory itself more likely to pop-up in future thought-branches.

In addition, when one of those pathways to the memory is used, and thus "enhanced" by the traveling neural energy (basically, when the memory is pinged as related or relevant to incoming data) that pathway seems to become more *fluid*—more likely to be traveled again when related data returns. Imagine these flashes of neural activity running our data-storage maze via associative connections between memory modules. More-fluid paths act like broader, more-easily traveled neural roadways. Less-frequently accessed memories seem to have weaker or less-fluid synaptic pathways connecting them to other data. Like narrow trails leading away from well-traveled thoroughfares, these paths are more apt to be passed by this neural lightning, which is likely seeking the path of least resistance (greater *fluidity*).

And every time one of these memory-stored neural-networks is accessed, the memory data itself becomes a little stronger—benefitting from the newly-generated memory potential that has now reached this data via our narrative loop and those subconscious associative processes. This is why—as noted—if one of those mundane, ticking-down-to-oblivion recent memories is going to survive its half-life, it quickly needs to be accessed again: to strengthen or create new associative pathways and leech more memory potential from our dialogue loop to help strengthen the data imprint on our neurons.

Even long-term memories, of course, have a tendency to fade or degrade as they age, but it appears that those neurons' data imprint & association strength is on a much different chemical clock than mere potential memories. This would make perfect sense in terms of how the brain mostly needs to use this long-term data: for *future* analysis and decisions.

And it's logical that the *less* a long-term memory is accessed, the more likely it is to fade away. Recalling or pinging a memory is innate proof that it remains potentially relevant and useful—and every time a memory is pinged, the accompanying energy adds a little more time to its clock. If a long-term memory is *never* pinged, that's innate proof of its uselessness, and thus the clock continues its countdown unextended, slowly making its way into the brain's junkyard of the almost-invisible.

Do these long-term memories ever *truly* fade forever—their data imprints disappearing from those neurons like potential memories that never make it? That is a *very* difficult question to hypothesize about without being able to autopsy individual neurons. This is because there would essentially be no perceivable difference in the resultant effects from either the data disappearing entirely or the data weakly remaining, but the incoming paths becoming so impassible or buried far, far away from any likely-to-be-traveled neural thoroughfare that they are simply never accessed again. My *guess*? We've still got a lot stuff hidden in the attic, but we just can't seem to find it anymore in our hoarder-ish-ly overstuffed cranium.

Now You Have It, Now You Don't

Although most memory-recall events *usually* help us to more-easily access that memory again, under certain circumstances—in a quirk of our memory mechanisms—briefly recalling an old, weak piece of stored data can sometimes make it *harder to* recall the data again. These instances are reflected in those "tip of your tongue" experiences, when you are *sure* you know something (or just briefly, imperceivably thought of it) but cannot quite recall it. In these cases, the old memory was likely accessed through a "*uniquely* unique" associative pathway. In other words, *you only thought of it because... yada, yada, yada.* Usually *yada, yada, yada* is some weird of set of nearly-random-but-intersecting associations triggered by something unexpectedly.

In the midst of writing the e-mail, a scent wafts in the window: the aroma from a neighbor's dryer vent, an ancient olfactory experience from your childhood. At the same moment, you glance at a single yellow candle glowing in the dusk. This combination fleetingly recalls a specific, powerfully-emotional, but long-forgotten moment from youth that involved both details. For a second you feel exactly like you're there again, but then it's gone. Hard as you try, you cannot bring back the moment or feeling again, and cannot seem to say exactly what you were remembering.

What happened? We just remembered the data—so shouldn't that now make it easier to recall? Unfortunately, *not always*. That data wasn't recalled because it was connected to well-traveled pathways, it was recalled because of a "*uniquely* unique" association. When that old scent was pinged (and scent holds a powerful, primal imprinting capacity—which has helped keep this old memory alive & available) there weren't many pathways connected to the scent, and the fact that we were also processing another unique image that just happened to connect to that same specific childhood moment helped to create the perfect conditions for pinging that faint, hidden memory. (You entered *exactly* the right data into the search engine.)

The problem here is partly the memory's faintness. When this old data bubbles up into our subconscious, its weak remaining memory potential & lack of informational detail (due to that slow ongoing degradation & rare recall of this specific data) might hinder its ability to reach (or be properly depicted within) our actual conscious roadway. But even though the actual details of this old memory are trapped in our subconscious, its unique data-match still likely registers slightly in that specific part of our brain that gauges validity. (And its attached emotions are quickly felt.) This is, after all, a momentary successful pattern comparison—the incoming data pinged something that resulted in a successful cross-match.

Because our brain has matched the unique conditions of this moment with the conditions of a specific memory, it wants us to take note (feel) and compare the data to see if there's something we can cross-apply to this moment. In this case, there's nothing in that old data that applies to anything currently on the table. Nonetheless, even though this faintness & ultimate irrelevance means we aren't consciously made aware of the data's detail, we briefly *feel* the sensation of a successful match.

When this kind of *just-thought-of-it...wait-a-second* event occurs during something like a *Trivial Pursuit* game and the faint memory actually *does* pertain to a matter currently on the table—and yet we *still* can't bring it to mind again—the other contributing culprit here is likely the *fear & anxiety* produced by your powerful desire to look smart & take another turn. These kinds of "survival" emotions produced when the likelihood of success is low & stakes are high naturally inhibits the fluid exploration of neural data required to re-ping that faint & literally *trivial* data.

Once the scent is gone (or the initial flash of that trivial answer has sped away) we no longer have easy access to that unique neural pathway connecting the old memory data. And something else kind of annoying has probably happened. We've been saying to ourselves things like: "*What was that? The candle reminded me of something, and that smell. What was that?*" In other words, we've been laying down recent and possibly now-urgent-feeling potential memories that are associated with the same data-pinging elements that might lead us back to that faint, hidden memory.

In essence, we've created a closed loop in which trying to remember the lost moment is most likely to lead us right back to that now-more-prestigious, just-laid-down memory of thinking about remembering it. We've trapped ourselves away from that old data, which is too faint to butt-in on the maddening (and now repeatedly reinforcing) loop of "*What did that candle make me think of?*"

This is likely why the best strategy for re-pinging that *just-slipped-away* old data is to try "retracing your steps" back into the memory—to try recreating the specific mental conditions that initially led you along that unlikely backroad to the ancient, nearly-hidden piece of data. *We were talking about... then you said... and I said... and then the wind blew over those flowers... that's it—I've got it!*

Therefore, as we've described, the less-frequently we access old data, the harder it is to find (or stumble across) in our vast data pile. And when it does finally pop up, that old data doesn't often stay long enough to make much use of its brief cameo appearance (or we're too suddenly-nervous over a *likely & trivial -yet-ego-bruising* failure to fluidly re-retrieve that thing you just knew 2 seconds ago).

Another very familiar, common & weird *now-you-have-it-now-you-don't-ish* neural event: *deja vu*. In the view of Narrative Complexity, *deja vu* is an easy-to-explain yet hard-to-pin-down event. It's easy because there seem to be a range of ways for this experience to occur. One way: a "hiccup" in our data chain in which data traces faintly reactivate neural networks after departing, causing a "ghost" of the data experience to trail behind it, resulting in an essentially simultaneous experience that seems to "remember itself."

Another way: the "pattern match" emotional responses (like *affirmation*) that indicate direct correlations between incoming & stored/predicted data momentarily "over-express" themselves (either through a calculation error or a brief purely-neurotransmitter imbalance) resulting in a feeling of "over-familiarity" with stimuli or events.

As we're fond of saying, *in other words*, in a system like human consciousness—in which "reality" & our familiarity with a specific experience within it both essentially result from the *re-representation* of incoming data constructed in a link-by-link fashion—the question isn't *why do we experience deja vu?* The question is really *why aren't we experiencing deja vu basically all the time?* (The apparent & somewhat *unrevealing* answer: despite the seemingly strong likelihood that a dynamic, highly-complex system like human consciousness would frequently fall "out of sync"—amazingly, the brain does an admirably consistent job of mostly maintaining a fluid, *hitch-less* conscious experience. Or at least it consistently *tricks us into believing* the experience is fluid.)

The Illusion of a Short-Term Memory Cache

Confession: while you weren't looking earlier, we swapped out the concept of a *short-term memory cache* with our own *minimum memory-potential half-life* concept. Within the systems of Narrative Complexity, this half-life mechanism can explain most of the effects associated with a short-term memory cache. The other primary mechanisms that help explain these effects are the previously-discussed memory module capacity (which is the real cause of the "item limit" associated with a short-term cache) and the soon-to-be-discussed *narrative-building mechanisms* (which generate most of the effects associated with short-term memory's *handling* of the data in its cache, or *working* memory).

And since I've never actually done experiments on a live human brain to measure anything like the half-life of mundane data imprints on our neurons, it seems fair that I explain some of the reasons why I believe Narrative Complexity's system is more plausible and likely than a short-term memory-cache model.

We can get right to the heart of the matter by re-examining our memory-wizard's recall of the 20 names. In a system that relies on a separate short-term memory cache, what are they doing that allows them to escape the cache's defined item limit? Has the memory-wizard's use of narrative somehow expanded the actual data capacity of their short-term cache? Not likely.

If such a cache exists, its data contents must be limited in one of two ways. One, it is only limited temporally—meaning we can fit an essentially unlimited amount of data into the cache, but that data will quickly fade unless it is somehow physically transferred to the long-term storage neurons. This seems highly unlikely, if not obviously impossible. What kind of specialized neurons would be required to compose a part of the brain that has real-world physical limitations (which is part of what *defines* a cache) yet unlimited data capacity? Magic neurons would be required, and we don't believe in magic neurons.

Which leaves us with option two: the cache is limited both temporally (data fades) and in data capacity (something reflected by that item limit). But this option still has that flaw when considering our scenario: it offers no plausible way for the memory-wizard's narrative technique to enhance the short-term cache's apparent data capacity.

If instead, as Narrative Complexity hypothesizes, potential memories are laid into the same system as our long-term storage, our vast data storage banks and powerful associative capabilities in essence provide that unlimited data capacity (by linking to always-available open memory modules and/or creating links to existing modules). This model requires only the temporal limitation (represented by our half-life) & individual module data capacity (*our* item limit) to help create those unique effects of a short-term memory cache. And this model still allows narrative strategies to help circumvent these limitations when building something like a list. Within Narrative Complexity's system, there is an obvious way (previously explained) in which the memory-wizard's narrative technique can aid in overcoming a module's temporal limitations and data capacity.

In a short-term memory-cache model, there are only a couple of "logical" explanations for the effectiveness of the memory wizard's techniques. One, they're somehow skipping the short-term memory cache altogether and writing the data directly into his long-term memory. But this would mean that *all* narratively-structured data would have a chance to skip the short-term cache, which does not seem likely and would make a short-term cache much less useful (and almost arbitrary in its use, since all kinds of data can be arranged into narratives).

The other "logical" explanation is that his technique allows him to escape the cache's data capacity limits by linking the short-term data to long-term data outside the cache (a type of chunking). But this would not explain how or why narrative would help achieve this. In fact, using narrative to achieve this without clearing the cache would require a type of *infinite chunking*—the story allowing him to continue accumulating its narrative (& item-linked) chunks within short-term-to-long-term Russian-doll component parts (which is about as implausible as our magic neurons).

Consider that in a short-term cache memory model, even if he tried to use story to somehow link short-term data to pre-existing long-term data, he would still only theoretically be able to stuff the first 5–7 narrative chunks into the cache before encountering a storage problem. Thus (without employing *infinite chunking)* he'd still be forced to quickly transfer each half-dozen set of narrative chunks to long-term memory in order to clear the cache for new incoming narrative items that must occupy the short-term cache. (Which defeats the whole purpose of using memory devices like creating a story, since this explanation offers no reason why *all* kinds of lists couldn't also magically make use of this *way more robust* "just-transfer-it-to-long-term-&-keep-going" method simply by *deciding* to transfer that short-term data to long-term.)

None of these short-term cache mechanisms are very efficient or make much sense, and none take much advantage of all of the other mechanisms that appear to be simultaneously working to generate our consciousness. In the end, no version of any cache-based short-term memory system is very *elegant*. In contrast, Narrative Complexity's half-lives, modular data components, and narrative-building (discussed next) effortlessly-yet-interdependently create all of the apparent effects of a short-term memory cache—and all with the kind of simple beauty that has *the elegance of the human brain* written all over it.

The Architect in You

Another conundrum of cognition that a type of short-term memory cache intends to address: the notion of *working* memory. When we're thinking about something, our cognitive & computational tools need to know what data they're handling at the moment. Working-memory models typically suggest that its temporary cache of data is the reservoir for the information that our cognitive tools are currently using. Narrative Complexity views this cognitive processing—*linear processing*, which seems to occur in most people's left hemisphere—as a type of narrative-building machine.

(As we noted in our first essay, referring to this as "linear" processing is misleading because it suggests an *algorithmic* "computer-like" processing that the brain does not truly employ. However—from our theory's view—compared to the highly-associative nature of our right hemisphere databank, the much more organized & sequential nature of that genuinely *parallel* left hemisphere process of cognitive rule application is different-enough that its *results* are usefully described & distinguished as a *linear* process.)

Throughout these essays, we've acknowledged that narratives are, at their core, prediction tools. And in essence, most mathematic equations are exactly the same thing: prediction tools. "*2 x 2 = 4*" is, at its core, a prediction tool that we can use when encountering 2 pairs of objects and want to successfully predict the total number of objects without actually counting. This mathematic equation is expressing the same kinds of predictive relationships as the story: "*If Jill pushes Jack, Jack falls.*" In the case of narratives, seeing the event actually happening (Jack falling) is equivalent to "counting" in the mathematic equation.

In other words, there are two ways to determine the result of something: watch it happen (count) or foresee what will happen by applying a predictive pattern that imports current data and processes it using a set of rules (mathematic or syntactic) that have been proven to yield reliable (essentially, repeatable) results. This commonality of purpose & mechanic is why our brain's narrative- & sentence-building machine can also be a pure computational machine.

Another way to think of it: this is likely why our left brain seems to govern activities as diverse as writing essays and parsing calculus. In both cases, the machine is doing the same thing—building narratives/predictions by applying known rules to current data—it just uses the results for a very diverse set of problems.

For this cognition process to work, it needs that pool of data to draw from when building its narratives or pattern predictions. Since we've already shown that any short-term memory cache would likely be a clunky, inefficient (and implausible) add-on to our systems of consciousness, the question here isn't whether or not such a cache could serve as this pool of data (it could, although in the same clunky & inefficient way it handles short-term memories). Rather, the real question is: can Narrative Complexity's systems handle this need without the addition of a clunky appendage like a *working* memory cache? Our answer: *absolutely*.

When a thought enters our subconscious processing—laying down that potential memory & setting-off those memory-pinging associations to recorded data—whatever current or previously-recorded data emerges from the process (just-laid-down and/or "pinged" data that possesses the strongest & most-fluid linguistic, symbolic, emotional, physical & sensory associative connections) is inhaled by our narrative-building machine. This machine's job is to quickly sort and make sense of this data (*discern a pattern*) in relationship to whatever narrative, environmental, or physical problem/goal is on the table. (Our emergent linguistic data is accompanied by that emergent environmental/sensory & physical data—all of which is used to build these narratives.)

How exactly does our system determine this problem/goal, which is a necessary point of reference for narrative construction? This is, for me, one of those particularly hard problems of consciousness. Keep in mind that the "emergent data" that comes out of our subconscious processing has patterns within it, but in many cases (when it's not straight-word-for-word recall of one specific narrative parcel) it no longer has any syntax. Thus, it seems that it would be hard to convey the "meaning" of a problem, or provide something that could actually help direct intent (essentially, determine which rules are contextually appropriate here). So something else is probably happening along the way—*but what?*

In the view of Narrative Complexity, this process is likely aided by either our ever-busy switchboard, the thalamus, or by our corpus callosum, which connects & transmits information between the right & left hemisphere of our cerebral cortex. To understand how this "point of reference" is handled, it helps to look more closely at how our brain achieves these "loops" of data. Although we've been talking about these loops (& will continue to) as something akin to fluid data paths (like a race track that our horses of thought speed around) the process is more like a daisy chain.

As each specific neural network is activated, it nearly-simultaneously activates other networks—allowing pattern data to be communicated between these networks & "re-interpreted" or analyzed by the just-activated network, then sent along in its newly-configured form to other neural networks. This multi-faceted, constantly diverging & merging, looping data-relay occurs so quickly that if we were to watch it running with the naked eye, all of its various links would seem to be consistently lit. But in our brain, there is a very specific (yet dynamic) sequence in which all of this data moves from link to link, allowing that fluid & cohesive experience of consciousness to emerge (in other words, unlike poorly-dubbed foreign-language films, in real life people's words match the movement of their lips).

What does this have to do with determining that problem/goal necessary to build a narrative response? This daisy chain sequence of neural activations gives us the parallel loops necessary for our emergent data to be analyzed according to our problem. According to our theory, when a just-heard narrative parcel arrives in the right hemisphere of our cerebral cortex, the activation of these new memory modules likely triggers the activation of at least three other primary networks: the hippocampus (which helps sear the memory, something we'll explore later), the right-hemisphere network of stored memories (that data-pinging Google search), and the thalamus or corpus callosum (which aids in *narratively-contextual rule application*).

It's also likely that in the micro-moment before these three networks are activated (simultaneous to the memory modules being *initially* activated, not *in response* to their activation) the thalamus & basal ganglia attach current sensory data (which they've just received) to that memory. Then (as we just noted) *in response* to these modules' activation, the thalamus or corpus callosum helps to "translate" & pass along that just-recorded syntactic narrative parcel for use by our left hemisphere's narrative-building tools (to help employ that *narratively-contextual rule application*).

This essentially feeds our syntactically-defined "problem" (the previous thought) into our rule-based, narrative-building left-brain network as (or just prior to) that same network is also being activated (via the corpus callosum) by the emergent right-brain data that was just pinged (when that thought was recorded). In other words, you can use the syntactically-translated intent or need expressed by saying to yourself (or someone/something else saying to you) dialogue like *How do I get to John's house? (I must…)* or *My daughters are hungry (therefore…)* or *That part fits perfectly (thus…)* to aid in defining your goal or problem—which helps you to filter out & select which rules to apply when using that emergent data to build the most appropriate/useful narrative response or problem solution (which is, at last, a description of the actual process that we define as *narratively-contextual rule application*).

And when we look more closely at our daily lives, it becomes apparent that we frequently help to spur along even many of our *most mundane* (& seemingly rote) cognitive tasks by internally asking ourselves tiny narrative-prompting questions: *what am I looking for? where did I put that? where did this come from? why is this here? how did this happen? how do I do this? who the hell did* that? *etc., etc., etc.*

When the previous thought does *not* directly contribute to, trigger or help define the subsequent thought (because a "train of thought" has been interrupted or superseded by some other *higher priority* event or stimuli) our narrative-building systems can apply its most-foundational observational/causal syntax process to this emergent data pattern (a kind of pre-language mammalian cognitive syntax we'll describe later). This means the very basic environmentally-spurred thought (*The branch is falling! These children are crying!*) can be constructed from the emergent data *without* needing narratively-contextual rule-application, because this fundamental rule application is defined by that environmental (& primarily physical or spatial) context. Once this kind of simple thought kernel is fed into our machine, more elaborate narratively-contextual thought-extrapolation can begin.

Thus, Narrative Complexity hypothesizes that our cognitive processes build all this emergent data into dynamic narrative responses by applying all those different types of mathematic or syntactic rules to that emergent memory, environmental & physical data. *This* is that pool of data required for cognition ("working" memory). Our cognition processes sort & slot the pieces into their appropriate locations in the prediction pattern according to how each piece is defined (a word's meaning/semantic content) and how each piece needs to be used (a word's function/syntactic role).

There's one piece of clinical evidence that seems to contradict the mechanisms of this cognitive model, but that I believe actually speaks to the human brain's amazing flexibility & plasticity: cases in which individuals have had their corpus callosum surgically severed (typically in order to reduce debilitating epileptic seizures).

Despite removing this direct line of communication between the left & right hemispheres of the cortex, these patients remain generally cognitively capable [10] (although they usually display a variety of unusual, smaller deficits in perception & cognition). How is this possible if the corpus callosum plays a vital role in feeding emergent right-brain data into our left-brain's narrative-building mechanisms? In the view of our theory, severing these connections is indeed like removing the main data highway between these mechanisms—nonetheless, this persistent emergent data can still find "detours" around the new roadblock via other neural roadways (the most likely replacement route probably runs through that highly-connected & efficient thalamus, which is already communicating lots of varied data between these two hemispheres). In addition, this "re-routing" is also likely what causes some of those unusual deficits in these patients.

The exact ways in which the brain makes all of this happen—how it accurately matches so many different kinds of patterns to so many possible rules, how it re-routes data around roadblocks to access those rules—are some of the more deeply *unfathomable* aspects of the human mind. These "rules" are seemingly as plentiful & diverse as the memories themselves. It is difficult to comprehend how the human brain could create a system in which we are instantaneously & dynamically able to select & apply these rules to data emerging from our subconscious in such a fluid & successful fashion—even after a *severe* disruption of the system. And yet, think about how fluid your thoughts are, how quickly you take the words you hear from someone else, comprehend all their nuance & data, then construct a complex immediate response by applying these rules to your own emerging data. We do it effortlessly, and thus, we know that the brain can manage a system of such complexity because…*it does*.

As hard as it is to imagine such an unfathomably complicated system resulting from just a fundamental set of repeating, interweaving mechanisms—I believe this is what our brain is likely doing in the process of cognition. When our mind generates thoughts & solves problems using the most-recently-consumed or emergent, related & highest-priority data, it does so by applying a vast, diverse set of rules that help to create the presently most relevant or useful narrative, predictive or problem-solving equation.

Although this view of cognition helps to explain how the minds of exquisite scientific problem-solvers like Albert Einstein have used complex (& essentially mathematically-syntactic) equations to unravel & demonstrate their intricate, innovative solutions to a wide-ranging array of mysteries—this explanation doesn't seem to address how someone like Einstein *also* used his extraordinary cognitive *spatial* capacities to achieve the initial insights that led to those innovative solutions. In the view of our theory, however, our mind's use of its spatial capacities *requires* those word-based thought parcels in order to generate & manipulate the objects that we imagine.

In other words, Einstein still needed to *describe to himself* his thought experiments about things like riding a beam of light through the cosmos or 2 differently-placed observers witnessing the same bolt of lightning—and his descriptions helped him to generate & manipulate the visual data that he imagined within his mind, allowing Einstein to derive his insights by observing & analyzing his own complex conjurations. His extraordinary spatial capacities (suggested by some morbid *post-mortem* examinations of his brain) essentially made him capable of generating (& sustaining) more complicated, multifaceted, intricately-interactive visual scenarios from those word-based descriptions. Old Albert is proof that when someone can generate & manipulate both complex narrative/mathematic equations and complex spatially-based visual conjurations (and possesses a mind not inured to old paradigms) they're a decent candidate for solving some pretty cool & difficult problems.

Narrative Complexity's view of this complexly "inter-causal," multi-rule-based, syntactic narrative-building process is reflected in the theories of grammar presented by linguists M.A.K. Halliday & Christian M.I.M. Matthiessen in their book *Construing Experience Through Meaning: A Language-Based Approach to Cognition.* [11] Their work (which presents brilliant, highly-complex explanations of the mechanisms & powers of grammar & language) strongly supports our theory's central hypothesis of a language-based cognition process.

And to clarify a specific bit of language that *I just used*: the term "inter-causal" syntax is intended to convey both the way that a previous syntactic unit (a narrative parcel) helps to define the construction of the next syntactic unit (the process we just described) *and* the way that individual words within those syntactic units can interactively *cause* the transformation of each other (impacting the words' specific functions & meanings within that syntax).

You Know It or You Don't

Anyone who's familiar with the currently most-accepted view of these cognitive phenomena (*Dual Process Theory*) might immediately have a question here: where are the *two systems*? In the view of Dual Process Theory, the brain employs two cognitive processing systems (or types of "reasoning") that help us to respond to our environment: an implicit, subconscious, associative system (system 1) and an explicit, conscious, analytic system (system 2).

In many ways, these two systems roughly correlate to Narrative Complexity's primarily associative data-storage system and its primarily syntactic narrative-building system. The main difference is that Dual Process Theory posits that these two systems can work essentially independently from each other. In fact, the theory suggests that our associative system 1 can be used to make a decision or calculate simple tasks without even engaging system 2. In *Narrative Complexity* (similar to its handling of short term memory) *both* of these kinds of reasoning are handled by the mechanisms of our singular internal dialogue loop.

(Ironically, in this arena we find ourselves *disputing* some of the ideas supported by the author of our beloved *Prospect Theory*, Daniel Kahneman, who is a strong proponent of Dual Process Theory. Hopefully our ensuing explanation will justify contradicting the *patron saint* of our emotions theory.)

Without taking the time to explain Dual Process Theory in detail, the best way to show how our model handles these same tasks with greater simplicity is to explore some examples that are commonly used to explain system 1 & system 2. In Dual Process Theory, the problem "*2 x 2=?*" is supposedly handled by system 1. Here the system's associative mechanics provide the instant answer, "*4.*" In this case, the claim is that system 2 has not been engaged because no real analysis or calculation is necessary. System 2 is engaged by the problem "*17x24=?*"—which does not provide an instant answer, but requires "conscious effort."

This effort is taken by Dual Process Theory as a sign that system 2 has been engaged—the calculation is explicit and demands our "analytical" processing. The theory often points to pupil dilation as a sign of system 2's engagement—something that I believe is merely a sign of more focused attention on a task, not a sign of specific systems being engaged. Our pupils, after all, also dilate during strong sexual arousal—which is not a case of anything particular analytical going on, but certainly a case of more focused attention on a task.

Using the mechanisms of Narrative Complexity these same exact system 1 & system 2 effects can be achieved simply by engaging our loop in different ways to solve different kinds of problems. The first problem (*2x2*) is merely an already stored (and very, very well imprinted) piece of data. When the problem enters our subconscious, the memory-stored answer of 4 pops right out in our emerging pool of data. And the narrative construction required to express this answer is *almost* non-existent. (Which is *not* the same thing as system 2 being unengaged.)

In fact, the ultra-simple response syntax of "*The answer is 4*" can be reduced to "*It's 4*" or even just "*4*"—because our brain isn't *stupid*, and it knows that in this case the only *truly* important syntactic element here is the actual solution. In other words, your brain hears the problem, 4 pops into our narrative building-machine, it drops the rest of the syntax because it's deemed unnecessary, and you shout out "Four!" before you even realize you're forming the words.

And because the answer arrives in your narrative-building machine with a *highly-valid* tag (and the problem itself isn't deemed highly important) there's no hesitation in responding or desire to actually apply a specific predictive rule to recheck our work through a true "calculation. " However, despite this answer's absolute obviousness to us, if our life *literally* depended on the solution, we might actually check that immediate pure-memory based answer by taking a moment to "calculate" (or maybe even ignore our predictive rules and count it on our fingers—I mean, our life *literally* depends on this here).

This is also why we're prone to be fooled by "trick" math problems that are essentially syntactically designed to fool us into arriving at the wrong answer. Dual Process adherents like to use these kinds of problems to demonstrate how system 1's associative reasoning is sometimes "flawed." But in the view of Narrative Complexity, when encountering these trick problems, people simply know that nothing particularly important is riding on the answer. And although narrative-building (system 2) is often referred to by Dual Process believers as "lazy" (which is why it "allows" system 1 to provide the wrong answer to the trick problem) I believe our narrative-building is really just trying to be as efficient as possible. This means that if an unimportant problem *looks* like (at first glance) a candidate for an obvious, high-priority rule or very-familiar stored data, we'll apply that rule or data, not check the answer, and move on. *That seems easy enough & not of any real significance, so we'll just make this assumption & move on.*

In response to these trick problems, it usually turns out that our assumption was wrong & we've been fooled by the "optical-illusion" syntax (in these problems, there is *always* a way to change the syntax in such a fashion that most people will apply the correct rules & get the problem right). *But who really cares that our assumption was wrong?* If our life was actually on the line, it's *very unlikely* our brain would accept the wrong answer without checking. Thus, in most cases when these kinds of errors occur —*it simply doesn't matter*. Which means our brain actually didn't make a particularly bad decision in assuming—after all, its job isn't to get *every* problem correct *all* of the time. Its job is to focus its highest resource-use on our highest priorities, and move through the rest as efficiently as possible. Meaningless mistakes are usually just that: *meaningless*.

Of course, we also make lots & lots & lots & lots (I could go on) of mistakes in rule application that *do matter*. But these cases are nothing like the intended-to-fool math problem. These meaningful mistakes aren't usually a case of "lazy" or trying-too-hard-to-be-efficient narrative-building—it's just a case, frankly, of *incompetence*. Bad rules, bad beliefs, bad rule-application & associations, a lack of useful memory data (I could go on). In other words—if it was important—you were probably *trying*, but trying just wasn't good enough. Our brains are awesome, but the humans that employ them aren't perfect.

Going back to our more straight-forward problem (*2x2=4*)—our response here is basically a super-quick, super-simple version of the loop. Nonetheless, there's no system or part of our loop that went unengaged—our memory was simply more relied-upon than our narrative-building for the answer. As with everything in our model, the whole loop *always* has to be completed for an actual thought or verbal response to emerge from us.

In the case of the second problem (*17x24*) it's unlikely that you've done that problem enough times to have a strongly-imprinted memory of the answer in your data-banks. Thus, after hearing this problem, your loop might first take a round or two processing internal dialogue about whether or not the problem is actually worth doing (*That's hard, but I get the point, I don't need to do this*).

If you choose to do the problem, you're likely to start applying some rules that help you to, essentially, syntactically divide it into parts that you've learned to calculate efficiently—something that might look like: *Okay, that's* (17 x 10) x 2 *plus* 17 x 4, so…*[(17 x 10 =170) x 2 =340] + [17 x 4 =68] =408*. And when you do this problem in your head, you're actually internally speaking those words to yourself—likely saying that first bracketed section as one narrative parcel, and laying *340* into your memory, so that data can be pinged in a moment and added to the *self-spokenly-arrived-at 68*. Again, like the simpler problem, this calculation relied on both our associative and narrative-building mechanisms to arrive at the answer—it simply relied on one more heavily because of the nature of the problem's difficulty and our *familiarity* with it.

(This "chunking" of cognitive tasks or calculations into more-easily managed components is an *intellectual* descendent of the *physical* process of *Motor Task Chunking*, which we'll discuss in our next essay.)

Once a problem becomes *familiar* (well-remembered) your brain can use its memory of the answer to provide that quicker response. So if you keep telling yourself right now "*17x24=408*" then tomorrow if you see that same problem, *408* will likely pop out almost as easily as *2x2=4*— even though *17x24* a much more difficult problem. But no magic of the mind has occurred here. The answer *408* is simply like any other memory data that's recent and has been repeatedly-recalled. And after time, if you never do that problem again, the data will likely fade and the problem will require more trips through our loop & more sophisticated rule-application to arrive at a solution.

And those essentially automatic responses happen in reaction to *all kinds* of incoming data. But, as shown, the instant response is not the result of our associative systems working *independently* of our more deliberate cognitive mechanisms. Rather, these responses simply require much less effort on the part of those narrative-building mechanisms, because the most-likely useful response has already been pinged in our databanks thanks to a previously identical (or nearly-identical) remembered experience.

Thus, when you see a vase start to tip, you automatically reach for it because you've seen a million things fall this way and your brain doesn't need to apply any rules to predict the result reliably. You see it tip, (your brain quickly shouts something like "Tipping!" or "That's falling!" or "The vase!") and you reach. But if the bookend tips over and starts a long chain reaction down the shelf that eventually knocks off your pencil holder (and that's never happened before) your first response to seeing the bookend tip might be to reach for the bookend and not get ready to catch the pencil holder.

Or you might pause for a moment, instantaneously scan the whole shelf, allow your brain to apply some physical rules to the scenario, and quickly (but not automatically) realize that you should be running for the other end of the shelf. Meanwhile, you're probably very quickly saying to yourself something like, "*That's tipping all those books…the pencil holder!*" or if you're really sharp, maybe just "*Bookend… books…pencil holder!*"

There are other implications that arise from the differences between Dual Process Theory's & Narrative Complexity's views of these systems (such as the apparent biases that Dual Process attributes to its systems) but exploring these differences isn't necessary to understand our theory's mechanisms. For now, the most important take-away here is that in *our* model, these narrative-building mechanisms that we're discussing are always at *some* level part of our conscious "reasoning" process, and *must* be engaged for any thought to emerge from our loop.

The Architect's Rule Book

Returning to our model's inner-architect and their syntactic, narrative-building rules —the next obvious question: where do those rules come from? There's at least one clear source of our rules: we learn them. In the view of Narrative Complexity, it seems absurd to assume that human babies enter the world with an understanding of *all* the myriad syntactic rules that govern sentence-building. Similarly, the narrative or causal rules that govern a specific skill-set (from chair-building to exploring physics) need to be learned through experience or study.

The other likely source of these rules at first seems more vexing to consider: we're actually born with them. This is vexing because it begs the questions: *What are these rules? What would they govern? How could they be purely fundamental & yet useful enough to begin building a complex, larger, inter-causal grammar?* According to our theory, these rules are the broader frameworks and most foundational principles—the type that help us to determine & recognize, for example, what a rule actually *is*, and how to construct new ones from the world around us. (Thus, *all* rules are ultimately built upon or somehow derived from these inborn rules.)

These are the kinds of rules that help us to understand—even before we've acquired language—that data usually requires a beginning, middle & end to make it useable. Thus, our likely-inborn fundamental rules are the rudimentary beginnings of *syntax*, whose first & most-basic purpose is to allow data to have start- & end-points—to define its limits & give it handles or borders, which are necessary to manage information as narrative parcels (essentially, as modularly-constructed but self-contained data packets).

And lest there be any confusion among adherents of "Universal Grammar" theories, what I am suggesting here is a much more scaled-down & fundamental-building-blocks version of inborn syntactic rules. ("Universal Grammar" theories propose that a broad range of specific & highly-sophisticated syntactic or grammatical rules have evolved to be inborn & essentially language-ready in all humans—a theory that's resoundingly debunked in Terrence Deacon's *The Symbolic Species*. [12])

How could a very young human brain's experiential recording mechanisms define such narrative or sequential beginnings & ends without the benefit of already-accumulated, rule-building life experience or without using the tools of language to "measure" such narratives? In essence, this is similar to asking: how did *any* pre-language mammal determine what defined a behavior- & prediction-aiding experiential data pattern as a self-contained, yet modularly-constructed unit?

More *specifically*: how did those earlier mammal brains (like dogs & monkeys) create non-linguistic-but-still-modularly-composed "proto-narratives" that allowed the determination of causal relationships and provided the capacity to use widely-varied, multi-sensory cortex-recorded experiences to aid in determining future behavior that helps to repeat (or dynamically create usefully-novel versions of) those causal sequences?

In the view of Narrative Complexity, our old friends *pain & pleasure* play a key role in catalyzing this process. Whenever strong pain or pleasure are experienced (i.e., an injury or a yummy) by pre-language mammals or very young humans, this experiential data module is viewed as a potential "end-point" (basically, as a gain achieved or a loss inflicted). Determining the "starting-point" of this narrative might then be as simple as identifying the most temporally-recent & recorded "high-attention" stimulus—a loud sound, a sudden movement, a novel scent, etc. (*basically, "spike" events that exhibit a certain category of specific attributes that allow them to be rudimentarily catalogued & cross-referenced as proto-narrative components*).

This kind of *retroactive narrative construction* is neurally possible because of the mechanics of "short-term memory" (or more accurately, the mechanics of priority-based data imprinting & the resulting memories' varying imprint "half-lives"). Those mechanics likely allow higher-attention/impact stimuli to hang around a little longer for soon-after pinging & comparison. In fact, this method of narrative construction might've been a powerful driver in determining how long a piece of recent data remains "viable" for possible use and thus, remains available to achieve longer-term imprinting. If recent experiential data does not attach itself to one of those pain/pleasure-spurred & retroactive narrative structures, the data is allowed to fade away.

Once these sequential, temporally-based end & start boundaries have been defined, it seems it would be easy to include other types of high-attention/impact *(spike)* experiential data (temporally-located within those boundaries) as different kinds of specific predictive modular elements within this narrative: high-attention/impact actions, reactions, events & "objects" (*inanimate* & *living*) that might be identified as (assumed) elements of causality within this sequence. This allows all these different elements to be rudimentarily categorized as proto-narrative syntactic components.

Of course, in a primitive system like this, there's lots of room for narrative-building errors, unreliability of data, and confusion between actual causes & mere correlations —which is why your dog's brain might mistakenly *assume* that spinning around 3 times before you fill its bowl is a *necessary* element of causality in the feeding sequence. It's also likely why the mechanisms of repeated recall (and its uses in strengthening frequently-pinged recorded data patterns) are central to mammalian cortex-based memory systems (recall uses that are *not* central to those earliest reptilian pain/fear-based amygdala memory systems). Those mechanisms were useful to mammals because they helped to reinforce memories of experiences that *repeated themselves*. This repetition essentially served as evidence of the original memory's *causal accuracy* (because the elements of a current narrative matched & recalled the original narrative, and generated the same result). This allowed repeatable (thus, presumably *reliable*) narratives to be more strongly remembered (leveraging their influence on behavior).

For this kind of mammalian proto-narrative, component-based & dynamic cognitive system to work efficiently, it would likely have to operate as a more primitive version of the same thalamocortical loop that's at the heart of human consciousness. Consider: in order to easily "go back a few steps" in one's experience & accurately temporally locate the likely "beginning" of a just-completed sequence, new incoming data must be sequentially fed into the same system that just recorded the data from earlier in the experience. As in humans, the experiential data loop in these creatures is like an ever-circling train that picks up new cars via sensory data input and drops them off in the brain's subconscious recording/associating mechanisms (where they hang around just long enough to determine if they were ultimately part of anything useful & worth remembering long-term).

This primitive system's effectiveness in generating useful, dynamic behavioral responses based on comparatively-related, cortex-recorded & narratively-constructed high-impact experiential data was likely a key driver in the development of the modern mammalian loop of consciousness. And if we shift our "wayback machine" into overdrive & travel into *hyper-speculation space*, we might glimpse the creature that I believe represents the earliest key evolutionary moment in the brain's journey toward this modern loop of consciousness: *lampreys* (jawless fish who were among the very earliest vertebrates—preceding sharks & *jawed*-fish).

Recent research on lamprey brain circuitry has revealed data pathways that I believe present a fascinating primitive correlation to our human loop: the integration of electro-sensory data (used to detect & track nearby movement) with visual data in the optic tectum via the dorsal thalamus (which will later contribute heavily to the development of the modern thalamus) & medial pallium (which will later contribute heavily to the development of the modern hippocampus, a crucial neural tool that we'll discuss next). [13, 14]

In the view of our theory, this is essentially the first appearance of what will become the thalamocortical loop of human consciousness. In addition to this circuitry primitively mimicking our own primary experiential data pathway, it also accomplishes something rather sophisticated: internally depicting (& tracking objects within) a multi-dimensional external environment via the integration of multiple sensory input sources (each of which are handling different kinds of stimuli in different ways, yet must "cooperatively" depict an integrated representation—a representation that critical behavioral & action decisions are entirely reliant upon). This is, essentially, the *very first* known appearance of that conscious-experience-inducing *internal model* that all vertebrate consciousness is built upon. In other words, *once upon a time* as lampreys swam about in those vast ancient seas, their sleek little selves were showing off a really, really cool new & super-clever way to view, interact with, and *experience* the planet earth & its creatures—a way that would hang around for a very, very, very (*and still counting*) long time.

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Returning to us humans & that matter of determining narrative limits or borders in order to *define* an actual modular memory structure—this task leads us to a specific part of the brain: the hippocampus. Research has shown that in humans the hippocampus is primarily involved in both spatial tasks (area maps) and memory tasks that help create long-term memories.[15] The "modern" hippocampus (having slowly evolved out of that medial pallium) essentially first appears in amphibians, where it is only involved in those spatial tasks.

It makes sense that the first vertebrates to explore land needed a new spatial tool & system to help them navigate this new *non-fluid* environment. And the hippocampus conveniently appeared between those ancient creatures' now-expanding optical lobes and their age-old cerebellum—a perfect place for coordinating what a creature sees & maps with its locomotion.

It's not until early mammals that the hippocampus also becomes involved in the formation of memories—which (according to our theory) is also the same time that those modular neural structures begin appearing in those early cerebral cortexes. Thus, it's not hard to imagine that the hippocampus' original role as a definer of borders & mapper of space led it to take on a similar role in this new & suddenly very active process: the recording of modular cortex-based memories (and the hippocampus was *already* talking to the entorhinal cortex in the management of those spatial maps). [16]

Science has shown that the hippocampus helps to transform current or recent incoming data into long-term memory data, and damage to the hippocampus can cause problems like the inability to form new memories.[17] This would make sense if, indeed, the hippocampus is involved in outlining incoming data & defining it as a distinct narrative parcel—basically firing (and thus searing) a narratively-defined set of neurons together and creating one of those modularly-constructed but still self-contained memory parcels. If the hippocampus isn't working, incoming data essentially remains "undefined" in our memories; even if it is narratively-constructed, it's like an unending sentence whose yarn is always lost because it rolls perpetually away without ever being clipped & saved.

And in the view of Narrative Complexity, the hippocampus applies some of its own *inborn rules* (the kind that define those syntactic boundaries) when determining how that incoming data is snipped & stored —helping to create "modular memory maps" by employing some of the same tools that the hippocampus originally used to create its spatial maps. (And if you're looking for a neural model for how our hippocampus interacts with those right hemisphere memories, I'd explore the very recent discoveries about how a our hippocampus works with grid cells to create & maintain those detailed spatial maps. [18])

Another major example of an inborn or pre-programmed rule set is something we discussed at the end of our second essay: music. As we hypothesized, music seems to be a kind of pattern primer that gives our mostly-blank brains a set of basic data-relationship rules to model subsequent data rules upon. And the complexity of both the patterns of music itself & our emotional responses suggests that our brain could easily come pre-programmed with a full set of fundamental, but robust rules that our cognitive processes use as a kind of narrative-building starter kit and guide the dynamic creation of new rules.

Which brings us back to that other source —learned rules. How does our brain actually *create* new rules? When contemplating the creation of new rules, it helps to compare them with another predictive cognitive device—one that we explored in our emotions essay: *beliefs*. In the view of Narrative Complexity, the evolutionary roots of our belief-building system (likely spurred by learning to prefer cooked meat over raw) are actually found in this more-ancient rule-building process.

In our emotions essay we described beliefs as essentially high-value, high-validity prediction tropes. These beliefs are intended to reliably predict (across a wide variety of settings & circumstances) what will likely result from a specific kind of action or behavior. And these beliefs are *all* arrived at through study or experience (*no inborn rules here*). When we learn a belief-building pattern-prediction from a well-trusted source or if we have repeatedly experienced events (especially high-impact ones) that we perceive to support the pattern prediction, then it can rise to the level of a belief—leading the prediction to be more frequently & broadly applied.

All of these things are essentially true about syntactic rule-building as well. Rules are intended to reliably predict (across a wide variety of settings & circumstances) what will likely result from the specific usage of a narrative or linguistic syntactic element. In addition, we can learn a rule from a trusted source & immediately begin applying it (*a teacher explaining a rule of grammar*). Or we can learn a syntactic rule via repeated experience, which is appears to be the primary and by-far most effective method of rule-building. *(We learn best not just by being told what to do, but by subsequently doing it ourselves—preferably repeatedly.)*

Our brain is *trained* to pick-up on & build these kinds of rules through repeated exposure, experience & application. And like beliefs, all of this powerfully convincing (trusted-source or high-impact: "I'll never do *that* again") or repeated evidence helps to make a rule "stronger"— more likely to be frequently & broadly applied. *In pluralization, adding an "s" is essentially a stronger (higher priority) rule than unique pluralization. Thus, in any ambiguous or unfamiliar linguistic circumstance requiring pluralization, we will likely choose to add an "s" instead of attempting a unique pluralization.*

This experientially-based, immersive-learning process is the foundation of human language acquisition. And at the center of language acquisition is the construction of another key narrative-building resource: our *vocabulary*. Science has speculated that our brain contains, essentially, a dictionary of words that it builds over a lifetime. [19] In our theory, this vocabulary resource is distinct from the words stored in our memories, although those memory-stored words are the original source of (and continually help revise) this dictionary. Just as we build distinct rules & beliefs from the patterns in the emergent right-hemisphere data that sparks them, we build our vocabulary of words from the same pool of emergent data.

To describe those words in more specific systematic terms, in our view they are, essentially: modular cognitive/neural components that possess a wide array of defining semantic & functional attributes and external associations—all of which can vary in malleability & strength, and that together determine the full range of the word's meaning, syntactic capabilities & symbolic capacities (content that can be—but is not *always*—embellished or revised with every experienced or studied usage of the word).

And according to our theory, these words are, at their core, comprised of & represented by their *phonemic components*. This means that when those word-based parcels of just-heard internal dialogue arrive in our right hemisphere for recording, they arrive (& are seared in those memory modules) as collections of *sounds*. Thus, when we talk about *language-based* memory & cognition we are actually talking about *sound-based* memory & cognition. (In deaf individuals, these components are likely visual and/or gestural-physical.) Every word's semantic & functional attributes are attached to or built around a core of sounds (essentially, a phonemic neural footprint) that serves as a word's unique & specific "identifier" (you might think of this phonemic footprint as a word's *social security number*).

The letters that comprise a word are also, obviously, very closely tied to its phonemic footprint—but written language is, ultimately, an *external* tool and still built around (& merely makes *extraordinary* use of) that phonemically-based process of language-based cognition. Keep in mind that humans were using verbalized words & internal dialogue to employ these language-based systems of memory & cognition long before written words came into the picture, and thus, those externally & internally heard words *must* have been represented by neural components that were based upon the sounds that comprised the words (aka, a unique phonemic footprint).

Moving on from words themselves and returning to that larger left-brain *vocabulary resource*, I also think it's very possible that this word-based vocabulary resource actually contains another set of items: people. I believe that the names of people we know are stored in our vocabulary like words; those names contain our most fundamental “definition” of that person. (If not actually contained *within* this vocabulary resource, our “people resource” is still likely a similarly-constructed & closely-related resource that’s used at the same point in the narrative-construction loop.) And the most important part of that definition ultimately: whether or not the individual is judged as an *Agent of Gain* or an *Agent of Loss* (discussed at length in our emotions essay).

This would be the perfect place for our brain to store this person-associated value (an essential element of emotional production). And a mechanism like this would allow this *potential* value judgement about someone to remain separate from—while still being impacted by—a *known* gain/loss judgement about them, recorded in our data storage. The same kinds of processes that we use to convert emergent memory data into rules & other vocabulary could also be used to define people & calculate their current value. And this catalog of people (represented by their names) would be a resource as vital as words themselves when building these narrative parcels.

But proposing such a “people resource” leads to an important question: how would our brain determine when a word that’s used for a creature (or object) gets filed as a unique “name” in our people resource and when it’s just filed as a regular object-defining word in our *general* vocabulary resource? Within our model, there appear to be at least a couple of methods for making such a distinction. The more deliberate & less intuitive way is simply to *give* the thing (living or inanimate) a unique name and to *repeatedly use* that name when interacting with & referring to that specific thing. In other words—thanks to that looping one-thought-leads-to-another internal dialogue process—our cognitive systems simply respond to that initial self-designation of this word as this specific thing’s unique name (leading the named thing to be filed in that people resource in the next round of processing). However, because any object is also closely associated with its object-identifying word (in addition to any unique name you might’ve given it) the *repetition* of that name-usage is key to ensuring that our cognitive processes handle that thing as part of our people resource and not just as a regular word.

And this distinction is important because once we’ve placed this name in that special people resource we’re highly prone to begin treating that creature or object like (& to think of it as) an actual person—*even if that thing is really just an un-alive, inanimate object.* This is why we can often have seemingly-illogical, but clearly-felt emotions for named (thus, *personified*) & revered non-living objects like our cars or stuffed animals or *pet rocks*. Of course, in cases like those stuffed animals—and those pet rocks, if you’ve painted a little smiley face on it—our brain is also making use of that other *less deliberate & more intuitive* method for judging other things as "people" (or at least as things worth naming & storing in that special resource): our mirror neurons.

As we discussed in Essay #2's exploration of emotion's evolution, mammals have long been using mirror neurons to help identify emotional states in other "like entity" creatures (as demonstrated by those rats who used mirror neurons to reflect the stress experienced by other rats). This means that our brains are built to automatically identify & analyze the human-like features & actions of other creatures (& objects)—intuitively leading those things to be handled differently within our cognitive & emotional systems.

In other words, because a willow tree doesn't in any way resemble a human, when its leaves shiver in the wind we don't automatically (& essentially *empathically*) intuit that the tree is scared or cold (and thus, we don't experience any emotional response to this observed shivering). But if you've simply drawn a face on a rock (and haven't even *named* it yet) then drop a heavy object directly on top of that smiling rock, you're likely to have a tiny, momentary (yet almost unavoidable) empathic *wince* or internal ping of *ouch* in response to witnessing this *merely metaphorical* cruelty (and/or you might enjoy a sinful little giggle over the poor helpless rock's misfortune). In terms of our people resource, this suggests that—in addition to our more deliberate method of simply designating (& repeatedly using) a unique *anthropomorphizing* name for a specific thing—our mirror neuron-based method of identifying & analyzing other things as "like-entities" also plays a key role in helping to shape & determine the contents of that people resource.

Now, because we're addressing how individuals speculate about the inner feelings & experiences of *other* individuals (or rocks) we've wandered into the territory of something that's referred to as "Theory of Mind" (or ToM, as it's commonly abbreviated in academic literature). Basically, Theory of Mind is defined as an individual's capacity to understand (or tendency to perceive) that another person (or rock) *has their own mind*, and thus possesses their own unique intentions & feelings & inner experiences that all motivate (& possibly predict) how that specific person will behave (or feel) in response to some stimulus or event.

Throughout history, much of philosophy has treated ToM as a kind of special case—essentially, as a unique capacity that's tied to a specific brain "module" or type of cognitive process that enables this kind of "mindreading" (aka, internally modeling the internalized experiences of others). However, as with most of the more complicated aspects of cognition, our theory views this process as a result of *multiple* systems working (as they always do) *in concert* to handle the various cognitive tasks required for understanding (or guessing at) the feelings & intent of others. (For those familiar with the various philosophical approaches to ToM, our view generally fits within a *simulation theory* approach—and for those unfamiliar with that approach, consider this parenthetical a rude & unnecessary interruption.)

Ultimately, according to our theory, this ToM capacity is a result of how our cognitive narrative-building & emotional systems *make use* of that people resource and those specialized mirror neuron mechanisms. Think of it this way: when we try to apply this "ToM capacity" to perceive or determine the inner experiences of others, what are we really doing? *We're predicting how they feel*. Sound familiar? Yes, ToM is really just another version of our cognitive & emotional systems doing *what they're always doing*: predicting results and making decisions based upon those predictions.

Because those systems are so diverse & versatile, there are actually multiple ways for us to make predictions about other people's inner feelings, desires & intent (and to take action based upon those predictions). Some of those ways are more intuitive & automatic (thus more useful for quick decision-making, but more likely to produce incorrect predictions if multiple factors are involved) and some are more deliberative & complicated (thus less useful in quick decision-making, but less likely to produce incorrect predictions if multiple factors are involved). To demonstrate, let's look at an example…

Instead of buying it online, Bob goes to a real-life bookstore to get a gift for his uncle's birthday (hey, it could happen). *As he scans the table of new books, his eye catches the cover a World War II tome—even though Bob himself is totally bored by war books, he smiles widely and nods, then reaches out to grab the book.*

I'm betting *all of you* just did the same thing —*you assumed that Bob's uncle desires books about World War II*. But you don't even know Bob's uncle! What are you, some kind of *literal* mindreader? *You wish*. Although you likely came upon this conclusion about Bob's uncle's inner desires pretty quickly, you actually used a little bit of that deliberative cognitive process: predicting the uncle's desire by analyzing circumstantial narrative elements (like the stated purpose of Bob's purchase & his response to seeing the book).

And it's easy to mess with this kind of narrative *assumption* (as opposed to a genuine automatic *intuition* of someone else's inner experience, which we'll discuss in a moment) simply by changing a narrative element: *Bob really, really hates his uncle.* Now when you think about Bob's smile at seeing the book, you might *assume* (aka, *predict*) that Bob's *intent* is possibly more mischievous or malicious—thus altering our *assumption* about how his uncle feels about WW II books… *maybe Bob's uncle is a peace-freak who actually hates anything about war.* We seem to be pretty good at predicting the desires & intent of the previously unknown Bob & his uncle purely based on a few nuggets of circumstantial evidence.

And we're able to make these predictions—without actually *knowing* either of the men—simply because *we know they're both people*. Therefore, when we initially encounter (& internally process) the men in the story, we designate them as *people* within our vocabulary resource. This leads them to be treated within our cognitive narrative & emotional systems as one of those people-resource-stored *Agents* (i.e., of Gain or Loss) as we process the rest of the story. Essentially, our cognitive systems re-orient our narrative prediction-building & emotional gain/loss, etc. analysis from ourselves (& our own desires) to the perspective of the Agents in the story (Bob & his uncle). These systems then do *what they're always doing*—make predictions that are based on (& produced by) the specific narrative and our emotional analysis of that narrative.

Returning to Bob's own act of "mindreading," we can see that he's using a method that's different from what we just used. If we go inside Bob's head to examine the kinds of predictions he was making about his uncle's desires, we can see evidence of a more automatic & *intuitive* method for predicting how others will feel & respond—a method that we can use when we *actually know* that other person (or are standing right in front of them when something happens). This method is why Bob might almost *automatically* smile when he sees the World War II book (even though he personally dislikes them).

Because Bob knows that his uncle uniquely loves such things (and this attribute is attached to that people resource "definition" of his uncle) and because Bob's intent in that moment is to find something his uncle will enjoy, those two pieces of data employ the emotional analysis that produces that instant *this-is-perfect* smile—an analysis that also, in the subsequent moment, allows Bob to do another (but now slightly more narratively deliberate) "mindread" and predict his uncle's inner state of happiness upon receiving the book, all of which ultimately leads to Bob's book-seeking *action*.

Furthermore, if Bob is standing right in front of his uncle when he opens the gift and witnesses his excited response, Bob's prediction about his uncle's inner state of happiness in that moment is likely also being shaped by those mirror neuron systems that help Bob *intuitively* identify his uncle's emotional state and thus *perceive* his inner feeling (and respond appropriately based on that prediction). The flaw, however, in more quick-action oriented & intuitive "mindreadings" is revealed if we consider another slightly-altered version of our Bob-&-his-uncle scenario: *his uncle already has a world-beating collection of WWII books and just started collecting Civil War tomes in their stead.*

Now the fact that Bob has always defined his uncle as a WWII buff (combined with his automatic, intuitive *people-resource-definition based* method for predicting his uncle's inner desires & consequent excitement) might lead Bob's "mindreading" to result in a poor action choice & an undesired outcome. However, if Bob takes some time to specifically recall his last visit to his uncle's home, that might spark consideration of some of those other mitigating factors—allowing Bob to adjust his initial automatic, intuitive (& incorrect) prediction about his uncle's inner feelings (*he'd love a WWII book*) and to produce a more accurate prediction (*he desires a Civil War book and would be disappointed by a WW II book)* by using those more deliberative & complicated methods of analysis that are capable of taking into account multiple factors in making such a prediction.

In the end, if Bob & his uncle have taught us anything here, it's that "Theory of Mind" is not so much a *special case* or *specific capacity* as it is just another multifaceted & contextually-varied result of human brains *doing their thing*—and applying that thing (*prediction*) to the motives, intents & feelings of others.

Leaving Bob, his uncle & ToM behind, and returning again to that specific people resource & all those persons of interest filed therein… Who's the *most important* person in our lives & minds? *Numero uno:* ourselves.

Much of the latest research strongly suggests that *self-related* descriptive data (personal traits, abstract qualities, behavioral characteristics, symbolic individuals or items, etc. that we associate with & define our identity) is stored separately from all of that narratively-based, associative, right-brain data. [20] And if we're looking for a likely left-brain location for this *definition of self*—that dictionary containing the definitions of words & people seems like the perfect place to stash *us*.

These word-, people-, & self-filled vocabulary resources are likely assembled & applied in the same loop locale as rule-building. This is *because* of the role words play in assembling a narrative parcel. Many of the words required to complete a parcel's syntax likely come straight from (or are *direct* vocabulary matches from) the emergent pool of data. But this mathematic or linguistic syntax also requires other words, the connective words and/or words that need to represent previously unassigned "values" (essentially, numbers or ideas) that are also part of this new equation. Those other words are drawn from our vocabulary.

Think of it this way: when we watch Jill grow hostile toward Jack and anticipate her pushing him (and Jack falling) our brain basically says "If Jill pushes Jack, he will fall." Here the sights of Jill & Jack come from that pool of emergent data (providing a direct correlation to their names). But it is the observation of Jill's hostility (not the sight of her pushing him, which hasn't happened yet) that's the actual *source* of the word "push."

And where exactly does the word itself come from? That vocabulary resource. When Jill's hostility data emerges, it helps us recognize a pattern in the moment, which calls up related rules—which in turn define the linguistic syntax used to express this pattern. The data also helps us to choose an appropriate word from our vocabulary to represent this value or idea as required by the defined syntax. Basically, during this syntactically-based narrative-building process, our brain has three main sets of resources that it applies to emergent data: a set of inborn rules, an accumulated set of learned rules, and an accumulated set of learned vocabulary. (And right beside them on our neural shelf is that accumulated set of beliefs.)

Keep in mind that all of these resources (although probably more-neatly organized & prioritized) are still using the same basic kinds of neural structures that our data storage uses. Thus, each of these massive collections includes within it a wide array of associations between the different rules or words. Our efficiency in managing *and* our individually-unique handling of these rules and vocabulary is likely affected by the way in which we've set-up these associations between them. Great "thinkers" (scientists, writers, philosophers, professors, etc.) likely have very-efficiently arranged & prioritized sets of rules governing their area of speciality.

However, this kind of rule-system & linguistic efficiency is not likely the same as what we generally consider to be *intelligence* (which reflects neural abilities that are very difficult to improve). We'll explore intelligence in detail shortly, but here's a quick example of why this is true: when we take an IQ test (designed to specifically judge "intelligence") we aren't actually using our system of learned rules to discern & respond to patterns. Rather, we are recognizing & applying patterns that are intended to be demonstrated *within the question itself* (and IQ test answers intentionally do not require a deep vocabulary). Thus, these kinds of tests isolate our more fundamental (and likely inborn) pattern recognition & application abilities.

And the essential sameness between rule/vocabulary/belief-recognition/building/application appears to be another effect of our brain's looping elegance. All of these resources are assembled & applied at basically the same point in the loop. As soon as our brain builds a narrative using rules & vocabulary, it immediately judges it for necessary emotional production. Thus, beliefs are used to help emotionally-analyze a narrative in the adjacent micro-moment after rules & vocabulary are used to build the narrative. This means that very closely-related parts of the brain would likely handle these three (*extremely*) broadly-based tasks. (And at the end of this book, you can explore our own very *rudimentary* model depicting a hypothesized data pathway through those closely-related brain areas as these systems are engaged.)

Show Me! Show Me!

Fundamentally speaking, this whole rule/vocabulary/belief-building process uses the same simple technique that's at the root of how our brain builds all of its systems from the ground up in a mostly-blank mind. It is using accumulated correlation to help determine rules of causation. In short, to our brains, repetition equals truth.

There appear to be at least two main reasons why our brain is so well-suited to use this deceptively-simple, correlation-leads-to-causation mechanism when building its self-defining architecture. One reason, that amazing loop. Here's a cool view of the loop that we haven't shared yet: it's basically our brain's way to apply the scientific method to human experience. We begin by observing (our external & internal data input systems) then we analyze (that subconscious process of associating, comparing & evaluating data) then hypothesize (our narrative/prediction-pattern building) then test our new hypothesis (act, speak or behave as a result of the narrative/prediction) and finally observe that result, beginning the loop again.

Amusingly, this cognitive-analysis sequence also exactly matches an acronym that was taught to me *many many moons ago* by an unlikely *Agent of Gain*—Mr. Kurtz, my high school driver's ed instructor. The acronym: SIPDE—*Search Identify Predict Decide Execute* (which is still a sound driving strategy). The more familiar you become with the basic neural principles behind our experience of consciousness, the more you realize how frequently they seem to "accidentally" duplicate themselves within every aspect of culture.

(In fact, if you really want to *freak yourself out* & become suddenly *over-aware* of how deeply & powerfully words have engrained themselves into the way that humans interact with the world: next time you're in a retail establishment, take a good look around at all of the *words* that are plastered *everywhere*, addressing *everything*. Product content, use & category, store organization & procedures, "lifestyle" & marketing messages, special product & service enticements, legal disclaimers, employee rules, name tags, exits, *etc.*, *etc.*, *etc.* Even in our heavily image-based & visually-overstimulating modern world—a huge portion of that *overstimulation* in our urban settings comes in the form of huge volumes of everywhere-in-sight *words*.)

Just as the repeated application of our *not-so-coincidentally-brain-loop-based* scientific method has helped humans to build a set of rules that govern construction within our physical universe, our internal dialogue loop uses this same process to build our own individual set of rules that govern construction within our mind. And because this loop is perpetually running at unimaginable speeds, it's able to conduct an almost uncountable number of tiny, rule-building experiments over the course of a lifetime.

Which leads us to the second reason why our brain is so well-suited to use this deceptively-simple mechanism to build its self-defining architecture: that extraordinary *computational depth* of our mind. In order to effectively build, manage & apply this massive collection of rules, you need a machine like—well, a machine like the one-of-a-kind human brain. And when you have that kind of processing power at your disposal, a seemingly-simple method like correlation leading to rules of causation can still result in a creature of amazing (and amazingly accurate) complexity.

As we noted, resource-building occurs—conveniently & elegantly—in exactly the same loop locale as resource-application. How do the same mechanisms handle the tasks of both building & application? Think of it this way: when our brain seeks to *apply* rules (& words) to that emergent data, the first thing it must do is discern a *pattern* in that data—so it can determine which rules will be used in narrative construction (undertaken in relation/response to our problem or goal). Part of this pattern recognition is a matter of matching emergent data to those learned rules. Another part is a matter of matching that data against those more fundamental inborn rules that define syntax itself.

When new data contains a pattern that exactly matches a learned rule, it reinforces that rule—makes it *stronger*. This pushes it further along that spectrum of correlation becoming causation. The causation "threshold" (likely determined *on a curve* based on our current hierarchy) is essentially the point where a pattern's validity/reliability scores high enough to qualify it (in our flexible hierarchy) as a rule or belief.

When new data contains a pattern that doesn't match any learned rules, but still matches some of those fundamental rules (thus defining it as a usable syntactic pattern) then our rule system takes that new pattern & makes it a new rule. *This* is one of those ways in which we build our resource of rules. Unfortunately, in these cases—because this is a rule's first appearance in our hierarchy—it's likely very, very low on that rule totem pole. This makes it easy for the rule to go unapplied—even when it's useful. In fact, the just-born pattern is barely a real "rule" at all. But this is how the *source* of this new rule can help. If the source is well-trusted (or involves a high-impact event) then the data is immediately judged as highly valid or significant, giving it greater prestige (*aka, more-fluid-&-likely-to-be-accessed incoming pathways*) when this first-timer is placed in our rule hierarchy.

Nonetheless, a rule doesn't even have to come from a *consciously-known* source to be built. Our brains automatically ferret-out rule-building pattern data from *every* experience. Having a "teacher" is simply a case of someone calling a rule to your attention, allowing you to rapidly accelerate that immersive, *soak-it-in*, rule-learning process of experience.

There are also those cases when new data contains a pattern that *partly matches* an already-learned rule or the new pattern *contains within it* an already-learned rule—and *in addition* this new pattern is also judged overall as a fundamentally valid expression of syntax. These new patterns can also become new rules—ones that have essentially been *built upon* or are *variations* of a known rule.

Beliefs & vocabulary are built in essentially this same way. The primary difference between these beliefs, rules & vocabulary are their purposes: beliefs are used to influence our actions out in the world (decisions & behavior) rules are used to influence the actions within our brain (narrative construction & syntax) and vocabulary is used to create definitions in our brain. Ever wonder why we all seemed so obsessed with stuff like top ten lists, rankings, and "commandments" (regarding pretty much *anything*) or why we seem to prefer viewing everything in our world as some sort of hierarchy? You can stop wondering. We're addicted to this stuff because our brains can never really get enough rule-building data—our minds are rule-building & hierarchy *junkies*.

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There's another aspect of linguistic expression that aids humans in adding meaning to these kinds of syntactic constructions: *inflection*. In the view of Narrative Complexity, inflection is essentially the result of applying emotional data derived from the *neurally-built* version of a narrative parcel to the subsequent *physical expression* of that narrative parcel. In other words—the narrative is built, it's analyzed for emotional production, then the narrative & its emotional data are sent (probably via the thalamus) to motor control areas that use this combined data to help determine *how* the language is expressed, *aka* vocal inflection.

Matching emotional expression to specific linguistic elements during the physical act of speech is a task that would seem to require more than just a purely motor-focused part of the brain—since the task is one of analyzing data (determining exactly *how* the emotion will impact the expression of certain linguistic elements) in addition to producing the necessary motor instructions. Thus, our theory hypothesizes that the key player in the matter of inflection is an area that research has suggested presents a unique combination of linguistically-analytical & motor-controlling capacities: Brocha's speech area (which appears to be the neural locus of speech production). In addition, it seems likely that Brocha's correlating "input" area —Wernicke's speech area, heavily involved in the analysis of heard speech—plays a similar role in interpreting the inflections in other people's speech.

Evidence of the separation between these tasks of syntax-building, emotional interpretation & inflection-application seems to be found in the kinds of *conflicted* inflections common among young toddlers. I've observed that young children (like my own) who are first developing their language skills will often express a conflicted or *uncertain* combination of inflection & language use. For example, saying "No" with upward-lilting inflection (essentially, an *uncertain* inflection—as opposed to the more natural downwardly inflected negative response) when the "No" response—even though grammatically correct—actually reflects consent.

Dad asked, "You never want to go anywhere without your blankie, do you?" The toddler replied, "No-ooo…" (with an ascending "ooo…"). Most adults in this situation would automatically "self-correct" this kind of expression and give the negative language its more common "downward-leaning" inflection—even though this linguistic response conflicts with the fact that they are technically expressing consent. *Dad said, "You never want to go anywhere without that iPhone, do you?" The teen replied, "No way, man."*

In the toddler's example, the detected-conflict's impact on the neural moment of inflection-application suggests that word choice & emotional analysis occur both separately *and* prior to the assignment of expression to each word choice. Thus, in the actual speech production, the word "No" was processed both according to the *functional/emotional* role it served in the syntactic structure (consent) and its separately-defined semantic content (rejection) —causing a conflict in the inflection that resulted in the *uncertain* (upward-lilting) expression of the "No."

Thus—because this process separately accounts for emotional & semantic content when determining inflection—a word can be inflected in a purely semantically-determined way, regardless of the word's functional/emotional role or vice versa or in some combination, depending on intent. In toddlers, their developing brain seems to have more difficulty in confidently resolving such inflectional conflicts, whereas adults seem more capable of flexibly adjusting inflection based on syntax, word-meaning & intent.

Because of the "musicality" of inflection & the innate use of basic inflection by toddlers, the rules that determine how speech is inflected are likely fundamentally inborn—and closely related to those inborn musical rules, which (as discussed in essay #2) specialize in analyzing & structuring data relationships according to emotions (the essence of inflection). This inborn capacity to apply & interpret inflection in *any* verbal utterance (even *before* an infant or toddler has developed a true capacity for language) likely helps us to construct (with the aid of those inborn *syntactic* rules) that *initial* basic neural framework necessary for developing the complex (& primarily *learned)* linguistic & cognitive processes that sustain human consciousness.

Of course, like almost all of our cognitive rules, these inborn foundational (& essentially musical) rules of inflection can all be revised & embellished according to experience—allowing for all of those individual (& cultural) tendencies of inflectional (& musical) expression. If our inflection mechanisms do, indeed, work in this fashion, then it suggests that (in addition to its other speech-producing duties) Brocha's area helps to "couple" emotional data with semantic content in the production of inflected speech, and Wernicke's area helps to "decouple" emotional data from semantic content in the interpretation of inflected speech.

In other words, this whole process of syntactic construction, analysis & expression is like a gigantic rule-, emotion- & belief-application festival. Each step along a thought's path from from our subconscious to our lips involves another layer of hierarchical analysis & application, helping to determine everything from the words we say to how we say them *before they're even spoken.*

The Great Syntactic Divide

Despite their cognitive similarities, the differences in purpose between all those rules, vocabulary & beliefs lead to an important distinction in how these resources appear to be built. The distinction: rules & vocabulary are built (& applied) *pre-syntactically*, and beliefs are built (& applied) *post-syntactically*. (And inflection, which is an ultimate motor result of this construction, is handled after both of those processes.)

This means that rules & vocabulary are built from (& applied to) the patterns identified in emergent subconscious data (which leads to the application of syntax to that data, thus "pre-syntactically") and beliefs are built from (& applied to) patterns detected in those syntactically-constructed thought-parcels (thus, "post-syntactically").

This essentially means that rules are based on "facts": pure data that can be arranged & matched to an identified valid narrative/prediction pattern, a pattern which is—or was at its root—derived from our inborn rules. In contrast, beliefs are based on our *interpretation* of those "facts"—in essence, what those facts *mean to us* (emotionally) according to the syntax in which they have been structured.

In other words, our beliefs (like *all* of our emotional mechanics) are behavioral guidance-&-prediction-patterns based on how we interpret the relationships within those syntactically-constructed “factual" data patterns. And these belief-defining behavioral patterns are *all* learned in some fashion or another over time (which is *different* from the rest of our emotional mechanics, whose behavior-influencing gain/loss equations & responses are all *inborn*—i.e., even our pre-toddler & belief-less selves *automatically* feel emotions like *sadness* when someone takes away our lollipop).

Now let me un-spin your head. First, here's a quick way to tell if your brain has constructed one of these high-level prediction patterns as a belief or a rule: *how do you feel when you you violate this belief or rule?* When we violate one of our beliefs, we feel *guilty*. When we violate a rule, we just feel...*stupid*. Thus, when we cheat (if we *believe* cheating is bad or wrong) we feel guilty. But when we violate a rule of grammar, we don't feel guilty, we feel incompetent.

And this doesn't just apply to rules of grammar. If we fail to apply reliable rules of narrative causality or physicality—leading to a bad result or an incorrect prediction—we aren't likely to feel guilty. Rather, we're likely to be dismayed or perplexed by our mistake, asking ourselves things like "*how did I not see that coming?*" In these cases, we don't feel that we *chose* our error; in fact, we probably *thought* we were applying our rules correctly at the time. Thus, the mistake merely makes us feel like a failure, not like a bad person. Violating a belief, of course, makes us feel exactly that way: *like a bad person*. In this case, we feel that we *did* choose our error (or felt powerless to resist its temptation) *despite* the fact that we knew what we were doing was "wrong" (likely to lead to an ultimately bad result).

This pre- & post-syntactic application of rules & beliefs likely plays a key role in the way that we consciously perceive these different kinds of "mistakes." Rules (pre-syntactic) are applied to emergent *unconscious* data—at the very beginning of the narrative-construction process—which is why overlooking or misapplying them feels like an unconscious mistake. But beliefs are applied to already-constructed parcels of dialogue (post-syntactically) and generate specific feelings (feelings that are *intended* to immediately call attention to any belief violation or compliance)—both of which (the dialogue & feelings) ultimately appear within our *Dynamic Core-based* arena of consciousness. Thus, we feel like we are *consciously aware* of our belief violations at the time we commit them, and are therefore *responsible* for our mistakes.

Which leads us to a probable truth that you aren't going to like—even though one of these actions (belief-application) feels more "voluntary" than the other, they're both essentially the result of very similar kinds of mechanics. Another way to look at it: our belief-application system (which is at the root of most of the big decisions that we *feel* we make voluntarily) is not any greater an "Agent of Self" than our rule-application system. They play equally vital & closely-related roles within the syntax-based systems that our consciousness uses to build predictions & make decisions. But, as noted, they're applied on opposite sides of syntactic construction within our internal dialogue loop.

Which is, come to think of it, actually a pretty *big* distinction—it's that *Great Syntactic Divide.* Is this distinction enough to say that our belief-application system is where the notion of "free will" might start to get a foothold in our consciousness? That's a delicious & dangerous question—and one that we'll save for our next (the *final*) essay. For now, it's more useful to focus on these systems' *similarities* in addition to their differences. The many similarities between beliefs & rules mean that we can often interchangeably use different combinations of both resources to arrive at or frame a decision. Examining an example of this should make everything here a lot more clear:

A high school student is taking a difficult test in a room full of other students. (The test is not graded on a curve, and no one powerfully admires the teacher—we'll note why these factors might be important later.) During the test, the teacher is called out of the room on an emergency. She says she'll be only be gone ten minutes, and that she trusts no one will cheat in her absence. She is, of course, wrong. As soon as she leaves, everyone except for our one student immediately begins using their notes and books. Our student hesitates, then finally thinks…

Now, our student could obviously think a plethora of things. But if they are going to eventually decide to use their notes or not (as opposed to the decision causing them to pass out from the pressure or run out of the room screaming) then their decision-making thought can likely be reduced to one of the following types of narrative constructions (essentially, types of belief- & ruled-based reasoning). I've labeled each example in order to help distinguish & define the different types of narrative constructions.

All of these constructions assume our student believes at some level that "Cheating is bad" & that everyone would benefit strongly from cheating (obviously, if they didn't think it was bad, they would simply cheat, and if there wasn't a benefit, they wouldn't have any need to cheat—except for a need, say, *to not look like a square*, which will also be covered). We'll start with the most-obvious construction…

BELIEF FAILURE: *I'm using my notes, which I know is totally cheating & I don't feel good about it, but I want a better test score—end of story.* There's not much to explain here. The potential gain was simply too tempting for this person & their belief lost the decision-making neural war—which can happen for lots of reasons: weak beliefs, strong need, big potential gain, ingrained behavioral patterns, etc. This person is likely to feel a good dose of guilt (& it's probably a familiar feeling to them).

Rule-based rationalism: *I'm using my notes, because everyone else is too, so it's not even actually cheating—it's basically an "open book" test now.* This person has found a way to avoid engaging their "Cheating is bad" belief by constructing & defining the narrative such that the act does not constitute cheating. This person is likely to feel little (if any) guilt about the act.

Belief-based rationalism: *I'm using my notes, which yes, is technically cheating—but everyone else is doing it.* This person has defined their act as cheating, thus activating their belief that "Cheating is bad." But for them, this is not an iron-clad belief—and somewhere above it in their hierarchy is the belief that "Bad things aren't as bad when everyone else is doing them." This belief essentially gives their brain permission to cheat under these specific circumstances, even though they would agree that they're cheating & that cheating is generally bad.

This reasoning might be replaced in other versions of this belief-based rationalism by beliefs like "If it doesn't hurt anybody else, it's not wrong" (which *grading on a curve* or *admiration for a teacher* might negate) or some version of the very simple & effective belief "I'm special—these rules don't apply to me." No matter how they rationalize it, this person is likely to feel at least some guilt over their act, but they can live with it.

Belief reliance: *I'm not using my notes. I don't care what everyone else is doing—that would be cheating.* This person is likely confident enough in their belief system that they are less prone to use rule-based rationalization in order to achieve a short-term gain. This confidence also likely makes them less prone to have an imprecise, but convenient belief-hierarchy in which over-generalized beliefs like "Bad things aren't as bad when everyone is doing them" end up as top-level beliefs (which is potentially very dangerous).

This person has been conditioned to feel that the best strategy is the application of strong, specific beliefs to brutally-accurate narrative construction. Guilt obviously isn't a factor here—and neither is the pain that can sometimes result from the perceived "loss" of an unexploited value gain like cheating. As desirable as it seems, this belief-confidence (which often results in socially-constructive behavior) can also get...*ugly*. If your belief system has, for example, over time been able to convince you of the absolute inferiority of certain other races & you've developed a naive overconfidence in these beliefs—well, in these kinds of cases strict *Belief-Reliance* clearly begins to show some of its potential flaws.

Belief confinement: *Cheating would totally help me, and everyone else is doing it,* *and it's not like it's gonna hurt anyone, but… what if I get caught? I just can't. I'd feel too guilty*. This person's brain (likely because of previous behavior-patterns) has used their narrative construction to give them several possible reasons to either violate their "Cheating is bad" belief or apply a higher level belief. Alas, their belief that "Cheating is bad" (and its prediction of possibly-dire consequences) is powerful, and it has confined their actions even in the presence of strong narrative motivations.

This is, of course, exactly what beliefs are *supposed* to do. Even though this person is likely to experience some of that "loss" pain from an unexploited gain, they're willing to suffer that pain instead of the guilt. And in more extreme versions of these *Belief Confinement-based* inner-conflicts, an individual's capacity to overcome that predicted & ongoing "loss" pain—in order to "make the right choice"—is heavily influenced by those endorphin-based *willpower* mechanisms discussed in essay #2, which are designed to aid us in exactly these kinds of *opposing-impulses* scenarios.

Belief Confinement can also be at the root of a student's choice to cheat in order *to not look like a square* ("Being popular is more important than anything" or "Being unpopular leads to misery"). The difference between this kind of narrative construction & *Belief-Based Rationalism* or *Belief Failure* is the goal of the behavior that the belief is "confining" or "rationalizing" or "failing to mitigate." In our rationalization & failure scenarios earlier, the student wants the gain of *a better test score;* the rationalization allows them to use a higher level belief to achieve the desired gain & the failure allows them to essentially *ignore* their beliefs. In the *to-not-look-like-a-square* confinement example, the student might actually prefer *not* to cheat (making the act of cheating feel more like a *loss* than a gain) and yet might still feel *compelled* to cheat (or *confined* to cheating behavior) in order to adhere to their powerful beliefs regarding what is socially acceptable in high school's uniquely-convoluted communal structure.

In other words—*Belief Failure*, *Belief-Based Rationalism & Rule-Based Rationalism* are all ways in which our brain chooses to violate a belief in order to pursue a gain (or avoid a loss). Oppositely, *Belief Reliance & Belief Confinement* are ways in which our brain chooses to adhere to a (usually strong) belief in order to refuse a gain (or accept a loss). Basically, in the properly "confining" hierarchical combination—beliefs can be used to *make us* do pretty much anything (just as *Belief & Rule Rationalism* can be used to *allow us* to do pretty much anything).

This does not mean, however, that in those confinement scenarios our beliefs are an essentially uselessly-relative & socially-manipulative tool. In truth, I think most of us make our most-difficult "correct" (most ultimately-beneficial) choices in this *Belief-Confinement* way—not in the swaggering, defiant fashion of the *Belief-Reliant* person. (And in human behavioral terms, flexibility is often the *most preferred* trait in a system or the state in which its "equilibrium" is most sustainable—*adaptability* being our primary evolutionary advantage.) Usually, when caught in the grip of a "tough call," we are wanting oh-so-badly that delicious in-our-reach gain, and are only kept from it by some annoying, nagging *behaviorally-confining* belief.

Which sometimes makes us wish that we *didn't have* those annoying beliefs hanging around and killing our buzz. But after this final example, you might feel differently. This one doesn't really *belong* in our examples (because it's based on a brain with an inborn deficit) but it *does* occur in some cases. And this outlier powerfully demonstrates the importance of beliefs. Plus, it's pretty fascinating—in a somewhat *disturbing* way...

Psychopathic behavior: *I'm obviously using my notes, because it'll help me & I probably won't get caught, and if I do get caught, I'll just point out that everyone was doing it, so she'll have to punish all of us, which is almost the same as punishing none of us.* This is what you get when you don't have a functioning belief system *at all*—which likely leads to the development of a more-robust rule system (in order to help create more-reliable complex predictions in the absence of prediction-aiding beliefs). Our theory hypothesizes that this non-functioning belief system is the primary neural deficit that is at the root of most psychopathic behavior.

A psychopath's lack of belief-invoked guilt or remorse, their tendency to be capable manipulators (a likely result of that over-compensating rule-development) and their focus on the pure value-propositions in every situation regardless of the situation's societal (belief-defined) "moral" constraints—these are all hallmarks of psychopathic behavior. And you can create all of those effects simply by shutting off someone's belief system.

Thus, it's a mistake to call psychopaths emotionless (as they are often described). Even without beliefs, the rest of their emotions can still function. This means that they can use them to make calculations about value gain/loss, predictions, and Agents of Value—which are crucial to that effective manipulative streak. And they display (and appear to feel) plenty of emotions: anger & rage (often apparently uncontrollable) over a loss, animosity towards potential Agents of Loss, gratitude for a gain provided, selfishness surrounding their own resources, pleasure over some machiavellian success, excitement over anticipated gains.

And it makes sense that some of the more evolutionarily-weighted emotions (like anger) would be expressed most readily & perceivably—considering these individual's lack of behaviorally-calibrating beliefs. Additionally, emotions (& brain areas) that are closely related to & often accompany disgust (like fear) might grow generally weaker in psychopaths—like a muscle that *under-develops* due to the total absence of those frequent disgust-related usages. (Keep in mind that *every time* we experience the disgust or guilt of belief violation, that judgement is predicting that the behavior is likely to lead to an eventual *loss*—which automatically triggers *fear.*) Regardless of how outwardly muted or powerful these emotions may appear in any particular psychopath at any particular moment, it's likely the emotions (and their necessary calculations) are in there somewhere.

Therefore, they're not always "faking" these emotional displays (although they often likely are). But—although psychopaths can *judge & feel* these emotions within themselves—much of our *behavior toward others* is guided by our belief systems. (Look at how people from different cultures or families are conditioned to *believe* that affection is expressed with different types of behavior—which is the source of much marital distress.) Thus, despite feeling the emotion, a psychopath may show little outward display of their feelings if they don't deem that behavior as helping them to get what they want in the moment.

They could calculate this decision using advanced rules, which—unlike beliefs—would only likely orient the behavior from the perspective of the individual's personal gain. In other words, a psychopath's human interaction is primarily a result of a pure self-value-based emotional calculation; the attendant behavior may or may not be necessary in their rule-based view.
And their success in manipulating others—in "playing" people to achieve their gains—directly contradicts another common misperception about psychopaths: that they lack empathy. Empathy is a function of our mirror neurons, and mirror neurons play a key role in our ability to perceive (& subsequently *manipulate*) the feelings of others. In addition, mirror neurons play a key role in lots of other *and much more fundamental* processes—like *language acquisition*. This means that if psychopaths were really suffering from "abnormalities" in those *mirror-neuron-based* empathy mechanisms, they'd display a lot of other much more apparent & developmentally-altered behavior than simply *behaving like assholes*.

Narrative Complexity actually hypothesizes that mirror-neuron-related dysfunction is at the root of two closely-linked [21] —but according to our theory, oppositely-caused—neural conditions that we'll discuss in more detail later: autism (overstimulated & indiscriminately-applied mirror neurons) and Asperger's (non- or low-functioning mirror neurons). Because mirror neurons (typically) are devoted to specifically identifying & analyzing other "like entity" data input, effectively perceiving how someone is reacting or feeling and then faking the appropriate response to achieve your gain *requires* empathy (in addition to strong rule-based prediction skills).

Unfortunately, even if you still have the ability to feel someone else's loss—and you're good at rationally understanding that their loss *isn't* actually your loss—but you don't have any beliefs that define pain-infliction as bad, then empathy can't make you a "better" person. (Even healthy, empathy- & belief-capable people who simply don't *believe* pain-infliction is always bad can make great & almost-guiltless torturers.)

In addition—in situations like cheating or stealing or murdering—beliefs are what help us to know when an obvious value gain or loss avoidance is better to be left alone (for some bigger reason than our own individual benefit). And beyond just teaching us *when & how* to express emotions like affection, beliefs are also what *compel* us to behave in those ways that express our affection (because we are normally driven to avoid the guilt of non-compliance).

We all learn how to best show our affection through whatever social group we are in, and we feel compelled to behave accordingly — judging how much affection we have for someone and calibrating what has been learned to be the *expected* response. Thus, we hug someone we view as a high potential Agent of Gain because that's what our beliefs tell us we *must* do if we've defined that person in this way (*if you don't hug your mom, you feel guilty*).

A psychopath can still judge someone as a potential Agent of Gain, but if there is no purely narrative reason to hug them at that moment (e.g., I want them to give me a cookie right now and hugging will help) then they aren't compelled to hug that person because they have no behavior-guiding belief that compels them to hug them *just because they have "affection" for them.*

Furthermore, even though they can technically have that affection for a person, they don't *feel* it in the same way that most of us do. That's because most of us accompany our pure potential-value-based affection with something else: *admiration*, which is an emotion that relies on beliefs. Consider this: *a son has a father who gives him everything he wants, but the son knows that his father murders innocent people to earn a living.* If this son is disgusted by his father's behavior and thus, does not *admire* him, the son's overall feeling of affection is likely not very high (or at least it's *conflicted*)—despite his dad being a high-value potential Agent of Gain.

It seems that without *admiration*, a child's love just doesn't have that same *shine*. Which is good description of how psychopathic children appear to feel about *their* parents. (In addition, since we learn so many of our beliefs from our parents' behavior, we are more likely to admire them —and acquire that *shine*—due to those common beliefs.)

This diversion into our darker brethren tells us one thing above all: beliefs are fundamental to a healthy human existence. But I think it also tells us something else: psychopaths are not inherently "evil" individuals. They haven't replaced healthy, productive, non-violent beliefs with some opposite, socially-destructive set of beliefs (which is a case for epidemiologically separating the now nearly-synonymous terms psychopath & *sociopath*—since the latter well-describes individuals whose systems all function, but whose beliefs are simply *totally screwed up*).

Psychopaths merely view the world as truly self-centered beings. All gains & losses are about *them*. And as they grow older, they essentially remain an emotional infant, but achieve the logical & perceptive capacities (and needs & desires) of an adult. Combine this with other aberrant behaviors that are likely to result from an out-of-control rule system (grown hulk-like in its lifetime of overcompensation & overuse) and you have the blueprint for *dangerous* psychopaths like serial killers.

Those aforementioned out-of-control-rule-system-based aberrant behaviors can include troubling stuff like: *ritualism*—ingrained & repeated rule-based behavioral "causal sequences" containing excessive, non-essential actions that are incorrectly perceived to be necessary in order to achieve the sequence's intended result; *fetishism*—ingrained & persistent need for specific pleasure-seeking acts (like sex) to be accompanied by highly-specific rule-based criteria in order for those acts to produce actual pleasure; and *extreme behavioral rigidity*—ingrained, persistent & inflexible adherence to one's personal rules regardless of the behavior's impact on others, and a rigid unwillingness to violate or compromise one's personal rules at the request of others, regardless of circumstance or social expectation.

So, *yes*, this is a combination that's very likely to very quickly produce very undesirable results, but that is not *necessarily* pre-destined based on the neural deficit. I believe that early intervention (toddler-age) with a focused program of rigorous, specifically-applied rule-building would help to make these people much more functional in society. Unfortunately, it would be awfully hard to be certain that undesirable results wouldn't eventually emerge. In the end, without our beliefs, human brains just don't work very well (that is, if a healthy social fabric is one of your goals).

Leaving behind our tangent into strangeness, and returning our discussion to *all* of the belief- & rule-application examples we've discussed—what do they *collectively* ultimately tell us? They tell us that when it comes to decision-making, our use of beliefs & rules to structure or frame that decision is highly flexible. They also tell us that *how* we structure that narrative and *how* we've prioritized our beliefs ultimately define every conscious (or *non-reflexive*) decision we make.

But a cognitive process like the one presented here also raises a question about those beliefs & syntax: if our belief resource is applied *after* syntactic narrative construction, how can we include conscious & verbalized consideration of those beliefs in that *pre-belief-resource* narrative-construction location in our loop? In the view of our theory, the answer to this is reflected in the way that we build our vocabulary resource from other occurrences of those words stored in our memory (& from the emergence of those words & their associated data in our "working" memory).

This kind of "dual-presence" in our right-brain memories & our left-brain cognitive resources is also true of beliefs. Those experiences in which we've been told a belief by others or thought about it ourselves is the data that's the *root source* of any belief that ends up in our cognitive belief resource. And some of those experiences (& thus the word-based narrative parcels that express those beliefs) are recorded long-term in our memories, making them available to be used in our narrative construction when situationally appropriate.

But merely *expressing* a belief in this way does not mean our behaviors or actions will automatically adhere to or be impacted by this *expressed* belief. That's because that behavior is determined by where this expressed belief *actually resides* in our belief resource hierarchy—aka, the belief's *strength*. This means that if our action or our syntactic definition of that action actually violates a belief that is *stronger* than the one we internally or verbally expressed, we might still hesitate to act or might feel guilty about the act even though it does not violate the *expressed* belief (which was expressed *instead* of the stronger belief merely because it was the first related emergent data to earn a slot in that particular round of narrative construction).

For example: *In the middle of a chaotic & un-policed protest march, your anarchist buddies urge you to throw the rock through the bank window, and you yell, "You bet I'm throwing this rock! The plutocracy must be attacked at every opportunity!" But in this same moment, as you cock your arm to throw the rock, you feel the urge to hold back, and suddenly your internal dialogue is filled with thoughts about what your mother would think. Next thing you know, you're dropping the rock.*

In our model, the rock-throwing hesitation could occur before the thoughts of your mother emerged (that momentary pause was what allowed you to generate them). Thus, the pause was actually the result of your intended action *violating* a very high level (but not yet consciously contemplated) & *bourgeois* belief like "Vandalism is wrong"—causing you to hesitate even though the action was strongly supported by your actual syntactic construction & your *expressed* belief (*and* your desire to look cool in front of your fellow anarchists).

Basically, we can *say* that we believe anything that we want or think we ought to believe, but beliefs are a *very real* thing—a specific & powerful element of our cognition. In other words, for our brains to actually guide our behavior according to a belief (e.g., produce guilt when it's violated) that belief *must have*—through experience or study—actually *earned* its place in our belief resource hierarchy. Thus, your capacity to identify & articulate a belief via memory-based data is not the same thing as actually having that belief filed & applicable within our belief resource.

This capacity to identify & articulate a belief via memory-based data *does*, however, explain how can we include conscious & verbalized consideration of those beliefs in that *pre-belief-resource* narrative-construction location in our loop. Which means, having answered our aforementioned question, we can move on to our *next* declaration about these narrative-building architects within us...

All Architects Are Not Equal

Here's something that's pretty obvious about humans and their rules: some of us display a greater capacity for handling, building & applying these rules. Generally speaking, this capacity appears to be pretty-well hardwired in us from birth. We'll take a broader look at this kind of *nature vs. nurture* in our brains near the end of the essay, but since we're going to talk about the hardwired capacity of our rule systems—essentially, our *intelligence*—we'll catch our first glimpse of *nature vs. nurture* here.

Current theory generally divides intelligence into two categories: "fluid" & "crystallized" (*their* terms, not mine). Fluid intelligence—long believed to be a fixed, life-spanning attribute, aka *nature*—is equated with "pure" reasoning, logical thinking, problem solving, pattern identification, etc. This is what IQ tests are intended to reflect.

Crystallized intelligence is considered to be a capacity to apply learned skills or information. Although most theory does not generally not *equate* crystallized intelligence with memory, it is, nonetheless, supposedly *reflected* by one's accumulated "general knowledge" or vocabulary. (Just exactly *how* are they able to explain why something would be *reflected* by accumulated knowledge, yet not actually *equate* to that knowledge? What adherents of this theory are intuiting is that the way in which we associate & organize our *rules* affects how we apply that *accumulated knowledge*.) Unlike fluid intelligence, crystallized intelligence is *not* considered to have a fixed capacity—aka *nurture*.

But a new chink has been found in the armor of fluid intelligence's supposedly *fixed* nature: recent experiments seem to have proven the ability to improve fluid intelligence through the practice of very specific mental tasks.[22] This practice (which must be done intensely & regularly to yield any results) typically involves something called *n-back* tests, which essentially provide practice in quickly remembering & matching items from a previous set of items in a sequence (the tests grow in difficulty as they progress). The subsequent increases in IQ scores are not huge (this isn't *Flowers for Algernon*) but *any* improvement in fluid intelligence appears revelatory in the eyes of most current theory.

However, in the view of Narrative Complexity the results of *n-back* practice are not surprising. Just as the flaws of a short-term memory cache are easily ironed-out by applying our preferred looping mechanisms, I believe those same mechanisms handle "intelligence" with greater elegance than the currently dominant "fluid" & "crystallized" models.

So, in the view of Narrative Complexity, is there a *fixed* inborn aspect of intelligence? Yes. In fact, there are several. But these fixed aspects aren't limited to the area of cognition ("fluid" intelligence). Likewise, the trainable aspects of intelligence are not limited to our areas of recall & association ("crystallized" intelligence). Yes, the effects of our inborn capacities have a much different *impact* on each of these systems, but this is mainly a result of each system's specific mechanics (its *use* of those inborn capacities) not because the capacities of one system or the other are *wholly fixed* or *wholly trainable.*

According to our hypothesis, the inborn elements that most impact all of these systems are likely the same: our individual neural networks' data & associative capacities, the strength of those imprinting systems, and the speed at which it can process data. But, as we said, the effects of these inborn capacities are very different in our narrative-building mechanisms ("fluid") and our data storage systems ("crystallized"). In our data storage, greater inborn capacities can result in things like a better memory (longer & more storage, more reliable recall) and a greater ability to usefully associate unlike ideas (likely achieved both through better processing speed & greater associative capacities—major factors in creative insight). Nonetheless, all of these abilities can be strongly improved through a couple of simple methods: study & practice.

Even if you have a greater *ability* to remember lots of data, you can't make much use of that ability if you don't actually *feed* lots of data into your brain. Conversely, even of you have inborn limitations in data storage, you can still store & access huge volumes of useful data by feeding lots of it into your brain and using learned memory techniques (like narrative) to help you remember & recall that data. This makes the usefulness of our data storage systems highly-malleable even despite our fixed inborn capacities.

In our data storage, the main mechanism that our brain uses to overcome those inborn limitations (in addition to applying memory devices) is that essential memory mechanic:

repeated recall. Repeated recall can help to make-up for those deficits of a weak imprinting system & slower processing because it helps increase imprint strength and the fluidity between associated data. These mechanics (and those leading to a more-organized rule-set) account for the "improvable" mental capacities associated with that (*hopefully-being-debunked*) "crystallized" intelligence.

Improvement of our narrative-building mechanisms, however, is more restricted by the fixed inborn capacities of our neural network. The main reason: that repeated recall is not very useful in improving those fundamental narrative-building mechanisms. IQ tests, therefore, tend to reflect those more *fixed* neural capacities because they essentially judge the kind of fundamental rule-recognition/application process that repeated recall does not enhance.

Why isn't repeated recall very useful here in making-up for our inborn limitations? For starters, this is one of those brief moments in the loop where our imprinting capacities (which can be enhanced by repeated recall) likely have little impact on the mechanism. Just *before* we build our narrative (back in that data storage maze) imprinting capacity is obviously important. And just *after* we build our narratives, each narrative's emotional output partly helps *determine* that imprinting capacity.

But *during* the actual narrative-building, imprinting capacity plays mainly one role: it helps us determine rule priority & make some rules stronger than others (within that *learned-rule* resource). Thus, someone with a greater inborn imprinting capacities might begin to apply a learned rule after fewer rule-building experiences than a weaker imprinter. Nonetheless, a weaker imprinter can still effectively learn & prioritize that rule via those imprinting-enhancing repeated recall mechanisms like study & practice.

Unfortunately—as mentioned earlier—this doesn't help in something like an IQ test, because that test isn't actually asking our system of learned rules to discern & build patterns. Rather, it's asking us to recognize & apply unique patterns that are demonstrated within the question itself—tasks that rely heavily on those *inborn* fundamental pattern rules. This kind of genetically-defined skill-source is also the reason behind some people's innately-greater musicality: because our basic musical rules are an individually-inborn resource.

Although study & practice can still help us to *learn* & *internalize* new rules over time (and help turn an innately mediocre musician into a better one) once a rule has been learned & internalized, the benefits of practice likely have little impact on how efficiently we ultimately *apply* all those rules (which is why, no matter how much you practice, you're never going to play music like *Prince*). That's because the ultimate efficiency of rule-application is generally governed by our inborn pattern & data processing abilities.

And when no *learned* rules are used, rule application is governed by that innate ability to efficiently recognize, compare, analyze and apply patterns in the construction of a *unique* (aka, *unlearned*) response—i.e., to provide an answer to pattern-problems like those on IQ tests (which judge something different than the memory-recall & association processes judged by a test of factual knowledge & learned rules).

Its heavy reliance on those inborn capacities & rules (and the absence of repeated-recall's benefits) make this fundamental rule-recognition/application ability awfully difficult to improve. But those recent *n-back* experiments have shown us that there's at least one way to improve this ability (although the effects are short-term & it's unclear whether or not those limitations can be overcome).

How do *n-back* tests help to achieve this IQ improvement? I believe these *n-back* tests teach us new rules that help us to apply versions of those "data maximization" techniques to rule-application. These new rules are so fundamental (but unique) that they can be broadly applied to the actual *process* of rule-application. These would likely be rules about how we arrange patterns most efficiently in order to increase data resolution & therefore conduct more complex pattern comparisons using the same physically-limited systems.

And the reason that *n-back* tests improve *most* people's performance is because these are such unique & typically-unnecessary rules that few of us ever find a way or need to learn them. Thus, the benefits appear across almost all demographic categories. In addition, the way in which these *n-back* tests are administered is what helps even individuals with lower capacity neural systems learn & apply these new rules: lots of intense practice. Here repeated recall makes its single contribution to rules: helping to imprint new rules & make them stronger. Once we've learned (via intense *n-back* training) this new *rule-maximization* rule, we can use it to slightly enhance our limited inborn rule-application capacities.

And the *temporariness* of the IQ improvements in these experiments is fairly predictable in the eyes of our theory. *N-back* tests aren't likely impacting our inborn, baseline rule-recognition/application ability—they're just providing us with a super-efficient rule-maximization rule. The problem with this unique new rule: in everyday life it's not very commonly *useful* (thus our unfamiliarity with it).

Once someone has stopped regular *n-back* practice, they don't actually apply these new rules in their lives. Therefore, they're no longer benefitting from the repeated recall that helped our *n-back* boot camp make these new rules so powerful & frequently-applied. Now when they take the same IQ test, those much stronger, less-efficient, but much more commonly-used inborn rules are applied *sans-maximization* to the pattern problems. Viola! We just got *dumber*.

But did we really? The fact that we soon stopped applying those rules tells us one thing about them: they're not very useful *in our actual lives* (which is why almost none of us ever learned them in the first place). Therefore, the *useful application* of our "fluid" intelligence—which is all that really matters—is not exactly the same as what an IQ test might be able to gauge. Although *n-back* training improved IQ scores, the impracticality of the new rules made them essentially *useless* in everyday rule-application—basically making the IQ improvement a reflection of nothing that truly matters. In fact, we could spend an entire essay talking about the *true* definition of intelligence. But we're smack-dab in the middle of another essay already, and we should probably get back to it…

Our Inner Theater

These matters of intelligence—and the rule-building, recognition & application that helps define it—are all mostly about how our brain *uses* memory data, but there are still matters left to discuss about that memory data itself. Matters such as our actual *experience* of consciously recalling memories. The most fundamental enigma about the experience of remembering: *what exactly are we watching in our heads?*

Usually when we retell an old memory to others or ourselves, we experience the sensation of seeing this memory play out in our minds—like a little inner theater projecting short films from your past. (Unless you suffer from the *inner imagelessness* of the disorder *aphantasia.*[23]) How does our brain manifest such a depiction? Our visual systems are immensely complex (a result of that ever-increasing importance within our vertebrate lineage) and from our meekly human point of view, the results are nearly *magical*—although research assures us that there is, indeed, nothing magical about it.

From our theory's view of this process, part of that *near-magic* is its ability to "superimpose" very faint images produced from internal dialogue data essentially *on-top-of* (or along with) that much more visually dominant & pristine *actual* environmental data. Because our "Dynamic Core" actively integrates multiple data sources via our pre-frontal cortex in the production of our conscious experience, once our internal dialogue (& its attached *memory-based & very low-fidelity* sensory data) enters that arena, it has fleeting access to those visual systems required to conjure that faint flicker of a narratively-produced image.

The typically extreme *weakness* of this narratively-produced image is why it helps to close your eyes or stare blankly downward when trying to replay these little movies: doing so cuts down on the amount of competing incoming *actual* visual data (closing your eyes) or lessens the attention devoted to competing incoming *actual* visual data (staring blankly). This helps to gives that timid memory-based visual data a fighting chance in its ever-losing battle for our visual resources.

Even when you're retelling a story that you've heard from & happened to someone else, you likely have one of these weak visual depictions running in your mind as you tell the tale. Take a moment to do it yourself: first retell in your mind a quick (but preferably old and not that important) memory from your own past, then follow it by retelling a quick (but old, not important) tale that happened to someone else. I'll wait...

Okay, now think back to those two retellings and ask yourself: were the movies in your mind substantively different in quality? Did your own memory appear in HD while the other only had the quality of a VHS tape? Not likely. More likely is that they appeared roughly the same in your head. *But how could that be?* Isn't one based on actual visual & experiential data while the other is merely a re-constructed imagining? I have some more news that might disturb you: I think they're both essentially re-constructed imaginings.

Once upon a time, your own memory might have been of superior quality, but (assuming you retold an old memory, like you were *supposed to*) this far down the line, that higher resolution has long faded away—primarily a result of that ongoing memory degradation. As proven by our own memory's likeness to the replaying of the other person's story—just because we can "see" a memory in our heads does not mean our inner theater is depicting an actual visual recording of the data.

What happened to our high resolution data? And what are we seeing now when we replay those old memories? What the hell is going on, am I imagining everything? Actually, *sort of*. Look at it this way, those depiction mechanisms that use memory-based visual data to generate the images that we "imagine" are the same mechanisms that use ocularly-received visual data to generate the real world images that we "see." Thus, in both cases, what we're actually *perceiving* is a Dynamic-Core-generated *model (inside our brain)* that is based-upon & integrating all of those varied sources of visual (& all kinds of other sensory) data.

Our brain builds (imagines) our visual depictions based on the data available. In our consciousness viewfinder, the world we see is of extraordinary detail because the data input system (vision) and its gush of visual data is directly connected to our viewfinder depiction system. The data available is robust & the system has evolved to perfectly match the data input to its depiction. This is, after all, the depiction system's primary job, and these two systems have likely been working together since the time of lampreys.

In contrast, the memory storage system in humans and that visual depiction system are slightly odd bedfellows. Memory storage basically needs to use just a small amount of the depiction system's resources in order to help its data represent this key (visual) element of a moment. And our recollections don't really require those full HD viewfinder depictions. More to the point: they couldn't create them even if they wanted to, because those memory modules don't have nearly enough storage capacity to contain that full gush of visual data we consume in a "real" moment.

This is something we discussed in our essay about dreams. When our memory data is the source of visual depictions, the results aren't particularly impressive. And if we compare the two—visual elements in our dreams and in our old memories—they seem to have essentially the same qualities.

Some might mistakenly perceive this concept of a "consciousness viewfinder" depiction as flawed proof that there is within our minds some sort of "homunculus" (a silly-but-persistent philosophical notion that there is "someone" or some essentially metaphysical "self" in our mind that "views" these brain-painted depictions). What I'm intending to describe here is the rich & constantly "refreshing" visual data input that is integrated into a sustained dynamic multi-sensory neural model (again, Edelman's "Dynamic Core") whose multi-sensory data is subsumed & analyzed (in a priority-based fashion) by our cognitive systems, which allow us to consciously "perceive" & respond to data presented in that dynamic multi-sensory neural model. (If it sounds like I'm splitting hairs, it's because *I am*—but the mechanisms of consciousness are definitely a locale where hairs need to be split on occasion. We'll split these specific hairs even further in our *Hard Problem Addendum*.)

The purpose of such a dynamic neural model—and the reason why our wildly complex & fluid consciousness viewfinder ultimately emerged in vertebrates—goes back to those *lampreys* and their clever, new capacity to integrate multiple data sources (visual data & electro-sensory data) in the construction of a unified & fluid internal depiction of their nearby environment. By using multiple data sources to achieve the same goals (essentially, depicting & tracking objects) they were able to produce more detailed, accurate & data-rich 3D models of their environment. In order for these multiple & varied sensory data sources to achieve this kind of complex, dynamic depiction there must be *some* neural arena in which this simultaneously (& *rapidly*) arriving varied data can be integrated into a unified model—*aka*, some primitive, rudimentary version of that *Dynamic Core*.

This neural arena is necessary because the *ultimate* goal of this whole process is for the creature to actually physically & appropriately *respond* to what's depicted in their environment. And in order to respond effectively (which, in part, involves *predicting* where something might move *next*) that simultaneous, varied data must be *sequentially* processed in both *temporal* & *spatial* terms. Thus, a dynamic neural field aids this process by helping to unify simultaneous, varied data sources, and then by using those unified neural "moments" to create sequential depictions that track (& in later creatures, *record*) some of that data (*spike* data, which engages a creature's "attention") both temporally & spatially—which is necessary for accurate predictions & physical responses.

These are the roots of our own human *consciousness viewfinder*. And although our highly- & exquisitely-evolved Dynamic Core hardly resembles its early, rudimentary appearance in lampreys, *all* versions of this neural arena in vertebrates serve those same core purposes described above. However, it's important to note that just because data *appears* (& is integrated) within this dynamic core/consciousness viewfinder depiction does not necessarily mean that the creature will *respond to* (or *record*) that particular data. In humans, we might think of this as being *aware* of something without actually fully *perceiving* its presence (via our cognitive processes).

The data within this neural arena that creatures are most likely to respond to is that *spike* data, which garners more "attention" (*aka*, is more likely to be sent on to & subsumed by the next step in the data-analysis process). In humans—in addition to being driven by spike environmental data—this "attention" can also be powerfully, rapidly & continually directed, redirected & focused via our internal dialogue mechanisms. And the whole process of perpetually & rapidly redirecting that attention, and equally perpetually & rapidly employing that internal dialogue to note & respond to nearly anything & everything in our purview creates the wonderfully fluid *illusion* that we are actually "perceiving" *everything* that our Dynamic Core is technically *aware of*.

(The neural relationship between our awareness & attention, and how it shapes conscious experience, is well defined by Princeton neuroscientist Michael Graziano's pioneering *Attention Schema Theory* of consciousness—although the mechanism that he dubs "awareness" is actually what we label "attention," and vice versa. [24] Narrative Complexity further discusses how awareness/attention impacts data-processing in the next essay.)

Returning to our consciousness viewfinder's depiction of those *old memories*... If *your own* old memory looked the same in your mind as your memory of *someone else's* story (as it likely did)—what, then, are these images we see in our old memories? And where do they come from? Before we answer those questions, let's look more closely at those recent memories that seem to be in higher resolution. When we replay something that *just* happened, it still has that uncanny dream-quality in our heads, but it usually seems to contain more overall detail than a replay of an old memory (although it's still not an HD viewfinder depiction). *How is our brain doing this?*

I believe our most-recent memories have, essentially, higher resolution "media attachments" that can be temporarily associated with the word-based memory data. The reason why it's useful (therefore evolutionarily plausible) to have these temporary, recent high res media attachments is essentially the same as the reason why mundane dialogue hangs around in our head for a brief time before disappearing. Both mechanics help to give us that small window to "go back and get something" or give another pattern sweep to events that we brushed-off when they first occurred, but immediately require a quick recheck.

As we discussed when exploring pre-human mammalian cognition earlier (those "proto-narrative" structures)—basically, throughout evolution it's been beneficial for our brain to be able to provide a comprehensive answer to the question: *wait*, *what just happened?* This is likely because we often don't know the *real* importance of what just happened until we see the result—until *after* it happens. And if "*what just happened?*" doesn't arise quickly, our brain takes that as permission to continue the standard processing of our recent memory-data according to its initial imprint—which ultimately allows most of those recent (and low priority) high res attachments to fade away, leaving more generic attachments to do their job.

What exactly are these high res media attachments & this generic stuff? The difference between these two goes back to associations & data resolution. When we're replaying one of those very recent scenes, its few specific narrative parcels don't have enough capacity in their modules to recreate in detail *every* visual (or other sensory) aspect of that replay. But its recentness means that there are plenty of easy-to-access (temporally-surrounding & closely-associated) memories that haven't faded away yet. And those memories might've focused on those other visual elements not contained in detail in the target scene. These other (likely only temporarily-stored) memory modules serve as high res media attachments: associated neurons that possess some of that relevant more-detailed sensory information.

Thus, when you replay those few, specific, very-recent narrative parcels (the scene) your brain can enhance the depiction with detail from that other closely-related sensory information—which is not actually temporally-simultaneous (and not actually contained in the target scene's few specific narrative parcels). Although none of our memory's version of high res visual data is nearly as robust as the HD viewfinder stuff our eyes process, using several of these focused-but-fuzzy object-depictions can help us to build a broader & more complete (higher res) overall scene than we can using the few focused-but-fuzzies that are contained in the target memory's limited narrative parcels. I know, *huh?* Don't worry, this example should clear things up:

Very soon after my wife came home, I replayed in my mind a specific moment of her arrival in which she walked up the steps & waved to our little girls, who were standing at the big front window. I could see the whole scene: the car she'd just parked in the street behind her, her expression & what she was wearing, what the girls were wearing as they stood in the window. Was it raining? Let me think…yes, it was raining lightly.

This very-recent memory seems full of detail. That detail, however, is likely a result of some *slight of mind*. We have been fooled into thinking we recorded all of these details in the actual scene's few narrative parcels. But these media attachments have likely been built from other surrounding moments that contained the richer detail of each specific element: *the moment when I saw my wife park her car, the moment I saw the girls run to the window.*

In the actual recalled scene—because my wife was the focus of my attention—the informational details of her expression & clothes might truly be contained within (or attached to) those narrative parcels' memory modules. And although the girls clothes & the car were likely ignored (or very *low res*) in the actual moment, during the surrounding moments—when those other elements were my focus—my brain recorded those images in more detail.

And when I think about the rain, *who knows where that data came from*—maybe looking out the window 10 minutes before. Nonetheless, adding it to the replay is a simple matter of the data being requested (by ourselves or others) and our brain judging that it has reliable-enough information to make the reasonable *assumption*, and quickly adding it to the replay. Even though they've come from other sources, these attachments' recentness (thus, their *undegraded-ness*) makes it all slightly more detailed and more convincing than that dreamy, old, unimportant memory I asked you to replay earlier.

If I try to recall the same moment several days later, it's likely that the "dreamy" quality has overtaken that high res memory. *What's happened now?* Now there's no longer any recent, related high res visual data—those media attachments weren't contained in important or retold narrative parcels and have since faded away. Now the replay must rely entirely on the scene's own few narratively-based parcels for its visual data. Because although none of the temporally-surrounding data has survived its half-life, I recalled this one specific scene several times —thus, it's still hanging around & accessible.

Now when I replay the moment, all I mostly have is that already-slightly-degraded specific image of my wife and the narrative framework: the words. And although those words aren't nearly as good as the real sensory data, they can still do the trick. That's because these words can help me to generate "generic" visual data when I replay the moment. So when the words "her car" appear in my retelling, my brain finds the most recent, reliable (thus most easily & likely-to-be-pinged) visual data for "her car" and uses that data to draw-up its dreamy version of her car in the memory retelling.

And if I continue to frequently recall this memory in this specific way, that particular generic car data might become essentially permanently attached to the original memory—which can be "re-written" little-by-little with each retelling, as the power of each new retelling slightly alters the memory imprints & structures, and their associations (or maybe even lays down an entirely new version of the memory, which eventually gets "first-ping" when the memory is called upon in the future).

Thus, every time I replay the memory later on, her car now continues to be depicted in exactly the same (but still dreamy) way. The eventual consistency of this generic attachment makes it seem like it was a part of the original memory. But it's simply placeholder data that became closely associated to that memory. Keeping this new attachment around long-term is no big deal because it's low-res & by now well-imprinted—thus having none of the drawbacks of the original high res media attachments from those recent, closely-related, but temporally-doomed memories.

Do I have any studies to support this hypothesis that memories are word-based patterns connected to recent high res media or generic attachments, which are primarily a re-imagining of the moment? *Not really*. Although—as discussed at the beginning of the essay—the latest neuroscience certainly indicates that our brains are very *capable* of (& possess the neural mechanisms required for) managing a system like this one. And I do, of course, have some personal anecdotes (very common experiences) that help illustrate these mechanics...

There's a memory I have from first grade that I have retold with great frequency. In short, it's a memory about hurriedly putting on my snowsuit & trying to get to the soon-departing school bus in time. When I tell the story, I can see it in my head: *Mrs. K's room, me leaning against a desk as an exasperated fifth-grader (our bus guide) helps me zip my snowsuit up, imploring me to hurry*. In my mind, the snowsuit is usually beige & hooded.
Would I be surprised if it was actually a beige winter jacket with blue snow pants &

a blue hat? Nope—that's entirely possible. In truth, although I *believe* it happened in almost the exact way I describe it—I wouldn't bet my life on it. What I *do* know is that whenever a related topic comes up, these are the words I generally use to retell the story that comes to mind, and these are the images I usually see in my head when I tell it. (In fact, I tend to see—as we often do—this ancient memory from a 3rd-person POV. In other words, I *see* my young self in the memory—which is an obvious tip-off that this movie is being re-imagined.)

This kind of common experience supports the notion that all memories are primarily language-based. Consider that most media attachments' detail—high res or generic—is dependent on what usable, recent, cross-matching sensory data is available to supplement our word-based memory *at the time of that specific retelling*. Therefore, if I'd retold this story when I was in 3rd grade, I might still have a high-quality, relatively-recent memory of that specific snow suit, and thus the memory's linguistic components "first grade" & "snow suit" would combine to ping a more accurate, detailed version of the suit.

By now, that data is long gone. All that's left are the words "first grade," "snow suit" & "beige," which are more than enough for my brain to create the generic visual item that I've seen in this memory consistently for the last 20 years. Accurate or not, *I still remember* the snow suit, the desk, the classroom. And for most of us, those three words—*I still remember*—are good enough. We'll battle 'til the cows come home in defense of something we *still remember*.

Of course, since each of us has memories that are essentially equally unreliable, your vehement belief in those memories isn't any less justified than the next person's. So go ahead, *swear* you remember. Nobody's really in any position to claim their version is more valid. (Unless, possibly, if that original event was simply *way* more important to them when it first happened—leading that virgin narrative to be both super-strongly imprinted and frequently, accurately recalled).

More Ghosts In The Machine

Depending on how closely your *own* mind was paying attention to our essay's recent data and your ability to apply the most appropriate syntactic rules—you *may or may not* recall that I promised personal *anecdotes* (plural) to support our hypothesis that memories are word-based patterns attached to sensory & emotional data. So, here's our *plural*. This anecdote helps to show just how powerfully word-based our memories are.

More than a decade ago my grandmother, in her early 80s, was diagnosed with Alzheimer's. As anyone who's witnessed their progression knows, Alzheimer's & other forms of dementia are diseases of exponential sadness. I often felt that my grandfather—who cared for her in their home & then visited her daily in her nursing facility until his end at 95—was living with a ghost. She was someone who might mystically, inexplicably, briefly appear out of the ether, then quickly disappear again into the shadows of the other side, unreachable. And that apparition of her—in a ghost-like truth—was usually temporally displaced: not perceiving or understanding the actual moment she was in, but arriving from and to somewhere else, a place only she could see.

In the time just before she moved to a nursing home—that final period when she was still occasionally almost-present—I spent an emotional, melancholy afternoon with her. It was the holidays and much of the family was gathered at my uncle's home. The occasion was, in fact, the last time I felt like I actually spoke to *her*—although she is still alive & this experience was almost a decade ago. During that afternoon she sat beside my grandfather on the couch, mostly with a contented far-off gaze. But every so often, some part of the conversation would spark something in her and a vaguely-related anecdote (usually from the long-ago past) would come spilling out in great detail.

There was one particular story that got caught in a kind of loop that afternoon. It was a story from her youth about a giddy weekend at a lakeside cabin with some relatives, and it included an aunt of hers who was a larger-than-life figure. I'd heard her tell it before in almost the exact same fashion & detail. And on that afternoon—after the story was brought to the surface in her mind—she told it not once, but multiple times, pausing briefly between each telling, then beginning again as if it had just come to her.

This is common behavior among Alzheimer's victims and other dementia sufferers. One of the extraordinary things about witnessing this kind of recollection is that someone who couldn't tell you whether or not they just ate that sandwich is suddenly able to fluidly, lucidly & *expressively* retell a decades-old story in great detail. Beyond that, in this case (as is common) my grandmother told the story several times in a row using *the exact same words*. Not almost the same words, but the *exact* ones. In addition, she inflected them almost identically, and accompanied them with the same facial expressions and asides—pausing at the same spots to provide the same details about the larger-than-life aunt, claiming each time how she could vividly picture the person or scene she was describing.

What is happening here? How is this brain's disrupted system able to recall such detail? And why is the detail so exactly identical in its depiction? As far as we can tell, Alzheimer's victims have developed a build-up of plaque in their neural structures. Basically, the plaque build-up inhibits our neural lightning storm. This not only cuts off lots of once-fluid data pathways among our right hemisphere's storage neurons, but ultimately disrupts our entire loop—turning a person into, essentially, a misfiring computer. Nonetheless, the brain is a persistent and adaptable machine. When one part is damaged permanently, it tries to reallocate resources and move necessary systems to a still-functioning area, re-shaping its self-built architecture wherever possible.

In situations like Alzheimer's, at some point this persistence is overwhelmed by the problem. But until then, that persistence can still occasionally propel a piece of incoming data to an actually relevant & still unobstructed-by-plaque memory. When this neural network is activated, these specific narrative parcels might (for any number of reasons) still contain good resolution. This allows the story to be told in an entirely natural & detailed fashion. If the brain can still find some path through the loop (which gives us access to speech & expression based on what's scripted into the data) then for a moment the ghost can come to life. In this moment of telling the person is suddenly there, back from their oblivion— although not still quite with *us*, but somewhere else. Nonetheless, that somewhere else is rich with detail and emotion.

And the linguistic & expressive exactness of my grandmother's (and other Alzheimer's & dementia victims') multiple retellings—their *verbatim-ness*—seems to support that primary hypothesis: memories are word-based patterns. My grandmother recalled the memory each time word-for-word because that's how the data was stored: *word-for-word*. Keep in mind that Alzheimer's sufferers at this stage seem to have great difficulty taking newly-processed emergent data and using rules to construct complex *now-related* narratives. This is why they are almost never *in the moment* with us even when the ghost seems to have brought the person back briefly. Their mind is in a semi-dream-state, primarily grounded in & generating "reality" from the memory data.

This is because their processing of the present is limited to the most basic *I am here now & you are with me now* depictions. This seems to be the most central & primitive state of consciousness—the loop running in some bare-minimum mode. This is likely akin to that original state of self-awareness around which most other complex self-building mechanisms evolved (just as our modern emotions evolved around those still-present proto-emotions).

Because only this minimum state is (occasionally) achievable in Alzheimer's victims (eventually disappearing completely) the actual complex temporal & circumstantial details of the *now* essentially cannot be narratively-integrated by the damaged brain anymore (except on rare occasions). Thus, the retelling of stories cannot be tweaked or embellished on-the-fly according the present moment's audience or circumstances.

These limitations help result in the unaltered exactness of the repeated retellings. Everything my grandmother said was likely pure, unembellished, from-the-old-neurons recall—and that recall seems to have been, at heart, all about remembering the words themselves. The specific words in a specific order, each accompanied by specific images and a specific delivery must have been included in (& were likely the foundation of) that old memory-based data.

And we can't explain-away this exactness with the recent-memory mechanics that might make just-spoken data newly high-priority & easier to recall exactly. In an Alzheimer's victim, that first retelling *couldn't* suddenly get seared as a complex, accurate recent memory—making it easier to subsequently repeat in lengthy detail word-for-word.

These individuals have mostly lost the ability to record *any* new memories. Their recording mechanisms may temporarily come online enough to record a few repeatable, looping recent parcels—*that's a lovely sweater*—but not likely enough to record & repeat a long, detailed, identically-expressive narrative. So the source of any exact repetition *must* be that old long-term data. And if it's repeatable as a word-for-word, smile-for-smile narrative, then the memory data must be—at its core—stored as a *word-for-word*, *smile-for-smile* narrative.

I know, that's probably the third or so time I've tried to convince you, but I also know you have your doubts (reasonably) about memories essentially being the words we use to retell them. However, I think this final example is the most convincing—basically because there is no other decent explanation for my grandmother's (and other Alzheimer's/dementia victims') *verbatim-ness.*

Keep in mind that we did not design our memory solution *around* this Alzheimer's experience—our theory's memory systems are based on the needs, limits, capabilities, behavior & evolution of the brain. The fact that Alzheimer's victims' *verbatim-ness* is well-explained by the system we've already discerned hopefully just helps to *validate* Narrative Complexity*'s validity*. To me, it looks like further proof that the deeper you dig, and the more you connect our sub-systems' wide array of intra-cranial dots, the more sense our brain's entire elegant machinery seems to make.

When Good Brains Go Bad (or When They Get Unique)

As our exploration of the effects of Alzheimer's has shown us, it is often the saddest or most-troubling brain events that provide some of the most-unique windows into the mechanics of our minds. (*Ergo, the brilliance of Oliver Sacks.*[25]) And brain events that negatively impact memory & its surrounding cognitive mechanisms can create some of the most severe of these *deficits of mind.* Yet, troubling as they are, these deficits can help illuminate much about how memory & cognition work. In the view of Narrative Complexity, these neural deficits typically result from one of three general causes: system atrophy-cum-failure (aging), system disruption (injury, disease or inborn deficit), and system dysfunction (emotional or chemical imbalances). We'll examine these three deficit causal categories one-by-one.

First, *system atrophy-cum-failure as a result of aging*. It becomes a more obvious (and depressing) truth with each of our decades of existence: as we get older, those once awesomely-calibrated, highly-flexible, dynamic, resilient, easily-trainable systems in our body—from head to toe—start to atrophy or break down. Not only do we typically do big things with less grace—like run slower, jump lower, forget more often and see with less acuity—but humiliatingly little things begin to diminish everywhere (*we even urinate with less vigor, for goodness sakes—they forget to tell you that*).

Thankfully, it has been shown that sustained, robust & well-paced use of our bodies as we age can help to significantly slow this atrophy in many physical systems. And the biggest benefits of continued robust use seem to appear in the latter half of our lives, where such usage can essentially flatten the atrophy curve as we enter mid-life and can make our systems much more functional in old age. However, as demonstrated by even the most finely-tuned & hard-working elite athletes, that youth-to-midlife downward curve in functioning is essentially inevitable. Hard as we might try to avoid it, we are doomed to begin slipping from that maximum efficiency to that level where we can maintain a nearly flat-line decline after mid-life. And just as that youthful maximum efficiency is unsustainable, ultimately that mid-life flattened curve begins to degrade. As we push deeper into old age, that drop-off is likely to eventually become more precipitous.

Although science (& experience) indicates that our neural systems are among the most sustainable deep into old age—and the most positively-responsive to that robust use over time—like everything else in the body, its systems still ultimately atrophy, perform with less vigor, and fail.

If this decline mirrors our other systems, then our drop-offs in mental performance are primarily due to the physical mechanisms of our neural system weakening. The most apparent physical problem resulting in neural decline seems to be in the mechanisms producing our emotional juice & neural-loop energy. *(Egads, even our brain excretes with less vigor as we age!)* This likely contributes to the fact that—although we can still experience intense emotions in old age—generally speaking, even the most emotionally volatile of us tend to (as the saying goes) *mellow with age*.

In addition, the memory potential produced by these imprinting mechanisms is therefore less potent, leading to less efficient new-memory imprinting & recall performance. And it makes sense that the most-recent, likely mundane memories (those illusory short-term ones, which are already the weakest & quickest to vanish) suffer the most from this neural decline. This is why, as we get older, we forget stuff we were just thinking or just about to do *all the time*.

Such recent-memory deficits even seem to happen in individuals (like 80-year-old poets & professors) whose cognitive-processes remain extremely robust. Thus, it appears that this memory problem (fortunately) does not have a highly-detrimental impact on the use of already well-stored data and narrative-building rules. Therefore, we can still comprehend & tackle big problems with this typical neural deficit of age. (Although we should probably have a pen & paper handy as we calculate our solutions—so we can make use of that most primitive & rudimentary of memory-limit-circumvention techniques: *writing stuff down*.)

In fact, there are likely two opposing forces of aging that can make our minds both *less* and *more* capable as we grow older. Those atrophying imprinting systems & weaker neural connections (which lead to worse remembering & recall, and less fluid associative pathways) are obviously a detrimental aspect of aging. But older brains that have been well-fed & nurtured can also possess a distinct advantage: that life-long accumulation of deeply-interconnected data, rules, vocabulary & beliefs—which can lead to that calm, confident & assertive decision-making/problem-solving that exudes *I've seen all this before*. In other words, an aging brain can also mean a *wise* brain. (Some of these opposing forces of aging in the brain were recently explored by Mara Mather at the USC Davis School of Gerontology in her 2012 paper "The emotion paradox in the aging brain."[26])

Our second category of causes for these deficits of mind is not typically a wisdom-enhancer: *system disruption due to injury, disease or inborn deficit*. There are lots and lots and lots of ways for this to happen, and lots and lots of possible results. *(This is why you should, among other things, always wear a helmet and avoid inbreeding.)* But to illustrate this causal category, we'll first focus on some simple, common effects of general physical trauma (injury) to specific brain hemispheres. Two of the demonstrated results (in some cases) of these kinds of injuries: individuals with right brain trauma tend to make errors of *commission*, while individuals with left brain trauma tend to make errors of *omission*.

An error of *commission* is when someone gives (and believes) a nonsense description or explanation of a situation whose narrative elements are obvious to a healthy brain. *Someone with a right brain injury is shown a picture with a banana, a bowl of cereal and a carton milk, then told to explain the picture.* Essentially, they've been asked to create a narrative from these elements. Here a healthy brain is likely to say something like *pour the milk into the cereal, then spread some banana slices on top*.

But an injured right brain might, for example, have a hard time identifying the banana. This is because our data storage system typically appears to reside in our right brain. Thus, the banana-identifying memory data is garbled or inaccessible. As we said, there are lots of ways to mess up this system—but in one fashion or another, we've lost our ability to connect the incoming (environmental) banana data with the right-brain memory data used to *identify* the object as a banana. This makes it impossible to call-up the word "banana" (and its definition & use) from our still-working left-brain vocabulary resource when building our narrative here.

This injured brain works like a person with a limp, the hobbled right side forces the left side to do more work to *maintain reality* (narrative cohesiveness or validity). And the left brain contains most of those narrative-building mechanisms. So to make up for the unidentifiable object, it ends up "over-applying" some of its narrative-building rules. The left brain might view the banana more abstractly: *it's long and curved, with a narrow protrusion at one end*. Here the object has been defined by rules of physicality (patterns of appearance) not a vocabulary-based meaning. So it might try to derive the abstract object's use according to that rule-based definition, creating a seemingly-logical (to them) narrative. Thus, the right-brain impaired person might give an explanation like, *"Use that curved thing—I don't know what you call it—to open the carton of milk, then pour it on the cereal."*

This is an error of commission—they've made up something obviously absurd to explain & use the memory data they can't properly access. Forced to lean on their left brain's still-functioning narrative-building machine, they've created a dodgy narrative on-the-fly based on the insufficient incoming data. And yet, although it might feel a little fishy to the individual, they still believe it's a valid answer. This is because, not knowing what the object really is, there is nothing to indicate to them the absurdity of their narrative.

In fact, these right-brain impaired individuals might seem proud of their answers. They are prone to feel as if the pictogram & its one "unidentifiable" item is a kind of puzzle, and might take pride in the fact that they found any seemingly-functional use *at all* for the oddball item.

In contrast, errors of *omission*—which typically are associated with left brain trauma—are when someone can properly identify all of the pictogram elements, yet excludes the obvious use of one in constructing an explanation or narrative.

Therefore, if someone with this type of injury were given that same set of three images (carton of milk, banana, cereal) they might respond, *"Spread the banana slices on the cereal, then—I don't know—drink the milk while you eat it, but I guess you'd want a glass for it."* Here the right brain has done its job; it pinged all the correct relevant data about the objects and provided all of the syntactic elements necessary to create an obvious, likely narrative. It is not stumped by the banana, the cereal, *or* the milk—it *recognizes* all of them.

But the injured left-brain is misfiring, and its narrative-building rules & mechanics are no longer being applied efficiently or properly. Essentially, the machine has abandoned a piece of usable data (the milk), failed to apply an obvious rule (milk is added to cereal), and left the potentially-useful narrative-building element out of the primary narrative syntax. Here the healthy right brain likely isn't of much help (its job is mostly done by the time it turns over the data to the injured left-brain) but our mind might still try to solve this problem by tacking on some alternate, essentially narratively-separate use for the abandoned data—a story not very well interwoven with the primary narrative.

In the vast spectrum of brain injuries, disease & inborn deficit, of course, the ultimate effects of any system disruption do not always map so neatly to brain hemisphere & function. These systems are intricately intertwined, thus what appears to be faulty narrative-building might actually be something else in the system misfiring, causing an unforeseen cascade of effects that ultimately *presents* as a narrative-building error. This is why these types of brain-system damage & disruptions can produce such frustrating & mysterious problems. When you can't truly get under the hood to take a close look, it's easy to misdiagnose the real source of trouble.

Nonetheless, there is at least a general pattern to the results of certain types of disruptions—like the trauma-induced data-handling errors described above. And what we've at least shown here is that the evidence in these scenarios strongly supports Narrative Complexity's construction of looping mechanisms and the way that these mechanisms map to specific brain hemispheres.

Going beyond injury, we just discussed in detail a system disruption due to disease (Alzheimer's). And in terms of system disruptions due to inborn deficits, we already gave a whopper of an example of that too: *psychopathic behavior*. (Probably best not to revisit our dark brethren again at the moment—you never *really* know what might happen around those folks.) Since we've mentioned psychopathy, however, it seems appropriate to identify the neural disorder that (according to our theory) is essentially the *opposite* of psychopathic behavior: obsessive compulsive disorder (OCD)—the result of an *overly*-powerful and *indiscriminately-applied* belief system.

True behaviorally-disruptive OCD is marked by persistent, recurring & impossible-to-ignore compulsions & obsessions that carry a personal significance strongly (& illogically) disproportionate to the behavior's *actual* benefit. (*Read*: true OCD is *not* just a powerful-but-ultimately-frivolous *over-inclination* towards desiring neatness & order.) And in a cognitive system such as the one we've proposed here, all of those aforementioned behavioral symptoms could be produced by an overly-powerful and indiscriminately-applied belief system.

Consider that compulsions like unnecessarily repeating particular acts an exact number of times and obsessions such as washing one's hands after *every* possible exposure to infection are driven by the *belief* that *not* behaving in these ways is highly likely to ultimately lead to a bad result. In other words, OCD sufferers are constantly compelled to behave in illogical ways in order to adhere to their overly-powerful & indiscriminately-applied (i.e, inconsequential & predictively-ineffectual) beliefs. This dysfunction results in a kind of magical thinking whose dictator-ish control over behavior is, unfortunately, unmitigated by the magical thinking's illogic & inaccuracy. What, then, is the difference between these kinds of belief-driven compulsions & that rule-based *ritualism* mentioned earlier? A ritualist cognitively-but-unconsciously (& wrongly) *presumes* that they *must* perform this specific series of actions in order to achieve the intended (& usually specifically-defined) result of their ritualistic causal sequence. In contrast, a compulsive individual powerfully, consciously (& wrongly) *believes* that they *should* perform this (or these) action(s) because to *not* perform the action is—according to their belief—highly-likely to lead to an *ultimately* (& often broadly-defined or malleably-definable) bad result.

And when we examine the categories of compulsive behaviors that are commonly displayed by these *hyper-believing* individuals, it's not surprising that—in light of our belief system's strong connection to primal *disgust*, which is founded upon disease avoidance—OCD is often expressed in overly-powerful & indiscriminately-applied compulsions to engage in disease-avoiding behavior like hand-washing & other types of self-grooming or self-protective measures.

Although Narrative Complexity hypothesizes that the left hemisphere is the locus of the narrative building/analysis with which our belief systems interact—not much is known about what specific cortical areas are central to analyzing & employing those beliefs (our theory is the first to describe the particular kind of belief system proposed here). But since we know that beliefs are among the most-sophisticated & uniquely-human cognitive mechanisms, it isn't too much of a stretch to speculate that they make use of one our most-sophisticated & uniquely-human (& uniquely-great ape, -elephant & -cetacean) neural tools: spindle neurons.

Interestingly, one of the few brain areas where these spindle neurons have been located is the fronto-insular cortex (believed to be a key player in complex predictions & decisions). And it's been shown that the insula is highly-involved with processing that emotion that beliefs *rely* on: disgust. Thus, if we were going to venture our *best guess* at where to start looking for the roots of the neural dysfunction that results in psychopathic behavior & OCD, we'd venture somewhere in or around that *fronto-insular cortex*. (And research has shown that the brain phenomena that appear to correlate to psychopathy include diminished amygdala volume—which could result from the absence of those disgust-related *fear* responses aided by the amygdala—and dysfunction within that key neural disgust-processor: the insula. [27])

In the view of our theory (due to the insula's key role in managing disgust—whose modern emotional roots are closely tied to *embarrassment*) insula-related dysfunction is also likely a big player in another currently-mysterious neurally-based disorder—one that possesses a disturbingly high morbidity rate and a stubborn resistance to even the most intensive treatment: anorexia/bulimia. (Two disorders that are, according to our hypothesis, slightly different expressions of the same root neural dysfunction.)

Maybe the most vexing aspect of anorexia/bulimia is that it enables & encourages the one behavior that almost all chordates are inherently designed to avoid above all else: *starving to death*. Everything about chordate neural systems are, at some level, designed to achieve one ultimate goal: acquire & consume the resources necessary for survival (the most important resource being, of course, food). In other words: no matter what, eat something *or you will die*. What kind of dysfunction could subvert (continuously, often over the course of decades) this most primal & powerful of our desires?

I believe the answer to this question is hidden within that same vexing aspect: the ability to enable & encourage *not eating*—even when a hungry individual is presented with food that is clearly disease-free, ideally-prepared & deliciously-edible. There is, according to our theory, actually one unique (& brief) point in human evolution when human brains were likely *programmed* to avoid eating (apparently) disease-free, ideally-prepared & deliciously-edible food—*even when they were hungry*. This moment is the miraculous period during which our human ancestors (spurred by their control of fire) began to prefer cooked meat over raw meat, which (as discussed in Essay #2) led to the development of our visually-based *disgust* response toward raw meat and paved the neural roadway to our belief systems.

In our exploration of that evolutionary moment, we hypothesized that the primary behavioral mechanism & emotion that our ancestors used to socially reinforce that new, beneficial (but hard-to-achieve) *don't-eat-that-raw-yummy-wait-for-the-cooked-one* behavior was Pride/Embarrassment (*aka*, Inclusion/Ostracization). In other words, those human ancestors *shamed* each other into *not eating* (apparently) disease-free, ideally-prepared (to them) & deliciously-edible food—*even when they were hungry*.

This food-&-shame-based, socio-emotional behavioral mechanic likely served as a kind of evolutionary bridge between the early hominin brains that could not resist the desire to eat raw meat and those later, nearly-modern human brains that possessed (as we do) an inborn (visually-based) *repulsion* toward particularly bloody or "gory" raw meat. And it is not hard to imagine that before this *shaming-triggered-food-avoidance* completed its transformation into *visual-disgust-triggered-food-avoidance* there was specific neural circuitry designed to make these evolving humans more prone to *not eat* that desirable food in response to shaming. Eventually, those nearly-modern brains began to replace that *shaming-triggered-food-avoidance* with that more efficiently-applicable & reliable *visual-disgust-triggered-food-avoidance*—which could specifically encourage the *not eating* behavior in *all* raw-meat encounters.

And thus, in most modern human brains, that primitive, evolutionarily-short-term, *shaming-triggered-food-avoidance* circuitry is (if it still exists at all) a long-neglected, systematically-atrophied version of its once-powerful self. Essentially, if this vestigial ghost circuitry still even exists in most "normal" human brains, it no longer has enough privileged access to neural resources to have much impact on average behavior. Anorexia/bulimia, however, is the *opposite* of average behavior. And that's likely because, according to our theory, individuals who eventually develop anorexia/bulimia appear to possess a still anciently-powerful (or easily-revived) version of that primitive *shaming-triggered-food-avoidance* circuitry.

One of the things that seems abundantly clear when listening to the medical histories & personal stories of anorexics/bulimics is that nearly *all* of them can recount some powerful, preadolescent *shaming-based* experience related to their food consumption. In other words, at some point early in life nearly all sufferers of anorexia/bulimia were told by someone important (i.e., a close relative or a doctor) that they should *eat less food* because they were already or were about to become *fat*. (Or, in a smaller category of cases, individuals might've had some *other* powerful shame-based experience—like molestation—that essentially *cascades into* body-image-related & shame-based food-avoidance.)

Of course, not *all* people who have been shamed for eating too much develop eating disorders. In fact, although many, many people today have an "unhealthy relationship" with their food consumption habits (often due to socially-reinforced shame about their bodies) the vast majority still do not display anything close to a *life-threatening* capacity to refuse eating. Yet, as described, most anecdotal evidence suggests that nearly all true anorexics/bulimics have some powerful, preadolescent *shaming-based* experience related to eating. (And the subsequent behavior triggered by that shaming—behavior that seems to grow exponentially worse in adolescence—looks *exactly* like the kind of behavior triggered by our ancient proto-emotion *Ostracization* & its sibling-like descendant *Embarrassment*.)

This strongly suggests that it is not merely the food/weight-related social experience that is the source of this disorder. Instead, it suggests that a specific genetically-based dysfunction *pre-exists* in anorexics/bulimics and is *triggered* by the food/weight-related social experience. The dysfunction: a still anciently-powerful (or easily-revived) version of that primitive *shaming-triggered-food-avoidance* circuitry. And there is a unique problem posed by this old circuitry's reemergence in a modern human brain, one that wasn't present way back when it first came into existence: that old circuitry is now working *in conjunction* with those visual disgust & belief-based behavioral systems that long ago emerged from (and were *intended to replace*) those evolutionarily-short-term *shaming-triggered-food-avoidance* circuits.

This means that once this young, developing human has neurally (and, by dysfunctional accident, overpoweringly) defined *food avoidance* or *not eating* as top-of-the-list-high-priority behavior, that human's brain begins to calibrate its other behavioral systems in support of this newly vital (and survival-disadvantageous) goal of *not eating*. All of the sudden, those modern, ultra-powerful belief & rule systems come to the aid of this obsessive *not-eating* quest—setting up all kinds of behavioral fences that prevent the individual from doing anything that might interfere with achieving the unachievable thinness that has been defined (by that first food-shaming experience) as the socially-based reasoning for this all-important *not-eating* behavior.

Additionally, I believe that (because this dysfunction is ultimately rooted in our most social proto-emotion *Inclusion/Ostracization*) the onset of adolescence and the subsequent shift in brain chemistry that suddenly *heightens* the value of social inclusion in *non-kin* settings (the neural source of all that high school drama) essentially begins to give anorexia/bulimia & its dysfunctional circuitry *immense power* over behavior & decision-making at this point in life. In essence, the chemistry of adolescence is like a match that lights the tinder-keg of anorexia/bulimia's looming dysfunction.

This teen-aged emergence of the disorder's new power is mirrored by the ongoing construction & application of those modern behavioral systems: beliefs & rules (whose #1 priority is now *not eating*). And it's here that, according to our theory, we see the subtle-but-distinct differences emerge in how this neural dysfunction ultimately expresses itself: as anorexia or bulimia. There can be, obviously, a strong degree of overlap between those eating disorder sufferers who simply refuse to eat (anorexia or *restricting)* and those who sometimes eat, but regurgitate afterwards (bulimia or *bingeing & purging*). Eating disorder sufferers will often exhibit both behaviors to some degree. Nonetheless, research has shown that in addition to many individuals displaying only one or the other behavior, most "overlap" cases also show some clearly stronger tendency toward one behavior or the other. [28]

In the view of our theory, this distinction basically represents whether that individual's brain has come to favor a mainly *belief-based* or mainly *rule-based* strategy in pursuing their ultra-important *not eating* goal. Anorexia suggests a mainly *rule-based* strategy & bulimia suggests a mainly *belief-based* strategy.

The neural/behavioral difference between these two types of strategies mirrors the difference we described between *rule-based* ritualism & *belief-based* obsessive-compulsive disorder: a ritualist (anorexic) cognitively-but-unconsciously (& wrongly) *presumes* that they *must* perform this specific series of actions in order to achieve the intended (& usually specifically-defined) result of their ritualistic causal sequence. In contrast, a compulsive (bulimic) individual powerfully, consciously (& wrongly) *believes* that they *should* perform this (or these) action(s) because to *not* perform the action is—according to their belief—highly-likely to lead to an *ultimately* (& often broadly-defined or malleably-definable) bad result.

Basically, this means that anorexics' brains make it very difficult for them to engage in *any* bingeing, because their powerful rule-based behavioral sequences regarding *eating/not eating* simply do not allow for bingeing as part of the behavior. In contrast, bulimics' brains are generally more flexible in what they will allow—because they can set-up complex & interconnected beliefs that can *occasionally* permit certain behavior (*eating a lot* or bingeing) under the *self-promise* that it will be immediately followed by corrective behavior (*un-eating* or purging). This is a kind of belief-based rationalization.

A more rule-obsessive anorexic mind basically *cannot* "occasionally" permit *any* kind of food-related behavior—it *always* does everything almost *exactly* the same way in the pursuit of this unique *non-eating* goal. That's what rules are for: to be followed, always & without even thinking about it, *because they're rules*. As described earlier in this essay, the application of rules feels essentially inevitable & unconscious, while the application of beliefs feels like a conscious choice that we can make, and that we can sometimes convince ourselves to make a different one (*binge & purge* sometimes or *simply not eat* sometimes).

And in both anorexics *and* bulimics, these obsessively rewired & single-minded belief and/or rule systems can have a powerful impact on how the individual actually *perceives* (aka, *imagines*) their physical self—which can lead to the kind of body dysmorphia commonly associated with these disorders. No matter how thin you actually *are*, if your brain truly & powerfully consciously *believes* (or simply unconsciously *knows*) that the body it inhabits is "fat" then it will *perceive* the body it sees in the mirror as "fat" (and seek out any *actual* visual evidence that it can find to support this perception).

This disorder's high morbidity rate begs one question: how can we cure it? Our theory's full answer is longer than we have time for here (we've spent so long on this already that you've probably forgotten that explaining anorexia/bulimia isn't this essay's main purpose). But I will quickly say that the current model for intensive in-patient treatment (which frequently involves adhering to a long list of institutional rules & restrictions, and employs shaming/punishment-based strategies for enforcing those rules) is, unfortunately, a mostly wrong-headed approach.

What does a more ideal anorexia/bulimia treatment program look like? For one, it's done in an out-patient setting (developing new behaviors in a highly-non-real-world-&-isolated setting, then attempting to maintain those behaviors in an entirely different & highly new-stress environment is a perfect recipe for relapse & a significant waste of resources). During treatment, patients should live with relatives or other strongly-supportive (& healthy) individuals, but they should also have group meetings with other eating disorder patients & well-trained therapists on a daily basis at a local treatment facility (essentially, a "safe zone"). In addition, anorexics & bulimics should each receive specific treatment methods & therapy geared toward their different neural tendencies.

And maybe most importantly: there must be *no attempt at all* to employ *shaming* or *punishment-based* strategies as part of this behavioral therapy—to do so is as cruel (& dangerous) as throwing a burn victim into a fire. Tragically, the shaming of anorexics & bulimics (even those in treatment) is far too prevalent in our modern society, and it all-too-frequently has deadly results.

Moving on from the twin darkness of anorexia/bulimia —there are two other equally profound, yet not always devastating conditions that are (like psychopathy & OCD) the result of unique & seemingly-opposite neural circumstances (circumstances that are inborn, but are often expressed at different levels & with different developmental timing): autism, likely the result of overstimulated, indiscriminately-applied mirror neurons, and Asperger's, likely the result of non- or low-functioning mirror neurons. To categorize these unique neural circumstances as true deficits is, however, a mistake. I believe that, in truth, both of these "conditions" are merely another (and often an extraordinarily individual-specific) way to experience being.

And as shown by the myriad diverse & uniquely-talented individuals who possess these uncommon wirings, autism & Asperger's can also unleash the power of the human mind in surprising & amazing ways. Thanks again to the human brain's uncanny flexibility & its capacity to repurpose systems based on what other "normally" functioning mechanisms are available, "deficits" like the unique use of mirror-neurons can allow their highly-evolved power to be applied in those unexpected ways.

Consider, for example, the huge number of visual data points that those mirror-neurons are typically tracking when identifying, analyzing & remembering complex human facial expressions & physical movements. Now imagine that those resources are no longer devoted to human faces & movement, but used to help track & analyze *any* visually-composed palette. The repurposing of this power might help someone to, say, draw in detail the entire Manhattan skyline *from memory*—a skill demonstrated by the extraordinary autistic artist Stephen Wiltshire. Or imagine that those mirror-neurons allow an individual to internally, physically feel what it is to be a flag flapping in the wind *just by looking at a flag flapping in the wind*.

Or these unique autistic neural circumstances might produce someone like the legendary Temple Grandin—who applies her (often overstimulating) mirror-neurons & their empathy-producing capacities to the perspectives of other creatures (& combines this ability with that aforementioned enhanced ability to analyze complex visual patterns). These talents have allowed her to imagine & devise uniquely-humane & efficient slaughtering systems.

Of course, because mirror-neurons' typical highly-specialized facial analysis mechanisms help us to physically mimic the mouth movements required to first learn speech—severe autism can also disrupt speech development and, consequently, language acquisition. (The aforementioned artist, Wiltshire, was mute until the age of 5.) And interfering with language acquisition can powerfully alter the very *nature* of an individual's conscious experience. As with most systems in the human body, there's a very specific *give & take* involved with any unique circumstances.

Autism has also been shown to interfere with that "Theory of Mind" capacity we discussed earlier (predicting the internal experiences of others). This would make sense if, indeed, autism is primarily a result of atypical mirror neuron systems—because (as we hypothesized) our mirror neuron systems normally play a key role in intuitively understanding & predicting other people's feelings & intent.

In addition, those overstimulated and indiscriminately-applied mirror neurons can ultimately result in that commonly-observed *self-isolating* autistic behavior, which often includes repetitive physical acts or an intense focus on some external stimuli or pattern. The likely reason why these individuals seek such deep self-isolation is because their overactive & indiscriminate mirror neuron systems are *overloading* their pre-motor & somatosensory cortexes with all kinds of inappropriately-reflected incoming sensory data.

Indeed, it is hard for the rest of us to imagine what it might be like to experience the chaos of a young (& *barely-language-capable*) autistic mind as it is bombarded by powerful-but-disorganized sensory stimuli that is inappropriately reflected & experienced by those parts of our brain that help to define *our most innate physical perceptions of ourselves*. It is not hard to see how finding some excessively-repetitive set of actions or some deeply-immersive pattern to get lost within could provide exactly the kind of neural & physical relief that these people desperately seek: activity that might generate an intense (& reliably *predictable*) focus powerful enough to shut out the maddening & often *painful* chaos of the outside world.

This kind of autistic experience is also likely why strategies for pulling someone *out* of that chaos (& into a world that can be navigated) can be so widely varied: because basically *anything* that the brain can latch onto & use to begin making order out of the chaos can be the first step to "bootstrapping" this mind into a less chaotic world. However, because it's so difficult to have a decent idea what an autistic child's cross-wired systems might essentially *randomly* or *accidentally* latch onto, finding that path into their world (a path by which you might then begin to draw them out) can require almost *sleuth-like* observational skills.

Nonetheless, in all cases, the key to finding a path (if one even exists—for some the chaos may simply be too much) is truly attempting to *enter their world* and view their actions & desires (or *non-actions & non-desires*) from their point of view. If they enjoy something, *try to understand why*, and then *become part of their enjoyment*. The results of autism are ultimately expressed through deeply individualistic behaviors, and the best way to connect with any autistic individual is to truly share time in *their specific world*—to deeply ingrain yourself within the pleasure- & relief-seeking actions & patterns (& uniquely-individual *narratives*) that help to shape their experience.

In the case of Asperger's—where mirror-neurons are likely in opposite circumstances and *do not* effectively reflect *any* visual data to our somatosensory (tactile) & pre-motor (physical movement) cortexes—the absence of that chaos-generating *overstimulation* can make like life much more manageable than it is for someone with autism. In addition, many individuals with Asperger's also find ways to benefit from that neural-flexibility & repurposing. This means that if their mirror neurons aren't *reflecting* data, it seems that the brain can still often find a way to make analytical use of these powerful tools.

Thus, people with Asperger's tend to be better at organizing, associating & managing huge piles of *other* kinds of non-empathic data—like mathematic calculations or taxonomical information systems (exactly *how* these brain areas ultimately get repurposed likely depends on what new applications result in the most initial & ongoing pleasure, reward or relief).

Nonetheless, because developing children typically rely heavily on those mirror neuron's *reflective* capacities to help navigate social & person-to-person interactions, young people with Asperger's also have a strong tendency to exhibit their own types of (less intense) *self-isolating* types of behavior. And our typical reliance on those *reflective* capacities when learning complex physical actions is why individuals with Asperger's have more difficulty in honing such actions.

With Asperger's, these non/low-functioning mirror-neurons can also hinder early speech development, but again, it seems that these kinds of problems are typically much less severe than with autism. This is likely because the effects of autism are two-fold in regards to speech development & language acquisition: 1) specific, visually-perceived facial-data cannot be used to internally & physically mimic/learn speech acts, 2) all varieties of *non-human-focused* external sensory data are being reflected to the somatosensory & pre-motor cortexes, which actually *interferes* with the application of other systems in this speech-learning process.

In the case of Asperger's, this second problem is not an issue—which likely makes it easier for the brain to use other motor-script & rule-based (non-empathic) systems to aid in developing speech. The result is that early speech development efforts in these individuals are more deliberate, slower & less intuitive (essentially, less reflexive) than in typical neural circumstances, but once these motor scripts are learned and practiced, speech & language-use can still easily flower.

This lack of interference with compensatory strategies is likely why individuals with Asperger's typically have a much easier time than autistic individuals when integrating with social structures & circumstances geared towards "neuro-typical" individuals. Nonetheless, both Asperger's & autism can make it extremely difficult to empathically judge how others are feeling or behaving and thus, to respond appropriately. (And the subsequent lack of emotional data that these individuals reflexively derive from analyzing human faces also likely accounts for their natural indifference toward making eye contact when interacting with others.)

Which leaves us with our third category of causes for these deficits (or *uniquenesses*) of the mind: *system dysfunction from emotional or chemical imbalance*. This seems to be as inevitable in most people as the detrimental effects of aging.

We don't like to admit it, but almost all of us have some crossed emotional wires up there. It's hard for us not to—*knot* being the operative word. Because that's a lot what it's like up there in brain-town: one big spaghetti-bowl neural knot of data, emotions & associations. Our systems *mostly* handle that knot effortlessly, but stuff happens. Bad stuff. Sometimes it's bad stuff that ended up feeling way too good, reinforcing a self-destructive loop. Sometimes the bad stuff is tolerated because of an unnatural, overly-powerful fear of *even worse* stuff. In other words, *life is complicated*—and those complications can sometimes make our knot produce undesirable results.

This kind of *detrimentally-applied narrative logic* is at the root of much system dysfunction. These *are not* cases in which part of the system is physically misfiring, producing the kinds of chemical imbalances that lead to problems like bipolar disorder. These emotionally-based imbalances are actually a result of our systems doing exactly what they should be in response to the memory-stored & incoming data. But here the memory-data is producing some bad results. That's because the situation that led to that data was probably either emotionally extreme (like the highly-traumatic events of war) or painfully *twisted* (like being harmed by someone you love & trust).

In essence, these types of data use our own narrative-building & memory systems against our ultimate best interest. No matter how you slice it, this data is *trouble*. It's forcing us to use an *outlier* or a non-representative event to broadly shape our emotional responses counter-intuitively. *The war vet reacting violently to the tiniest provocation. The abused child growing into an adult who seeks an abusive spouse.*

In these cases, our view of the brain's memory tells us one very key thing about eliminating this kind of system dysfunction: *don't let the problem linger*. Because of the mechanisms of memory, every time these kinds of dysfunctional responses are triggered & repeated, the behavior only becomes more deeply ingrained and harder to change. When the brain begins to display this kind of dysfunction, it can quickly lead to a classic vicious cycle. Every almost-impossible-to-control behavioral response makes that response even more impossible-to-control in the future.

So how do we break that cycle? The key can be found right in those same memory systems. As discussed earlier, retelling a memory can slowly change the memory itself & its associations. This is partly our brain's way to keep narrative data up-to-date and optimally useful.

As noted, under normal circumstances repeated pinging (& retelling) is innate proof of data's usefulness. And if this useful data has been altered or embellished in the retelling, there has likely been a purpose: to somehow make the retelling *more* useful in that moment. The specific motivation for each alteration can vary. For example, some embellishments are intended to make the story more engaging for listeners. In other cases, some of the data may have degraded, and replacement data is inserted (a forgotten color detail replaced by a slightly different one in a retelling) in order to update the memory and keep it seemingly complete.

There's a shared secret behind all of these alterations: they somehow make us *feel* better when retelling the data. Engaging (essentially, providing pleasure to) listeners can evoke emotions like pride and generosity, and fixing a broken story detail likely gives us a little validity spike (essentially, more confidence in the story). And *sometimes* when a story makes us feel *bad* (like retelling a shameful act) we allow ourselves to change it little-by-little when we retell it, softening its sharp edges enough to make its retelling more tolerable.

Why would our brains let us do this? Because that painful narrative might contain some generally valuable data—after all, we do keep recalling it. Lessening the story's associated pain can allow us to use the data without having to suffer so much—which can lead to those unintended results, and may not be necessary anymore for our brain to retain the gist of the narrative.

This brings us back around to treating that trauma-spurred emotional imbalance. Psychologists often talk about the need to "process" bad memories in order to escape their self-destructive influence on behavior. This is essentially the above-described mechanism of changing a memory's emotional content & associations through retelling. Emotions are primarily narratively-produced, thus "reframing" the story when retelling and altering the narrative structure can help alter the emotions felt. These new emotions can now begin to help re-write that self-destructive memory data. Over time, if there's been enough change in the memory's emotional content & associations, pinging that memory no longer results in that bad data. We've "processed" the destructive memory using the mechanisms of our data-storage & narrative-building systems.

Frustratingly, these days pharmaceutical companies would like you to believe that this kind of emotionally-based system dysfunction is best treated by drugs. Let me be clear about my opinion here: *bullshit*. Drugs *might* be useful in some of the most extreme cases—helping to temporarily alleviate the most powerful, crippling emotional effects of the dysfunction in order to allow the memory re-writing mechanisms to do their trick. But even in these cases the drugs aren't really *solving* the problem, they're just helping to make it possible for the brain to use its own systems to solve it. Without engaging in talk or experiential therapy (like the highly-effective emerging virtual-reality techniques being used to treat PTSD) the drugs won't fix anything in the end.

In fact, I believe in almost all non-extreme cases of emotionally-based dysfunction, the drugs do more harm than good. There's no way to target a drug to one specific piece of memory data or a single set of narrative-building rules or a specific narrative-analyzing belief (which is *exactly* what we can do when "processing" or re-writing a memory). The drugs are making the *whole system* function improperly. Therefore, the mechanisms that need to do their jobs with precision in order to effectively rewrite that bad data are *also* being hindered by the drugs. This would seem to inherently make it harder for talk & experiential therapy to affect the necessary changes.

In the absence of one specific extremely unbalanced emotional response that *must* be mitigated for *anything* in the system to work effectively, the drugs likely do *almost nothing* to help solve the problem. You've simply numbed the whole system, and now your surgeon can't feel his fingers. Sure he was a little stressed & we thought calming him down would help his performance, *but not if he can't use his fingers*.

There are certainly those genuinely severe chemical imbalance or systematic emotional problems like bipolar disorder, schizophrenia, etc. (which we'll discuss in a bit) that require drug therapy to help make life manageable. Nonetheless, in the many *other* cases where some emotional imbalance is present, but not severe, I believe people are much better off training their *working* systems to compensate for these imbalances (instead of Zoloft, try *anger management*—a useful idea that has been given a bad name by practitioners who don't truly understand our emotional systems). The alternative is like taking Vicodin for muscle soreness—if you instead employ "hands-on" therapies and learn to live with it pharma-free, you'll likely be better at living.

Yes, there appears to be clear clinical evidence that a large percentage of individuals who suffer from symptoms like persistent, powerful & sometimes debilitating sadness or anxiety have demonstrated a lessening of these symptoms' persistence & intensity in response to drugs like anti-depressants. What I'm trying to point out here, however, is that using drug-regimens as a *primary* strategy for addressing these symptoms (particularly when the symptoms may be persistent, but not truly debilitating) is an inefficient & high cost approach to treatment—one that also has significantly fewer long-term benefits than a *neurally-rewiring* talk or experiential therapy approach.

The extra costs of these drug-regimens are both financial *and* neural. Financially, the amount of money that we *all* contribute (via insurance premiums & out of pocket costs) to the exploding profits of pharmaceutical companies is undoubtedly increased by the number of people who are nearly-automatically (& often-unnecessarily) prescribed some kind of anti-depressant immediately upon reporting symptoms. Neurally, the extra costs can come in the form of less sharp or fluid cognitive mechanisms, and generally less intense emotional experiences or responses. The problem with these costs is that they are neurally *global*. In other words, as described earlier, these drugs are not purposefully impacting the specific neural components that are actually the source of the symptoms—the drugs are impacting a global & fundamental mechanic that is broadly used *throughout* the brain.

The mechanic that the vast majority of these anti-depressants *globally* disturb is the management of serotonin in the brain (most anti-depressants fall into the category of either an *sri*, serotonin reuptake inhibitor, or an *ssri*, selective serotonin reuptake inhibitor). Can pharmaceutical serotonin management in the brain have a significant impact on the symptoms of depression & anxiety? *Of course it can.* Can pharmaceutical serotonin management in the brain also have a significant impact on a whole slew of other neural systems that play vital roles in maximizing our daily functionality & experience? *Of course it can.*

Are there alternative methods for alleviating these symptoms that do not challenge the effectiveness of all those other systems? *Absolutely* (e.g., that *neurally-rewiring* talk or experiential therapy.) Unfortunately, effectively applying those other therapeutic methods requires a deeper & truer understanding of our emotional & neural systems than many psychiatric professionals currently possess. Nonetheless, the *effective* application of other non-drug-based therapies can also have those additional *long-term* benefits that are not provided by most drug regimens (regimens that are basically built to keep an individual on the drugs for extended & often indefinite periods of time). The long-term benefit of *neurally-rewiring* your memories, rules, vocabulary & beliefs through therapy is that in *future* challenging emotional & cognitive circumstances, your brain will be *much better prepared* to effectively handle those challenges.

Messing with serotonin management in the brain for extended or indefinite periods of time ultimately has very few long-term benefits for the brain. In a way, the drugs simply put the actual systematic problem into "stasis"—still present in the wiring of the dysfunctional system, but its potency numbed by a general anesthetic. As soon as the anesthetic is removed, the still-wired problem is free to fully express itself again, which leads to a reapplication of the anesthetic, *etc.*, *etc.*, *etc*. This may be a wonderful business model, but it is clearly a poor treatment strategy.

And in many ways, most of the wide array of lesser "mood disorders" & similar diagnoses that the psychiatric establishment & pharmaceutical companies are misguidedly attempting to medicate into "normalcy" are phantom ailments. As we'll discuss near the conclusion of this essay, the human brain (like the rest of the human body) is purposefully designed (*aka*, evolutionarily-driven) to result in a variety of configurations, the vast majority of which are capable of effectively functioning within our world.

When your 3-year-old is projected to be shorter than 95% of the population, are you inclined to give them growth hormones? *I certainly hope not.* Why, then, are children whose brains tend to reward novelty & activity over deep engagement & sustained focus (aka, *ADHD*) medicated in order to achieve a more median level/type of mental engagement? Why are slight variations from the norm in brain traits less acceptable than slight variations from the norm in other physical traits? Have these other types of brains not proven to produce their own uniquely-useful results in previous human societies?

In fact, over the course of civilization, humankind's incremental progress has no doubt at times been powerfully *aided* by individuals whose brains possessed these more highly-varied & less conventional wirings. Consider that throughout history many of the most obsessive, hyperactive & risk-taking individuals have been among those who have pushed human exploration & discovery past existing boundaries (individuals who, in modern America, might be medicated into mediocrity before adolescence even arrives).

Yes, it's also fair to say that these categories of brains & the individuals they inhabit are more likely to find themselves at greater risk of personal harm (& even increase the risk-exposure of those closest to them). But the fact that these types of brains remain fairly commonplace in human society (much more commonplace than brains with *true* & *highly survival-adverse* disorders like schizophrenia) clearly indicates that the higher risk factors inherent in these less-conventional wirings has not outweighed the occasional benefit enough to result in a strong Darwinian *de-selection* of these neural traits among humans.

Quite the contrary: these brains seem to keep popping up in decent numbers because occasionally some of them can provide a few *awesome* benefits for the rest us of. Indeed, the rest of us might even tend to be more tolerant & *supportive* of such high-benefit (& possibly high-cost) eccentricity in order to continue reaping those broader gains—thus allowing this brain's unique wiring to aid in its *reproductively-benefitting* longer-term survival in a cleverly round-about fashion.

In other words, human brains aren't meant to be "perfect" (or to perform in exactly equal capacity & manner). They're meant to be *adaptable* & *malleable*—to both the specific needs of their environment *and* the needs of the social unit/structure in which they live. And humans do not build monolithic ant-like societal structures requiring nearly-identical parts that perform in exactly equal capacity & manner; our societies are complex & diverse structures that require a vast range of different brains & bodies to fulfill their various & multifaceted roles.

Ultimately, psychiatry's current determination of particular behavioral profiles as *dysfunctional* (those aforementioned & abundantly-diagnosed "mood" or "personality" disorders) is not founded upon any evolutionary or neural reasoning for defining them as "deficit-based" instead of simply natural & desirable variations within our adaptation-based species. It's merely that modern American society has both become more enamored with an everyone-should-be-normal-(&-*happy*) ideal and, at the same time, grown toward requiring a more monolithically-defined set of skills from its median & high-earning laborers, which has resulted in an educational system & culture that have also grown more monolithic in their goals (because no one seeks to be—or expends resources on cultivating—*low-earning* laborers, despite their absolute necessity within our society).

This has led a scientifically-unmoored & pharmaceutically-profit-driven psychiatric establishment to gear its own practices toward shaping individuals' behavior according to these newly-monolithic neural standards. And none of the aforementioned institutions has provided any sound reasoning for why their particular view of neural perfection ought to be considered the ideal model for *all human behavior.* It's simply that their model best fits the perceived needs of those humans who currently manage the economic & employment systems in America, humans who are primarily (& naturally) seeking to reap the most benefit from those systems for themselves & those around them (which is what humans & their ancestors have long been programmed to do).

Consider that there is not even a truly agreed-upon definition of the *symptoms* of many of these lesser "disorders" within the professional medical realm—and the psychiatric community fully admits that it has no truly biological basis for identifying many of these "disorders" or explaining why they are truly neural deficits instead of merely variations. But this certainly hasn't prevented these professionals from prescribing millions of pills in order to aid in "correcting" these mysterious, poorly-defined & often apparently completely-inexplicable "conditions." (Which, in the end, isn't much different from a carnival barker hawking neatly bottled & labeled "remedies" from the back of his horse-drawn wagon.)

In our early 21st-century America, probably the most egregiously erroneous & damaging of these phantom diagnoses is that aforementioned & quickly-becoming-infamous acronym: *ADHD* (Attention Deficit Hyperactivity Disorder). Let me also be clear about my opinion on this: *ADHD is B-U-double-hockey-stick-Shit*. Yes, some kids are more hyper than others, and they also tend to be more easily distracted, making it harder for them to sustain focus. *So what.*

This is not a disorder. It is merely a human brain that's developing along a less-common, but still functional & useful path. We've simply taken the biggest bulge in the bell curve, decided it was easier to use a one-size-fits-all educational/behavioral strategy, then declared everyone outside the bulge *dysfunctional*, and we're now trying to medicate them back into the bulge with dangerous stuff like Adderall —more commonly known as *speed*. (And when *truly uncontrollable* behavior in children is tagged as ADHD, that's just pure *misdiagnosis* of an *actual* neural problem.)

Of course, what's really happening (and was eminently predictable) is that we're turning lots of slightly-outside-the-bulge kids into *speed addicts*. And we're so cavalier about applying this phantom diagnosis that we're prescribing *even more* speed to a bunch of teens & young adults who are *pretending* to be slightly-outside-the-bulge just so they can, y'know, *take some speed*—which has lots of very short-lived, but very awesome benefits that result in lots of long-term problems. (And young people's brains are naturally totally enamored by those kinds of emotional equations.) Once again, like most of those prescription-triggering lesser "mood disorders,"*ADHD* is not even a neurally-defined phenomenon. It is merely & flimsily a vague, scientifically-baseless set of "diagnostic" standards. *ADHD* is, essentially, the result of a *questionnaire*—one whose imprecision does not impede its power to recommend pharmaceutical remedies.

Even deeply research-based examinations of newly-emerging hypotheses for ADHD's neural basis—like the insightful 2010 paper "*Is the ADHD brain wired differently? A review* *on structural and functional connectivity in attention deficit hyperactivity disorder*" by German neuroscientists Kerstin Konrad & Simon B. Eickhoff [29]—mostly conclude with some academic version of: *basically, beyond some broad & contradictory strokes, we still have no idea what actually causes this or what it's really all about.*

One exception is a recent 2017 brain-imaging study that claims to substantiate ADHD's status as an *actual* neural dysfunction by identifying multiple subcortical brain regions that appear *underdeveloped* (display below-average volume) in individuals who present ADHD's "symptoms." [30] This is, in our view, completely *unsurprising*—because we merely see these *less-common* (outside-the-bulge) behavioral profiles to be a simple case of *less-common* (but functional) neural developmental arcs, ones that are no more "dysfunctional" than those less-common *physical* developmental arcs. And our view is bolstered by that same study's observation that many of these individuals' *underdeveloped* brain regions eventually "catch-up" to "normal" brains by adulthood. In other words, the study presents no real proof that ADHD is the result of some neural *disorder*. Rather, it seems to support the notion that these brains are merely developing along different, less-common, but *within-normal-variance* arcs.

Considering all of the broad, deep uncertainty surrounding ADHD, the over-diagnosis of this phantom condition (and the resulting over-prescription of speed to children) represents nothing less than an epidemic of malpractice —an entirely unnecessary one.

There is, however, one emotionally-based neural situation that is not a true neural *deficit*, yet ought to be seen as its own disorder: sociopathic behavior. As we mentioned when discussing its difference from psychopathic behavior, according to our theory sociopaths actually possess fully-functioning neural systems. The disorder results from learned & highly-destructive—either self-destructive, societally-destructive, or both—rules & beliefs that compel & allow this person to act violently or callously in the service of achieving their goals.

Most repeatedly-violent criminals are essentially, at some level, sociopaths. And I believe that reforming these individuals' belief & rule systems in a way that makes them less destructive in society is harder than is typically assumed (and for the most part, is not typically achieved nor seriously attempted in the American penal system). This is because it's likely that the best strategy for reforming these sociopaths is years of intense & individually-tailored psychotherapy administered by a well-trained expert—combined with a living environment that powerfully rewards socially-constructive behavior & provides strong models of such behavior. I don't think I'm going out on a limb by saying that our penal system does not employ these strategies—nor does it have any intention to.

Moving on to those primarily-emotional disorders that actually *are* the result of genuinely severe chemical imbalance or neural-system problems—there are two that appear, like autism & Asperger's, to be opposite dysfunctions in essentially the same system: bipolar disorder & major depressive disorder.

In bipolar individuals, those core pain & pleasure emotional poles at the root of *all* emotions seem to be prone to drastic swings, resulting in the extreme expression of emotions located within the currently-dominant pole. Theoretically, this could be a result of something like dysfunction in the output of left-brain emotional equations (i.e., a processing glitch that always leads to "maximum" pain- or pleasure-based responses) or dysfunction within the mechanisms that produce neurotransmitters as a result of those emotional equations. In either case, the result of bipolarism is an individual whose "average" emotional responses occur at levels that actually far *exceed* a typical average—leading to swings between mania (hyper-positivity) and deep sadness (hyper-negativity).

Major depressive disorder is often mistakenly equated with the kind of deep sadness that is experienced during the downswings of bipolarism. But actual accounts of the experience from major depressives suggests something much different. Depressives actually typically describe the worst part of their experience as the *total absence of any kind of feeling*—positive or negative.

One way to view the primary difference between bipolar disorder & major depressive disorder: the former is essentially *too much* intense emotion, while the latter is essentially *no emotion at all*. In the view of Narrative Complexity, major depressive disorder thus suggests a problem with a mechanism that we mentioned back in Essay #2 after the Emotions Matrix: our *engagement/boredom* mechanisms. In our model, these emotional mechanisms would be impacted by data judgments like *novelty* & *relevance*—helping to determine if the incoming data is particularly unique or useful (positive novelty & relevance judgements= engagement, which produces actual emotions; negative novelty & relevance judgements=boredom, an emotionlessness that leads us to seek something else to be engaged by).

In major depressives, it seems that this engagement mechanism simply doesn't *engage*—making any subsequent emotional production essentially impossible. In other words, these individuals are perpetually & soul-draining-ly *bored*—utterly craving some stimuli or interaction that might result in some actual emotion (which is a craving that boredom is *meant* to trigger). And despite this empty craving, they can't even really *imagine* feeling anything again. It's a kind of bottomless hollowness.

Thus, according to our theory, this appears to be a specific dysfunction in the emotional mechanisms that *employ* those novelty & relevance judgements. Essentially, for someone with major depression: nothing *interests* them & nothing *matters* to them (aka, nothing is *emotionally* responded to as novel or relevant).

And on the blog "Hyperbole And A Half" I found a fascinating, personal, first-hand anecdotal description of a depressive episode in which the experience that triggered their suddenly-growing emergence from utter boredom was oddly (& almost solely) *novelty-based*: the sight of a single, lonely piece of shriveled corn lying astray beneath the refrigerator.

In this account, the inexplicable, but palpable *oddness* of this sight, and the strange way in which it somehow perfectly symbolized this individual's lost state of being—the quirky *connection* between a highly-novel judgement & a personal judgement that it closely matched (aka, *high novelty + strong relevance*)—this experience suddenly set off a powerful & outsized attack of hysterical, uncontrollable *laughter.* (And in our essays' *Comedic Addendum*, we explain the vital role that novelty plays in humor.)

This burst of powerful novelty-based emotion began parting the clouds—helping their deeply-depressed-self into the world of the *feeling* again. It's as if this connection finally brought the brain's novelty & relevance responses back online, allowing it to emotionally *engage* once more. This would, indeed, make sense if major depressive disorder was essentially a dysfunction in our novelty/relevance-employing emotional mechanisms—a dysfunction that prevents the *engagement* required to produce *any* emotions.

The last major systematic neurally-based dysfunction we'll discuss is the one that remains most mysterious in the view of our theory: schizophrenia. One of the factors that makes schizophrenia so confounding is that is seems to be both a broadly-based & a traveling-over-time neural problem, resulting in behavioral dysfunction that can be expressed differently as individuals age. Studies have suggested that in people with schizophrenia there are often specific portions of the brain that exhibit a loss of gray matter—basically, these areas possess less functional neural tissue than normal.[31] This problem appears to begin in parietal lobe regions that support visuospatial and associative thinking. As it progresses, the problem seems to reach more high-functioning & perceptual areas of the brain —leading to more severe psychosis, i.e. powerful hallucinations, and false-but-convincing narratives that can prompt (outwardly-nonsensically) obsessive or anxiety-ridden behavior.

In an earlier version of this book, we theorized that the “traveling” tissue death observed in schizophrenics suggested that the problem could be, at its root, vascular. (And recent brain research has detected evidence of vascular dysfunction within the brains of schizophrenics.[32, 33]) However, a study published in January of 2016 has shed new light on schizophrenia’s possible genetic roots.[34] The research provides compelling evidence that schizophrenics’ neural dysfunction is a result of “overly-aggressive” synaptic pruning (a mechanic that is a vital to brain development). And as time passes, the cumulative damage from too much synaptic pruning increases the severity of the neural dysfunction.

Regardless of how the dysfunction ultimately spreads, this broad range of shifting symptoms seems to make it very possible that much diagnosed schizophrenia is actually other as-yet-unidentified brain dysfunctions that present similarly to one stage or another of schizophrenia and are conveniently tossed into the schizophrenia basket. There is much research to be done before we can definitively identify the full causes & pathology of “true” schizophrenia, but a good starting point might be to require the observation of *multiple* dysfunctions that change or progress over time (typically creating greater-over-time interference with conscious perception).

In other words, currently the sudden appearance of auditory hallucinations (which can lead to all kinds of other symptoms) in a 25-year-old might be diagnosed as schizophrenia (despite no previous emotional or mental problems) when it is, in fact, a specific problem in the auditory cortex (which can lead to other processing problems that result in those other symptoms). As we've noted before, until we can get a good look at what's actually happening "under the hood" there are likely to be many unique neural circumstances & disorders that will remain a mystery at their root.

A Final Mantra: Don't Lose Your Mind

I was a teenager of the 80s. Thus, vividly imprinted into my memory is the image on the cover of Douglas Adams' book "The Hitchhiker's Guide to the Galaxy"—an iconic circle & “thumbs-up” above the words *Don't Panic.*[35] In addition to being a delicious wordplay joke (the icon suggesting a *Don't-Panic* “button”) it was, for me, a little subversive mantra. A way to remind myself when necessary to *stay in the moment*. If I were to create a subversive little mantra for this essay, it would be: *Don't lose your mind.*

The wordplay here is a bit more dire than Adams'—our hidden image is not a Wile E. Coyote-esque adornment, but rather, an amnesia-induced nightmare. Nonetheless, its meta-message is the same: *be in the moment.* If there's one central life-lesson that we can learn from our exploration of the brain's data storage & handling systems, it's the value of being *present*—attentive & engaged—in our moment-to-moment experiences. Maintaining this strong, immersive & interactive connection with our environment & its people is the best way to *optimize* those magnificent systems of consciousness. These are the moments that make us *feel* and *remember* our lives—that help us to powerfully sear our neurons with those vivid memories whose stories & detail create that deep, rich texture of a fully-lived existence. *(All of which is a strong argument against living your life through a screen in your hand.)*

Conversely when we say "*Don't lose your mind*" we're also reminding ourselves to *be* in *all* moments (or as many as possible) present *and* past. More succinctly, *remember.* That is, after all, the real sum of our mind: the accumulation & ongoing recollection of all those moments in which you were once *present* enough to create a memory. As evidenced in heartbreaking examples like Alzheimer's, once we lose access to all of that remembered data, we truly do lose our minds—which is, of course, to lose our *selves.*

Who are you? In a strange (but real) way you are a constantly-shifting location in that ever-humming cerebral cortex. Who we are in any given moment is essentially comprised of what we have *access to* within our data storage at that moment. And amongst that lumpy, folded, gray matter, our access to all of those other moments comes through the moment we are *currently* occupying.

This potential-memory thought-parcel provides each moment's doorway to everything you currently are. That fresh eddy of neurons—alive with new energy & associations—provides the propulsive force that catapults our mind's lighting both forward in time—to our next thought—and backward through our history, into the modules of our memories. This *at-the-moment* location in your neurons and its capability through association & construction to bring forth all the necessary information to know & produce *who you are* is—in that strange-but-real way—where *you* centrally *exist* at this very second. *Don't lose your mind.*

If we looked at ourselves this way more often, we would likely take better care of this almost-magical machinery inside our skulls. *(Again, why you should always wear a helmet.)* And not just protect it from physical harm, but work diligently to keep it active & robust, to avoid feeding it a steady stream of narrative junk food that's all short-term pleasure with no long-term gain (which is why someday you'll *barely remember* most of the junk), to seriously consider the *emotional impact* of how we behave within, respond to & *think about* our lives. All of these are key factors in how our brain remembers, associates & constructs the self-building data in our minds. These are the things that make us *who we are*.

At the heart of all this is that aforementioned conundrum: *nature vs. nurture*. There are plenty of people who would have you believe that one or the other has the upper hand in this "battle." But in truth it's not a battle at all, it's a *joint engagement*. Our brains are designed to allow nature & nurture to work together in building who we are in a way that best adapts our particular genetic expression of a human to its specific environment. This is why humans are so *awesome*. We're like these amazingly-differentiated Lego pieces intended to work complexly & interchangeably together—creating systems & structures (of all kinds) that ultimately aid in the propagation of more human genes.

Our variable *natures* are determined by subsets of subsets of systems within all of us that each have slightly different levels of inborn functionality. In a big-system physical way we can see this expressed in people with different visual acuity, muscular strength, height, lung capacity—*every* system allows for lots of variability that does not overtly harm overall functionality. This aids the human genome in producing all of those awesomely-interchangeable Lego pieces, which in turn allows human society to fill all the various roles needed to maintain & build its complex systems & structures—protectors, thinkers, crafters, cultivators, and on and on. Humans are, in essence, a bizarrely macro version of those modular neural components—an externalized societal expression of that highly-adaptable system of programmable, interchangeable, malleable, associated parts that is our network of neurons.

And our variable inborn nature is also powerfully expressed in the systems that *construct* that neural network. Certain brains release certain chemicals in slightly different increments; others handle the results of certain emotional equations in ways that produce slightly different data outputs; others exhibit a greater natural fluidity in certain synaptic structures; others possess a slightly more robust capacity to match multiple patterns. Within our deeply-interwoven systems, such variations can produce a vast array of different types of human brains. And all of our own individual variations makes each of us more prone to make certain kinds of choices in certain kinds of situations. This is the *I am who I am* part of our minds—the very-hard-to-change tendencies of personality that continually shape our path through existence.

Why would human evolution allow brain functionality that is so highly variable? In other words: *Wouldn't it be better for everyone to be as "smart" as possible? Wouldn't humans with the most-brilliant processing systems have been most likely to survive our evolution?* Not necessarily. This is because everything in brain development is a *trade-off*. This is obvious in our main physical attributes (e.g., more brute strength is likely to lessen speed & agility). And those brains with greater processing speed & a powerful capacity for more complex pattern analysis & construction—they seem to be (we'll try to be delicate here) more likely to become *unstable*. (An analogy: *when something has more strands, it's easier for things to get tangled.*)

Thus—like everything evolution seems to spit out—the variability of human brain capabilities appears to be the result of a risk/reward proposition. As a species, we're better off in general if we employ both powerful, unstable processors and less robust, but more-reliable machines in our mix. In addition, these different types of brains would be likely to ultimately *desire* different kinds of roles in society, aiding in that world-winning evolutionary strategy of *intra-species Lego-ization*.

The other partner in this *joint engagement*, however, is an equal titan in the matter of self-building. *Nurture* is no weakling. Although our nature is responsible for our innate tendencies to behave in certain ways, ultimately the actual decisions themselves are primarily determined by all that data we've *experienced*—by our memories. This is the *you are what you eat* part of our minds.

The way in which those memories impact how we view ourselves and the choices we make—the very *lives we live*—has been the topic of this entire essay. In essence, it's the topic of all these essays. Because whether we're talking about our emotions, dreams, or internal dialogue loop, all of those mechanisms of consciousness require one primary element to make them run: data. And sometime around the age of 2 or 3 the vast majority of the data that influences *who we are* comes not from the present moment, but from our data storage banks, our *memories*.

Don't lose your mind. I actually have some personal experience in this mind-losing area that helped spark many of the insights in these essays. As mentioned in the first essay, I had my own (and thankfully brief) Alzheimer's-esque episode in my late 30s that produced myriad fascinating results. In short, I had a migraine-induced seizure that resulted in an hour of unconsciousness & subsequent temporary partial-amnesia (and included that brief sensory-deprived, but linguistically-conscious experience described in Essay #1). The most severe amnesia lasted only a couple weeks, and within 3-4 months my mind was mostly back to maximum efficiency—although "short-term" memory problems persisted for a little longer.

And another *odd effect* that persisted: weak validity judgements of old data. e.g., I could fully & accurately write-out from memory a frequently-used, but 20-year-old pancake recipe—yet when I looked at my written-out recipe on paper, I couldn't actually tell whether or not it was, indeed, accurate. For months, I had to call my mother to confirm the recipe every time I made the pancakes. It was weird—but may have been the result of the long-ingrained recipe being present in (& executable via) my rules resource, yet still *unconfirmable* via the hard-to-access memory-based recipe data (whose incoming paths had been buried by my seizure's neural electrical avalanche).

When I first awoke in the emergency room, I knew, generally speaking, *who* I was, but not much else. My memory of that moment (and yes, I *do* ironically have a memory of a moment in which I essentially had no memory) is primarily one of feeling lost & *embarrassed*—embarrassed that I didn't know anything about how I'd gotten there or where I even was in the course of my own life.

And the experience that I had over those next few hours was the beginning of the fascinating strangeness of forgetting, of *losing your mind*. Only one thing concerned me after I awoke: building a story about myself. At the time we were expecting our second child, I was applying (unsuccessfully) for a fellowship, and it was (very importantly) the middle of a Bears' season. And as I emerged from my fog, those were the narrative threads that I felt compelled to fill in. Totally lost in time, I asked over & over: *Did we have the baby? Did I submit the application? Are the Bears having a good season?* (I'd watched the team get pummeled by the Cardinals earlier that day, and my Bears obsession follows me everywhere: once under the effects of the anesthetic *versed*, the only thing I wanted to talk about was an injury to defensive end Alonzo Spellman's shoulder.)

I asked those questions repeatedly because, although the vague idea of each was stuck in my head, I had no narrative within which to place them. And my brain *needed* narratives desperately at that moment—something to hang my hat on, to help me say something more to myself than the bare-minimum *I am here*. Simply speaking, my consciousness wanted to do its job. But without proper access to its data-banks, the narrative-building machine was sputtering & coughing out confused nonsense. And it *recognized* this pattern-less data as nonsense, so it kept putting questions into the prompt, seeking the information it needed to complete its equations and get the loop flowing again.

The only information it had at its disposal was the most-basic, strongly-imprinted, self-defining data—conveniently stored in that left-brain vocabulary resource. Although my right-brain-based memories would take weeks to become truly functional, that vocabulary resource (as well as other narrative-building left-brain mechanisms) seemed to come online fairly quickly & smoothly; the evidence of this being my reasonable (although still fuzzy) ability to understand language, talk, identify people, and answer the question: *Who are you?* (Just thinking your name or seeing your face in a mirror sets-off a cascade of super-imprinted self-definitions: *I'm a writer, Rebecca is my wife, Vivienne & Camellia are my daughters…*)

The only other data that kept popping up was those vague ideas—*the baby, the Bears, the application*—whose presence was the likely result of their recently frequently-recalled nature & high-priority. It's the same as the reason why our dreams use this kind of data to start their dialogue loop: it's the most handy & available, *right here on the shelf*. But it wasn't until my access to that larger data-bank began to grow that I was able to begin feeling like *myself*. As soon as I was able to start building narratives about the present with the help of stored data, I was able to get my bearings.

And one of the most interesting things about the next several weeks—as the severest amnesia faded—was how what I *remembered* all seemed to come in narrative strands. In other words, it wasn't like my memory slowly & sequentially expanded deeper into the past—first remembering last week, then last month, etc. Rather, certain narratives suddenly became available. "*Right, we took Vivienne out to Fairfax for Halloween, and we…*" or "*I had finished that part of the poem, but I was going to change…*"

In the latter case, when this narrative became available I suddenly remembered very specific details about the revisions I was intending (and even a kind of *nuance* about my ambivalence over making them). I'd been putting off the revisions and hadn't thought about them in awhile, so that data was actually several weeks old—yet some of the more recent memories did not return until later. And some memories never returned at all. Although, as a frequent journal-writer, I still had some record of these memories. Yet, to this day, when I reread those unremembered entries, it *feels* like they were written by someone else.

There was no temporal pattern to my re-remembering. The remembering occurred *narrative-by-narrative*. And I can say from experience, without access to those narratives, you feel exactly how we might imagine a ghost does: *here, but not*—temporally displaced & terrifyingly at sea. In these moments, we are afraid of one thing above all others: that we might never return. *Don't lose your mind.*

In the end, our brain is designed to function as (and, if necessary, rebuild its architecture from) only the minimum version of ourselves—the *I am here now* version who is usually the first to reappear from any particular neural ether (this is even who we often are momentarily when we first awake in the morning). And although this *simple being* may be good enough for our brains, it's not good enough for *us*. We are, quite reasonably, desperately attached to all of the data that we've grown so familiar with & dependent upon. To feel it vanish is nothing less than the purest & most profound sense of loss that we can imagine.

During that decade-ago afternoon with my grandmother, just as we were leaving my uncle's house, a moment occurred—it was the moment that I feel is last time I ever really saw *my grandmother*. I was in the doorway, saying goodbye to her, when suddenly from nowhere she *returned*. You could see it in her eyes, that human thing that knows itself & its place in the world had come to life one more time. This was not the temporally displaced ghost, it was my *grandma*.

Although the confusion was still there, I could see how she felt in the way she looked at us (partly through that powerful tool—empathy). I could see what she knew: *that we were all together for the holidays, that we were her grandchildren, that we were leaving her.*

And there was one other piece of knowledge I could see in her mind, something that was likely accessible because it had long been a dominant thought: *I am sick & my memory is fading*. This knowledge made her say goodbye in a way that she knew she might never be able to again. And the tears our goodbyes produced in her, the sadness of the moment she actually *perceived* came from one basic narrative that her mind could still process in the moment: *"I am here with you now, and I may never be again, because I am losing my mind."* She is—as I write this—still *here*, but her *stories* are not.

This is how we know ourselves, how I rebuilt my *self* from the ether—by assembling the only pieces of *being* that we can find lying around our neurons: *narrative-by-narrative*. Like my grandmother's rote recitation—*word-for-word*, *smile-for-smile*—when all that's left are the barest-bones of our mind to view amidst the emptiness, the only things we can truly see are the *stories* in those bones. These are the supple skeletons of words & syntax that carry with them the flesh of our lives. *Don't lose your mind*. In the end, this can only mean one thing really: hold tight to your stories, your memories—*they* are who *you* are.

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