All Architects Are Not Equal

by R. Salvador Reyes [Excerpted from "Narrative Complexity: A Consciousness Hypothesis," Essay #4-Memory & Cognition, pp. 149–153.]

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—although not quite realizing—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.[20] 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 technique that our brain is using to overcome those inborn limitations (in addition to applying memory devices) is the use of 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 is partly determined by that imprinting capacity.

But *during* the actual narrative-building, imprinting capacity has mainly one effect: it helps us determine rule priority & make some rules stronger than others (within that *learned-rule* resource). Thus, someone with a greater inborn imprinting capacity 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* new rules over time (and can help turn an innately mediocre musician into a better one) once a rule has been learned & prioritized, 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* 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...

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Footnotes:

20. Jaeggi, Susanne M., et al. "Improving fluid intelligence with training on working memory." *Proceedings of the National Academy of Sciences* 105.19 (2008): 6829-6833.