

The Evolution of Disgust & Human Belief Systems

by R. Salvador Reyes [Excerpted from “Narrative Complexity: A Consciousness Hypothesis,”
Essay #2-Emotions & Beliefs, pp. 68–77.]

...Those frequently-mentioned belief systems finally bring us to what might be the most crucial & pivotal development in the evolution of emotion, one that likely occurred alongside the emergence of social structures in the heart of that 700 million year blink: disease avoidance behavior—essentially, primitive *disgust*. Early disease avoidance appears to be based on identifying a specific subset of olfactory data within a larger scent pattern. For example, rats could detect & identify a subset of disease-indicating olfactory data within the larger scent pattern of another rat, which triggered survival-aiding *avoidance behavior*.

(The unique neural mechanics & roots of primitive disgust are well-explored by Hanah Chapman & Adam Anderson in their 2012 paper “Understanding Disgust.” Additionally, as their paper notes, humans’ & other animals’ *distaste* response—primarily spurred by specific stimuli like bitterness, and intended to identify toxicity as opposed to a possible disease-source—is much more primitive & less sophisticated than disgust. ²¹)

In the view of Narrative Complexity, this neural mechanic—applying a specific, but broadly-applicable subset of data to larger

data patterns in order to determine avoidance behavior—is what unites *all* forms of disgust. This mechanic is demonstrated by advancing mammals’ capacity to specifically judge, for example, disgust-producing (& possibly-illness-causing) *rottenness* across a wide variety of unlike fruits & meats.

As mammals evolved, different species developed different levels of disease avoidance behavior—likely based on the species’ specific natural disease-resistance. (Thus, species with greater natural disease-resistance, like dogs, would require less powerful & broadly-applied primitive disgust responses.) Hominids not only inherited this olfactory-based, disease-avoiding disgust, but they also seemed to possess a particularly powerful version of it—demonstrated in our strong, primal aversion to the scents & tastes of harmful resources like rotten food or feces (stimuli that don’t seem to particularly bother the olfactory systems of mammals like those aforementioned dogs).

And since we’ve mentioned dogs, it seems fair to note the unique disgust response displayed by their cultural counterparts: *cats*. Felines appear to express this avoidance

behavior by reflexively attempting to *bury* or *conceal* the offending material (and they even seem to reflexively seek out a burying-favorable location—a pile of sandy dirt or a litterbox—when depositing their own offending material). Disgust’s cross-applied-data-subset mechanic is evident in this behavior too: cats will reflexively display this *paw-reach-&-pull* burying action when encountering a range of different kinds of novel (but powerfully-scented) stimuli. I’ve seen cats do this in response to items as diverse as ashtrays & coffee puddles—despite the fact that these items’ overall, complicated scents are much different from each other & from feces.

For early humans, these flexibly-applicable primitive disgust mechanics were so useful that they eventually made a spectacular & crucial leap: from the olfactory systems to our visual & cognitive systems. What spurred this leap? Narrative Complexity hypothesizes that the key event occurred long after hominid brains had already left all others in the dust, when our human ancestors finally did the deed: *making fire*. This discovery now allowed them to cook their food, which ultimately forced our ancestors to develop & nurture an unprecedented ability: eschewing the primal, *hardwired* desire to eat raw meat in favor of exercising the *learned* behavior to wait & eat the meat *after* it’s been cooked (and eating the cooked meat offered a

plethora of advantages in areas like digestive efficiency, food storage & general health—i.e., *avoiding food-borne disease*).

In his 1999 paper "The Raw and the Stolen," Harvard anthropologist Richard Wrangham hypothesizes that the advent of cooking by early *Homo erectus* populations played a significant role in the evolution of human social systems.²² Wrangham theorizes that, initially, cooking was primarily used to take greater advantage of underground storage organs (essentially, root vegetables) during periods of food scarcity. He also hypothesizes that the cooking of meat didn't emerge until *after* the cooking of these root vegetables had already made a significant impact on our evolving human social systems. (Although the earliest environmental evidence of cooking with fire—i.e., hearth-like structures in human-inhabited caves—only dates back to around 1 million years ago²³, Wrangham believes that evidence derived from the *Homo erectus* fossil record suggests that the cooking of underground storage organs might've actually begun around 1.9 million years ago.)

In the view of Narrative Complexity, despite the powerful impact that cooking root vegetables had on the evolution of human social systems, this behavior would not have impacted the evolution of human cognitive systems in the same dramatic way that

cooking meat would have. Essentially, from our theory's perspective, developing & nurturing a preference for those cooked underground storage organs over the raw versions of the same resources presented less of a *cognitive emotional challenge* than developing a preference for cooked meat vs. raw. This is because the cooking of underground storage organs likely made these less desirable (but in times of scarcity, *necessary*) food resources generally more desirable & palatable (i.e., making their consumption much easier & significantly more pleasurable). In other words—when they were initially presented with the choice between immediately consuming raw storage organs and waiting to consume the new & improved cooked versions during periods of food scarcity—our human ancestors' brains did not have to work very hard to convince themselves (& their communal cohorts) that waiting to eat the cooked version was (for a variety of reasons) highly preferable.

In contrast, raw meat was a food resource that was commonly sought out & consumed by our human ancestors—even during periods of resource abundance. Simply put (although, as Wrangham suggests, those early humans probably didn't consume *large quantities* of raw meat) our ancestors actually *liked* eating raw meat, and chose to do so even when raw meat was not a *last-resort* food resource. Thus, unlike those raw

underground storage organs—which were probably viewed as an *eat-it-or-die* food resource—raw meat was a food option that early hominids & their primate ancestors had instinctively *enjoyed & desired* for millions of years whenever the option presented itself.

How does all of this relate to those primitive mammalian disgust mechanisms making that spectacular leap from the olfactory systems to our visual & cognitive systems? Well, for starters, it helps to explain why developing a strong *preference* for cooked meat over raw meat would've required more complicated cognitive gymnastics than simply choosing to eat those cooked underground storage organs instead of the raw versions. (And evidence of our modern disgust mechanisms' strong ties to meat-eating can be found in modern *Homo sapiens* innate *disgust* toward most raw meat, which is *not* something that most humans tend to display in response to those raw underground storage organs.)

Thus, when our human ancestors initially began to choose & prefer the consumption of cooked meat over raw, they likely needed to employ some of their more advanced cognitive powers—like their advanced version of *willpower*. In choosing to wait for cooked meat instead of simply eating the perfectly yummy & desirable raw meat, those early humans were demonstrating the

ability to exercise their willpower in the service of a *learned & predicted long-term gain*—not just an in-the-moment, inhibition-overcoming, *get-up-&-run!* self-willed impulse. In addition—because these human ancestors did not yet possess those behavior-calibrating & socially-nurtured belief systems that ultimately emerged from this behavior—the primitive emotional mechanic that these early groups of humans likely used to help socially reinforce the advantageous, new *don't-eat-that-raw-yummy-wait-for-the-cooked* behavior was that original emotional/social tool: Pride/Embarrassment, which enabled the effective *shaming* on non-conformers.

This suddenly-useful ability to develop a preference for cooked over raw meat was so advantageous that it quickly (in evolutionary terms) began to evolve into a hardwired, primal *avoidance* or *rejection* of (*disgust toward*) that raw meat. And the very close association between that socially-enforced *embarrassment* of eating raw meat & hominids' subsequently-evolving, hardwired *disgust* toward the raw meat likely accounts for the strong *overlap* between the modern emotional experiences of *socially-based Pride(in self)/Embarrassment* and avoidance behavior's *belief-based* descendent, Satisfaction/Guilt—and its *other-entity-judging* counterpart *Pride(in other)/Disgust*.

But there was something even more unique about humans' newly-evolved & hardwired *disgust* toward raw meat—this avoidance behavior was based on detecting & identifying a subset of *visual* data, *not* olfactory data. (Two systems that are—as we'll discuss in the next essay—uniquely isolated within vertebrate brains.)

Consider this: we are often repulsed by the *sight* of particularly bloody or "gory" raw meat, but there is nothing about the *scent* of raw meat that causes a similar repulsion (that's how we can tell by *smell* if raw meat is rotten, because we aren't actually repulsed by the *scent* of raw meat unless it's gone bad). In other words, the thalamocortical loop that is at the heart of our consciousness (& whose cortex-based cognitive systems were primarily rooted in ever-growing visual systems) now had use of this *data subset/behavior avoidance* technique: *disgust*. Consider that no other (or *non-cooking*) species seems to be *disgusted* by the *sight* or "thought" (essentially, the thalamocortical *perception*) of anything in particular. Even our near & dear primate relative, a Chimpanzee, nonchalantly *handles* their feces, even though the *scent* would likely prevent them from eating it. And it's quite clear that no animal other than humans is disgusted by the sights or textures of raw meat. Indeed, this visually-based application of a disgust response appears to be uniquely human.

Once this mechanic joined humans' thalamocortical cognitive toolbox, it began to do some truly amazing things. How? Let's look one more time at what this unique tool, disgust, really does: it uses a broadly-applicable, but rigidly-defined subset of data to evaluate a wide range of resources and determine which ones to accept or avoid/reject—an ability that was neurally-expanded via our learned capacity to resist a primally-motivated short-term gain (raw meat) in exchange for a longer-term gain (cooked meat).

Doesn't all of that sound an awful lot like *beliefs*? And what's that feeling we have toward someone who has violated one of our beliefs? The same as raw & bloody or rotten meat: *disgust*.²⁴ Avoidance. Disgust. Belief violation. / Acceptance. Admiration. Belief compliance. *When Rodney saw that the yummy was poopy, he winced—and when he smelled the poop, he gagged. Then Rodney looked at the wanderer and shook his head, disgusted by the other man's violation of a solemn truth: Don't shit where you eat.*

~

How amazing was this meat-cooking behavior—behavior that allowed the extraordinary evolutionary emergence of beliefs? Consider this: those early humans' closest ancestors had likely been eating raw meat for at least a few *million* years before

the advent of cooking. This means that those first instances & traditions of consuming (& encouraging the consumption of) cooked meat would have gone against millions of years of *hardwired* urges & desires.

As simple as it seems to us now, this ability to *significantly* self-delay gratification was a profound leap of logic—a kind that no other earthbound creatures had truly made, a leap that I believe marks the real beginnings of humanity as we know it. I've described this self-delayed gratification as *significant* because: a) fire-building & cooking involved the expenditure of additional resources—time, effort & actual physical resources—at a moment that likely often occurred not long after expending significant resources to *acquire* (hunt & butcher) the meat, and b) for most of those early humans that hard-earned raw meat was *already* perfectly yummy & desirable *exactly the way it was*. These kinds of factors help to distinguish our earliest ancestors' meat-cooking behavior from the behavior demonstrated in a very recent experiment that showed chimpanzees were willing to exchange a raw slice of sweet potato for a yummier cooked slice by placing the raw item into a simple device that produced a cooked slice after being shaken briefly—a process designed to mimic basic cooking.²⁵

(Some might also point to behavior like *seed-caching* in birds as examples of non-human

self-delayed gratification, but in these cases there is no current impulse to overcome, and therefore no gratification being delayed. When the bird caches the seeds, it's likely not very hungry *at that moment*. Thus, the cached resource is viewed as an excess—not as a very currently-desirable item whose value increases if the entity expends resources in order to help “improve” the item while self-delaying that current desire.)

And the powerful belief systems that ultimately emerged from this capacity to *significantly self-delay gratification* played an important role in our species' survival during a critical period of evolution. As the modern human came onto the scene 200,000–100,000 years ago, climate was fluctuating frequently & dramatically. In the regions of Africa where those modern humans lived, this climate instability resulted in environments that switched between lush & arid in mere thousands of years. These evolutionary pressures likely favored the selection & survival of human populations with the strongest ability to understand & dynamically adapt to the ever-changing environment by generationally passing-on these populations' ever-adapting knowledge & practices. Such abilities were based in their brains' complexly-modular, problem-solving, language-based capacities, which also allowed for the evolution of beliefs both within those brains *and* within the now-continuous, ever-sophisticating & emerging *cultures*.

And the human brains & cultures that demonstrated the strongest ability to learn & apply these newly-evolving belief systems would've been inherently better at dynamically adapting to the maddeningly-metamorphosing African landscape (we'll give an example of why in a moment). This process of Darwinian selection favoring the "believers" was likely accelerated significantly during the middle of this 100,000 year window via an event referred to as a “bottleneck” in human evolution. This bottleneck was a short period in which severe, sudden cooling of the planet reduced the human population to near extinction.

The plummeting population led to significant reduction in genetic diversity in our species—and recent analysis of the human genome has shown that *everyone alive today* is a descendant of that small pool of humans that stubbornly (& *ingeniously*) persisted along the South African coast during this bottleneck. One of the most provocative & compelling scenarios depicting this crucial moment in evolution is presented by paleoanthropologist Curtis Marean in his 2010 paper about the coastal adaptations that emerged in this tiny group of remaining humans.²⁶

Marean hypothesizes that this prehistoric coastal community consisted of possibly only 600 people, and that the keys to their survival were abilities such as the

sophisticated use of fire in tool-building, and exploiting the sea & other coastal resources for their primary survival needs. (Including behavior like *harvesting shellfish*, which was only efficient at the lowest tides—unless modern humans have since lost those coastal humans' ability to *breath underwater*.)

The tool-building & creative problem-solving skills were probably well-enabled by those modular cognitive systems. But some of the other adaptations—such as planning (& relying on) that harvesting of shellfish during low tides—are the kinds of learned behaviors whose powerful predictions would have required that newly-developed & very specific cognitive tool: a belief system. (In Essay #4, we'll explore in detail just how *uniquely* specific this cognitive system is.)

Consider that understanding tide cycles & correlating the movement of the moon to the harvesting of food is not the same as understanding how to build a tool or a fire, which involve direct causal relationships in their construction. These humans could not have understood *how* the moon makes the water move in the same way that they would've understood that striking two stones made a spark that ignited dry grasses—they could only observe and then come to *believe* that there was a correlation between the water & the moon. In addition, this period provides the earliest evidence of

humans using red ocher (our inaugural art supply) in symbolic & ceremonial ways—which is more proof of a sophisticated belief system being present in these humans' brains.

How exactly does this kind of belief (*whenever the moon has this appearance/position, the water will be very, very low the next morning*) correlate to that original *data subset/behavior avoidance* technique that it evolved from? The "data subset" here is *the unique appearance/position of the moon that "causes" the water to be very, very low*—a data subset that is compared to the larger data set represented by the moon's & tide's "overall behavioral pattern" (their full yearly, lunar & daily cycles).

Even if these humans were making this prediction purely according to tide patterns instead of using the moon, this would still be a version of comparing a data subset (low tide periods) to a larger data set (the full tidal cycle). Although, because tides vary in a yearly & lunar pattern in addition to their daily patterns, it was likely actually easier & more reliable to recognize the *lowest-tides pattern subset* by using the moon than it would've been via the tracking of water level patterns alone.

Either way, if these humans *weren't* using *some* form of a belief to guide this behavior, then they would've simply been harvesting

shellfish essentially randomly: whenever they noticed that the tides were low enough. This obviously wouldn't be a very reliable method for managing vital resource acquisition, and it doesn't seem to represent the kind of *advantageous* behavior that would be such a great way to survive *the world's greatest winnowing of humans*.

The *emotional* role of a belief like “*whenever the moon looks like this, the water will be very, very low*” is exhibited during actual *behavior* when, for example, more-basic urges or desires come into conflict with that belief in choosing an action. Let's imagine, say, that on the morning of the lowest negative tide (which provides that lunar cycle's only opportunity to harvest the least-accessible & survival-aiding mollusks) our coastal human is very, very tired, and thus chooses to sleep late instead of harvesting mollusks at dawn.

When he puts his head back down on his grass mat & chooses to forego foraging, he might use as his lame excuse something like “I will collect shellfish later.” And as he says this to himself, our coastal human likely feels a pang of *guilt*: “I cannot shellfish later, I should wake up now.” (And this guilt is essentially being *disgusted* by one's own behavior.) Unfortunately for his *now-less-likely-to-be-reproduced* genes, this pang loses out to the pang of his comfy grass mat. This *guilt* is produced by violating his strong

belief that “*whenever the moon looks like this, the water will be very, very low the next morning*.” (And he saw the moon look *exactly* that way last night.) In other words, he is making a choice that his brain *believes* will likely lead to an ultimately undesirable result (based on a highly valid & valuable prediction trope built from experience & study).

Our coastal human would therefore likely feel this guilt even if he was only harvesting the food *for himself*—eliminating other possible guilt sources, like failing to contribute to his social group or to fulfill a commitment to others. Consider that even if we are the only ones who will likely suffer the possibly negative consequences of our actions, we're still likely to feel at least *a little* guilt or inner-conflict if those actions represent the violation of a strongly-held belief.

The obvious evolutionary advantage of strong *belief-based emotions* in situations like our coastal human's *inner conflict* is that the most-likely-to-survive brains are those that feel enough *guilt* (& exhibit enough *willpower*, whose *endorphins* are unfortunately in short supply during this sleepy inner-conflict) to actually *get up & forage* instead of succumbing to the primal urge for more sleep (which is, again, a lot like waiting to eat a cooked steak instead of succumbing to the primal urge to eat the yummy bloody steak).

Exploring Mearan's coastal scenario shows why human populations with the most evolved cognitive belief systems would've likely owned a key advantage in surviving this bottleneck, and it provides the perfect avenue for this essential human trait to emerge as one of the most powerful & fundamental aspects of modern humanity—because all subsequent human evolution sprang from this harshly-selected tiny population of our best "believers."

Making efficient, reliable predictions about our world based on learned (but not entirely *provable*) correlations between events that often have mysterious, but observable relationships—and the development of a specific cognitive system devoted to this mechanism—is at the root of what separates us from all other animals. Consider that *many* other creatures—birds, aquatic mammals like dolphins & whales, elephants, other primates—have the modular neural capacity for language, and can display the profound behaviors, emotions & even the learned, generationally-fluid *traditions* that can result from such a proto-linguistic capacity (however rudimentary). But they do not have *beliefs*. And I propose that it is our beliefs, and the emotions that they engender, that truly make us *human*.

~

FOOTNOTES:

21. Chapman, H. A. and Anderson, A. K. (2012), Understanding disgust. *Annals of the New York Academy of Sciences*, 1251: 62–76. doi: 10.1111/j.1749-6632.2011.06369.

22. Wrangham, Richard W., et al. "The raw and the stolen." *Current anthropology* 40.5 (1999): 567-594.

23. Berna, Francesco, et al. "Microstratigraphic evidence of in situ fire in the Acheulean strata of Wonderwerk Cave, Northern Cape province, South Africa." *Proceedings of the National Academy of Sciences* 109.20 (2012): E1215-E1220.

24. Chapman, Hanah A., and Adam K. Anderson. "Things rank and gross in nature: A review and synthesis of moral disgust." *Psychological bulletin* 139.2 (2013): 300.

25. Warneken, Felix, and Alexandra G. Rosati. "Cognitive capacities for cooking in chimpanzees." *Proceedings of the Royal Society of London B: Biological Sciences* 282.1809 (2015): 20150229.

26. Marean, Curtis W. "Pinnacle Point Cave 13B (Western Cape Province, South Africa) in context: the Cape floral kingdom, shellfish, and modern human origins." *Journal of Human Evolution* 59.3 (2010): 425-443.