

Individual Differences Models

Within the main text, we report a significant interaction between frequency and valence in predicting reading speed. However, to further control for potential effects of demographic variables (age, sex) or individual variation in affective traits (anxiety, depression), an additional series of linear mixed effects models was constructed via restricted maximum likelihood estimation as described in the main text. Reading speed, in words per second, was again predicted by passage position, average word frequency, average lexical valence, and their interactions as fixed effects, with random intercepts per participant and per passage. Measures of individual difference were collected by participant self-report, and included biological sex, age, anxiety as operationalized by the 44-item Total Score of the Screen for Adult Anxiety Related Disorders (SCAARED (Angulo et al., 2017)) and depression as operationalized by the 8-item Patient Health Questionnaire (PHQ-8 (Kroenke et al., 2009)).

For each measure described above, both the individual difference measure and its interaction with valence were entered into the main model as additional predictors. As in the main model, all individual differences models demonstrated a significant frequency \times valence interaction ($p < 0.004$), as well as main effects of frequency ($p < 0.001$) and valence ($p < 0.001$, with the exception of the sex model, see below). The age model demonstrated a main effect of age ($p < 0.001$) such that older participants read more slowly across all passage halves; none of the other models demonstrated a main effect of the additional predictor. Furthermore, no interaction between valence and each individual predictor was seen in any of the supplementary models. In the model that included biological sex, the main effect of valence shifted just above alpha level ($p = 0.055$). Caution, however, should be taken in interpreting this model given the low number of participants ($n = 4$) in the male group.

In addition to biological and trait measures, models were run to assess the influence of state affect/mood, operationalized by the Positive and Negative Affect Schedule (PANAS, assessed for the current moment at the time of study participation (Watson et al., 1988)). Only a subset of study participants completed the PANAS questionnaire ($n = 47$, 43 female and 4 male). These two models, one each for the 10-item positive and 10-item negative affect subscores, were structured identically to the other individual differences models outlined above. While both PANAS models continued to show strong main effects of frequency ($p < 0.001$) and valence ($p < 0.001$), the frequency \times valence interaction was somewhat attenuated in comparison with the main model while still remaining significant ($p < 0.016$). No main effect of affective state, nor interaction with passage valence, was identified in either PANAS model.

Data and analysis code for all supplementary models is available at the link provided in the main text.

Passage Stimuli

Below are the passage stimuli presented to participants to read aloud. Titles are for descriptive purposes, and were not presented to participants. In each passage, the underlined word indicates the point at which emotional valence shifts.

“antarctica” (positive-to-negative)

The first expedition to the South Pole was led by an explorer from the newly independent country of Norway. In the southern hemisphere, springtime occurs in October, so the courageous Norwegian team of five men and 52 dogs set off from their camp in mid-October 1911, hoping to reach the geographic South Pole. Skilled on skis, they traveled for two months and arrived, safe and sound, by mid-December. Victorious, they returned to civilization, pleased to have triumphed over the British expedition. The British team embarked on a similar quest via a different route with a fatal conclusion.

Five weeks after the Norwegians conquered the Pole, the British arrived. They were severely disappointed to find a letter left by the Norwegians to confirm their defeat. Dejected, they turned back, planning to meet a support team in early March around Latitude 82, but the team never appeared. Suffering from frostbite and running out of food, they waited in the merciless cold just 12 miles from their main supply point. Violent storms raged outside their tent and suspicion crept in that they had been abandoned. Their pursuit of the Pole ended in grim misfortune.

“bats” (positive-to-negative)

Bats are the only flying mammal. The smallest has a six-inch wingspan; the wings of the largest, the flying foxes, extend over one and a half meters. Microbats send out ultrasonic sounds that produce echoes. The returning echoes allow them to “see” in their nightly quest for food. A different kind of bat, the megabat, eats fruit, which it finds with its senses of smell and vision.

Across Asia and the Pacific, there are strong positive cultural associations with this furry, winged creature. In the West, it is popularly connected to death, darkness, and witchcraft. Most microbats hunt on insects, but not vampire bats. There are only three species of vampire bat, all of which are blood suckers. Under the cover of darkness, they use infrared radiation to locate blood hotspots on their sleeping prey and attack from the ground, approaching on all fours. With razor sharp teeth, they make a small bite and spend about thirty minutes draining the wound. Their saliva prevents the blood from clotting. Although it's creepy, the victim does not lose enough blood to do them harm.

“bees” (negative-to-positive)

Colony collapse disorder has been documented since 1869. Although its cause is still unidentified, its symptoms are manifest: a hive is abandoned by its bees, leaving behind the honey and the queen. It is currently speculated that colony collapse disorder is triggered by the interplay of multiple stressors, such as parasites, pesticides, and an inadequate diet. These rampant fears about colony collapse disorder concern one particular strain of bee that prosperes worldwide, on every continent.

There are 20,000 known species of bee around the globe, of which eight make honey. Honey is produced from the nectar of flowers and is stored in honeycomb. A single beehive can generate more than 60 pounds of honey each year. This liquid confection is, of course, sweet and delicious, but it can also be employed for therapeutic purposes, especially as a topical antibiotic in herbal medicine.

“broccoli” (positive-to-negative)

Broccoli is great for heart health. High in fiber and various vitamins, this tasty vegetable has been found to support the immune system with its antioxidant properties. It originated in the northern Mediterranean during the Roman Empire and was brought to North America in the 19th century.

The broccoli family is very diverse, including cauliflower, Brussels sprouts, and kale. There are a variety of ways to cook broccoli and its delicious friends, such as stir frying and pickling. Some methods of

preparation moderate the family's repulsive bitterness. That pungent and unpleasant flavor is most distinct in cabbage and horseradish. It is caused by sulfur-containing compounds that actually interfere with iodine absorption in the body. So, although these vegetables may curb your risk of cancer and heart disease, you should avoid consuming too much, especially if you suffer from an iodine deficiency or other thyroid problems. The thyroid is a gland; it uses iodine to make hormones that control your metabolism. Today, the widespread availability of iodized table [salt] counteracts iodine deficiencies.

(Note: The bracketed word was erroneously not included in the experiment. For this reason, the "broccoli" passage was excluded from all analyses.)

"caramel" (negative-to-positive)

Making caramel is a risky undertaking. Particles of sucrose and glucose are heated until they brown, then combined with fat to yield a sticky, elastic substance. The primary dangers are splatter and seizing, both of which threaten the moment that cold fat hits scalding sucrose. If the boiling mixture touches skin, it adheres and burns the flesh. If the mixture seizes, you are left with clumps of hard, useless sugar. If nothing goes wrong, then the consequence of this difficult process is a magical, chewy confection.

There are all kinds of caramels: crunchy brittles, jiggly flans, ice cream drizzles, and soft squares that simply melt on your tongue. A more recent trend in caramel is the addition of sea salt. First invented by a French pastry chef in 1977, salted caramel became a worldwide craze around 2008. Scientists have found that the combination of sugar, butter, and salt creates a reward cycle that makes you crave the candy even more after every bite.

"cars" (negative-to-positive)

Gasoline-engine cars were once loud, dangerous, and expensive. These disadvantages were conquered in the early twentieth century. The noise emitted by the exhaust of an internal combustion engine was suppressed by the muffler. The difficulty of hand-cranking was eliminated with the electric starter. And mass manufacturing by Henry Ford decreased the price. The electric automobile was all but forgotten. But as concerns intensified around pollution and the cost of fuel, the dependence on gasoline no longer struck consumers as such a bargain.

And so began the rise of the modern market for electric vehicles. Quieter and more affordable to maintain, electric motors are especially desirable for their association with clean energy. In 2019, the seductive Tesla triumphed over the innovative Nissan Leaf as the top-selling electric car in the world. Historically, electric-power cars were the first automotive vehicles on the road. Although they were eclipsed for a century by the petroleum powertrain, they have made a powerful comeback.

"congo" (positive-to-negative)

Six percent of the Earth's surface is blanketed in rainforest. From the temperate forests of the Pacific Northwest to the tropical Congo, these evergreen canopies are the longest-living ecosystems on the planet. They are also a refuge of diversity, serving as home to a wealth of plant and animal species.

People have inhabited rainforests for thousands of years. Today, more than 75 million people live in the Congo Basin. These residents have witnessed as tragedy unfolds, destroying the fragile woods they inhabit. Both industrial logging and slash-and-burn agriculture, where sections of trees are cut down and then burned to cultivate crops, have led to major deforestation in the region. Deforestation has made the area more accessible to commercial hunters, igniting a poaching epidemic that is killing off midsize

animals faster than they can reproduce. And social unrest means that the dangers of ambush, kidnapping, and robbery remain high in some areas.

“dams” (positive-to-negative)

A dam is a gateway that is designed to direct the flow of water. The first known dam was built in Jordan over 5000 years ago. An important ambition in the construction of a dam is to provide sufficient water, both for drinking and for cultivating local farmland. In modern history, this water has also been employed for its hydropower capabilities and dams have become a significant generator of electricity. Humans build these structures, but so do beavers. Using tree branches and vegetation to form their quirky lodges, beavers create an infrastructure that contributes positively to local wetlands.

Dams are an incredible invention. When they fail, the consequences can be catastrophic. Sudden flooding can lead to costly damage to buildings and even death in the nearby population. Failures are typically caused by a poor design leading to a structural breach. The risk of disastrous flooding is not the only downside to dams. New dams drastically degrade rivers, causing the loss of entire ecosystems and the endangered species who occupy them. For example, the Chinese river dolphin was forced into extinction in part due to construction of the Three Gorges Dam. It is not always apparent whether the benefits of dams are adequate to outweigh their destructive repercussions.

“dentist” (negative-to-positive)

Tooth decay and gum disease are infections that can increase your risk for diabetes and heart trouble. This is why regular dental appointments are critical. But some people are terrified of going to the dentist. This fear of drills, needles, and oral pain can cause those who suffer from it to avoid the dentist. Ironically, this only inflates the probability of cavities and other dental problems.

Dentists need to have compassion for all their patients. Have you ever noticed how friendly and talkative everyone is when you go in for your annual cleaning? While they shine up your pearly whites, they calm you with conversation. You always rise from the chair with minty fresh breath and exciting, new knowledge of your hygienist’s personal life. The American Dental Association recommends that you get your teeth cleaned at least once every year.

“depression” (negative-to-positive)

The Great Depression was a severe economic recession that had devastating, worldwide consequences. On October 29 of 1929, dubbed “Black Tuesday,” billions of dollars were lost and some investors were totally bankrupted. In the United States, unemployment shot up to 23%. It was especially hard on farmers in the Great Plains, who suffered a decline in crop prices and a punishing drought that crippled their economy. Herbert Hoover became president just before the crash and was long scorned for his refusal to involve the federal government in relief efforts.

As the situation grew more dire across the country, the talented Franklin Delano Roosevelt rose to power. He quickly launched a series of creative resolutions designed to provide economic relief and steer the country toward recovery. The most popular was the Civilian Conservation Corps, a volunteer program that offered employment to young men and sought to improve national morale. CCC projects, such as building bridges and roads, focused on the preservation and improvement of the land and its natural resources. Two national parks – Big Bend and The Great Smoky Mountains – were almost completely built by CCC volunteers. The program successfully planted 3.5 billion trees and created 711 state parks.

“dogshow” (negative-to-positive)

Dog shows, also called breed shows, are controversial. Some argue that they are detrimental to the welfare of the breed because, by selecting for shallow characteristics, they weaken genetics and engender abnormalities. This focus on the superficial, they contend, leads to disease, from which many competitors suffer. For example, pugs are bred with shortened skulls for the infamous squashed muzzle. But this distortion of the skull causes respiratory troubles and bulging eyeballs that are prone to injury.

At a show, contestants are judged not against each other but against the standards for their breed. Those that conform to these standards take the prize, which is simply a point toward a championship title. These points demonstrate that a particular puppy has been found to be a superior example of its breed. In theory, this indicates that the dog has an ideal appearance and is in excellent health. Breed standards often use terms like “alert,” “intelligent,” and “energetic” because the intent is to maintain the integrity of the breed. Pups are carefully groomed for shows and prance around the ring to show off their stellar physique. Show training is intense and requires lots of love and determination to teach a dog how to bring home the gold.

“dolphins” (positive-to-negative)

Dolphins are intelligent sea creatures who mostly prefer warmer, tropical waters. A thick layer of blubber helps with buoyancy and serves to streamline their flexible bodies. They have excellent hearing, which is adapted for both air and water. Sociable and playful, dolphins live in pods of up to a dozen individuals. In Greek mythology, dolphins were esteemed as the helpers of humankind. Seeing dolphins swimming in the wake of a ship was considered a good omen by the Ancient Greeks and many ancient coins pictured a young man riding on the back of a dolphin.

Over the past several decades, the devastating decline in the dolphin population has been the cause of grave alarm. This precipitous drop has been provoked by many factors, particularly noise pollution. Noise pollution refers to the underwater sounds of boat traffic, torpedo testing, and offshore drilling. All this unnatural noise is very stressful to dolphins. It interferes with how they navigate and can even prove fatal: in some cases, dolphins rush to the surface to avoid all the racket. Surfacing too hastily can cause decompression sickness, an illness induced by dissolved nitrogen in the body and which can lead to paralysis and death.

“flying” (positive-to-negative)

Air travel today is very efficient, carrying jetsetters from one side of the globe to the other in a matter of hours. In the Sixties, however, traveling by airplane was a glamorous affair. Passengers got dressed up, the in-flight hospitality was luxurious, and everyone had lots of legroom. During this Golden Age of flying, champagne flowed freely at the bar and the guests were served lobster. It was like a cocktail party in the sky. With no one puking in the seat next to you or hogging the armrest.

In the Seventies, deregulation triggered pricing wars that caused service levels to plummet. Under the strain of fierce competition, airlines were forced to shove more bodies into each flight and to cram more flights into each day. Airports became hectic and airplanes cramped. Now, any minor disruption to the schedule causes insufferable delays and the entire ordeal is a relentless assault on one’s patience.

“grizzly” (negative-to-positive)

The grizzly is a subspecies of the brown bear, notorious for its aggressive tendencies. Weighing over four hundred pounds, grizzlies use their formidable size to frighten opponents. If size fails to terrify, their long

claws and fearsome bite can inflict considerable damage. Their claws are four inches long and the grizzly jaw is strong enough to crack a bowling ball.

With a varied diet, the grizzly has a reputation for hunting in waterfalls. Salmon jump these changes in elevation and bears are excellent fishermen. The rise of ecotourism has made bear-watching a fashionable activity and the skill of the bear in salmon fishing is a consistent favorite. Salmon are rich in the nutrients that are needed to prepare for hibernation, especially for females. Mother bears give birth to cubs in their winter dens and their autumn meals must provide them with enough strength until the spring.

“icefishing” (positive-to-negative)

Even on frozen lakes and rivers, anglers can catch all kinds of interesting and edible fish. Before selecting a desirable location, these intrepid fishermen confirm that the ice is strong enough with a handy rhyme: “Thick and blue, tried and true.” This ensures that the ice is safe to walk on.

Ice fishing is an inexpensive sport as you only need a handful of tools and a warm set of clothes to spend several enjoyable hours fishing without frostbite. With a saw or chisel, you drill a hole in the ice; alternately, you cut through it with an axe. Next you must remove the slush. Some anglers just drop in a hook and line, and wait. Others linger over the hole, on the lookout for a target, ready to plunge a spear into the frigid brine. In some places, the ice is dotted with shanties because anglers have constructed narrow shacks to stave off the cold.

“mantis” (negative-to-positive)

The mantis shrimp is a puny but aggressive crustacean who works alone and leaves its solitary burrow merely to hunt. There are two categories of mantis shrimp. “Speakers” have pointy, barbed forelimbs that they use to stab and snag their prey. “Smashers” bludgeon their victims with an oversized, club-like appendage. This terrifying weapon strikes at the same velocity as a gunshot; it is so fast that it makes bubbles in the water around the unfortunate adversary. The mantis shrimp’s poor victim is hit twice: first by the claw and then by the shockwave, either of which is deadly.

The need to dominate in close-range combat may be the origin of the most amazing and elaborate visual system ever discovered. Two eyeballs are mounted on stalks and move independently of each other; each eyeball also has its own trinocular vision. Together, these visual advantages provide the mantis shrimp with excellent depth perception. What’s more, some species of mantis shrimp have 16 types of photoreceptor cells, giving them the power to perceive an immense rainbow of color, from deep ultraviolet to far red. Many mantis shrimp are brightly colored themselves, such as the attractive and prized peacock mantis. These crustaceans use color like a special language during mating rituals, actively illuminating themselves in vibrant, fluorescent colors that only other mantis shrimp can see.

“realty” (positive-to-negative)

Buying a home is an exciting endeavor. Although it is a major financial commitment, it offers the opportunity to build your credit and grow your equity for the long-term. Selecting the right real estate agent is crucial since this person will advocate on your behalf during the negotiation process. You also want to secure a low interest rate.

In a hot market, it is important to know what you can afford so that your home-buying adventure sidesteps foreclosure. If you overextend yourself, you may fall behind on your monthly loan payments. Don’t forget that you don’t just have a mortgage to pay, you also have taxes and insurance, not to mention the cost of upkeep and any necessary repairs. Debt can make some people anxious, so budget appropriately.

Ultimately, the stress of managing a mortgage is not so different from that of being a tenant. Just now the landlord is you.

“skunkowl” (positive-to-negative)

The great horned owl is a nocturnal bird native to the Americas. It is easily recognized by its tufted feather “horns,” called plumicorns, and its large, yellow eyes. A symbol of strength, courage, and beauty, the great horned owl has an unmistakable hoot, four to five syllables in length. Special feathers allow it to fly soundlessly through the twilight as it skillfully seeks its next meal, often a rabbit or a hare. A surprising victim of this formidable predator is the skunk.

The skunk advertises its smelly defense with warning stripes down its back. If provoked, it sprays a foul liquid that can cause temporary blindness in its careless and unfortunate adversary. The odor has been described as a combination of musk, garlic, burning sulfur, and sewer gas. This stinky weapon is so revolting that the skunk has very few predators, making the owl a notable exception.

“sun” (negative-to-positive)

Lumens measure light emission. The human eyeball is unable to stare at anything discharging too many lumens, which is why a partial solar eclipse is so hazardous and deceptive. The parts of the Sun not obstructed by the Moon are just as blinding as they are on a typical day. In the blackout, the pupil dilates and each exposed cell on the retina is assaulted by rays of light. This literal “sunburn” causes lesions, inflicting irreversible damage.

Dangerous and destructive, sunshine is still the most important source of energy for life on Earth. The Sun fuses 600 million tons of hydrogen into helium every second and radiates that energy as sunlight. Solar power technology transforms this energy into a renewable source of electricity. The first solar thermal power station was built in Egypt in 1913 and the largest solar power plant in the world today glimmers in the Californian desert. Rooftop solar panels empower individuals to harness the power of the Sun.

“vegas” (negative-to-positive)

Las Vegas was founded in the early twentieth century, but 1931 was the critical year in its urban development. The fledgling metropolis legalized casino gambling and dropped the minimum residency for divorce to six weeks. That year also marked the start of construction on the nearby Hoover Dam and the influx of laborers enabled Vegas to avoid catastrophe during the Depression. In the Fifties, before testing moved underground, nuclear weapons were detonated only 65 miles from downtown.

Known as “Sin City,” Vegas has long been infamous for vice and varied illicit pursuits. Pleasure and entertainment have made the city’s reputation, and it has been popular for its lavish hotels and celebrity performances since the Forties. But it was first famous for the abundant wild grasses and natural spring water available in this beautiful desert valley. Named “The Meadows” by Spanish explorers, Vegas was a “resort” town before any were built with neon. Travelers could refuel in the valley on their journey westward. Today, Vegas is its own destination, made easy to schedule with its average of 310 sunny days each year.

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