

The Foundations of Compellingness

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Some things in this world are compelling, such as beautiful scenery, scary stories, and sports. They might give us pleasure, or make us feel they are important, or motivate us to pay attention, or inspire curiosity. Other things, such as patterns of raindrops or lists of random numbers, are not compelling. To date there is no cross-domain framework that attempts to explain the underlying psychological reasons why some things are compelling and other things are not. I present the compellingness foundations framework, which attempts to show that the same underlying psychological reasons explain why things are compelling to human beings, including religion, arts, and sports. The foundations include the desire for social information, the presence of detectable patterns, incongruous information, and the generation of strong emotions.

Keywords: art, religion, aesthetics

Many things capture the attention of people, and other things are ignored. From sports, jokes, attractive people, traffic accidents, movies, music, to stories about heroes and gods from long ago, we find these things *compelling*. Other things are not compelling: the endless variety of dirt patterns on the streets in the spring, static heard on the radio, or rambling stories that seem to go nowhere. What properties are shared by compelling stimuli? This is the central question of this paper, which will introduce a framework for understanding compellingness.

Despite a great deal of work on what makes artistic works pleasurable and interesting, and a great blossoming of work on cognitive approaches to religion, these two subfields usually don't interact. However, many of the things that attract people to art are the same things that attract us to religion. Could it be that everything that is compelling is so because these things trigger similar underlying psychological proclivities? In this paper I describe the *compellingness foundations framework*,

a unified approach to understanding compellingness. It is meant to help explain what kinds of things will be compelling to people in terms of basic psychological foundations that compelling things exploit. It is the first framework that attempts to describe similarities in what makes things compelling across many domains, including sports, art, religion, conspiracy theories, music, and so on.

I characterize the class of “compelling things” with a list of family-resemblance features, without appeal to necessity or sufficiency: compelling things are interesting, draw and sustain our attention, are fascinating, make us more likely to believe them (in the case of propositions or explanations), make us feel curiosity or pleasure, and are easier to recall from memory. Some compelling things are beautiful and some are funny, but others, such as car accidents and horror movies, can be scary or cause some other negative affect. But we are drawn to them nonetheless.

The first foundation holds that stimuli featuring people, representations of people, or person-like entities, and particularly conflicts between them, will be more compelling. The second foundation holds that we will find compelling those stimuli that make us feel emotional, primarily hopeful, happy, angry, or fearful. The third foundation holds that we are attracted to patterns. We delight in finding them, and stimuli that feature patterns of any kind (repetition, similar colors) give us pleasure. The fourth foundation holds that some amount of incongruity, or mystery, is compelling. Rather than causing delight, incongruity creates drive, a motivation to understand.

Presented is a framework that describes how features of stimuli interact with characteristics of our underlying psychology to make us find things compelling. My contribution is a framework for understanding the compellingness of many domains in terms of the same psychological foundations. This paper is organized by the foundations, not domains. That is, I do not have a section on religion, and another on the arts, and yet another on sports. Instead, the following sections describe how each foundation can inform compellingness in a wide variety of domains.

Social Information

Many animal species are solitary, but *Homo sapiens* is not one of them. Our ancestors have lived in richly social environments since before we were even human beings. Our very survival, then as well as now, depends on understanding and navigating a network of other people. The dominant theory of human evolution holds that we spent a great deal of our evolutionary history (as human beings) in groups of nomadic hunter-gatherers. For those ancestors, as is true of hunter-gatherers today, survival depends on cooperation. Without others, access to food and shelter, as well as protection, was greatly enhanced by coordination with a social group. Reproduction and child-rearing are also facilitated by cooperation.

Several theories have even suggested that an increasing social reasoning ability was the reason for the explosion of general intelligence and brain size that human beings enjoyed during this era (Humphrey, 1976). These selection pressures, both cultural and biological, resulted in a human mind exquisitely tailored for paying attention to, perceiving, and thinking about people. These theories include the Machiavellian intelligence hypothesis (Byrne and Whiten, 1988), the Vygotskian intelligence hypothesis (Moll and Tomasello, 2007) and the social brain hypothesis (Acedo-Carmona and Gomila, 2016; Dunbar, 1993).

Even a casual look at the arts reveals that most art is about people. Static plastic arts (paintings, sculpture, drawings, and so on) can be abstract, but more often than not feature depictions of human beings. In a survey of art works from an art history book, Davies and McManus (2014) found that 78% of the works contained depictions of at least one human being. This was not affected by historical periods. This trend is most clear in narrative arts (those that tell stories, such as written fiction, film, theater, and so on). Even stories that are about animals or aliens often anthropomorphize — the characters in the stories are *psychologically* humanlike, be they the fish in *Finding Nemo* or the droids of the Star Wars franchise. Indeed, the whole concept of what a story is, in the artistic sense, is nearly incomprehensible without referring to characters in conflict. Even non-narrative dance performance, too, is about people, in that we are watching people move, often in emotionally expressive ways.

Music is perhaps the most abstract of the arts, and instrumental music serves as an interesting challenge to the social information foundation. However, at least in the Western world, music with lyrics (sung by people, of course) are much more popular (Ren and Kauffman, 2017), and the themes of popular songs tend to be about evolutionarily important social issues, such as love, sex, and interpersonal conflict (Hobbs and Gallup, 2011). Songs purely about inhuman phenomena, such as gravity or how wood decomposes, are much rarer. There is also evidence that melodies are better remembered when sung than when played on a musical instrument (Weiss et al., 2012), and that the emotional impact of instrumental music mimics that of speech prosody (Lui et al., 2018). As neuroscientific evidence suggests that human voice sounds activate more brain regions than non-voice sounds (Levy et al., 2001), it makes sense that the compellingness of the human voice informs even our preferences for, and reactions to, instrumental music.

We can see that nearly all sports involve human participants (animal sports, such as dog racing, are much less common and popular).¹ It is interesting that even with an entire field of sports psychology, relatively little work has been done to explore the psychological reasons people enjoy watching them. But we can

¹None of the ten most popular sports in the world involve non-human animals. See <https://www.worldatlas.com/articles/what-are-the-most-popular-sports-in-the-world.html>

use features of sports to speculate on why we find them fascinating. Most sports are competitive, suggesting that sport might be, in part, symbolically standing in for violent struggle. The kinds of skills required for success in many competitive sports are those same skills that would be useful for combat and other physical skills useful for hunter–gatherers, and are hard-to-fake indicators of general health (running, avoiding, hitting, use of strength, speed, and so on). It is also noteworthy that people tend to root for athletes and teams that represent them, often through geographic affiliation, such as one’s local basketball team. In other words, our interest in sports spectatorship makes sense in light of our interest in people and competition between groups and individuals. If we look across animal species, we can see many examples of non-violent competition that superficially resemble violence (Arnott and Elwood, 2009). Crabs, for instance, will often avoid an all-out fight by waving their claws around (Glass and Huntingford, 1988). When it is clear which crab would win the fight, the loser of the competition backs down and neither crab gets hurt. Mantis shrimp will engage in “ritualized fighting,” delivering non-lethal blows to each other in contests over territory (Green and Patek, 2018).

There is also evidence that compellingness of social information affects beliefs. Casual observations of the way we interact with beliefs suggest that belief systems couched in terms of human-like stories are more easily processed. Science educators sometimes anthropomorphize inhuman forces to help students understand scientific principles (e.g., “the water wants to find its level,” McGellin et al., 2021; Zohar and Ginossar, 1998). Anthropomorphization of non-human entities is common in children, and gradually fades, suggesting that the attribution of folk psychological states to inanimate objects is a part of a genetic predisposition (Carey, 1985). At four years of age, many children believe that *all* motion is intentional (Smith, 1978).

The importance of social information also helps understand the prevalence of conspiracy theories, which are belief systems that are almost completely composed of *psychological* explanations for poorly understood phenomena. For example, most scientists believe that the HIV virus jumped from non-human primates to humans. They believe there is a *cause*, but not a *reason*. Many people find explanations such as this are unsatisfying, as though a part of our mind wants a reason couched in terms of human motivations, above and beyond some physical cause. As a result, one conspiracy theory surrounding the etiology of HIV involves a government conspiracy to create a virus to kill minorities (Nattrass, 2012). Some currently believe that COVID-19 is a biological weapon (Nasir, Baequni, and Nurmansyah, 2020). The fact that nearly all conspiracy theories are essentially explanations based on secret human motivation suggests that social information is a large part of their appeal. Unfortunately, the little laboratory research that has been done has not always supported this hypothesis. When participants are given explanations for phenomena couched in terms of mechanical

forces versus belief and desire categories, they are actually more willing to accept mechanical explanations than anthropomorphized ones (Schoenherr and Thomson, 2021; Schoenherr, Thompson, and Davies, 2011). Another study found that anthropomorphized science explanations did not lead to impaired understanding (McGellin, Grand, and Sullivan, 2021).

There is a great deal of evidence that a key part of religions worldwide and throughout history is the belief in anthropomorphic supernatural beings. Atran (2002, p. 4), for example, even includes belief in supernatural agents as part of the definition of a religion. Guthrie (1993) presents a review of evidence for our tendency to perceive animacy, and humanity in particular, in a wide variety of natural phenomena. The explanation for this is that animate living things are simply more important in the natural environment than inanimate things, resulting in a hypertrophy of attribution of agenthood (Boyer, 2001).² Specifically, people attribute humanlike *minds* to gods (as opposed to human physiology, see Shtulman and Lindeman, 2016). Events without obvious physical causes are often supposed in religion to be caused by the intentions of gods (Atran, 2002, p. 66).

But it goes further than that — just as in conspiracy theories, religion provides the desired *reasons* for things, sometimes even in the face of obvious physical causes. Indeed, magical thinking often accompanies, rather than simply replaces, explanations that scientists might offer. In particular, physical explanations seem to satisfy the epistemic need for causes, but often not for reasons. For example, anthropologist E. E. Evans–Pritchard was working at a site in which a house collapsed and killed some people because the structure had been weakened by termites. The informants speculated on what those people might have done to bring the disaster onto themselves. The anthropologist suggested to the informants that they knew about the termite cause, but the informants still felt that there was more explanation needed — why did that house fall at that time, on those people (Evans–Pritchard, 1937, pp. 69–70)? Because the contemporary scientific worldview does not hold that physical accidents always have some reason associated with that person’s previous social behavior, science does not provide satisfying answers to those who assume that they do have some reason. This makes them draw on explanations from realms of religion and the supernatural.

Valanced Emotions

Some things are good for us, some things are bad for us, and others are, for the most part, irrelevant to our evolutionary interests. It makes sense that animals would evolve to find important those things that were relevant to their

²Boyer’s (2001) attribution of agenthood is also known as agenticity (Shermer, 2012), overactive theory of mind, hypersensitive/hyperactive agency detection device (Atran and Norenzayan, 2004; Haidt, 2012), or anthropomorphism (Guthrie, 1993).

survival and reproduction. We evolved emotional responses to things according to how they can help or harm us. Broadly speaking, things that can harm us often generate a motivating negative emotional response, which I will refer to here as “negativity,” and things that can help us give us positive affect (positive feelings associated with pleasure, or the anticipation of pleasure), I will refer to with the shorthand of “positivity.” We evolved to feel balanced emotions (positivity and negativity) for certain environmental stimuli,³ and as such, contemporary stimuli that evoke hope or negativity will be compelling, even if they have nothing really to do with our survival and reproduction — for example, a horror movie. The generation of positivity or negativity is the second foundation of compellingness — emotional stimuli are more compelling.

Positive Emotions

When we see food that can nourish us, people who might make good mates, and other things that help us achieve our implicit adaptive goals, as well as our explicit, day-to-day goals, we get a feeling of positivity or enhanced motivation. Positive feelings can result from achievement of goals or in the anticipation of goal achievement, but they can also result from what we might view as “cheats.” Fantasizing, using cocaine, playing videogames, or being in denial all might result in positive feelings in the absence of any real accomplishment, bypassing the normal routes to gratification of our ancestral past.

How can positive and negative emotions help us understand what we find compelling in the arts? Many of the reasons we like to experience art (be it in a painting, a television show, or a story told to us) are the same reasons we are interested in the things that those artworks represent. That is, things that give us positivity and negativity in real life give us the same emotions, perhaps attenuated, when they are experienced as represented in art. When I’m talking about art I’m talking about the most popular kinds of art, that is, art that is consumed most often. In modern Western culture, this means all of the advertising, popular television, music, and so on. In pre-industrial cultures this means art that communities make for themselves. In contrast, the kinds of art that philosophers often struggle with, like conceptual pieces or found object artworks such as Duchamp’s *Fountain*, are so unrepresentative of most of the art that has ever existed that we can safely treat instances of fine art as outliers — and are so rare and unusual that a *general* theory of art need not even attempt to describe their appeal. Full appreciation of fine art, such as Warhol’s *Brillo Soap Pads Boxes*, requires knowledge of art history and context, and an understanding of art venues (such as museums)

³There is an important nuance here: the emotional response is more accurately described as the result of an appraisal (Sherer, Shorr, and Johnstone, 2001). Food looks appetizing, and can generate a positive emotion and drive, but the same food might evoke nothing, or even disgust, if the subject has already eaten their fill of it.

where art is displayed (Bullot and Reber, 2013, p. 125), lessen the cross-cultural effects described in this paper.

Indeed, when we look at the kind of paintings that people with no particular interest in art prefer, they like outdoor landscapes, rather than non-representational pieces (Barrow, 1995; Wypijewski, 1998). This corresponds to research showing that being in actual nature improves cognition (Hartig et al., 2003) and makes us happier than being indoors, even though we often think it will not (Capaldi et al., 2014; Nisbet et al., 2009; Nisbet and Zelenski, 2011). The landscape images people prefer tend to correspond to the kind of places in which people would prosper. Before the age of eight, children tend to prefer landscape images depicting where humans spent most of their evolutionary history — the African savanna. After that, people tend to prefer looking at images of the environment they grew up in (Balling and Falk, 1982; Orians, 1986; but see also Lyons, 1983 for a dissenting opinion). Farmers prefer landscapes depicting good farmland (Lyons, 1983), and people tend to prefer images of more rugged landscapes as they transition from childhood to adulthood, presumably because they are better able to traverse it (Synek and Grammer, 1998). Popular landscapes feature good places to camp — views from a vantage point of refuge, with animals, vegetation, and water, from high up (Appleton, 1975; Buss, 2016; Mangone et al., 2021; Orians and Heerwagen, 1992; Sporre and Stich, 2010). These results suggest that the landscapes people like are based on environments that are adaptive, and for that reason we evolved to get positive feelings when viewing them, be they in real life or in representation.

This effect of liking or disliking *representations* of things because of our reaction to *actual* things is not restricted to landscapes. Much of our appreciation of external representations, be they pictures, movies, or recordings, depends on parts of our brain failing to completely distinguish representation from reality. Using the rough classification of System 1 and System 2, representing the evolutionarily older, faster, more hard-wired brain functions versus the newer, more deliberate, slower, multipurpose brain functions, we can approximately say that System 1 subsystems can't effectively distinguish representation from reality (Stanovich, 2004). For example, your fusiform face area reacts the same way whether it's looking at a flesh-and-blood person in front of you or a picture of a face in a magazine. That we respond to representations and reality so similarly is so obvious that scientific papers will sometimes refer to pictures of faces simply as "faces" (Kanwisher and Yovel, 2006). Pictures of snakes elicit fear emotions like actual snakes do (Landová et al., 2012). A large part of why we find many works of art compelling is simply because much of our brain thinks that what the art depicts is real. System 2 knows we are only watching a movie, but System 1 is scared of the zombies.

Positivity is also a factor in the kinds of beliefs we find compelling. There is a great deal of evidence that people are more likely to believe things that make

themselves or the group they identify with look good (Alicke and Sedikides, 2009; Taylor and Brown, 1988), and are less likely to believe facts that are perceived as counterevidence for belief structures they already have (Nyhan and Reifler, 2010; Pennycook and Rand, 2021).

Negativity

We are extraordinarily sensitive to dangerous information. The well-established *negativity bias* means that we pay attention to and better remember stimuli that cause negative affect (Baumeister et al., 2001; Hilbig, 2009). For example, we are faster at detecting words in stimuli when they are negative (Nasrallah et al., 2009). Fear changes our mental state to prepare for danger, and has effects on shifting attention, weighting of goals, sensitizing perception, as well as the priming of certain actions, such as fighting, freezing, and running (Dutton, 2009, p. 25; Klein, 2002).

We can see evidence that this effect is in part due to evolutionary pressures on the targets of phobia. The most common phobias concern ancient dangers, such as heights, closed spaces, snakes, and spiders, rather than the most common dangers of the modern world, such as knives and cars (Seligman, 1971). Even monkeys have a built-in propensity to learn to fear snakes (Cook and Mineka, 1990; though evidence is not conclusive, see Tierney and Connolly, 2013).⁴

Although people tend not to hang frightening pictures on their walls, we are nonetheless compelled by disturbing imagery (some theories of negative emotions and art ignore the idea that negative emotions can contribute to how compelling a work is, e.g., Silvia and Brown, 2007). In particular, many people enjoy horror movies, which generate billions of dollars of revenue every year (Polák et al., 2020). The question of why people willingly submit themselves to stimuli that will (and indeed, because it will) generate negative emotions seems mysterious (the “paradox of horror,” Gaut, 1993), but it is consistent with the attention we pay to other negative events, such as car accidents, fights, and house fires. We like horror movies for the same reason we rubberneck traffic accidents — because a deep part of our mind thinks that this is important information for our own survival (the reason people like sad movies is different — we tend to find compelling only those sad movies that are “moving,” which, when seen, generate positive affect; see Hanich et al., 2014). According to the threat simulation theory of dreaming (Revonsuo, 2000), a main function of dreams is to mentally rehearse dangerous situations, particularly those relevant to our ancestral environment. But we dream about modern dangers, too, and the fact that people often have nightmares about

⁴Negative responses to animals involve both fear and disgust (which are correlated at a rate of $r = .72$). A spider, for example, is both scary and disgusting to people, where a bull is scary but not disgusting (Polák et al., 2020).

horror movies further suggests that parts of our brain don't know it's just a movie — so we dream to practice what we'll do when the zombies come for us, because System 1 thinks we have seen such things happen to other people in our community. Situations we feel negative about are not pleasurable but can be compelling because they feel important.

The negativity of statements affects our belief in them. Assertions that feel important are more likely to be believed. We can see this for things that we are afraid of (Hilbig, 2009), in that people are more likely to believe generalizations about dangerous things than they are about positive ones (Cimpian et al., 2010). News media are compelling, be they television, radio, in print, or on the internet, and the popular news favors negative stories (Soroka, 2012), and news has gotten more negative over time (Pinker, 2018, p. 50). People prefer to read negative stories, even though people appear to be unaware of this preference (Blaine and Boyer, 2018; Trussler and Soroka, 2014). One newspaper reported a drop in readership by two-thirds when it tried to have only positive headlines (“Russia: ‘Good News Day,’” 2014). When consuming negative news stories, people are more aroused, and have stronger and longer reactions (Soroka and McAdams, 2015). Similarly, contemporary legends (popularly known as “urban legends”) are more likely to be retold if they are scary (Fox Tree and Weldon, 2007). Rumors, too, tend to be negative, with sometimes devastating consequences. For example, increased polio deaths resulted from the rumors that the polio vaccine causes polio (Boustany, 2005), and we see similar problems with the “anti-vaccer” movement in contemporary society.

The discomfort associated with anxiety, uncertainty and chaos tends to lead people to supernatural beliefs, superstitions, and religion. In particular, people often resort to supernatural explanations of negative events, whether these explanations are taken from one's culture or constructed on the spot. These effects have been observed in anthropology as well as in laboratory experiments (Epley et al., 2008; Gray and Wegner, 2010; Kay et al., 2010), suggesting that the origin of many religious beliefs and rituals, as well as their continued popularity, might be the result of a psychological reaction to uncertainty in the environment, and uncertainty is often a negatively valenced experience. For example, Malinowski (1948) found that the Trobriand fishermen had more superstitious beliefs and rituals concerning fishing in the open ocean than in the lagoon, where catch sizes have a much lower variance. In baseball, we see superstitious rituals more often when playing positions with highly unpredictable outcomes (pitching and batting) than for more predictable ones, such as outfielding (Gmelch, 1971). Even pigeons engage in “superstitious” behavior when faced with an unpredictable environment (Skinner, 1948). Individual differences in the perception of randomness predicts belief in the paranormal — people who think that rolling three 2s in a row on a die is unlikely to be due to chance are more likely to have paranormal beliefs than others (Brugger et al., 1990).

There is a common belief that one of the reasons that religion is so popular is that it gives its users freedom from negativity and hope for something better. We can see evidence of negative emotion making religion compelling at a societal level — religions thrive where life is hard. Religion is more prominent in societies that are dysfunctional (Paul, 2009), have a lower standard of living (Rahman et al., 2011), have higher income inequality (Ruiter and van Tubergen, 2009), and have less overall trust (Berggren and Bjornskov, 2011). Negative feelings of any kind, including fear (Ahmed et al., 2011), anxiety (Jackson and Francis, 2004), loneliness, thinking about death (Norenzayan and Hansen, 2006), or financial or physical insecurity (Bartkowski et al., 2011), all correlate positively with religiosity. It might well be that religion provides a buffer to stress (Clark, 2018, p. 125). Many believe that religion's ability to give people a sense of hope is the only explanation for the existence of religion. But though the big five religions⁵ tend to have relatively hopeful outlooks, many religions feature supernatural entities that are feared and not a source of comfort at all — examples include Melanesian witchcraft (Boyer, 2001, p. 19), and pre-Columbian Mexican and Mayan religions (Atran, 2002, p. 75). It is tempting to think that hope is the primary reason many religious people believe in an afterlife; it relieves us of a fear from death. Although this is likely to be a factor, it is complicated by a few empirical facts: across religions, not all afterlife scenarios are happy (Guthrie, 1993, p. 13). And even within the big five religions we see differences. Contemporary Christians do not really believe they are going to hell, but Muslims are more likely to, and as a result have more anxiety about death than have the non-religious (Ellis et al., 2012).

Positivity and negativity might be looked at as the opposite ends of some psychological continuum (Ellsworth, 1991), so why should they both be compelling? The effects of negativity on how often news stories are shared on social media are mixed. Acerbi (2022) found in an experimental setting that negative and threatening news-like stories were more likely to be shared on social media. However, Berger and Milkman (2012) found the opposite effect, that viral information tended to be positive. The latter study used actual news articles as materials, where the Acerbi study used stories made up for the experiment. Looked at in this way, the extreme ends of this spectrum are compelling, and the center is less so (Kauschke et al., 2019). These two conflicting drives stem from different psychological needs: our need to attend to what can hurt us versus what can help us. The things that won't make our lives any better or worse are less compelling.

Patterns

The essence of prediction is noticing patterns in the world. As prediction helps people reach their goals, be they personal (such as one's in-the-moment desire to

⁵ The "big five" religions are the five religions that are most popular and influential today: Christianity, Islam, Judaism, Hinduism, and Buddhism.

eat peanut butter) or evolutionary (the free-floating genetic “goal” to reproduce that might manifest in phenotypical sexual desire, Dennett, 2017, p. 87). Perceiving patterns means we have detected some regularity in the world that might be exploited in the future. We evolved to find pleasure in the detection of patterns (Gopnik, 2000). As a result, the detection of patterns is one of the foundations of what we find compelling. When we experience something that we can detect patterns in, particularly discovering new patterns we have not yet habituated to, we like it more.

Patterns range from simple texture patterns across space, which help us perceive surfaces and distance, to complex patterns over time, such as motifs in music, or to the recognition of a similar plot structure across films in the same genre. Of course, there are great individual differences in what patterns we have noticed in the past, and this will influence what each of us finds compelling. Expertise in any field means that more patterns are available for perceptual processes to detect. We all differ in what patterns we can perceive, and knowing a field better allows one to detect more patterns. What might seem new and interesting to a novice does not arouse the expert to the same extent. We see evidence across domains: art experts prefer more abstract and conceptual paintings (Hekkert and van Wieringen, 1996) and car experts prefer cars with more unusual designs (Hekkert et al., 2003). Simply exposing participants to innovative car designs in the laboratory results in a preference for even more innovative designs (Carbon and Leder, 2005).

Visually, we are particularly sensitive to the pattern of bilateral symmetry (Reber, 2002). Boyer (2001, p. 133) speculated that this was because when an animal appeared as bilaterally symmetric, it was more likely to be facing you. We find symmetry in people attractive, possibly because it is (weakly) indicative of high intelligence (Prokosch et al., 2005).

Recognition or familiarity is often triggered by the sensing of a pattern. The delight we get from patterns manifests itself in the perceptual fluency (or facilitation) effect, which is that we tend to like things better when they are easier to understand and process. We perceive familiar stimuli as being visually clearer (Whittlesea et al., 1990), louder (Jacoby et al., 1988), more pleasant (Zajonc, 1968), longer, more recent (Whittlesea, 1993), more attractive (Winkielman et al., 2006), and more truthful (McGlone and Tofiqbakhsh, 2000). Even stocks perform better when they have pronounceable names (Alter and Oppenheimer, 2006), presumably because they trigger pattern detection more strongly than unpronounceable names.

Simple repeated exposure is enough to facilitate some stimuli. This has been found with faces, as in the false-fame effect (Jacoby et al., 1989), but also works with ideas. Statements seen repeatedly are rated more likely to be true, even when people are told beforehand that the statements are false (Begg et al., 1992). The increased facilitation makes them more believable (Kuran and Sunstein, 1999).⁶

⁶Note there is also an effect of social pressure, e.g., social proof (Sherif, 1935), the bandwagon effect, the herd instinct, or simply “conformity” (Asch, 1951; Goidel and Shields, 1994).

Statements written in a color that is more difficult to read (Reber and Schwartz, 1999), or spoken in an unfamiliar accent (Lev-Ari and Keysar, 2010) makes people find them less believable (Adee, 2012). Statements that rhyme (such as “woes unite foes”) are judged as being more accurate than semantically-similar statements that do not rhyme (such as “woes unite enemies”). A perceived rhyme is an additional pattern associated with the statement, increasing its compellingness (McGlone and Tofiqbakhsh, 2000). Paintings that are understandable are better liked (Szubielska et al., 2021).

Finding patterns is so crucial to survival and reproduction that humans evolved not only to find pleasure in finding them, but to be hyper-sensitive to them as well, as evidenced by our tendency to experience patterns even in random data.⁷ People are more likely to make inaccurate inferences about their environments when their sensory link with reality is compromised, be it through drugs, dreaming, stress, or sensory deprivation (Previc, 2006, p. 526). Unexpected and unusual misfortune, in particular, tends to be interpreted as punishment from gods or witches in religions worldwide (Boyer, 2001, pp. 169–194).

It could be that religiosity is partly explained by the over-reaching of our pattern-making tendencies. Many mental illnesses, including mania, schizotypal disorder, and schizophrenia, are correlated both with higher religiosity and a greater sensitivity to perceived patterns, real or otherwise (Rogers et al., 2009).⁸

It is likely that an overactive pattern detection system also explains a good deal of people’s beliefs in conspiracy theories (Bruder et al., 2013). First, people who believe in one conspiracy theory are likely to believe in others, and people who don’t believe in any particular conspiracy tend to not believe in any of them (Swami et al., 2011). This suggests that there are traits that facilitate belief in conspiracy theories in general. Conspiracy theorists tend to be angry, mistrustful, feel alienated from society, and feel helpless over their lives (Abalakina–Paap et al., 1999; Dyrendal et al., 2021). Recall that lack of control, and chaotic environments in general, tend to increase magical thinking. People primed to feel out of control see more patterns in random stimuli (Whitson and Galinsky, 2008).

Because pattern detection is so adaptive when perceiving the natural world, we carry that preference into the arts. Pattern is used to great effect in all of the arts, from limited color palettes in paintings, to shape patterns in computer generated fractal imagery (Aks and Sprott, 1996), to repeated symbols in fiction, to “reincorporation” in theatrical improvisation (Johnstone, 1999) and “call-backs”

⁷ The illusory detection of pattern in random information is known variously as the clustering illusion, pareidolia, apophenia, patternicity (Shermer, 2012), and illusory correlation.

⁸ Schizotypy is more common in cult members and religious people than in the general population, but persons with psychosis in general tend to be less religious (schizophrenia is a kind of psychosis; Previc, 2006, p. 514). Further complicating the picture, relatives of schizophrenics tend to be more religious (Gilovich et al., 1985).

in stand-up comedy, to the use of a “leave-behind” in film (or “Chekov’s gun,” Mar and Oatley, 2008). An analysis of music found that 94% of musical passages (motifs) were repeated elsewhere in the same work (Huron, 2006).

Two components of compellingness, which we might think of as *liking* versus *wanting*, have different brain processes, according to some researchers (e.g., Berridge, 1996; Litman, 2005). The wanting system is often triggered by interesting aspects of stimuli, is associated with drive, desire, and compulsion (Gopnik, 2000; Labroo and Pocheptosova, 2016; Zeki, 2004) and appears to work through divisions of nucleus accumbens and amygdala, and mesotelencephalic dopamine systems. Interesting aspects of stimuli trigger wanting, as will be covered in more detail in the section on incongruity.

Liking, in contrast, is associated with pleasure and appears to work through the GABA/benzodiazepine, opioid, and cannabinoid systems. Often liking and wanting feelings happen at the same time, as when we eat a delicious food — we like it and want to eat it. But they are distinct neural systems that can be dissociated. Some people with addictions, for example, experience much craving but little pleasure. They compulsively keep doing their addictive behaviors not for the pleasure it brings but merely to reduce the feeling of needing to engage in the behavior (Litman, 2005). Like picking a scab, we sometimes have urges to do things that generate no pleasure. It could be that many compulsions are like this, as in the rituals of obsessive–compulsive behavior. The opposite, perhaps, can happen too. We might describe the way some people approach art as a detached aesthetic experience, characterized by high liking but low wanting (Chatterjee, 2004; Marsolais, 2003). The detection of patterns is more strongly associated with *liking*, where incongruity (the subject of the next section) is more strongly associated with *wanting*.

Pattern and incongruity can both be compelling, but, like positivity and negativity, are fundamentally at odds with each other. For example, in simple polygon stimuli, complex stimuli are judged to be most interesting, but simple ones are rated as more enjoyable (Day, 1967). People also prefer moderately complex music (North and Hargreaves, 1995). But unlike positivity and negativity, pattern and incongruity must both be present for the most compelling stimuli: there is a balance. Pattern seems to increase pleasure, and incongruity increases interest and motivation to understand (Silvia, 2006, p. 8). Too much pattern and there’s nothing to learn (e.g., a white wall represents a pattern in that it is a repeating expanse of the same color), and too much incongruity and we lose faith that there’s anything there to be discovered (e.g., white noise has high information, from an information–theoretic perspective, but is not interesting). Both cases result in a lack of interest. I will return to this topic at the close of the next section.

Incongruity

Although it is well-established that pattern-recognition and fluency increase the liking of stimuli, there are also clear effects of compellingness in what appears to be the opposite characteristic: incongruity. For my purposes, information has incongruity when it involves something poorly understood, ambiguous, novel, uncertain, unusual, challenging, complex, or contradictory. My suggested solution to this puzzle is twofold: first, in line with Berlyne (1960), optimal compellingness is often found in the mid-range between the overall understandability and complexity of stimuli. Second, whereas patterns make things compelling because they are pleasurable, incongruity makes things compelling because incongruity makes them *interesting* (Berlyne, 1960; Silvia, 2006), triggering the wanting system described in the preceding section. When participants are asked whether they “like” a work of art, for instance, they very well might be responding positively in the presence of either pleasure or interest. For this reason it very well might be the case that empirical studies that show that interesting stimuli are “liked” conflate two psychological responses, both relating to compellingness. Turner and Silvia (2006) found that some paintings were rated as of high interest even when they were rated as low in enjoyment and pleasantness. A sense of incongruity often arises in the presence of complexity, novelty, ambiguity, conflict, and uncertainty, all of which increase interest (Silvia, 2006, p. 25), suggesting that they all load on a common factor (Evans and Day, 1971).

Even monkeys will engage with puzzles and will sometimes prefer doing them to gathering food (Harlow, 1953). Humans are the slowest-developing species in Mammalia (Richerson and Boyd, 2008, p. 136). We are curious creatures, born with few mental abilities but a great capacity and desire for learning (Hebb, 1949). When something holds the potential for us to understand it, it is more likely to be compelling (Izard and Ackerman, 2000; Silvia, 2006). We want to figure it out. It is very telling that a great deal of the findings in developmental psychology of infants *requires* this to be true. The often-used “looking paradigm,” in which researchers pay attention to when an infant perks up and looks longer at something, only works because of our species’ natural, intense curiosity. When do infants look longer? The same times adults do: when they perceive incongruities they expect (perhaps tacitly) that they can resolve with attention.

In the arts there is a very old folk idea that good artworks have “uniformity amidst variety” (Hutcheson, 1726/2004). Although the axis is sometimes described as one of simplicity vs complexity, empirical studies since the late 1800s have found evidence of the balance between pattern and incongruity in visual stimuli (Birkhoff, 1933; Eysenck 1941; Munsinger and Kessen, 1964; Smets, 1973; Witmer, 1893), even when incongruity, or complexity, was formalized in different ways (for a review of conceptions of visual complexity see Donderi, 2006). Berlyne (1960) and White (1959) introduced the factor of arousal: there appears

to be an inverted U-shaped curve where pleasantness of a stimulus was low with low arousal (or complexity), then climbed, and finally descended again as arousal (or complexity) got too high. Yerkes and Dodson (1908) found that performance grows with physiological and mental arousal, but not if there is too much. The foundations of pattern and incongruity in the framework presented here builds on this previous work by suggesting that this inverted U-shaped curve applies not only to sensory information, but also for that of stories, explanations, and more, as I will now describe.

Patterns and incongruity can be perceived over space (as in a painting) or time (as in a film or a piece of music). As we notice patterns, pleasure increases, but then, when there's nothing new to figure out, interest wanes. Simple patterns are quickly classified as pleasing, but this feeling rapidly diminishes over time. Moderately complex images get more pleasing over time, to a point, and then start to decrease (Day, 1967).⁹ As we habituate to patterns, we seek novel stimuli to maintain interest, suggesting that there is an exploratory drive we (and other animals) will work to satisfy (McClelland, 1953). White (1959) surveys numerous findings showing cross-species drives for exploration and novelty-seeking.

We can look to popular music to see how songs manipulate the curiosity generated by incongruity and the pleasure generated by the detection of patterns: many popular songs begin with a simple melody or rhythm, and after eight or 16 bars will introduce another sonic element. Just as we detect the pattern in the music, a new element is introduced to re-capture our interest. At a broader level, a song might have two verses with the same melody before introducing a chorus. And after the verse-chorus pattern is established, a bridge is introduced. By skillfully introducing new patterns just as old ones become less interesting, composers are able to make songs that are pleasurable and satisfying for their entire duration.

Too much incongruity can also strike people as boring because they have no hope of finding patterns. In landscape art, for example, people prefer moderately complex landscapes, finding impenetrable jungle scenes as well as simple plains scenes less attractive (Kaplan and Kaplan, 1983). There are similar mid-range effects found in music appreciation (Bhatara et al., 2011). Being *forced* to perceive information that is too simple or too complex (for example, by having to sit for an hour in a waiting room) can result in increased stress, which supports the idea that mid-range complexity is maximally pleasant (Taylor et al., 2005).

In architecture and park design, spaces are made more inviting by hiding things — curved trails in parks and residential areas invite exploratory movement in a way that straight paths and roads do not. This is likely why museums are often designed as a series of connected rooms, rather than rooms branching off of a

⁹ Museum curators sometimes refer to great artworks as being “bottomless,” meaning that no matter how often you return to them, there is always something more you can get out of them (Csikszentmihalyi and Robison, 1990).

central hallway, like many homes and offices are (Wineman and Peponis, 2010). If an individual can see the entirety of a room, they will be less likely to enter and explore it. As such, museums put extra walls to occlude the backs of rooms so that people will feel a desire to walk around the walls to see what is behind them (Rohloff et al., 2009).

In narratives, certain kinds of important information get deliberately left out to entice the audience to continue consuming the story. Headlines and chapter endings often offer “hooks” that make one want to read further, as opposed to revealing the content right away. The hook is often some narratively important question that is raised but is as of yet unanswered. Even in scientific papers, we see some titles that basically summarize the conclusion, and others that merely ask the question, requiring you to read the paper to know what it found (e.g., “Does Chaos Make You More Religious?” versus “Chaos Makes You More Religious”). It is common now for online article headlines to only tease the content (commonly known as “clickbait”), sometimes containing phrases like “what happened next will astound you.”

The compellingness of incongruity can be seen in sports fandom, as well: as much as people prefer their favorite sports teams to win, people prefer to watch a close game than one in which their team wins by a large margin. Not knowing how the game will turn out makes us want to keep watching (Paul et al., 2011), demonstrating just one of many ways that incongruity makes sporting events compelling.

Quotations, too, are made more memorable and likable when they exhibit incongruity in the form of an apparent contradiction. For example, “if you don’t stand for something, you’ll fall for anything,” and “less is more,” and “art is the lie that tells the truth” are all made more compelling by including opposites. “Less is more” really means “less is sometimes better,” but the latter does not sound as profound. Incongruity can also be leveraged to understand the compellingness of funny stimuli. Puns, for example, are essentially incongruities that play with double meanings. A saying like “forbidden fruit creates many jams” benefits from the incongruity generated by the pun. It is likely, in fact, that all laughter is generated through a reaction to incongruity. The dominant theory of why we laugh is the relief theory, which holds that laughter is a communication that what appears to be dangerous is actually safe: there has been a false alarm, or a “benign violation” (McGraw and Warren, 2010). This explains why most laughter happens in the presence of nothing funny at all. For instance, people laugh on roller coasters, or when they see someone they know in a place they didn’t expect. Because laughter communicates safety in the presence of something apparently dangerous, even tickling is explained by the benign violation theory: tickling only happens on vulnerable parts of the body that are being stimulated but, importantly, not actually being harmed. Being stabbed on the bottom of your foot does not tickle, because it is a violation that is not benign. Apes and rats also have laughter, though at least in rats it is too high-pitched to hear (Panksepp and Burgdorf, 2003), suggesting

that the laughter response is evolutionarily old. We laugh at jokes because the situation or punchline is somehow incongruous — a violation (Katz, 1993). But because telling a joke is in a safe context, it counts as a benign violation. Although many comedians and comedy writers include shocking or disturbing material, in these cases it is the very violation of social norms in a (relatively) safe context that provokes the laughter response. If these jokes were truly hurtful to an individual the response is not laughter. As such, for such “unsafe” comedians, audience members will often disagree about whether the jokes are funny or offensive.

Scholars of religion have found that the supernatural entities that religions tend to have follow some striking patterns related to the incongruity foundation. Supernatural entities, which include things like ghosts, deities, bleeding statues, or persons with magical powers are members of some class — say, inanimate objects, but, importantly, with one or two features from another class. For example, a tree that can listen to conversations is a tree in all respects, but it has one feature from the class of people. These classes correspond to “core knowledge theories” (Carey and Spelke, 1996): systems of belief and understanding (including an ontology) about large classes of things in the world. Supernatural entities are surprising and counterintuitive, but because the features that violate the entity’s primary class are few, they are known as “minimally counterintuitive” ideas. Experimental studies show that these kinds of minimally counterintuitive or “counterontological” concepts are better remembered and thought to be more plausible as part of some real religion, in comparison with mundane ideas (with no counterintuitive features, such as a baby with a birthmark) or merely counterfactual ideas (such as a baby who can cook soup¹⁰ that do not break ontological boundaries, or ideas that break too many boundaries (Atran, 2002; Lindeman and Aarnio, 2007; for a skeptical view see Purzycki and Willard, 2015). The fact that religious ideas break some (but not too many) boundaries suggests, again, that maximally compelling information in many domains has a balance between pattern and incongruity (McReynolds, 1956), much like many other compelling stimuli discussed in this paper. This effect can also be seen in stories with fantasy elements. The metamorphoses that happen in stories tend to be between similar (but not identical) kinds: people to animals, rather than to plants (Kelly and Keil, 1985). The most famous Grimm’s Brothers folktales were those whose supernatural features were minimally counterintuitive (Norenzayan et al., 2006).

Successful sacred texts are written with a certain degree of ambiguity, and religious leaders will sometimes deliberately speak ambiguously (Whitehouse, 2000, p. 75). Nonsensical statements are more acceptable when provided in a religious

¹⁰ A baby that can cook soup breaks some categorical boundaries (young child vs. adult), but these are not thought to be the primary categories that matter. Although there is disagreement on exactly what these categories are, in every ontology they tend to be very broad, such as material objects, living things, ideas, and humans.

context (Fondevila et al., 2011). Religious communications, including those in scripture, must be interpreted. Generating one's own understanding might make the resulting interpretation more valuable and compelling to the reader due to a version of effort justification (an effect of valuing group membership more if one endured some cost of entry; Aronson and Mills, 1959): an idea is more valuable if it is hard-earned, and people prefer ideas they come up with themselves (the "generation effect," see Slamecka and Graf, 1978). Struggling to interpret something means it is more deeply processed, and potentially more compelling than ideas merely consumed (Davies, 2012). Further, vague information tends to be interpreted in a favorable way (Mishra et al., 2011). Idea effort justification might also help explain some of the appeal of poetry, which deliberately obfuscates language (Dissanayake, 1995), resulting in readers having wildly different interpretations (Richards, 1960), often based on personal experiences (Rosenblatt, 1978).

Incongruity is more compelling when we perceive it to hold the promise of a resolution (Berlyne, 1971, p. 215; "solvability of ambiguity" in Muth et al., 2015; Silvia, 2006). We can think of compelling incongruous things in terms of three categories. The first is "absurdism," where the stimuli might have incongruities for which there is no satisfactory resolution, such as surrealist and Dadaist art, magic shows, so-called "psychic" performers, and zen koans. Second are "puzzles," for which the reader can be expected to come up with their own resolution to incongruities introduced in the stimuli, such as crossword puzzles, most video games, and art whose meaning is coded but potentially decipherable, such as cubism (Muth et al., 2015). And third we have "mysteries," where the resolution is represented explicitly in the stimuli itself. Traditional mystery novels are like this, where the villain is revealed at the end, but this also includes any meaning given later to something incongruous revealed earlier, such as a gun mysteriously seen on the shelf. Musical incongruity, such as a blue note in jazz, can later be resolved with more context, making certain musical patterns "mysteries" as well. Scientific papers are mysteries, in that they ask a question about how the world works (setting up an incongruity) and then at the end reveal the underlying pattern that resolves it. On this classification, riddles are puzzles, but jokes are mysteries. Each of these kinds of stimuli manipulates our sense of interest and pleasure in different ways.

Although incongruity generates compellingness all by itself,¹¹ in interacting with a given stimulus there might be oscillations between interest and pleasure over time (as in the case of a story or music) or as meaning is generated in the mind of the audience while thinking about a static stimulus. Exposure to incongruous stimuli generates interest, but over time can lead to the finding of patterns (e.g., insight, understandings, the "aesthetic aha effect," hidden Gestalts) that then

¹¹ In this paper I focus on responses of average people, but there are individual differences regarding how strong the effect of incongruity is (Furnham and Avison, 1997).

generate pleasure (Leder et al., 2004; Muth and Carbon, 2013; “uncertainty reduction” in Van de Cruys and Wagemans, 2011).

Conclusion

The compellingness foundations framework is an attempt to find human psychological tendencies that stimuli can exploit to generate interest. Because the intended scope is all of humanity, I have glossed over cultural influences on what we find compelling. This is not to deny such influences, as they are great, but rather to focus on cross-cultural foundations on which these cultural influences build, and to explain the broad constraints on cultural variation that we observe. Culture is so powerful that it might have the potential to overturn anything we might propose to be a part of human nature. However, cultural influences that violate our shared psychology will be rare. For example, because fat, salt, and sugar are nutritious but rare in our evolutionary environment, for example, *most* cuisines will favor those tastes. For the same reason I have avoided talking about individual differences, though they are often significant. For example, some individuals have high “ambiguity tolerance” that makes them appreciate incongruity more than others do (Furnham and Avison, 1997; Muth et al., 2015). Although aesthetic preferences regarding art are often thought to be highly idiosyncratic, there is in fact agreement across sex, intelligence, personality, and culture (Che et al., 2018; Winner, 1982, pp. 66–67).

The compellingness foundations might appear disunified, as I have described several independent reasons people find things compelling. Perhaps future scholarship will reduce the number of foundations to a smaller, more fundamental set. But the compellingness foundations framework is valuable because it is the first general theory of compellingness to be proposed — and by “general” I mean attempting to explain *all* of the things we find compelling, including art and all its kinds, sports, religion, conspiracy theories, and so on. The existing theories of why we find things compelling tend to be specific to a particular domain, such as religion (e.g., Boyer, 2001; Guthrie, 1993), or static visual art, such as paintings (Berlyne, 1971).

In summary, a great deal of what makes things compelling can be explained by a framework that holds that compelling things trigger some subset of a few psychological foundations: our interest in people and in social relationships, our tendency to focus on things of potential benefit or detriment to us (positivity and negativity), the pleasure we get from recognizing and discovering patterns, and the drive to understand, which we get from incongruity. Technically, it is the *appraisal* of these things that cause compellingness (Silvia, 2006), rather than the objective qualities of the stimuli, but as people respond similarly in many cases, I have avoided repeating this important nuance in this paper.

An understanding of common psychological tendencies will help cross-discipline research in areas of aesthetics (both empirical and philosophical),

religious studies and the cognitive science of religion, as well as many other domain-specific subfields studying things such as sports, marketing, urban legends, and gossip. These isolated research programs have much to learn from each other.

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