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The recalibrational theory: Anger as a bargaining emotion

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Abstract

This chapter uses the adaptationist program (Williams, 1966) - to predict and explain the major features of anger. According to this approach, anger evolved by natural selection to bargain for better treatment. Thus, the major triggers of anger (e.g. cost impositions, cues of disrespect) all indicate an increased willingness (on the part of the offender) to impose costs on the angry individual. Once triggered, the anger system bargains using the two primary incentives that humans have available to modify others' behavior in favor of the focal individual: the imposition of costs and the denial of benefits. This simple functional sketch of anger is then supplemented with additional considerations needed to address the resultant selection pressures created by bargaining. This process offers functionally sound and theoretically justified explanations for: anger in aggressive and cooperative contexts, the role of apologies and their sincerity, the content of sex-specific insults, the computational structure of "intentionality" in the context of anger, and the origin of the implicit rules of combat.

Keywords: welfare tradeoff ratio; anger; recalibrational theory; aggression

How should a researcher characterize an emotion like anger? One could list features of the emotion, or describe the behaviors that result from it. One could reference the increased blood pressure, the facial changes, and so on. However, without a description of the emotion's function, this approach will be merely descriptive – a list of facts¹, understandable only by rote memorization and explained with shallow metaphors or post hoc analogies (e.g. anger is an aggressive response to personal attacks (Lazarus 1990); or, anger is a steam engine that releases psychic pressure). Evolutionary psychology offers a better explanation rooted in modern evolutionary biology – the same explanation that is routinely used to characterize every organ of every species on the planet except – oddly – the human brain (Tooby, 2020).

What is the evolved function of anger?

Emotions are evolved neural programs that govern perceptual, physiological, cognitive, and behavioral responses to important ancestral problems (Al-Shawaf et al. 2016; Tooby & Cosmides 1990; Tooby et al. 2008). According to the recalibrational theory of anger (Sell, Tooby & Cosmides 2009; Sell 2011; Sell et al. 2017), anger evolved to address a particularly potent ancestral selection pressure: the need to bargain for better treatment. In other words, anger increased our ancestors' reproduction by recalibrating the welfare-consideration mechanisms in the skulls of other humans. Thus, to understand how anger works, we have to understand how humans ascribe value to the welfare of other humans (i.e. if you want to understand a key, you must first understand a lock).

How do humans assign social valuation? Again, a functional account offers a more thorough and satisfying explanation. Over evolutionary time, animals would have faced selection pressures to avoid imposing costs on some subset of their conspecifics. For example, because of the shared genetic interests of kin, selection should have designed mechanisms to identify kin (Lieberman, Tooby & Cosmides 2007) and exploit their interests less ruthlessly than non-kin (Trivers 1974). Similar selection pressures led to the evolution of mechanisms that valued the welfare of others to avoid costly aggressive contests (Hammersetlin & Parker 1982), to avoid harming those who emit positive externalities (Tooby & Cosmides 1996), to preserve a reputation for cooperation (Nowak & Sigmund, 1998), and so on. While often studied separately, these selection pressures would have to have led to an integrated design so that decisions can be made during actual conflicts of interest, where different factors may point in different directions (e.g. do you take a sandwich from a physically formidable but unintelligent second cousin if no one is looking?).

Such considerations led researchers to posit the evolution of a mechanism for computing the aggregate weight one places on another individual (relative to one's own welfare) when making decisions that affect both. This is called the *welfare*

¹ This feature-listing approach may also lead one to conclude that anger lacks biological reality if one finds, as one does, that many anger events lack one or more of the features in the canonical list (cf. Barrett, 2006).

tradeoff ratio (WTR), and it is defined as an internal regulatory variable that is consulted when the organism considers a tradeoff between their own interests and another individual's (Sell et al. 2017; Tooby et al. 2008). The WTR acts as a discount variable when comparing the value of a resource (or action or state of affair) for the self versus the value to another. For example, if a friend wanted you to help them move (say, a value worth approximately 10 units of welfare to your friend) on your only day off (the loss of which would be worth approximately 6 to you), your WTR toward your friend would determine whether you would say yes or not. A WTR of .5 would discount their interests (estimated to be of value 10 for them) by 50%. Thus, mathematically, for organism X considering a tradeoff with organism Y, organism X's WTR-system selects the self-beneficial action whenever: $V_x > WTR_{xy} * V_y$ (where "V" represents the value of the resource). In other words, X will attempt to take the resource (or deny the benefit) whenever they value the outcome more than the other values the outcome, discounted by X's WTR toward Y. Thus, the welfare tradeoff ratio one has toward another is an index of how much one "cares" about the other individual's welfare when making decisions.

With this simple sketch of the human valuation-setting system, we can then derive from first principles how anger bargains for better treatment. The anger system would need to interface with the WTR calibrating system in the other individual's mind and recalibrate the other person's welfare tradeoff ratio so that it places greater weight on the interests of the angry person (Tooby et al. 2008; Sznycer & Lukaszewski, 2019; Sznycer, Sell, & Dumont, in press). This analysis leads to specific predictions that can be tested to determine if anger evolved for that function.

The major features of anger indicate design to recalibrate welfare tradeoff ratios

If the recalibrational theory of anger is correct, each of the major features of anger must be well-designed to bargain for better treatment – usually by recalibrating the target's welfare tradeoff ratio in favor of the angry individual.

Feature #1: Anger activates in response to indications of a low welfare tradeoff ratio

The primary triggers of anger are cues that another has a lower-than-acceptable welfare tradeoff ratio toward the angry person. Such cues are evident – in theory – from many different behaviors, because the weight one places on another's welfare is likely used by many different cognitive mechanisms (see Sell et al. 2017). For example, we attend more closely to individuals whose interests we value highly (e.g. spouses, children, dangerous high-status individuals, beloved cooperators). Therefore, if person X lacks interest in person Y, this may indicate that X holds a low WTR toward Y, and thus trigger anger in Y (e.g., walking away while Y is talking, tossing a free copy of Y's book in the trash, responding with "no" when Y asks if X wants to hear a story).

Sell reports an analysis of naturalistic anger-based arguments that reveal at least twelve computationally distinct triggers of anger (2017). The most common of these is also the most theoretically clear: the target of anger imposes (or indicates a willingness to impose) a hefty cost on the angry person in order to get a relatively small benefit, e.g. refusing to pick up a friend who needs a ride in the rain.

When someone imposes a cost on you, the WTR equation predicts *a priori* the roll of three important variables: the magnitude of the cost imposed on you (i.e. V_x , how bad was it for you?), the magnitude of the benefit the imposer received from harming you (i.e. V_y , what did they get out of it?), and the person the WTR is assigned to (i.e. WTR_{xy} , who did they think they were doing it to?). The lowest WTR_{xy} is indicated when the target imposes a large cost (high V_x) for a small benefit (low V_y), knowingly on the target (WTR_{xy}). Empirical demonstrations across six cultures (including industrial and foraging peoples), confirmed each prediction for both men and women. Anger is more likely to be triggered as the cost imposed on you *increases*, as the benefit for imposing it on you *decreases*, and when the imposer knew it was specifically *you* that would be hurt by their actions (Sell et al. 2017).

Note this account of the trigger of anger can also explain the special role of intentionality in anger. A cost imposition indicates a lower WTR most clearly when the target has advance knowledge of the large magnitude of the cost they were imposing, the small magnitude of the benefit, and knowledge that the cost would be borne by you in particular. This is why a person can – sometimes – successfully diffuse another’s anger by statements such as, “I’m sorry, if I thought it would hurt you that badly I wouldn’t have done it...” and, “I’m sorry, I thought if I didn’t do this I would lose my house!” and “I had no idea it was you in the car, I never would have done that to you if I had known.” The fact that such statements can diffuse anger suggests that anger is not triggered by harm *per se*. Anger is triggered by indications of an insufficiently high WTR. Again, the use of these defenses and their effectiveness at defusing anger has been empirically confirmed across cultures (Sell et al. 2017).

Another common trigger of anger involves cues of “insulting beliefs” (Sell 2017). Because WTRs themselves are calibrated by estimates of traits (e.g. an estimated kinship index regulates WTRs for kin (Lieberman, Tooby & Cosmides 2007), a relative formidability estimate regulates WTRs among men (Lukaszewski et al. 2016; Sell, Tooby & Cosmides 2009), then indications that another person underestimates you on one of these WTR-relevant traits will evidence a lower WTR. If Tony thinks you are stupid, then Tony will hold a lower WTR toward you (assuming your relationship is one in which intelligence is relevant to WTR calibration). This explains why deliberate insults can trigger anger so easily, but also why what counts as an insult differs between different kinds of individuals (e.g. calling a woman sexually promiscuous is more insulting than calling a man such (Preston & Kimberley 1987), because WTRs toward women are calibrated more by sexual fidelity (Buss et al. 1990)). This explanation also accounts for the fact that unintentional insults are still anger provoking; e.g. if a person does not intend to call

you stupid, but nonetheless thinks this, it is still a trigger of anger because the WTR is still impacted by this estimation of your intellect!

Additional triggers of anger include co-opting decisions for the other individual, a lack of empathy, lack of cues of friendship such as self-disclosure and a desire to be in close proximity to the other person, and so on. Each trigger has certain inborn assumptions about the WTR-system, e.g. that we feel more empathy toward those that we have high WTRs toward, which are intuitive but remain potential avenues for future research.

Taken together, these triggers of anger indicate that anger itself responds to cues of an insufficiently high welfare tradeoff ratio in the other individual. This is – of course – good evidence that the evolved function of anger is to recalibrate those WTRs.

Feature #2: Anger-based arguments follow a WTR- “grammar”

The most common behavioral response to anger is rapid communication with the target, i.e. an argument (see Averill 1982). Indeed, anger activates vocal changes making one’s words louder, more rapid, and generally clearer (i.e. the opposite of mumbling; see Banse & Scherer 1996), yet more evidence that the function of anger is to influence the mind of the target.

Furthermore, the semantic content of these arguments appears to follow a kind of cognitive grammar of welfare tradeoff ratios. When anger is triggered by an act of cost imposition, for example, the subsequent arguments focus on the magnitude of the cost born by the victim, the magnitude of the benefit gained by the offender, and whether the offender’s action was intentional (see Sell 2017; Sell et al. 2017). Targets of anger, meanwhile, often counter these claims to diffuse anger. This creates a kind of back-and-forth bargaining situation with the angry person attempting to demonstrate that the target has a deficient WTR, while the target defends themselves by arguing their WTR is higher than the angry person is claiming.

When triggered by insulting beliefs, the arguments again appear to conform to the grammar of WTRs, specifically whether the target of anger really believes you are deficient on the WTR-calibrating trait and whether or not that trait is relevant to the calibration of their WTR toward you, e.g., “I didn’t say you were stupid, I said you made a mistake...anyone can make a mistake” and, “who cares if you are a bad driver? You are a brilliant and powerful man...”

The mere existence of highly motivated verbal communication between the angry individual and the target of anger suggests that the function of anger is to recalibrate the mind of the target (one can compare this to hatred, wherein communication with the target is anathema, see Sell & Lopez 2020, also this volume). The fact that these arguments appear particularly focused on the WTR-setting machinery of the target indicates that anger functions primarily to upregulate the WTR of the target.

Feature #3: Anger-based aggression functions to bargain

A living animal is highly ordered matter, and minor alterations to this order (e.g. a bruised aorta, injury to kidney) can bring about dysfunction and death. This fact can be exploited by animals to extract benefits from conspecifics by making the prohibitive cost of disorder (aggression) the price of non-compliance.

Aggression can solve multiple adaptive problems for animals, and thus comes in different forms, e.g. predatory aggression, mate retention, fear-based aggression (Huntingford 2013). Anger-based aggression, however, most resembles a kind of bargaining aggression (sometimes called “ritualized aggression” or contests of assessment) that functions to change the mind of the antagonist and trigger submission or retreat (Sell 2011; Sell & Lopez 2020).

During ritualized aggression, combatants deploy relatively safe forms of aggression that are designed to determine which combatant would win a more protracted and dangerous bout of aggression. First, the animals typically start with perceptual assessments, e.g. vocal displays, staring contests, and so on. During this stage, animals will often adopt formidability enhancement displays that exaggerate the size of their weaponry (e.g. bare fangs, inflate body size). If both animals persist, the tactics can escalate to more valid and dangerous indicators of fighting ability, e.g. pushing, various kinds of wrestling, and eventually potentially lethal aggression. Crucially, this style of aggression typically terminates when one combatant submits. The function of this aggression is to recalibrate the target’s internal representation of the focal actor’s aggressive formidability so that they relinquish the contested resource and/or accept their lower position in the dominance hierarchy.

When human anger triggers aggression, it typically takes on the same form as this ritualized aggression, and for the same purpose: to recalibrate the target. Welfare tradeoff ratios are calibrated (for some types of relationships) by formidability, i.e. the ability to impose costs on others. This is particularly true of young men (Wilson & Daly 1985), and explains why it is particularly insulting to a young man to be called weak, cowardly, or otherwise incapable of harming others. In those types of relationships, if one detects that another holds a WTR that is too low, they can be recalibrated by demonstrations of formidability (along with the implicit threat that said formidability can be used against the target) in the form of ritualized aggression.

Just as with many other animals, men typically start a fight with visual and auditory assessments. Previous research has established that humans can accurately estimate the upper body strength (a powerful predictor of individual fighting ability) of adult men from both visual and auditory assessment (Sell 2012). When combatants do not recalibrate, the aggression can then escalate until one submits or until one is clearly defeated (Felson 1982; Luckenbill 1977; Sell 2011).

These fights are graduated and incremental in the risk involved, and often conform to a kind of logic of “fairness” that functions to preserve the accuracy of the assessment (Romero, Pham & Goetz 2014; Sell, Sznycer & Meyers, *under review*; Sell & Lopez 2020). In other words, the aggression is not designed to inflict injuries directly, but

to demonstrate the *ability* to inflict those injuries reliably. This necessitates using combat tactics in situations that preserve the validity of the outcome; i.e. the fight has to be “fair” to prove someone actually “won”. If given the option of, for example, hitting someone when they are not prepared, anger-based aggression typically relinquishes this opportunity precisely because a win through this “unfair” route would not be diagnostic of, and would not communicate one’s superior fighting ability. Indeed, anger-based aggression is clearly signaled to the target with loud expressive movements, arguments, and a universal expressive anger face.

Feature #4: The universal human anger face

Ritualized aggression in non-human animals typically starts with formidability enhancement displays that exaggerate cues of fighting ability via modifications to the posture, facial configuration, piloerections, and/or weapon displays. Since most ancestral human aggression was powered by upper body strength (Sell, Hone & Pound 2012), one would predict that humans have such displays as well. Additionally, if the recalibrational theory is correct, anger should trigger these displays.

Indeed, human anger is known to generate a universal, closed-mouth anger face by pulling seven distinct facial muscles (see Sell, Cosmides & Tooby 2014). It is clear that this face is part of our universal nature (e.g., it is produced by six-month-old infants and congenitally blind children). Furthermore, the shape of the face itself is revealed to be a formidability enhancement display. The distinct facial action units that comprise the face each - independently - increase the perceived strength of the face that produces it (Sell, Cosmides & Tooby 2014). For example, the anger face thins the lips by pressing them firmly together, an effect that increases estimates of the man’s strength. The same effects are found for the flared nostrils, the lowered brows, the raised cheeks, and the raised mouth.

This account of the anger face explains both the existence of the facial configuration (i.e. in order to enhance cues of formidability during early aggressive bargaining), but also the *particular configuration* that it has (i.e. the anger face specifically exaggerates those features that are used to estimate upper body strength, see Sell 2012). Such functional explanations highlight the explanatory power of evolutionary theories – especially relative to alternative accounts that merely catalog features without predicting or explaining them.

Feature #4: Anger coordinates bargaining in cooperative relationships

Enhancing cues of fighting ability can recalibrate WTRs in relationships based on formidability, but there are other types of bargaining. The relationship between adult sisters, for example, is typically not determined by their ability to personally inflict injury on one another. Instead, anger between such individuals should demonstrate

the traits that calibrate WTRs in cooperative relationships: specifically, one's ability to *benefit* the other (i.e. cooperative ability).

While not well explored empirically, anger contests in such contexts appear to follow similar “fairness” rules between individuals who benefit from each other. The contest will involve the temporary withdrawal of cooperation such that the angry person treats the other as if they were no longer a valued other. In a bid to recalibrate their WTR, the person lowers their own WTR toward the target; as if to say, “This is how I will treat you if you don’t treat me better.” Such tactics work - when they work - as implicit threats to terminate mutually cooperative relationships. If the target of anger is willing to end the relationship rather than recalibrate, the cooperative relationship may end and potentially be replaced by one enforced by formidability.

Again, anger appears designed to demonstrate the angry individual's capacity to deliver (or deny) benefits to the target in order to provoke recalibration. This creates the seemingly contradictory behavior of seeking out a person in order to ignore them, or paying close attention to someone to determine if they know you are ignoring them. In both cases, the angry person demonstrates a temporarily lowered WTR to the person, e.g. lowering facial and vocal affect as if talking to a stranger, pretended to not remember person-information, showing a lack of interest in being with the person, and abdicating duties on which the other relies, such as a husband not taking out the trash or a sister not helping her brother with his homework.

As with ritualized aggression, early bouts of cooperative withdrawal typically forgo serious withdrawals, e.g. a mother may “forget” to pay her son's cell phone bill but still remember to pay his college tuition. Moreover, these bouts terminate when the target of the anger recalibrates and apologizes, indicating the temporary nature of these contests and their function to recoup cooperation in mutually beneficial relationships. Indeed, research shows that after such bouts of anger, the dyad typically report feeling a better understanding of each other and a “closer” relationship (Averil 1982).

These bouts of cooperative withdrawal reveal that the function of anger is to recalibrate the target rather than inflict costs on it. The anger system appears to turn off when the target recalibrates, regardless of whether the individual has been hurt or not. This is particularly illustrated by apologies.

Feature #5: Bargaining power calibrates thresholds for anger

Anger functions to leverage one's bargaining power to recalibrate the target's WTR. The ability to do this is thus limited by one's bargaining power. Those with more bargaining power can demand better treatment from others and are predicted to become angry over a greater range of offenses, because WTRs are calibrated by the interactants' relative ability to inflict costs and bestow benefits, i.e. by their relative bargaining power. Meanwhile, those with low bargaining power may resort to other strategies to deal with individuals with low WTR (e.g. hatred, avoidance, acceptance, see Sell & Lopez 2020).

Bargaining power comes in part from the ability to impose costs. For ancestral human males, this would have stemmed in large part from physical strength (upper body strength in particular). Therefore, men with greater upper body strength should set lower thresholds for anger and have a greater history of engaging in aggression. This prediction (and others) have been confirmed in a number of societies, including US college students (Sell, Tooby & Cosmides 2009), Aka hunter-gatherers (Hess et al. 2010), Swiss adolescents (Sell, Eisner & Ribeaud 2016), and professional athletes (Webster et al. 2020).

Feature #6: Apologies extinguish anger

The function of an adaptation can often be understood by noting the conditions that deactivate the adaptation (e.g. the function of hunger is partly revealed when one is satiated and hunger deactivates, Al-Shawaf 2016). Research suggests that the most effective way to defuse an incident of anger is to offer a sincere apology.

Apologies are verbal indicators of recalibration, typically captured by phrases such as, “I was wrong” or “I’m sorry”, which contain words that indicate a change of mind, e.g. “regret” or “mistaken”. Apologies – if estimated to be sincere – demonstrate that anger has fulfilled its function and the target has recalibrated their WTR. As such, they are astoundingly effective at canceling anger even without tangible restitution (Frantz & Bennigson 2005). The fact that indicators of mental change are usually sufficient to deactivate anger is a powerful argument that the function of anger is recalibration rather than damage or punishment. The distinction between sincere and insincere apologies remains to be explored from this perspective, but a series of basic predictions can be derived with ease: i) apologies should become dramatically less effective the second time as they indicate the first apology was not followed by an improved WTR, ii) effective apologies should be accompanied by statements acknowledging the magnitude of offense (i.e. that the original WTR was indeed too low) rather than a defense that indicates the original WTR was justified, and iii) behavior after a sincere apology should be closely monitored for evidence of change.

Conclusions

The features reviewed above are only a fraction of the full complex design of anger. Subroutines in the anger program include remarkably complex adaptations; e.g. anger prepares the body for the possibility of aggression with well-known physiological effects such as increased respiration rate and blood pressure, but there are almost certainly perceptual changes, cognitive search routines (such as a sudden awareness of nearby weapons and allies), risk evaluation programs (such that one remembers kin that depend on you before accelerating in an act of road rage), memory searches for previous indicators of low WTR from that same target, and so on. The negotiation process of anger also appears to include cognitive searches for information to verify that the target of anger actually holds a low WTR; e.g. angry

people interrogate the targets of anger, “why did you do this?” “do you know who you’re screwing with?” “what made you think I would agree to this?” and so on, see Sell et al. 2017. Other subroutines in anger would be needed to detect WTRs from comparisons, e.g. a friend wouldn’t loan you his car, which didn’t provoke anger until he agreed to loan his car to Tony. Given the strength of the selection pressure, it is likely that the anger bargaining system and other connected adaptations are extremely complex and well-designed. Much additional work will need to be done in this area.

The advantage of using evolutionary theory to explain human behavior is that hypotheses can be derived from a theory that is known to be true (Dawkins 1976). Another individual’s consideration of one’s welfare would have been a powerful selection pressure for our ancestors. This selection would have led to the evolution of an adaptation for upregulating another’s concern for your welfare whenever feasible. The engineering requirements for this adaptation would include – at a minimum – the ability to detect cues of devaluation in another, and behavioral responses to that devaluation that leverage bargaining power in a cost-minimizing way (at first) to provoke recalibration, and finally the ability to detect when recalibration is successful. This is obviously a description of anger. More than that, though, this chain of reasoning from first principles is strong enough that if human anger did not exist in our species in roughly the form that it does, it would be a positive mystery in evolutionary theory. No such statement could be truthfully made from non-evolutionary theories.

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