Control over Anger and Aggression:

Why Mean People may not be as Mean as you Think

Thomas F. Denson

School of Psychology, University of New South Wales

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Correspondence regarding this chapter should be addressed to:

Thomas F. Denson
University of New South Wales
School of Psychology
Sydney, NSW 2052, Australia
Email: t.denson@unsw.edu.au
Phone: +61 2 93851305

Mean people suck. We have probably all seen the novelty bumper stickers and t-shirts. Some of us may have even had the same thought or voiced it from time to time. Mean people, almost by definition, intentionally hurt us, which is the hallmark of aggressive behavior (Anderson & Bushman, 2002). Aggressive people are often characterized as socially reckless and unconcerned about controlling anger-driven impulses or the consequences of their aggressive actions. This chapter examines another possibility. Perhaps mean people are usually motivated to control their aggressive behavior, but are unable to effectively do so.

This chapter is concerned with aggressive behavior that is motivated by anger. This type of aggression is known as affective, impulsive, hostile, or reactive aggression. Reactive aggression stands in contrast to instrumental (also called proactive) aggression, in which harm is secondary to a primary goal (e.g., hitting someone to take her purse). Nearly everyone can recall a time in which they have acted on anger, hurt someone, and later regretted it. What makes "normal people" different from "mean people" may simply be a matter of frequency of such control failures.

In the first section of this chapter, I discuss why what we think about aggressive people is important for how we think about reducing aggression. In the second section, I present empirical evidence drawing largely from social neuroscience that in many instances, aggressive people may try to control themselves, but ultimately lack the ability to do so. In the third section of this chapter, I describe experiments showing that increasing self-control capacity reduces aggression in people high in trait aggressiveness. In other words, when self-control capacity is increased, mean people do not behave as maliciously as might be expected. In the final section, I discuss future research avenues and some further implications of the research presented in this chapter.

What We Think about Aggressive People is Important for How We Deal with Them

Lay theories are people's "fundamental assumptions…about the nature of the self and the social world" (Molden & Dweck, 2006, p. 193). Lay theories of aggressive individuals play an important role in how scientists and members of the general public think about rehabilitation and preventing aggression. For instance, people who believe that moral character is fixed (versus malleable) believe that the purpose of imprisonment is primarily to punish rather than to rehabilitate (Gervey, Chiu, Hong, & Dweck, 1999). Moreover, when the harm caused by a perpetrator is perceived as intentional, harm-doers are punished more severely than when the harm is perceived as less intentional (Darley & Pittman, 2003). Lay people typically show a preference for this "just desserts" approach in which offenders are punished in accordance with the harm they have committed (Carlsmith & Darley, 2008).

If mean people are thought to intentionally hurt others due to a fixed unwillingness to control an aggressive outburst, then a "just desserts" approach to justice may be appropriate in some circumstances. Punishment should potentially deter future acts of aggression in an attempt to avoid future punishment; however, a just desserts approach should not alter the fundamental moral character of the aggressor. By contrast, if one thinks of mean people as intentionally unwilling to control their behavior, but malleable in terms of character, attempts could be made to increase empathy and the awareness of the harm inflicted by unrestrained aggressive actions. Presumably, these types of interventions should lower aggression by increasing motivation to restrain anger-driven aggressive impulses.

In contrast to the just desserts approach, if the harm done was an unintentional act of poor impulse control, retributive justice will not deter future acts of aggression. Enhancing empathy or awareness of the consequences of aggressive behavior should prove equally futile. If poor self-control is the proximal cause of aggression, improving self-control capacity should be the most effective way to reduce future aggressive episodes. In the following sections, I describe evidence suggesting that aggressive people may be typically motivated to control aggressive impulses. Moreover, improving self-control capacity may be an effective strategy for reducing reactive aggression.

Motivation and Brain Mechanisms in Aggression-prone People

This section reviews the empirical literature on motivation to control anger-driven aggression and the neuroscience underpinning anger control. Aggression and violence (i.e., extreme acts of aggression) have been on the decline in Western societies since the Middle Ages. In his book on the decline of violence, (Pinker, 2011) attributes much of this reduction to changing social norms that proscribe aggressive behavior. As examples, in contemporary times, these changing norms have produced fewer and less deadly wars, lower homicide rates, lower tolerance for aggressive sports, and improved treatment of women, children, and animals (Pinker, 2011). Indeed, in many societies, one’s chances of being murdered are the lowest they have ever been. Because non-aggressive behavior has become normative, one implication is that people are typically motivated to resolve conflict without resorting to aggression and violence.

Perhaps the earliest investigation into the possibility that violent individuals are motivated to control anger-driven aggression comes from the literature on overcontrolled hostility (Megargee, Cook, & Mendelsohn, 1967). Overcontrolled hostility occurs when individuals attempt to control aggressive behavior, yet subsequently fail to do so. Overcontrolled hostility is a component of the Minnesota Multiphasic Personality Inventory and has been observed in prison populations (Verona & Carbonell, 2000). This loss of self-control is notable given the much sought-after rewards for effectively controlling aggressive urges (e.g., early release, access to visitors).

Baumeister and colleagues' strength model of self-control provides an explanatory framework for understanding why overcontrolled hostility might lead to failed self-control (Baumeister & Alquist, 2009; Baumeister, Vohs, & Tice, 2007; Muraven & Baumeister, 2000). According to the strength model, engaging in an initial act of self-control tends to temporarily impair a subsequent act of self-control. Individuals high in overcontrolled hostility may become depleted due to effortful anger regulation, which heightens aggression. Indeed, research shows that engaging in one self-regulatory process can heighten subsequent aggression (DeWall, Baumeister, Stillman, & Gailliot, 2007; Finkel, DeWall, Slotter, Oaten, & Foshee, 2009; Stucke & Baumeister, 2006; for reviews, see Denson, DeWall, & Finkel, 2012 and DeWall, Finkel, & Denson, 2011).

There are problems with asking violent offenders and other aggressive individuals about their degree of motivation to control aggressive. One obvious problem is that they may not be truthful. Violent individuals may also wish to appear more motivated than they actually are. Aggressive people may also lack insight into actual levels of motivation.

A more fruitful alternative to relying on self-report measures may be to examine brain responses to anger-inducing situations. During the past decade, cognitive and social neuroscientists have made great progress in mapping the neural regions responsible for self-control (Hassin, Ochsner, & Trope, 2010). Much of this work has identified the neural substrates of basic executive functions such as inhibition, working memory, and attentional control that support self-regulatory goals. This self-regulatory circuit partially consists of the dorsal anterior cingulate, medial prefrontal, orbitofrontal, and lateral prefrontal cortices. Brain responses in this circuit should presumably be less influenced by social desirability concerns than self-reports.

The dorsal anterior cingulate cortex is thought to monitor discrepancies between actual and expected states in the environment (Botvinick, Cohen, & Carter, 2004). The dorsal anterior cingulate also monitors the emotional salience of stimuli and is activated in response to challenging situations (Gasquoine, in press). Within the context of anger provocation, the dorsal anterior cingulate might be involved in detecting a discrepancy between one's expected state of being treated fairly and one's actual state of being unduly harmed. Once a discrepancy is detected, the dorsal anterior cingulate cortex is thought to recruit brain regions in the prefrontal cortex that support higher order executive functions. For this reason, the dorsal anterior cingulate cortex has been called a "neural alarm system" (Eisenberger & Lieberman, 2004). Relevant prefrontal regions recruited by this alarm system include those implicated in emotion regulation (medial, dorsolateral, and ventrolateral prefrontal cortices, orbitofrontal cortex), inhibition (dorsolateral prefrontal and ventrolateral prefrontal cortices), and social cognition (medial prefrontal cortex; Amodio & Frith, 2006; Lieberman, 2007; Ochsner & Gross, 2008; van Gaal, Ridderinkhof, Scholte, & Lamme, 2010).

Eisenberger, Way, Taylor, Welch, and Lieberman (2007) investigated the effect of social exclusion on activation in the dorsal anterior cingulate. Social exclusion increases anger and aggression in the laboratory and real world (Leary, Twenge, & Quinlivan, 2006; Twenge, Baumeister, Tice, & Stucke, 2001). The sample consisted of 32 healthy men and women who varied in a genetic predisposition toward aggression. Specifically, participants possessed either the low expression allele of the monoamine-oxidase A (MAOA-L) gene, the high expression gene (MAOA-H), or a combination of the low and high expression allele (MAOA-LH). MAOA-

L individuals are at heightened risk for developing antisocial behaviour such as engaging in violence (Caspi et al., 2002). After a time, participants were then socially excluded from a computerized ball-tossing game. The authors hypothesized that individuals at risk for aggression may have a heightened threat detection system accompanied by poor emotion regulation capacity. If so, the dorsal anterior cingulate cortex should be most active among MAOA-L individuals as this neural alarm system should be highly responsive to interpersonal provocation. Results confirmed this notion. Specifically, of the three groups of participants, MAOA-L individuals showed the greatest activation in the dorsal anterior cingulate in response to social exclusion. Moreover, MAOA-L individuals reported being highest among the three groups in trait aggressiveness and interpersonal hypersensitivity.

The intriguing contribution of this study is that individuals genetically predisposed toward aggressiveness showed more activation rather than less activation in the dorsal anterior cingulate cortex. This finding does not allow us to determine whether the MAOA-L participants intended to harm others or control themselves. However, it does document that aggression-prone people showed hyper-responsiveness in a region responsible for the recruitment of brain regions implicated in self-regulation. Presumably, if aggressive individuals did not care about regulating their responses to interpersonal mistreatment, they would show no change in activation or even deactivation in the neural circuitry underlying self-control.

A second study conceptually replicated the (Eisenberger, Way, Taylor, Welch, & Lieberman, 2007) findings using a different anger provocation. Participants were 20 healthy men and women undergraduates who varied in trait aggressiveness (Denson, Pedersen, Ronquillo, & Nandy, 2009). During an initial laboratory session, participants completed a packet of personality questionnaires, one of which was the Aggression Questionnaire (Buss & Perry, 1992), which measures individual differences in self-reported trait aggressiveness. Approximately two weeks later, participants returned for a neuroimaging study, ostensibly about cognitive ability and mental imagery. During scanning, participants were rudely insulted by the experimenter, which increased anger from baseline. Results showed strong positive correlations among self-reported trait aggressiveness, state anger, and activation in the dorsal anterior cingulate cortex following provocation. Thus, aggressive individuals were the most angry and showed the greatest activation in the dorsal anterior cingulate cortex. In other words, greater anger induced by the insult likely increased dorsal anterior cingulate cortex activation, presumably to recruit prefrontal regions implicated in self-regulatory processes. These findings converge with those of (Eisenberger, et al., 2007) in showing heightened responsiveness in the neural circuitry of self-control for people at risk for aggression.

In addition to genes and traits, another way of identifying aggression-prone individuals is by examining hormone concentrations. Recent work suggests that there is a specific hormone profile, which confers risk for aggression. Basal concentrations of the hormones testosterone and cortisol have been implicated in aggression-dominance and avoidance-submissiveness, respectively (Denson, Spanovic, & Miller, 2009; Eisenegger, Haushofer, & Fehr, 2011). However, meta-analysis suggests only weak and inconsistent effects of testosterone on aggression in humans (Archer, Graham-Kevan, & Davies, 2005). In order to account for these inconsistencies, recent theorizing suggests that the effect of testosterone may be dependent on concentrations of cortisol (Carre & Mehta, 2011; Mehta & Josephs, 2010). In support of this *dual-hormone hypothesis,* endogenous testosterone was positively correlated with severity of violent crimes among male offenders, but only when cortisol was low (Dabbs, Jurkovic, & Frady, 1991). The same endogenous dual-hormone interaction was found when correlating testosterone with reactive aggression in delinquent male adolescents (Popma et al., 2007). Another study observed a reversal of this dual-hormone effect in response to provocation in undergraduate women. Testosterone predicted reactive aggression among participants with high levels of cortisol (Denson, Mehta, & Ho Tan, in press). These studies suggest that “trait” levels of testosterone and cortisol may jointly determine risk for aggression.

In a functional magnetic resonance imaging (fMRI) study, 19 healthy men provided saliva samples to assess testosterone and cortisol (Denson, Ronay, von Hippel, & Schira, in press). In order to examine neural activation specifically during anger control, a female research assistant took participants aside and informed them that the experimenter was getting upset with participants for not doing the task properly. The assistant emphasized that the study was part of her Ph.D. thesis and limited funding was available. It was therefore extremely important that participants remain calm even if angered by the experimenter. Participants were subsequently insulted during scanning. Results showed that induced anger control activated the dorsal anterior cingulate cortex as well as regions implicated in emotion regulation. Self-reported anger control was positively correlated with activation in the dorsal anterior cingulate cortex. This finding provides converging evidence for the role of this region in recruiting regions implicated in self-control processes.

In support of the dual hormone hypothesis, additional analyses showed that testosterone was positively correlated with bilateral activation in the dorsolateral prefrontal cortex, which is a key region implicated in emotion regulation, but only among men with low levels of cortisol. This same pattern of data was observed for activation in the thalamus, which is involved in regulating arousal and emotional processing. Thus, individuals with a hormonal predisposition toward aggression showed the greatest responses in the neural circuitry underlying self-control and emotional arousal.

In summary, these three fMRI studies suggest that when angered, aggressive people are characterized by inefficient neural responses in brain regions implicated in self-regulation. The hyper-responsiveness occurred regardless of whether the study participants were (a) genetically predisposed toward aggression; (b) high in trait aggressiveness; or (c) hormonally at risk for aggression. One implication of these three fMRI studies is that aggressive people may try to exert control over anger and aggression, but may lack the ability to do so. If poor self-control is the problem, boosting self-control capacity should lower aggression in aggressive people.

Before proceeding, a caveat is in order. The idea that altered functioning in prefrontal brain regions may be responsible for aggressive behavior is not new. Several reviews have highlighted the notion that self-regulatory functions supported by the prefrontal cortex are critical in controlling violence and aggression (Blair, 2004; Davidson, Putnam, & Larson, 2000; Denson, 2011; MacDonald, 2008; Raine, 2008; Raine & Yang, 2007; Siever, 2008; Wilkowski & Robinson, 2007). During cognitive tasks, much prior research with clinical populations (e.g., people with antisocial personality disorder, murderers) discovered hypoactivation in the prefrontal cortex of antisocial people relative to healthy controls (e.g., Raine, Buchsbaum, & LaCasse, 1997).

In contrast to this prior research, the fMRI studies described here examined relatively high-functioning groups of university students exposed to anger-inducing situations such as social rejection and insult. The intriguing aspect of the emerging body of neuroscience research described here is that it specifies the form of this dysfunction in “normal” people. Dysfunction may take the form of hypoactivation, hyperactivation, and abnormal connectivity between regions. Thus, the novel aspect of these three fMRI studies is the observation of hyperactivation in the neural circuitry of self-control among aggression-prone individuals.

Interestingly, one subgroup of antisocial people – psychopaths – tend to show increased activation during emotional tasks (for a review, see Raine & Yang, 2007). Because of emotional deficits in psychopathy, (Raine & Yang, 2007) hypothesized that psychopathic individuals may require increased effort to achieve the same level of performance as controls. This notion is very similar to the observation that aggression-prone undergraduates are characterized by increased activation in the neural circuitry of self-control (Denson et al., 2009; Eisenberger et al., 2007). Specifically, when angered, people high in trait aggressiveness likely require increased recruitment of prefrontal control.

Boosting Self-control Capacity Reduces Aggression for Aggressive People

Baumeister and colleagues' influential strength model of self-control (Baumeister & Alquist, 2009; Baumeister, et al., 2007; Muraven & Baumeister, 2000) provided the theoretical basis for experimental work on self-control and aggression (for reviews of the aggression research, see Denson et al., 2012; DeWall et al., 2011). The strength model specifies two means of augmenting self-control capacity. The first is by practicing self-control over an extended period of time. This extended practice is often referred to as self-control training (SCT). Practicing self-control in one domain (e.g., practicing better posture) for a minimum of two weeks can improve self-controlled behavior in a variety of additional domains (e.g., healthy eating, preventing smoking relapse; Muraven, 2010; Muraven, Baumeister, & Tice, 1999; Oaten & Cheng, 2006a; 2006b; 2007).

The second method of improving self-control capacity in the strength model is by consuming glucose (Gailliot & Baumeister, 2007). Glucose improves self-controlled behavior in a variety of domains (DeWall, Baumeister, Gailliot, & Maner, 2008; Dvorak & Simons, 2009; Gailliot et al., 2007; Masicampo & Baumeister, 2008), although the exact mechanism remains enthusiastically debated (Beedie & Lane, 2012; Hagger & Chatzisarantis, 2013; Inzlicht & Schmeichel, 2012; Kurzban, 2010; Molden et al., 2012; Niven, Totterdell, Miles, Webb, & Sheeran, 2013; Sanders, Shirk, Burgin, & Martin, 2012). Meta-analytic evidence shows that both SCT and glucose consumption exert large effects on enhancing self-control (Cohen's *d*s = 1.07 and 0.75, respectively), although the number of studies included in the meta-analysis was relatively small ($k_{SCT} = 9$ and $k_{glucose} = 5$; Hagger, Wood, Stiff, & Chatzisarantis, 2010).

Self-control Training (SCT)

There are only two studies examining the effects of SCT on aggressive urges and behavior. In one of these studies, 40 female and male undergraduates participated in a two-session study two weeks apart. At the first session, participants were depleted of self-control capacity via an attentional control task (Finkel et al., 2009, Study 5). They subsequently completed a self-report measure of the likelihood that they would act aggressively toward their romantic partner if provoked. Participants were then randomly assigned to one of three conditions. In two of the conditions, participants practiced self-control by either using their non-dominant hand for everyday tasks (e.g., using a computer mouse) or regulating habitual speech patterns (e.g., saying "yes" instead of "yeah"). In a third control group, participants did not practice self-control. At the conclusion of the two-weeks, participants returned to the laboratory, were again depleted, and completed the aggressive inclination measure. Results showed that participants in both SCT conditions reported a decrease in aggressive inclinations toward their romantic partner.

Although this study did not assess aggressive behavior per se, it does suggest that SCT may be helpful for reducing actual aggression. A recent experiment confirmed the effectiveness of SCT for lowering aggressive behavior in aggression-prone people (Denson, Capper, Oaten, Friese, & Schofield, 2011). At an initial laboratory session, 70 female and male undergraduates completed a measure of trait aggressiveness (Buss & Perry, 1992). They were then either randomly assigned to the SCT condition or the control condition. As in Finkel et al. (2009, Study 5), in the SCT condition, participants used their non-dominant hand for everyday tasks for two weeks. The undergraduates in the control condition answered simple math problems during the two-week interim. In the second laboratory session, participants listened to a two-minute speech via webcam about another participant's life goals and subsequently presented a speech of their own. In reality, the speech partner was a prerecorded actor. Participants were then given the opportunity to evaluate their partner's speech. All participants were insulted by the bogus participant (i.e., "what a waste of my time listening to you"). Next, under the guise of a competitive reaction time task (cf. Bushman, 1995; Giancola & Chermack, 1998; Taylor, 1967), participants were given the opportunity to aggress by blasting the provocateur with loud bursts of white noise. The noise blast intensity and duration served as the measure of aggressive behavior. Finally, participants reported how angry the provocation made them feel.

Unlike, Finkel et al. (2009, Study 5), there was no main effect of SCT. However, results did show an interaction, such that SCT was most effective in reducing aggression among participants high in trait aggressiveness (Denson, et al., 2011). Specifically, in the control condition, we observed the usual relationship between trait aggressiveness and heightened aggressive behavior. However, in the SCT condition, this relationship was reduced to zero. As is evident in Figure 1, participants high in trait aggressiveness who completed two weeks of SCT were no more aggressive in response to provocation than participants low in trait aggressiveness. Thus, SCT was most effective for people considered to have the strongest urge to aggress (i.e., those high in trait aggressiveness) and provided no added benefit for those considered to have minimal aggressive urges (i.e., those low in trait aggressiveness). Moreover, participants in the SCT condition reported lower anger as a result of the provocation than those in the control condition. This latter effect did not interact with trait aggressiveness. Presumably, all people are capable of becoming angry in response to provocation, but only those high in trait aggressiveness have difficulty refraining from acting on the anger-driven impulses. In sum, this study found that boosting self-control capacity can help aggressive people control their behavior.

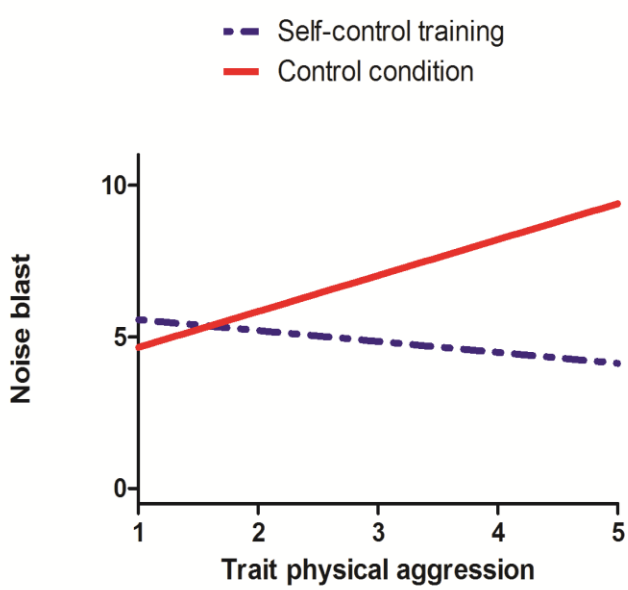

Figure 1. *Aggressive behavior as a function of trait aggressiveness and SCT. Adapted from Denson et al., (2011).*

Glucose

A series of studies investigated the notion that low levels of glucose may be responsible for heightened aggression (DeWall, Deckman, Gailliot, & Bushman, 2011). Two correlational studies showed that diabetic symptoms and state-wide rates of diabetes were positively associated with trait aggressiveness and violent crime, respectively. Moreover, in a third study investigating a sample of 122 countries, the proportion of people who lacked an enzyme for glucose metabolism correlated with higher rates of violence. These findings link low glucose and poor glucose metabolism to heightened aggression.

A recent experiment examined the effect of consuming glucose on aggressive behavior (DeWall, Deckman, et al., 2011). Sixty-two male and female undergraduates consumed either lemonade sweetened with sugar or an artificially sweetened placebo beverage. Participants then played a competitive reaction time task in which they were given the opportunity to blast a fictitious opponent with loud white noise. Participants who consumed the glucose drink blasted their opponent with less intense noise than participants who consumed the placebo.

Another two experiments examined the extent to which consuming glucose might be most effective in reducing aggression for those high in trait aggressiveness (Denson, Von Hippel, Kemp, & Teo, 2010). Presumably, people low in trait aggressiveness lack strong impulses to harm others or are effective at controlling the impulses when they occur. If so, bolstering self-control capacity should be most beneficial for those high in trait aggressiveness, but provide no added benefit for people low in trait aggressiveness.

In the first of these experiments, 80 female and male undergraduates were told that they would consume a sugar drink in a study of glucose and performance on laboratory tasks (Denson et al., 2010, Experiment 1). Participants first completed a measure of trait aggressiveness (Buss

& Perry, 1992) and were depleted (or not) by having to cross out the letter *e* in a page of text with 398 instances of the letter *e*, but only under certain circumstances (e.g., when *e* appeared in a word with a vowel appearing two letters before the *e*). Next, participants consumed 40 grams of sugar in a lemon drink or a placebo containing 2 grams of sugar. The experimenter was blind to the actual drink condition. Participants were then provoked via the webcam procedure used in Denson et al. (2011; i.e., "what a waste of my time listening to you") and given the opportunity to aggress by blasting the provocateur with loud bursts of white noise.

The analyses revealed main effects of glucose and depletion. Participants who consumed the glucose drink were less aggressive than those who consumed placebo. Conversely, replicating prior work (DeWall, et al., 2007; Finkel, et al., 2009; Stucke & Baumeister, 2006), depleted participants were more aggressive than non-depleted participants. However, these results were qualified by a two-way interaction between glucose condition and trait aggressiveness. Specifically, as expected, there was a significant relationship between trait aggressiveness and aggressive behavior for participants in the placebo condition, but not in the glucose condition. Figure 2 shows these results. This data suggest that glucose was most beneficial for those who were expected to have the strongest aggressive urges: people high in trait aggressiveness. Moreover, glucose was effective for reducing aggression among those high in trait aggressiveness even when depleted. There was no added benefit for participants low in trait aggressiveness as they displayed low levels of aggression regardless of whether they consumed glucose or the placebo.

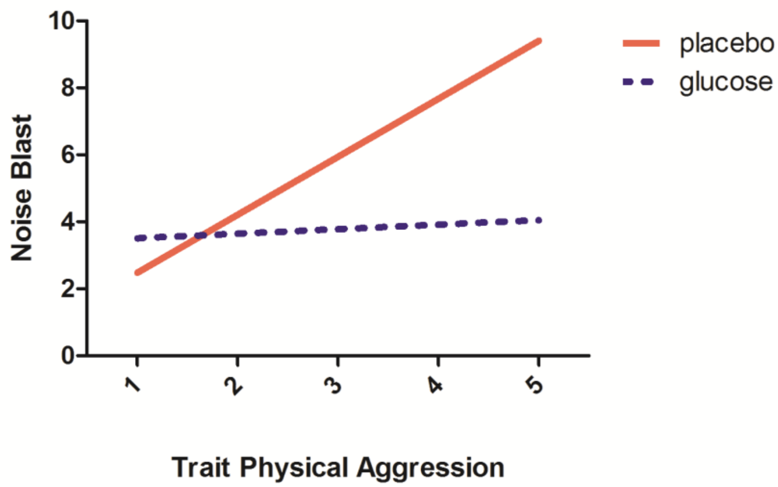

Figure 2. *Aggressive behavior as a function of trait aggressiveness and glucose. Adapted from Denson et al., (2010, Experiment 1).*

Because the depletion manipulation in the first experiment did not moderate the interaction between trait aggressiveness and glucose, the second experiment replaced the depletion manipulation with a provocation manipulation (Denson et al., 2010, Experiment 2). Participants in the provocation condition received the same insulting feedback as in the first experiment. In the no-provocation condition, participants received a neutral evaluation of their speech (i.e., “nice speech, your life goals sound pretty reasonable”). The pattern of data for the provocation condition replicated that observed in the first experiment. Specifically, trait aggressiveness predicted aggressive behavior for participants in the placebo condition, but not for those in the glucose condition (see Figure 3). These results show that glucose can help people high in trait aggressiveness control the urge to harm another person when provoked.

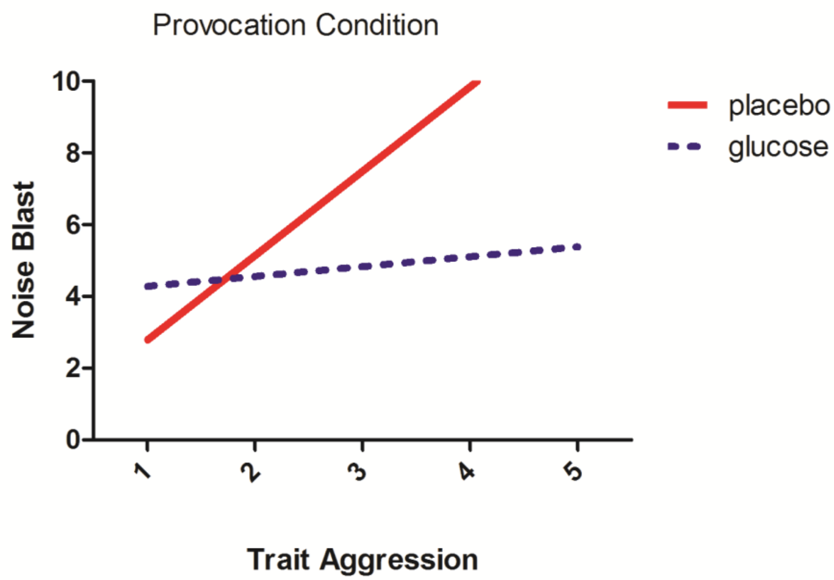

Figure 3. *Aggressive behavior as a function of trait aggressiveness and glucose in the provocation condition. Adapted from Denson et al., (2010, Experiment 2).*

Two of the findings from the Denson et al. (2010) glucose experiments would not have been predicted from the strength model of self-control (Baumeister & Alquist, 2009; Baumeister, et al., 2007). The first is that among participants in the no-provocation condition, the observed pattern of data was opposite to that observed in the provocation condition (Denson et al., 2010, Experiment 2). Specifically trait aggressiveness predicted aggressive behavior for participants in the glucose condition, but not for those in the placebo condition (see Figure 4). It is possible that glucose may have motivated aggressive individuals to harm others in the absence of instigation to do so. A second aspect of the data that would not have been predicted by the strength model is that glucose did not lower anger in either experiment (and was not assessed in DeWall, Deckman, et al., 2011). The strength model suggests that glucose is a common energy source underlying diverse forms of self-regulation. A prediction derived from the model would be that glucose should have improved emotion regulation, which should have been observed as less self-reported anger among participants who consumed glucose than those who consumed placebo.

Figure 3. *Aggressive behavior as a function of trait aggressiveness and glucose in the no-provocation condition. Adapted from Denson et al., (2010, Experiment 2).*

The inconsistencies of the results of the glucose experiments with the strength model are part of a growing discussion on the underlying mechanisms of the effects of glucose on behavior. For instance, simply rinsing the mouth with glucose is sufficient to augment self-controlled behavior (Molden, et al., 2012; Niven, et al., 2013). Moreover, glucose may not be depleted to a measurable extent by acts of self-control (Beedie & Lane, 2012; Kurzban, 2010) as previously thought (Galliot et al., 2007; Gailliot & Baumeister, 2007; but see Sanders et al. 2012 for a depletion effect on blood glucose levels). More research is required to determine the roles of glucose in reducing and increasing aggressive behavior and the individual differences and situational contexts that moderate these effects.

Summary and Further Considerations

The literature reviewed here suggests that mean people may not be as mean as is often assumed. Social norms proscribing aggression and violence are widespread (Pinker, 2011). It is thus likely that aggressive people would be aware of these norms and seek to abide by them. Moreover, there is some evidence to suggest that aggressive people may often be motivated to refrain from lashing out at others. For instance, the social neuroscience evidence suggests that aggressive people are characterized by neural hyper-responsiveness in the circuitry underlying self-regulation. However, perhaps the strongest impetus for rethinking how we think about aggressive people is the fact that when their self-control capacity increases, they become much less aggressive. Although the exact mechanisms remain unclear (Inzlicht & Schmeichel, 2012), treatments designed to boost self-control capacity can help aggressive individuals control themselves (Denson et al., 2010; 2011). For instance, when provoked, relatively highly aggressive undergraduates who practiced self-control in a very simple way for just two-weeks or consumed a glucose beverage were less aggressive than those who did not practice self-control or consumed placebo (Denson et al., 2010; 2011). As predicted by the strength model, the self-control capacity manipulations were effective for aggressive people but not for less aggressive people. In other words, we may wish to consider the serious possibility that aggressive individuals wish to behave non-aggressively and will do so with one caveat: they must have sufficient self-control capacity.

In some sense, the fact that boosting self-control capacity in aggressive individuals can lower aggression may not be surprising to many in the scientific community. For instance, if self-control is experimentally *lowered* through alcohol intoxication, not everyone behaves aggressively. Alcohol-induced aggression is primarily perpetrated by people who are predisposed to aggression in the first place (e.g., Borders & Giancola, 2011; Denson, White, & Warburton, 2009; Miller, Parrott, & Giancola, 2009). Boosting self-control among aggression-prone people is the flip side of the coin. Future research could even examine the possibility that SCT could reduce alcohol-induced aggression among those most at risk.

Based on the research reviewed here, bolstering self-control capacity might eventually be incorporated into interventions designed to reduce aggressive behavior. Some thought should be given to who might benefit most from bolstering self-control capacity. The experiments reviewed here suggest that such interventions should help reactive aggressors better control themselves in response to provocation. However, caution is warranted. When not provoked, consuming glucose augmented aggression relative to placebo among university students high in in trait reactive aggression (Denson et al., 2010, Experiment 2). Thus, depending on who receives the treatment, it is entirely possible that boosting self-control capacity might have unintended or adverse consequences.

There are instances in which self-control may be required to aggress. For instance, engaging in instrumental aggression may require exertion of self-control in order to overcome the inhibition to harm another person (Grossman, 1995; Rawn & Vohs, 2011). Thus, boosting self-control may help combat military personnel or members of law enforcement fulfill their roles. However, one implication is that for people predisposed to engaging in instrumental aggression (e.g., bullies, organized criminals, psychopaths; Glenn & Raine, 2009), boosting self-control capacity could make them even more likely to do so. Similarly, boosting self-control capacity might increase the likelihood that people who become anxious and avoidant when provoked may “stick up for themselves” by engaging in reactive aggression. In sum, much more research with a wide variety of aggression-prone populations is required before incorporating SCT or glucose into large-scale interventions.

Conclusion

This chapter began by proposing the notion that mean people may not be as mean as we often think they are. I hope that the review and interpretation of the data presented here might facilitate a reconsideration of how we think about and treat aggressive individuals. Healthy people relatively high in reactive aggression have inefficient brain responses to anger provocation. Moreover, when given the ability to control themselves, they do. In conjunction with more research, reconsidering how we think about aggressive people might eventually lead to an even more peaceful planet than the one we live on.

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