

The importance of physical strength to human males

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Abstract

Fighting ability, although recognized as fundamental to intrasexual competition in many non-human species, has received little attention as an explanatory variable in the social sciences. Multiple lines of evidence from archeology, criminology, anthropology, physiology and psychology suggest that fighting ability was a crucial aspect of intrasexual competition for ancestral human males and this has contributed to the evolution of numerous physical and psychological sex differences. Because fighting ability was relevant to many domains of interaction, male psychology should have evolved such that a man's attitudes and behavioral responses are calibrated according to his formidability. Data are reviewed showing that better fighters feel entitled to better outcomes, set lower thresholds for anger/aggression, have self-favoring political attitudes, and believe more in the utility of warfare. New data are presented showing that among Hollywood actors, those selected for their physical strength (i.e. action stars) are more likely to believe in the utility of warfare.

Keywords: Physical strength, evolutionary psychology, aggression, anger, warfare, income redistribution

Animals have complex adaptations that allow them to rapidly apply force to objects and to structure the physical world in ways that facilitate their survival and reproduction. In creatures with endoskeletons, such actions depend on a musculoskeletal system composed of strong, rigid mineralized tissue (i.e. bones) connected to bundles of contractile fibers laid out in stripes that shorten when stimulated by the nervous system (i.e. muscles). These systems allow the organism to manipulate and shape its environment in beneficial ways. Of course, other organisms are also out there lifting, pushing, pulling, throwing, and stacking the world in ways that are beneficial to them. Consequently, conflicts of interest arise between organisms, and these have generated powerful selection pressures that have contributed to the evolution of various complex organismic design features which function to win these conflicts. The most straightforward way to win a conflict of interest is to disable the functional machinery of the other organism, i.e. inflict physical damage. For example, to compromise the integrity of the oxygenating circulatory system, to interrupt neural connections between the central nervous system and the peripheral musculature, to disable the perceptual systems, or to fracture load-bearing bones and hinder movement, and so on. Actions such as these, that involve the detrimental modification of another organism's machinery, are typically described as acts of 'aggression'.

Analyzed unemotionally and with the full range of animal species in mind, aggression is the disordering of another organism's functional machinery – typically in a manner that disrupts that other organism's ability to pursue its fitness interests at the expense of the aggressive animal. Of course the machinery that makes up an organism was selected precisely because its organizational structure aided in the replication of the

genes comprising it, and thus genes that coded for design features that allowed an animal to resist the disordering attempts of their conspecifics, often by disordering said conspecific first, would be selected for. The deployment of mutually-incompatible behavioral strategies designed to thwart organismic design can be succinctly called ‘combat’.

Animals have been differentially affected by selection pressures for combat, but evolutionary biologists and behavioral ecologists have found the concept of “fighting ability” (i.e. resource holding power/potential, formidability) to be a crucial variable when trying to explain numerous aspects of animal behavior and physiology including: the design of animal weaponry, the factors underlying dominance and status, the nature of aggression, sexual dimorphism and sexually differentiated life history strategies, the dynamics of territory and ownership, predator/prey relationships, mating competition and mate choice, and aggressive posturing and signaling.

Convergent evidence from multiple sciences shows that these same selection pressures have actively designed the phenotype of human beings, particularly that of the adult male. Both anthropological (Low 1988) and genetic (Hammer et al. 2008) evidence indicates that humans, like many other mammalian species, are effectively polygynous – i.e. there is greater fitness variance among males than among females. This means that the upper limit of a man’s potential reproductive success is far greater than for a woman, but there is also a much greater chance that he will die without leaving any descendants at all. Consequently, there was stronger selection on males to be willing to get involved in violent, aggressive competition with other males (Daly & Wilson 1988) as the benefits of competition were proportionally larger and the costs of failure smaller. Moreover, in

addition to shaping a male psychology that is willing to use risky aggression to resolve conflicts of interest with other males, the selection pressures associated with effective polygyny will also have favoured the evolution of anatomical and physiological traits in males that are important for success in such encounters.

Design for aggression among human males

Contrary to common belief, human violence has been steadily declining over recorded history (Daly & Wilson 1988; Eisner 2001). The modern pacification of human beings has led scholars to underestimate the frequency of aggression in ancestral societies (Payne 2004). Indeed, it is difficult for the average citizen of the western world, without anthropological training, to appreciate the pervasiveness of aggression and violence among the males of many small-scale societies. Lawrence Keeley (1996) shows that across a spectrum of contemporary foraging societies (e.g. Jivaro, Yanomamo, Mae Enga, Dugum Dani, Murngin, Huli & Gubsi) the percentage of all male deaths that arise from violent confrontations with other males can average over 30%. In contrast, in the modern United States homicide is only the 15th most common cause of death accounting for 0.8% of male deaths in 2007 (Centers for Disease Control and Prevention 2010). To put this in perspective, if modern western societies had homicide rates as high as some foraging peoples, a male graduate student would be more likely to be killed than to get a tenure track position.

While modern foraging people are not the ancestors of modern humans, their lifestyles resemble those of our ancestors in important ways, including the lack of modern medicine, police, formalized written systems of law, nation state militaries, and other

features of modern society with implications for the possibility and utility of using physical aggression to resolve conflicts of interest (Kelly 1995). More direct evidence of the prevalence of combat during human evolutionary history comes from archeological records and excavations from which forensic evidence has been gathered (Keeley 1996; Walker 2001). These show a high prevalence for physical aggression as well as the male bias in frequency. Similar findings emerge from examinations of the historical record going back hundreds of years (Daly & Wilson 1988).

The most compelling evidence that human males have undergone selection for the efficient deployment of physical aggression is the sheer number of features that (when compared to women) show evidence of special design for this purpose. Table 1 lists some of the documented sex differences that likely resulted from more intense selection on males for physical aggression. Because of the inherent similarities between damaging the phenotypes of prey and conspecific competitors, it is difficult to know how much of this design was the result of selection for hunting ability rather than success in aggressive encounters with conspecifics. Nonetheless, once a design feature had been favored by natural selection due to its benefits in one domain, it would lower the cost of participating in the other, e.g. if males evolved features that allowed for the efficient pursuit and subduing of prey, these same features would have lowered the costs of conspecific aggression, and vice versa.

Fighting ability and upper body strength

As Table 1 indicates, there are sex differences in many traits that likely contribute to fighting ability including the ability to dissipate heat, perceive and respond rapidly to

threats, estimate the trajectory of thrown objects, integrate perceptual systems rapidly, resist blunt force trauma, and accurately intercept incoming objects. That said, few of these traits will be more predicative of fighting ability than the differential capacity to apply force to an object or adversary, i.e. physical strength. Ignoring for the moment the complicated nature of social conflict, the ability to disable a competitor will almost always require the application of force either directly with one's musculoskeletal system, or indirectly using weapons. Humans appear to know this intuitively as evidenced by the mental conflation of fighting ability and strength: subjects shown photographs or played voice samples of men and asked to rate "toughness in a fight" or "physical strength" will respond with almost perfectly correlated ratings regardless of the phrasing ($r = .96$ for photographs, $r = .98$ for voices, Sell et al. 2009, 2010).

An analysis of ancestral forms of aggression shows that it is particularly upper body strength that is most crucial to fighting ability. This holds for ancestral combat with weaponry (Brues 1959) including spears, bows, handaxes, clubs and rocks which would have been propelled using upper body strength (indeed, no primitive weapon has ever been found that is primarily propelled by lower body strength). Moreover, upper body strength is also crucial for unarmed combat, particularly the wrestling, grappling, rending and choking that most likely characterized ancestral combat according to analyses of skeletal remains (Walker 1997). Consequently, it is intriguing to note that in modern humans sex differences in muscularity are most pronounced for the upper body with males on average having upper arm muscle volumes that are 78% greater than females while the difference for thigh muscle volumes was only 50% (Lassek & Gaulin 2009) and that these differences in muscle volume lead to predictable differences in strength. For

example, Stoll et al. (2000) found that adult males are able to exert 77% more force across various measures of upper limb strength, but only 58% more force on measures of lower limb strength. While in young adults specifically, Bohannon (1997) found sex differences in strength of 92% for upper and only 58% for lower limb muscle actions. These patterns are consistent with the idea that upper body strength in particular has been of critical importance in male intrasexual competition. Finally, the literature on strength assessment demonstrates the importance of upper body strength in judgments of fighting ability (see below).

Physical strength and assessment mechanisms in humans

In nonhuman animals the ability to assess the fighting ability of conspecifics has been widely documented. For example, auditory cues alone are sufficient, in many species, to reveal fighting ability, in red deer (Clutton-Brock & Albon, 1979), common loons (Mager, Walcott & Piper, 2007), toads (Davies & Halliday, 1978), owls (Hardouin et al. 2007) and feral horses (Rubenstein & Hack, 1992). Additional evidence comes from aggressive conflicts in which animals assess fighting ability using aggressive displays rather than engaging directly in potentially more lethal forms of conflict. For example, red deer will parallel walk, roar, and finally antler wrestle but do not stab each other from behind or the side with antlers (Clutton-Brock & Albon, 1979). Cichlid fish engage in parallel swimming, mouth wrestling and tail beating before engaging in highly-damaging combat (Enquist & Leimar, 1983; Enquist, Leimar, Ljungberg, Mallner & Segerdahl, 1990). These interactions provide individuals with important information about the physical formidability of rivals; information which can be used by assessment

mechanisms in the brains of each organism to estimate the probability of winning more intensive combat and therefore trigger facultative escalation or retreat as appropriate.

Given the frequency and selective importance of aggression and combat during human evolutionary history, it would be surprising if humans had not been tailored by selection to assess the fighting ability of conspecific males. Indeed, evidence from four distinct cultures including hunter-horticulturalists, industrialists and pastoralists shows that cues of physical strength are present in the body, face and voice, and that these cues can be extracted and assessed rapidly and with good accuracy (Sell et al. 2009, 2010; see Figure 1). In addition to this simple test, there is evidence of complex functional design in the assessment system showing that judgments of strength are dependent on cues that convey specific information about the kind of strength most relevant to fighting ability: i.e. upper body strength in males. For example, ratings of strength tracked physical strength independently of height and weight even when rating a voice or face. Furthermore, upper body strength was more closely tracked by ratings than was lower body strength. In all cases, the physical strength of males was more accurately assessed than that of females, even when females were doing the ratings.

Physical strength as a calibrator of mental adaptations

A central nervous system enables animals to engage in complex regulation and structuring of motor activity. Muscle movements are therefore contingent on information that can be stored internally, and thresholds of behavior can be regulated in a facultative manner according to new information acquired about the physical and social environment. The kinds of information that animals will assess and store will depend on

the fitness consequences that such information had in the environments in which that animal's species has evolved. As has already been noted, the efficiency with which an individual can render its opponents unable to function is a crucial variable particularly for human males, so much so that humans develop the ability to assess this variable through at least three separate channels (body, face and voice). Information about relative formidability would be useless if it were not influencing other psychological adaptations involved in the regulation of behavior. Consistent with this, fighting ability, as measured by upper body strength, has been predicted and shown to correspond to the functional modification of behavior in a host of evolutionarily relevant domains.

Strength and anger

According to the recalibrational theory of anger, anger is an adaptation designed by natural selection to regulate conflicts of interest in ways that lead the target of anger to increase the weight placed on the interests of the angry individual when making decisions (Sell 2005, 2011; Sell, Tooby & Cosmides 2009). The anger system responds to cues indicating that the target does not value the angry individual's welfare very highly, e.g., the target imposes large costs on the angry individual for trivial benefits, the target thinks the angry individual is weak, ineffectual, unworthy of trust, or the target is uninterested in the wants or needs of the angry individual. Once triggered the anger system then deploys negotiative tactics such as cost imposition and benefit withdrawal that function to incentivize the target to recalibrate the weight they put on the angry individual's welfare in the future. Because cost infliction is one tactic that anger deploys to bargain for better treatment, and because personal fighting ability is one subcomponent of one's ability to

impose costs generally, it follows that males who are better fighters will have more power to bargain for better treatment. This increase in bargaining power will make anger more effective for better fighters (all else equal), and lead better fighters to feel entitled to better treatment from others, deploy anger more readily, use physical aggression more frequently and succeed more in conflicts. These relationships have been shown empirically in multiple US samples (Sell, Tooby & Cosmides 2009) and among non-Westerners such as East Indians (Archer & Thanzami 2007) the Aka of the Central African Republic (Hess et al. 2010) and the Tsimane of Bolivia (Sell et al. *forthcoming*).

Furthermore, the same pattern of effects was found between measured strength and anger as was found in the assessment literature on perceived strength: physical strength that was most combat-relevant drove the effect. Like the assessment literature, physical strength and not height or weight accounted for the relationship between strength and anger (Sell, Tooby & Cosmides 2009, Supplementary Information). And again, like the assessment literature, it was upper body strength rather than lower body strength that predicted anger. When performance on upper and lower body weight-lifting machines (i.e. leg press and chest press) are regressed on anger, the only effect is from chest strength (std. $\beta = .33$, $p = .08$) not leg strength (std. $\beta = .02$, $p = .93$). The same effect is found when upper and lower body are regressed on scales measuring the use of physical aggression (chest strength, std. $\beta = .31$, $p = .08$; leg strength, std. $\beta = .09$, $p = .64$) (from data published in Sell, Tooby & Cosmides 2009). Finally, again mirroring the assessment literature, the effect of physical strength on anger was reliably found only in males (though see Hess et al. 2010).

In contrast to ancestral environments, interpersonal physical aggression is rarely used within modern Western societies to resolve conflicts of interests. However, if human males evolved facultative mechanisms that are calibrated by assessments of their own fighting ability and the fighting ability of others, then these processes are predicted to continue to exert effects on behavior in contemporary environments in ways that are not rational. Just as human phobias are calibrated for ancestral dangers (Marks & Nesse, 1994), our faculties that govern interpersonal conflicts, feelings of entitlement, political decision-making, sexual attitudes and a host of other domains of human interaction were designed in an environment in which violence was much more common than today. In such an environment, one's probability of successfully imposing one's will on another and the probability of resisting another's will were partly a function of one's personal fighting ability and the fighting ability of those one could count as allies. This idea, that decision-making mechanisms and motivational systems evolved as solutions to problems faced by our ancestors in past environments, and that consequently they may not necessarily produce optimal outcomes in contemporary environments, is a core element to the evolutionary psychological approach (e.g. Tooby & Cosmides 1990).

If ancestral males could benefit from making facultative adjustments to their sense of entitlement and willingness to impose on others according to assessments of their own personal fighting ability, then we should expect evidence for such mechanisms to persist in modern humans. Specifically, this predicts that in our modern world, even when the rational effect of upper body strength has been minimized due to modern weaponry, comparatively low rates of violent interpersonal aggression, the existence of large and well-regulated police forces and judicial systems, and the extinction or

markedly reduced exposure to natural predators, a man's mental faculties will still respond in predictable ways to his personal fighting ability. In other words, the effect of physical strength on the minds of modern men in the Western world should be far greater than is warranted from a reasoned analysis.

There are now research programs underway that indicate the far reaching effects of physical strength for modern men on such diverse topics as attitudes toward crime and punishment (Petersen et al. 2010), calibration of extraversion and other personality variables (Lukaszewski & Roney 2010), attitudes towards egalitarianism (Price et al. 2011) and endorsement of various political attitudes (Sell, Tooby & Cosmides 2009; Petersen et al. *forthcoming*).

Strength and political attitudes

Attempts to explain the distribution of political attitudes in modern populations by reference to rational choice have met with limited success. For a given topic, such as attitudes about income redistribution, those who benefit from the particular policy, e.g. the poor, are often no more in favor of it than those who are hurt by the policy, e.g. the rich (Kumlin 2007). This makes little sense if one expects modern political attitudes to stem from reasoned consideration of evidence and the careful selection of policies that are likely to benefit oneself if implemented. On the other hand, if modern political attitudes arise from psychological mechanisms that evolved to guide behavior in ancestral environments, then one would expect a modern cost-benefit analysis to have limited success in explaining voting behavior. Consequently, if it is the case that social decision-making mechanisms evolved to respond to ancestrally-relevant variables such as fighting

ability, then an understanding of how these mechanisms function could help shed light on individual differences in political attitudes that are otherwise difficult to explain.

By way of example, a new study by Petersen and colleagues shows the effect of physical strength in men on attitudes about income redistribution (*under review*).

Analyzed without the complications of macroeconomics¹, income redistribution is a simple conflict of interests: the poor benefit by taking the wealth of the rich and the rich benefit by not having their wealth confiscated. Looking at three large samples of US, Argentine and Danish men and women, there was little relationship found between one's socioeconomic status and one's attitude toward redistribution of wealth. The wealthy were not reliably opposed to having their income taken, nor did the poor reliably support taking the wealth of the rich. This is puzzling only if viewed from a rational choice perspective.

If viewed from the perspective of ancestral conditions without nation states and complicated taxation systems, the issue of income redistribution looks very different. There were no anonymous "rich" that could be taxed, but recognizable neighbors and acquaintances who could look at you while you attempted to lay claim to their resources and whom you would most likely interact with for years to come. Likewise, the "poor" would not have been a distant and relatively unknown group of people in need, but rather neighbors and acquaintances who could benefit from resources that you owned and may or may not turn to violence if they did not get what they wanted. In this context, the costs and benefits of laying claim to resources (your own or others) depended heavily on your ability to defend your own interests, one component of which would have been physical strength and fighting ability. As with anger, those men who were physically more

formidable could defend themselves against those who would confiscate their resources, and would be better able to impose their will on others when in need themselves.

Across three countries with varying political systems, Petersen et al. (*under review*) found that physically strong men, operationalized by flexed bicep circumference, were significantly more likely to hold self-favoring attitudes toward income redistribution. Poor men with thicker biceps were more likely to favor income redistribution, while rich men with thicker biceps were more likely to oppose income redistribution. These effects were robust even when controlling for factors known to affect political attitudes, e.g. age, SES, education. No effect of physical strength was found for women, who ancestrally were much less likely to use their own personal fighting ability to secure or defend their resources. This same three way interaction between physical strength, SES, and sex was found among US college students, Argentine college students, and a cross-national representative sample of Danes.

The same type of analysis applies to attitudes about warfare. Ancestrally, wars were fought with weapons that depended on upper body strength for the bulk of their destructive force. In such conditions, a man's probability of surviving and benefiting from armed conflict would have depended, to a large extent, on his personal fighting ability. Moreover, men may evaluate the utility of warfare using mechanisms that evolved to assess the costs and benefits of interpersonal violence. Consequently, to the extent that our modern political attitudes arise from mechanisms that respond to ancestrally-relevant cues rather than to modern rational analyses, one would predict that a man's personal fighting ability should still be a powerful predictor of his attitudes about the utility of war. All else equal, strong men should believe that warfare makes us safer

by punishing and deterring our enemies. Weaker men should be more swayed by arguments that warfare puts us in greater danger by encouraging and provoking our enemies.

This basic prediction has now been confirmed in three populations including two samples of US college students (Sell, Tooby & Cosmides 2009), Argentine college students and a national sample of Danes (Petersen et al. *under review*).

These lines of research demonstrate the pervasive effect of upper body strength on the minds of modern men. If the results are taken seriously, it suggests that many large, nation-state level decisions are being made by men whose attitudes and decision-making processes are informed by an ancestral calculus that weighs one's personal fighting ability as a relevant variable even when discussing national military action.

Warfare and the Hollywood action star

If attitudes about warfare are causally tied to a man's own sense of fighting ability, we would expect professions, industries, and coalitions of strong powerful men to be more likely to endorse attitudes about the utility of political aggression as a means of resolving conflicts of interest. More interestingly, even among professions that are typically left-leaning² with respect to attitudes about war we should expect to find exceptions among those who are physically formidable. We tested for this pattern among a small group of physically strong men, Hollywood action stars, who work and reside in a culture that is left-leaning compared to contemporary America, particularly when it comes to views on the utility of warfare. If physical strength in men leads to more positive views of the utility of war, then even in a population with predominately leftist

attitudes, such as Hollywood actors, those actors known for their physical strength and formidability should be more likely to be supportive of military action.

To test whether action stars were significantly more likely to believe in the utility of warfare, we gave individual surveys to 36 undergraduates at UCSB and 13 faculty and staff members of the Department of Anthropology to list four Hollywood actors of each of the following categories: action, dramatic and comedic. Any actor who was listed more than once in a given category was included in our analysis. If an actor was mentioned in more than one category, he was placed only in the category for which he was mentioned most frequently. This process produced a list of 80 actors (see Supplemental Information).

Each actor was then put into one of two political categories regarding the utility of warfare: leftwing (i.e. warfare leads to more problems) or rightwing (i.e. warfare solves problems). Because the actors were largely American citizens and working in America during the late 20th century, the “anti-war” position was indicated by the support of the Democratic Party who, to a large extent, opposed the Vietnam and Iraq wars that constitute America’s most significant foreign military actions in the latter part of the century. The complications of history make this a simplification, but for the purposes of this study what matters is the public perception of the parties’ platforms. The Democratic Party has been the party supported by those who wish to end foreign incursions and the Republican Party has been the party supported by those who wish to use the US military to attack America’s enemies (Aldrich et al. 2006). The actor’s political affiliation was assessed using a five-step ordered procedure:

- a) if the actor had run for office as a member of a political party, he was classified as a supporter of that party. One actor was classified by this criterion.
- b) if the actor's political donations to one party were more than double those to another, he was classified as a supporter of that party. Thirty-eight actors were classified by this criterion.
- c) if the actor made direct statements regarding a military action by the United States he was categorized accordingly. Eight actors were classified by this criterion.
- d) if the actor made direct statements of support for a party or a politician, or if they spoke at a party fund raiser or convention they were categorized accordingly. Eleven actors were classified by this criterion.
- e) finally, if not classified by any previous criteria, actors were classified by any stated support they had for leftwing or rightwing causes. Only three actors were classified according to this criterion based on support of these leftwing causes: desire for more regulation of free market capitalism, support for Che Guevera, and preference for government-provided universal health care.

Of the original 80 actors, 61 were categorized by one of the criteria above and included in our analyses. Of the 19 actors who could not be classified according to the support for a US political party, 16 were non-US citizens for at least part of their lives. Only three US citizens were not classifiable. As expected, Hollywood actors are generally more supportive of leftwing politics and politicians; with 47 of the actors (77.0%) being categorized as left wing and 14 (23.0%) categorized as right-wing. Despite that general pattern, a chi-square test indicated significant differences in the distribution of political attitudes between different categories of actors ($\chi^2 = 15.0$; $df = 2$;

$p < 0.001$). As shown in Figure 2, those actors who are known for their physical strength and formidability, action stars, were the exception. More than half of Hollywood action stars in our sample (56.3%) were right-wing according to our categorization process. These included such imposing figures as Arnold Schwarzenegger, Bruce Willis, Chuck Norris, Clint Eastwood, Sylvester Stallone, Dwayne Johnson (“the Rock”), and Charlton Heston. Post-hoc comparisons indicated that right-wing categorizations were significantly more common ($\chi^2 = 13.9$; $df = 1$; $p < 0.001$) among action actors (56.3%) than dramatic actors (4.2%). Similarly, right-wing categorizations were more common ($\chi^2 = 5.5$; $df = 1$; $p < 0.05$) among action actors than comedic actors (19.0%).

Consistent with the hypothesis that physical strength is linked to positive views of the utility of warfare, many of the action stars categorized as leftwing were indeed physically less imposing than their rightwing counterparts. For example, Nicholas Cage, Tom Cruise, Pierce Brosnan, and Keanu Reeves are prominent leftwing action stars but do not appear to have the same physiques as Schwarzenegger, Stallone or Chuck Norris. Furthermore, several of the rightwing comedic and dramatic stars were also physically formidable, such as Matthew McConaughey and Vince Vaughn. Though they were not mentioned repeatedly by our subjects, and thus did not contribute to our analysis, there are many other physically formidable actors who contributed or supported rightwing political causes including James Earl Jones, Tom Selleck, LL Cool J, Lorenzo Lamas, Dean Cain, Mickey Rourke, Clint Walker, Clancy Brown, Chuck Connors, Ronald Reagan, “Hulk Hogan” and Kurt Russell.³

Although physical height, compared to upper body strength, is a less powerful predictor of anger, aggression and entitlement in men (Sell, Tooby & Cosmides 2009),

less closely tracked when subjects rate “fighting ability” from the body, face (Sell et al. 2009), and voice (Sell et al. 2010), and less sexually dimorphic (Lassek & Gaulin 2009), it is nonetheless an objective measure that covaries with physical strength and predicts, to some extent, fighting ability. Because the height of actors is reported online⁴, this allows for an additional test of the hypothesis that actors who are physically more formidable are more likely to be rightwing with respect to the utility of war. A simple independent t-test compared the height of rightwing actors (mean = 72.7 inches) with the height of leftwing actors (mean = 70.3 inches) on our list and showed that the rightwing actors were significantly taller, $t(59) = 2.8, p = .007$. This is noteworthy since, unlike degree of muscularity, height is not subject to behavioural modification (e.g. through resistance training). Whereas men with positive beliefs about the utility of violence could be more motivated to develop their upper body strength through training, an association between height and views on the utility of warfare could not arise in such a way.

Conclusions

Upper body strength in adult males is a crucial variable that appears to have impacts on a wide range of mental mechanisms that were designed by natural selection at a time when personal physical aggression was far more common and individual differences in fighting ability were far more relevant for the resolution of conflicts, the deployment of anger and aggression, the calibration of political attitudes and the consequences of warfare. Despite the steady decline in physical aggression and violent deaths that have accompanied Western civilization, the human mind is still designed for ancestral environments (Tooby & Cosmides 1990), and this is evidenced by many lines

of research. Sex differences in body size and strength, perceptual and spatial abilities and physiological systems still show combat design in adult men. The existence of assessment mechanisms in the minds of men and women that track and respond to cues of upper body strength also testify to the importance fighting ability had for our ancestors. And finally the persistence of associations between upper body strength and psychological and behavioral variables in modern men shows how powerful the selection pressures were: physically stronger men have been shown to feel more entitled to better outcomes, to set a lower threshold for the triggering of anger and physical aggression, to have more self-favoring attitudes about income redistribution and believe more in the utility of warfare.

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ENDNOTES

- 1- Some theorists and political ideologies argue that redistributive policies may actually have wider benefits that improve life for the rich and poor alike, while others conversely claim that unfettered markets are more important for economic growth and consequently everyone's welfare. The details of these arguments are unlikely to be well known to the broader voting population, and the effect these ideas may have on voting behavior cannot explain any relationship between physical strength and attitudes about income distribution.

- 2- Where the terms “left” and “right” are used in the present manuscript they are intended to refer to their commonly understood meanings in the contemporary US – i.e. “left-leaning” refers to beliefs typically associated with the Democratic Party including a more “dovish” approach to war while “right leaning” refers to beliefs associated with the Republican Party including a more “hawkish” approach to war.
- 3- As with every human subject, Hollywood actors will have far more nuanced beliefs than can be captured in any dichotomous coding scheme. Kurt Russell and Clint Eastwood, for example, identify as libertarians, Bruce Willis has repudiated the religious right’s influence on the Republican Party, and Terry Bollea (“Hulk Hogan”) supported Obama and describes himself as “middle of the road” though he feels that the US should have continued the 1990 Gulf War until Iraq was conquered. These variations may be obscured when averages or categorizations are used in statistical testing, but it is important to keep in mind (particularly because actors are identifiable public figures) that individual beliefs and attitudes will vary considerably within categories.
- 4- These measurements stem from various reports of unknown reliability and need to be treated cautiously until replicated.

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Table 1: Sex differences that suggest male design for combat in humans

Male humans have:	Reference
greater upper body strength	Lassek & Gaulin 2009
taller bodies	Alexander et al. 1979
heavier bodies	Loomba-Albrecht et al. 2009
higher basal metabolic rates	Garn & Clark 1953
faster reaction times	Der & Deary 2006
thicker bones in the jaw	Humphrey et al. 1999
faster mental rotation and spatial visualization	Voyer et al. 1995
more accurate throwing	Jardine & Martin 1983
more accurate blocking of thrown objects	Watson & Kimura 1989
more interest in the practice of combat skills	Gibbons et al. 1997
stronger bones	Schoenau et al. 2001
greater bone density specifically in the arms	Wells 2007
easier heat dissipation	Burse 1979
more hemoglobin in the blood	Waalén & Beutler 2001
higher muscle-to-fat ratio	Loomba-Albrecht et al. 2009
larger hearts	Tanner 1970
higher systolic blood pressure	Tanner 1970
broader shoulders enabling efficient weapon use	Brues 1959; Tanner 1989
larger sweat capacity	Burse 1979
larger circulating blood volume	Burse 1979
greater resistance to dehydration	Burse 1979

tolerance for risk and dangerous activities	Wilson, Daly & Pound 2009
faster sensory frame shifting	Cadieux et al. 2010
thicker skin	Shuster et al. (1975)
larger lung capacity	Gursoy 2010
greater use of physical and homicidal aggression	Daly & Wilson 1988