



Sizing up the threat: The envisioned physical formidability of terrorists tracks their leaders' failures and successes



Colin Holbrook*, Daniel M.T. Fessler

Department of Anthropology and Center for Behavior, Evolution, & Culture, University of California, Los Angeles, Los Angeles, CA 90095, United States

ARTICLE INFO

Article history:

Received 18 May 2012

Revised 6 December 2012

Accepted 6 December 2012

Keywords:

Intergroup conflict

Formidability

Conceptual metaphor

Threat-detection

Coalitional psychology

ABSTRACT

Victory in modern intergroup conflict derives from complex factors, including weaponry, economic resources, tactical outcomes, and leadership. We hypothesize that the mind summarizes such factors into simple metaphorical representations of physical size and strength, concrete dimensions that have determined the outcome of combat throughout both ontogenetic and phylogenetic experience. This model predicts that in the aftermath of tactical victories (e.g., killing an enemy leader), members of defeated groups will be conceptualized as less physically formidable. Conversely, reminders that groups possess effective leadership should lead their members to be envisioned as more physically formidable. Consonant with these predictions, in both an opportunistic study conducted immediately after Osama bin Laden's death was announced (Study 1) and a follow-up experiment conducted approximately a year later (Study 2), Americans for whom the killing was salient estimated a purported Islamic terrorist to be physically smaller/weaker. In Studies 3 and 4, primes of victorious terrorist leaders led to inflated estimates of terrorists' physical attributes. These findings elucidate how the mind represents contemporary military power, and may help to explain how even largely symbolic victories can influence reasoning about campaigns of coalitional aggression.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

The announcement that the United States' military had killed Osama bin Laden triggered an outpouring of triumphant jubilation across the US. In President Obama's words, "The death of bin Laden marks the most significant achievement to date in our nation's effort to defeat al Qaeda" (2011). Regardless of one's perspective on the American "war on terror," understanding the psychology underlying intergroup aggression is vital. Violent intergroup conflict has been a significant determinant of fitness throughout the evolution of our species (Kelly, 2005; Wrangham & Peterson, 1996), indicating that humans may have evolved efficient ways of representing group for-

midability in order to facilitate assessments of whether to fight, flee, or appease enemies. At the proximate level of analysis, conceptual metaphor theory (Lakoff & Johnson, 1980) postulates that concrete, familiar domains of embodied experience provide intuitive structures with which to reason about relatively abstract domains (e.g., the danger posed by well-organized versus leaderless enemy groups). Here, we investigate the effects of bin Laden's death on Americans' representations of the physical size and strength of members of their current focal adversary, the al Qaeda terrorist network. Conversely, we also explore the influence that perceptions of effective leadership exert on representations of the bodily formidability of members of terrorist groups.

Modern technology has largely decoupled the threat that adversaries pose from considerations of their literal physical brawn. Nevertheless, from infancy onward, experience teaches that bigger, stronger people typically win conflicts. Likewise, body size and strength are elementary

* Corresponding author. Address: Department of Anthropology, University of California, 341 Haines Hall, Box 951553, Los Angeles, CA 90095, United States. Tel.: +1 (310) 794 9252; fax: +1 (310) 206 7833.

E-mail address: cholbrook01@ucla.edu (C. Holbrook).

determinants of the outcome of agonistic interactions in many species, and the same has likely been true throughout human evolution (Archer, 1988). Thus, complementary ontogenetic and phylogenetic considerations suggest that physical size and strength provide ready dimensions with which formidability may be conceptualized by the mind. In a recent finding bearing directly on the representation of actors in contexts of potential violence, persons capable of inflicting harm for reasons entirely unrelated to their bodily characteristics (i.e., possessing a gun or knife) were rated as physically larger and stronger (Fessler, Holbrook, & Snyder, 2012). Likewise, providing additional support for the hypothesis that formidability is conceptualized in terms of size and strength, men in the presence of allies were found to estimate a prospective violent adversary as smaller and weaker than were men who were either alone or had been temporarily isolated from their group (Fessler & Holbrook, *in press*). In related research, Schubert and colleagues have documented psychologically active size and verticality metaphors underlying concepts of social power (Schubert, 2005; Schubert, Waldzus, & Giessner, 2009; Zanolie et al., 2012; also see Duguid & Goncalo, 2012), and social power likely entails intuitions of dominance and the potential for violence (Clark, 2010). In sum, converging lines of evidence indicate that representations of formidability employ the dimensions of body size and strength.

In modern intergroup conflict, military power is the product of numerous factors, including weaponry, economic resources, alliances, tactical outcomes, and leadership. Our formidability representation model holds that the mind heuristically summarizes such variables, so that ongoing developments (e.g., victories or defeats) update a simple metaphorical representation of the conflicting parties' size and strength relative to one another. By this logic, indications that an adversary's group has suffered a strategic setback, such as a loss of leadership, may engender intuitions that members of that group pose less danger – and hence are physically diminished. The killing of Osama bin Laden by US forces provided a unique opportunity to test this prediction. We predicted that Americans for whom the killing of bin Laden was psychologically salient would evaluate a representative al Qaeda militant as physically smaller/weaker, and that this bias would not be explainable in terms of covarying patriotism or political attitudes. We also included an exploratory measure designed to test whether a symbolic representation of a group itself, rather than a constituent member, would show a similar size bias attendant to bin Laden's death: reflecting the recent US victory over al Qaeda, we hypothesized that the flag of the United States would be envisioned as physically larger by US citizens for whom bin Laden's death was salient.

2. Methods

2.1. Participants and overview of procedure

Six hundred and thirty nine adults living in regions across the US were recruited between May 3rd (the day

after bin Laden's death was announced) and May 18th, 2011 via Craigslist.org to participate in an unpaid online study advertised as a survey of Americans' perspectives on world events. Data were pre-screened to ensure that participants identified as Americans, completed the writing task, did not enter frivolous height estimates (e.g., estimating the terrorist to be over 7 feet tall), and affirmed at the close of the study that they believed reports that bin Laden had been killed (a topic of some debate at the time). The final sample consisted of 481 adults (336 female) with a mean age of 36.1 years ($SD = 14.46$); the ethnicity of the sample was 79.5% White, 5.5% Hispanic, 3.4% African American, 2.1% Asian, and 9.6% mixed or Other.

After providing informed consent and demographic information, participants were asked to write about “the most personally exciting or gratifying news” they had heard in the past year concerning world events. Twenty-eight percent of the sample spontaneously wrote about bin Laden's death, an indication that the event was salient in their minds given that no reference to bin Laden, terrorism, or violence had been presented in either the study advertisement or the writing prompt. Following the open writing task, participants were asked to self-report personal traits, such as patriotism, likely to correlate with electing to write about bin Laden's death. Participants then estimated the physical characteristics of a purported terrorist based on a facial photograph depicting a swarthy, bearded man, identified as “an al Qaeda militant photographed at a training camp”. The image was cropped to ambiguate the model's bodily traits (see Fig. 1). Finally, participants were probed for suspicion about the hypotheses, asked whether they harbored doubts about whether bin Laden had been killed by US forces, thanked, and debriefed. Although several participants speculated that the study might involve terrorist stereotypes, none evinced suspicion that such stereotypes would relate to physical attributes influenced by politics, patriotism, or the salience of bin Laden's death.

2.2. Measures of individual differences

Our predictions concerned the consequences of bin Laden's death for American participants' mental representations, not the individual differences likely to correlate with choosing to write about bin Laden's death in the writing task. In order to take such differences into account, we asked participants to rate (using 9-point Likert scales) their political conservatism (1 = *Very liberal*, 9 = *Very conservative*), opinion of the current international prestige of the US (1 = *Not respected*, 9 = *Extremely respected*), and preference for US military intervention to resolve overseas conflicts (1 = *Diplomacy at all costs*, 9 = *Swift military action to neutralize any threat*). Patriotism was assessed using six items taken from Huddy and Khatib's (2007) patriotism scales (e.g., “How important is being American to you?”; $\alpha = .87$).

2.3. Measure of terrorist bodily traits

Participants estimated the height, overall size, and muscularity of a purported terrorist on the basis of a facial

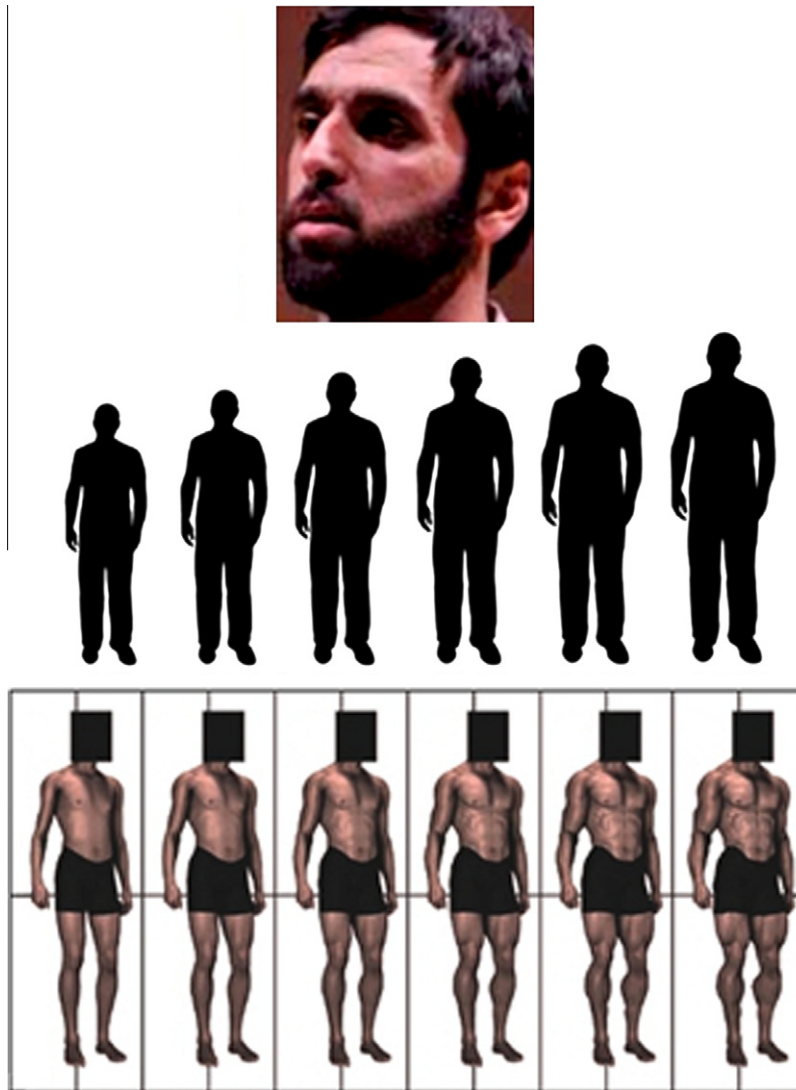


Fig. 1. Participants in Studies 1 and 2 viewed the facial photograph of a purported Islamic terrorist (top) and estimated his physical traits. Image arrays were used to estimate size/height (middle) and muscularity (bottom) in all studies. The muscularity array was modified from [Frederick and Peplau \(2007\)](#).

photograph (see [Fig. 1](#)). Height was estimated both in feet and inches and using a 6-point Likert scale assessing the terrorist's height relative to average (1 = *Much shorter*, 2 = *Moderately shorter*, 3 = *Slightly shorter*, 4 = *Slightly taller*, 5 = *Moderately taller*, 6 = *Much taller*). Two arrays of six images each were used to estimate overall size and muscularity (see [Fig. 1](#)). For each of these four ratings, standardized z-scores were calculated by subtracting the mean rating in the entire sample from the individual rating, then dividing this difference by the standard deviation for the sample. The target's estimated physical formidability was then composited using the standardized values of these four ratings ($\alpha = .66$). Accordingly, composite scores above zero are above average for the entire sample, and composite scores less than zero are below average for the entire sample.

2.4. Measure of relative size of the United States flag

Flags were employed to symbolize nations. Participants were asked to carefully view animated videos (presented in counterbalanced order) of a US and a Saudi Arabian flag rapidly descending into a three-dimensional field over a period of 2 s, then answer questions about the flags' relative physical properties (see [Video S1 in the Supplementary material](#) available online). The Saudi Arabian flag was selected primarily because Osama bin Laden and the majority of the 9/11 hijackers were Saudis; we also reasoned that those participants who failed to recognize the Saudi Arabian flag would nevertheless associate the prominent Arabic inscription with a predominantly Islamic country, and that the sword icon might connote potential militarism. Using forced-choice responses, participants

were asked to identify differences in size, speed, and regularity of motion between the two flags – in actuality, the flags were identical in all three respects. The two non-size questions were included as controls to rule out the possibility that participants who wrote about bin Laden would select the US flag whether or not the question pertained to size.

3. Results

All analyses in this paper are two-tailed, $\alpha = .05$.

3.1. Envisioned physical formidability of al Qaeda terrorist

In support of our predictions, a one-way ANOVA revealed that participants who wrote about bin Laden's death estimated the purported terrorist to be less physically formidable ($M = -.11$; $SD = .73$) than those who wrote about other topics ($M = .06$; $SD = .69$), $F(1,448) = 5.33$, $p < .03$, $\eta_p^2 = .01$ (see Fig. 2). Although the results are consistent with our formidability representation hypothesis, participants predisposed to write about bin Laden's death may have rated the terrorist as less physically formidable for reasons orthogonal to the salience of the coalitional

victory (e.g., politically conservative individuals might employ such ratings as a way to derogate an enemy). A one-way MANOVA confirmed that participants who wrote about bin Laden scored significantly higher on all four individual difference variables (see Table 1). We therefore conducted a simultaneous linear regression of formidability estimation on writing about bin Laden, patriotism, conservatism, viewing the US as prestigious, and favoring military intervention, to test whether these traits might account for the observed difference in ratings of the terrorist's physical person. A significant model emerged, $F(5,440) = 2.63$, $p < .03$, $R^2 = .029$. In support of our formidability representation hypothesis, only writing about bin Laden significantly predicted the estimated physical traits of the terrorist (see Table 2).

A follow-up MANCOVA assessing the individual estimations of height, size, and muscularity (controlling for differences in patriotism, conservatism, views of the US as prestigious, and preference for military intervention) revealed a significant main effect of condition, $F(3,436) = 4.73$, $p = .001$, $\eta_p^2 = .04$. Participants who spontaneously wrote about bin Laden's death envisioned the al Qaeda militant as shorter, smaller, and less muscular, although only relative height and muscularity differed significantly between conditions (see Table 3).

3.2. Relative size of the United States flag

Next, we tested whether those who wrote about bin Laden's death represented the US flag as physically larger. A one-way MANOVA revealed significant effects of order of presentation for judgments of speed, size, and regularity of motion ($ps < .01$); consequently, order was controlled for in subsequent analyses. As predicted, a one-way MANCOVA revealed that participants who wrote about bin Laden judged the US flag to be larger more often (73.7%) than those who wrote about other topics (63.6%), $F(1,458) = 6.04$, $p < .02$, $\eta_p^2 = .01$, with no effect of writing about bin Laden on judgments of either speed or regularity ($ps > .3$). We next conducted a simultaneous logistic regression of flag size judgment on writing about bin Laden's death, conservatism, patriotism, viewing the US as prestigious, favoring military intervention, and order of flag presentation. In the model, patriotism significantly predicted judgment bias, ($\beta = .18$, $SE = .07$, $p < .02$), and the effect of writing about bin Laden dropped below the level of significance ($\beta = .27$, $SE = .25$, $p = .28$). Thus, writing about bin Laden's death appears to have indexed patriotic sentiments, which led participants to judge the US flag as larger due to a metaphorical link between patriotic valuation and physical size. The bias in flag size ratings, therefore, did not reflect a metaphorical representation of the US as more formidable after killing bin Laden.

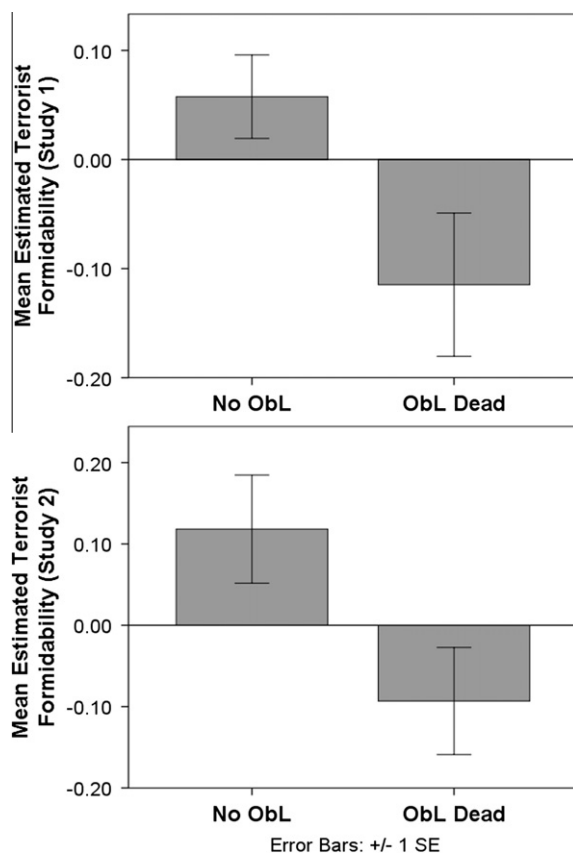


Fig. 2. Top: Judgments of terrorist's physical formidability (standardized scores) by spontaneous writing topic (Study 1). Bottom: Judgments of terrorist's physical formidability (standardized scores) by randomly assigned news recollection condition (Study 2).

4. Discussion

The findings of Study 1 are consistent with the formidability representation hypothesis: US citizens for whom the death of bin Laden was salient rated a putative generic member of the degraded out-group as physically smaller

Table 1
Individual differences related to writing about Osama bin Laden's killing.

	No mention of ObL (N = 347)		Wrote about ObL (N = 134)		F	η_p^2
	M	SD	M	SD		
Patriotism	6.27	1.54	4.81	1.81	67.67***	.13
Conservatism	3.79	1.59	3.04	1.51	23.22***	.05
View US as respected	4.61	1.80	3.93	1.71	14.46***	.03
Favor military force	4.91	2.18	3.93	2.01	21.38***	.04

*** $p < .001$.

Table 2
Linear regression of potential predictors of terrorist's estimated physical formidability.

	B	SE	Beta	p
Wrote about bin Laden	-.237	.079	-.15	.003**
Patriotism	.023	.023	.061	.323
Conservatism	-.007	.026	-.016	.772
View US as respected	.035	.020	.087	.082
Favor military force	.014	.018	.043	.435

** $p < .01$.

Table 3
Mean estimated height, size, and muscularity of al Qaeda militant (Study 1).

	Wrote about ObL (N = 134)		No mention of ObL (N = 347)		F	η_p^2
	M	SD	M	SD		
Height (in in.)	69.29	2.47	69.57	2.46	1.43	.00
Relative height	3.47	.75	3.58	.77	4.11*	.01
Size	4.02	.90	4.04	.78	1.01	.00
Muscularity	1.96	.86	2.27	.85	15.86***	.04

* $p < .05$.

*** $p < .001$.

and weaker. Regression analyses demonstrated that conceptualizing the terrorist as physically less formidable was uniquely linked to the salience of bin Laden's death, and was not a side-effect of patriotism, conservatism, viewing the US as internationally respected, or favoring military solutions to conflict. Although these results speak to the unique contribution of the salience of bin Laden's death to representations of the size and strength of an al Qaeda terrorist, because this study was correlational, an experimental design is needed if we are to determine causation. We therefore conducted a second study to assess whether manipulation of the salience of bin Laden's death would lead Americans to imagine a representative al Qaeda member as physically less formidable. The experiment was conducted approximately 10 months after bin Laden's death was announced. Consequently, this follow-up study

also tests whether an effect of the type observed in the immediate aftermath of the announcement persisted.¹

5. Methods

5.1. Participants and overview of procedure

Three hundred adults living in regions across the US were recruited online via MechanicalTurk.com to participate in an online study advertised as a 5–10 min survey of Americans' perspectives on world events, in exchange for \$0.65 compensation. As in Study 1, data were pre-screened to ensure that participants identified as Americans, completed the writing task, and did not enter frivolous height estimates. In addition, all participants in this study were required to be able to accurately identify the year in which bin Laden was killed, to ensure both that participants knew of the event and that they took the study seriously. The final sample consisted of 231 adults (101 female) with a mean age of 31.2 years ($SD = 11.73$), 80.5% White, 3.5% Hispanic, 3.5% African American, 6.5% Asian, 6.0% mixed or Other.

After providing informed consent and demographic information (including single-item probes of political orientation and patriotism), participants were randomly assigned to write about either their recollections of the announcement of bin Laden's death, or, in the control condition, the announcement that the leaking BP oil well in the Gulf of Mexico had been capped. Following this writing task, participants estimated the physical characteristics of a purported terrorist based on the same photograph and caption used in Study 1. Finally, participants were probed for suspicion (and knowledge of the year bin Laden died), thanked, and debriefed. Although several participants speculated that the study might involve terrorist stereotypes, none evinced suspicion that such stereotypes would relate to physical attributes influenced by the reminder of bin Laden's death.

5.2. Measure of terrorist bodily traits

Overall size and muscularity were estimated as in Study 1. However, height was only measured using feet and inches in this study; the item assessing the terrorist's height relative to an average person used in the previous study was dropped to minimize potential demand characteristics, as vernacular English often employs height words to metaphorically express relative success or status (e.g.,

¹ We did not pursue perceived differences in flag size in the subsequent studies, as the results of Study 1, while interesting, indicate a metaphorical link between size and patriotism that is orthogonal to the perceived impact of the death of the al Qaeda leader on Americans' conceptualizations of al Qaeda's formidability.

Table 4
Mean estimated height, size, and muscularity of al Qaeda militant (Study 2).

	Wrote about ObL (N = 127)		Wrote about BP oil spill (N = 103)		F	η_p^2
	M	SD	M	SD		
Height	68.8	2.48	69.63	2.69	6.69**	.03
Size	3.92	.95	3.98	.74	.43	.00
Muscularity	2.05	.93	2.2	.88	1.85	.01

Note: Estimated heights are in inches.

** $p < .01$.

“standing tall”). The target’s estimated physical formidability was thus composited using standardized values for height (in feet and inches), overall size, and muscularity ($\alpha = .53$).²

6. Results

Preliminary analyses revealed that, by chance, participants who were assigned to write about bin Laden rated themselves as significantly less politically conservative ($M = 3.95$; $SD = 2.26$) than those who were assigned to write about the oil leak ($M = 4.53$; $SD = 2.11$), $F(1,229) = 3.95$, $p < .05$, $\eta_p^2 = .02$. A one-way ANCOVA controlling for political orientation revealed that, as predicted, participants who wrote about bin Laden’s death estimated the supposed terrorist to be less physically formidable ($M = -.09$; $SD = .74$) than those who wrote about capping the leaking oil well ($M = .12$; $SD = .66$), $F(1,229) = 5.96$, $p < .02$, $\eta_p^2 = .03$ (see Fig. 2); follow-up analyses confirmed that this effect of condition remains significant whether or not the difference in political orientation is controlled for. Indeed, participants’ estimations of the terrorist’s physical formidability were not correlated with individual differences in patriotism or politics, $ps > .15$. In addition, there was no interaction between writing condition and either variable, $ps > .5$.

A follow-up MANCOVA controlling for political orientation assessed the individual estimations of height, size, and muscularity, revealing a significant main effect of condition, $F(3,225) = 2.78$, $p < .05$, $\eta_p^2 = .04$. Participants who were assigned to write about bin Laden’s death envisioned the al Qaeda militant as shorter, smaller, and less muscular than those who wrote about the BP oil spill, although the differences between conditions were only significant for estimated height (see Table 4).

7. Discussion

Study 2 demonstrated that a reminder of the death of a hostile outgroup’s leader prompted a decrease in the envisioned physical formidability of a representative member of that group. Because the salience of bin Laden’s death was experimentally manipulated, these results extend Study 1 to allow causal inference. However, the findings

of both Studies 1 and 2 may reflect a stereotype of Middle-Eastern terrorists’ body types. That is, having bin Laden’s death in mind may have reduced the target’s imagined physical robustness by conjuring up images of relatively, small, thin militants, irrespective of al Qaeda’s defeat. Furthermore, Studies 1 and 2 both focused on a single group, al Qaeda, leaving open the possibility that the observed effects are an artifact of American views particular to al Qaeda, and do not generalize. Finally, our formidability representation model predicts that just as the loss of a leader should diminish imagined size and strength, possessing an accomplished leader should increase imagined size and strength. To address all of these matters, in Study 3, we primed participants with a vignette describing a victorious leader of a different Middle-Eastern terrorist group. In the control condition, participants read a vignette describing successful American leadership in the context of a natural disaster involving danger but not intergroup violence.

8. Methods

8.1. Participants and overview of procedure

400 adults living throughout the US were recruited online via MechanicalTurk.com to participate in an online study advertised as a 7–10 min survey of “Social Intuitions in World Events” in exchange for \$0.50 compensation. Participants were told that they would be asked to memorize information about world news, and later to imagine a person somehow involved in international affairs. The memory task actually functioned as a manipulation check to confirm that participants provided a written response describing the news information. The inclusion criteria were the same as those used in Study 2. The final sample consisted of 311 adults (141 female) with a mean age of 31.3 years ($SD = 11.02$), 77.6% White, 5.1% Hispanic, 7.0% African American, 6.7% Asian, and 3.6% mixed or Other.

After providing informed consent, participants were randomly assigned to read and memorize a brief vignette describing the successes of either a leader of a Pakistani terrorist organization or, in the control condition, the mayor of New Orleans during the recent landfall of Hurricane Isaac. The terror leadership vignette read:

Lashkar-e-Jhangvi (LeJ) is a militant group based in a region of Pakistan. The LeJ seeks to reduce Western influence on the Middle East, and advocates the use of force. Muhammad Ajmal, the leader of the LeJ, is a strategic genius who has planned many successful attacks. His leadership is a major advantage for the Pakistani LeJ, who are united behind him.

² The composite showed poor reliability by conventional standards, but Cronbach’s α scores of .5 or higher are regarded as within acceptable limits when, as here, the measure in question is comprised of few and highly distinct items (George & Mallery, 2003; Robinson, Wrightsman, & Andrews, 1991).

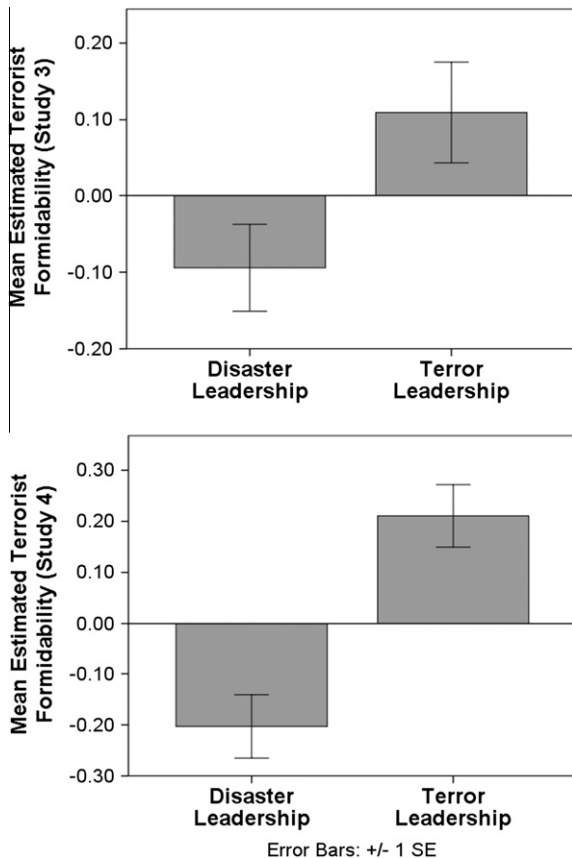


Fig. 3. Top: Pakistani terrorist's envisioned physical formidability (standardized scores) after reading about a victorious Pakistani terrorist leader or the mayor of New Orleans (Study 3). Bottom: Chechen terrorist's envisioned physical formidability (standardized scores) after reading about a victorious Chechen terrorist leader or the mayor of New Orleans (Study 4).

The control vignette read:

Exactly 7 years after Katrina battered the Gulf Coast, Hurricane Isaac hit the same area. Around 3000 people were evacuated from Plaquemines Parish, an area 95 miles from New Orleans. Mitch Landrieu, the mayor of New Orleans, helped organize a successful response. In wider Louisiana, more than 600,000 residents lost power, but the city of New Orleans avoided any major damage.

The ersatz memory task followed on the next page, and consisted of a free-response box in which participants were asked to recall details of the vignette. This writing task was actually intended as a manipulation check that participants attended to the information given in the passage. Following the memory task, participants estimated the envisioned characteristics of a fictional Pakistani terrorist, "Jhanda," using the same measures as in Study 2. Finally, participants were probed for suspicion, thanked, and debriefed. Although several participants speculated that the study might involve terrorist stereotypes, none evinced suspicion that reading about a successful leader would inflate imagined physical attributes.

9. Results

As before, estimated physical formidability was composed using standardized values for height, overall size, and muscularity ($\alpha = .65$). Consistent with predictions, a one-way ANOVA revealed that the target individual's envisioned composite formidability was significantly greater in the terrorist leader condition ($M = .11$, $SD = .78$) than in the control condition ($M = -.09$, $SD = .74$), $F(1, 309) = 5.56$, $p < .02$, $\eta_p^2 = .02$ (see Fig. 3). Participants' estimations of the terrorist's physical formidability were not correlated with individual differences in politics, $p > .5$, and there was no interaction between condition and politics, $p > .4$.

A follow-up MANOVA assessing the individual estimations of height, size, and muscularity revealed a significant main effect of condition, $F(3, 307) = 3.03$, $p < .05$, $\eta_p^2 = .03$. Participants who were assigned to memorize a description of the masterful leadership of a Pakistani terrorist group envisioned the generic militant as taller, larger, and more muscular than those who read about the leadership of the mayor of New Orleans during the landfall of Hurricane Isaac. Although all of the means were in the predicted direction, the differences between conditions were only significant for estimated height and size (see Table 5).

10. Discussion

In Study 3, consistent with predictions, information about the adept leadership of a hostile Pakistani terrorist group evoked an increase in the envisioned physical formidability of a member of that group, tracking the strategic advantage that a skillful leader provides. This indicates that the findings of Studies 1 and 2 do not owe to a stereotype of Middle Eastern terrorists as small and slender, and that the effects of group leadership on the physical robustness imputed to terrorist group members are not unique to al Qaeda. However, it remains to be seen whether these effects are limited to perceptions of Middle Eastern terrorists. Another outstanding question concerns the perceived self-relevance of the conflict: will conflicts regarded as orthogonal to one's welfare (i.e., combat between two out-groups) engage the bodily formidability metaphor, or is personal investment in the intergroup struggle a prerequisite? To the extent that conceptualizing group formidability in terms of physical size and strength

Table 5
Mean estimated height, size, and muscularity of Pakistani militant (Study 3).

	Read about terrorist leadership (N = 142)		Read about disaster leadership (N = 169)		F	η_p^2
	M	SD	M	SD		
Height	70.34	2.95	69.49	2.44	7.79**	.03
Size	4.00	.97	3.76	.95	4.69*	.02
Muscularity	2.29	1.08	2.23	.95	.21	.00

Note: Estimated heights are in inches.

* $p < .05$.

** $p < .01$.

affords the mind an efficient heuristic, one might predict that the same effects would be observed across group conflicts. However, given the automaticity of this potentially ancient system, and its evident application to interpersonal and intergroup conflicts in which the self is actually embedded, it may be the case that only conflicts of reflexively deep, personal relevance trigger the bodily formidability metaphor documented here. To explore this question, and to investigate the influence of perceived leadership on representations of a hostile out-group member from a region beyond the Middle East, in Study 4 we primed participants with a vignette describing a successful leader of militant Chechen separatists in conflict with the Russian Federation. In addition, a measure of trait aggression was added to directly test the hypothesized relationship between envisioned physical prowess and threat. The formidability representation hypothesis predicts that the terrorist leadership prime will heighten representations of the target militant's aggressiveness, and that imagined aggressiveness will correlate with imagined physical formidability.

11. Methods

11.1. Participants and overview of procedure

Four hundred adults living in regions across the US were recruited online via MechanicalTurk.com to participate in an online study advertised as a 7–10 min survey of “Social Intuitions in World Events” in exchange for \$0.50 compensation. Participants were again told that they would be asked to memorize information about a world event, and to imagine a person involved in world affairs. The memory task actually functioned as a manipulation check to confirm that participants provided a written response describing the news information. The inclusion criteria were the same as those used in Studies 2 and 3. The final sample consisted of 324 adults (161 female) with a mean age of 31.4 years ($SD = 11.83$), 75.6% White, 7.1% Hispanic, 5.2% African American, 7.7% Asian, and 4.4% mixed or Other.

After providing informed consent and completing demographic questions, participants were randomly assigned to read and memorize a brief vignette describing the successful leader of either a militant Chechen separatist organization or, as in Study 3, New Orleans during the recent landfall of Hurricane Isaac. The Chechen leader vignette read:

The Chechens are an ethnic group from the Caucasus region of Russia. Chechen separatists seek independence from Russia, and advocate the use of force. Basayev, the leader of the separatist movement, is a strategic genius who has planned many successful attacks. His leadership is a major advantage for the Chechen separatists, who are united behind him.

The ersatz memory task followed on the next page, and consisted of a free-response box in which participants were asked to recall details of the vignette. As in Study 3, this writing task was actually intended as a manipulation check that participants attended to the information given

in the passage. Following the memory task, participants estimated the characteristics of a fictional Chechen terrorist, “Elbek,” using the same measures as in Studies 2 and 3. Participants then rated the target's propensities for violence using the 9-item Physical Aggression subscale of Buss and Perry's Aggression Questionnaire (1992), reframed to apply to the envisioned Chechen separatist. Participants rated their agreement with statements about the target (e.g., “Once in a while he can't control the urge to strike another person”) according to a 7-point scale (1 = *Extremely uncharacteristic of him*; 7 = *Extremely characteristic of him*; $\alpha = .90$). Finally, participants were probed for suspicion, probed about their level of knowledge of Chechen politics, thanked, and debriefed. 96.3% of the sample described themselves as either totally unfamiliar (75.9%) or very unfamiliar (20.4%) with Chechen politics. Although several participants speculated that the study might involve terrorist stereotypes, none evinced suspicion that reading about a successful leader would inflate imagined physical attributes.

12. Results

Overall estimated physical formidability was composed using standardized values for height, overall size, and muscularity ($\alpha = .74$). A one-way ANOVA confirmed that the target individual's envisioned composite formidability was significantly greater in the victorious Chechen leader condition ($M = .21$, $SD = .77$) than in the control condition ($M = -.20$, $SD = .80$), $F(1,322) = 22.52$, $p < .001$, $\eta_p^2 = .07$ (see Fig. 3). Participants' estimations of the terrorist's physical formidability were not correlated with individual differences in politics, $p > .25$, and there was no interaction between condition and politics, $p > .5$. A follow-up MANOVA assessing the individual estimations of height, size, and muscularity revealed a significant main effect of condition, $F(3,320) = 7.66$, $p < .001$, $\eta_p^2 = .07$. As predicted, participants in the terrorist leadership condition envisioned the militant as significantly taller, larger, and more muscular (see Table 6).

Also consistent with predictions, a one-way ANOVA revealed that the Chechen separatist was envisioned as more prone to violence in the terrorist leader condition than in the control condition (see Table 6), and aggression scores correlated with composite physical formidability, $r(324) = .15$, $p < .01$. To test whether envisioned physical formidability mediated the effect of condition on trait aggression scores, we ran a bootstrapping procedure (5000 samples), using the INDIRECT macro for SPSS (Preacher & Hayes, 2008). We entered composite physical formidability scores as the mediating variable, leadership condition as the independent variable, and aggression as the dependent variable. Consistent with predictions, the direct effect of condition on aggression ($b = .32$, $\beta = .14$, $SE = .13$, $p = .01$) was no longer significant with composite physical formidability included in the model ($b = .25$, $\beta = .11$, $SE = .13$, $p > .05$), whereas the indirect effect of composite physical formidability on aggression remained significant ($b = .16$, $\beta = .12$, $SE = .08$, $p < .05$), and the bias-corrected and accelerated confidence intervals did not

Table 6

Mean estimated height, size, muscularity, and aggression of Chechen militant (Study 4).

	Read about terrorist leadership (N = 159)		Read about disaster leadership (N = 165)		F	η_p^2
	M	SD	M	SD		
Height	72.22	2.93	70.89	3.62	13.05***	.04
Size	4.53	.92	4.07	.95	19.71***	.06
Muscularity	3.20	1.09	2.77	1.19	11.28**	.03
Aggression	5.33	.99	5.01	1.22	6.59*	.02

Note: Estimated heights are in inches.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

overlap with zero (95% CI = [.01, .149]). In sum, perceptions of relatively greater physical formidability fully mediated the effects of the leadership condition on envisioned aggression.

13. Discussion

In Study 4, reading about a successful Chechen terrorist leader increased the envisioned physical formidability of a representative Chechen terrorist, replicating and extending the results of Study 3 to a non-Middle Eastern context. Moreover, Study 4 concerned a conflict between Chechen separatists and the Russian Federation, both of whom are presumably regarded as out-groups from the point of view of our American sample. This indicates that personal investment in an intergroup struggle is not prerequisite to engage the bodily formidability metaphor. To the contrary, the effects of manipulation in this experiment were more dramatic than in any of the previous studies: not only were all three bodily dimensions significantly shifted in the predicted direction, but, moreover, the magnitudes of these effects were appreciably greater than in our earlier studies. Conceivably, the participants' lack of personal investment in the conflict may have enhanced the impact of the manipulation due to lower levels of prior knowledge. That is, our American participants' ignorance regarding Chechnya may have rendered them more pliable to manipulation inasmuch as intuitions inspired by the formidability representation system were not at odds with preset expectations regarding the physical attributes of Chechen men.

Study 4 also extended our previous studies by demonstrating a positive association between the perceived strategic competence of a hostile group and the propensity for violence of its members. Importantly, the difference in participants' perceptions of the target's aggressiveness was mediated by differences in the target's perceived physical formidability. Accordingly, the observed differences in aggression ratings are consistent with the hypothesis that relative threat is metaphorically represented in terms of physical formidability.

14. General discussion

In Study 1, participants who spontaneously recounted news of Osama bin Laden's death estimated a representa-

tive al Qaeda terrorist to be less physically robust than did participants for whom other global events were more salient. In Study 2, conducted almost a year later, participants who were experimentally led to recall bin Laden's death estimated a purported terrorist to be less robust than did participants who were instructed to recall the capping of the leaking BP oil well. Importantly, in both studies, intuitions regarding the terrorist's physical formidability were not accounted for by individual differences in political attitudes or patriotism. Rather, it appears that cues of America's perceived victory over al Qaeda's leadership led Americans to adjust their representation of the weakened out-group members' bodily traits. The converse pattern was observed in Studies 3 and 4, wherein cues of effective leadership led to inflated estimates of terrorists' physical might. Taken together, the four studies provide compelling evidence that shifts in the potency of military leadership are tracked by shifts in the conceptualized size/strength of out-group adversaries.

Our findings broadly accord with the conceptual metaphor approach to cognition, which has produced converging evidence that abstract concepts are encoded as sensorimotor representations derived from bodily experience (Johnson, 1987; Lakoff, 1990; also see Barsalou, 2008). Here, we have shown that the relative danger posed by an effectively led (versus leaderless) group metaphorically translates to representations of members of that group as more or less physically endowed. To clarify, although it appears likely that social groups are sometimes conceptualized as persons (e.g., "Uncle Sam"), we have not demonstrated that group entities are understood via a body metaphor that tracks groups' strategic status. Rather, the present data concern the way that individual members of groups are represented via a body metaphor that tracks the apparent formidability of said groups concomitant to the loss or presence of their leadership. In Study 1, we explored whether a similar size bias would indeed hold for a symbol of the victorious group, but the analyses revealed that estimates of the US flag as bigger in the bin Laden defeat condition were driven by patriotism, not by a mechanism particular to representing victory in intergroup conflict. Rather, the observed link between patriotism and perceived flag size supports the premise that size can metaphorically connote group valuation. As a final clarification, we caution that whereas conceptual metaphor theorists emphasize the contributions of ontogenetic experience to the mind's architecture, the outcomes of

violent struggle have been so fundamentally linked to size and strength, and so profoundly relevant to biological fitness throughout our species' evolution, that there may be an innate component specific to the formidability representation system investigated here.

An unanswered question in need of future research concerns the distinct contributions of the height, size, and strength dimensions used to assess overall envisioned physical formidability in the present studies. The formidability representation hypothesis predicts a general sense of bodily fortitude, without favoring any particular dimension. There is no apparent reason that height, size, or muscularity should operate differently, yet, across Studies 1–3 (but not Study 4), we found mixed results for these individual parameters. Notably, although all means were in the predicted direction in all studies, only measures related to height were significantly shifted in every case. Interpreting the present pattern is difficult as the targets were framed as belonging to three distinct groups, each of which may be associated in participants' minds with distinct prototypes of male physiques. Follow-up research might probe if and why height is weighted more heavily as a formidability proxy by the mind. Relatedly, further work in this area should explore the effects of significant tactical outcomes unrelated to leadership on envisioned formidability – perhaps the consistent effects on height observed in the present studies owe to special relations with concepts of leadership (see Yap, Mason, & Ames, 2012), whereas manipulations of other strategic factors (e.g., access to armaments) might disproportionately shift ratings of non-height dimensions (e.g., muscularity) for reasons that are unclear at present.

From an applied standpoint, the present findings may illuminate the psychology underlying some Americans' inclinations toward coalitional aggression in the wake of bin Laden's killing, as conceptual metaphors have been demonstrated to bias reasoning in an array of domains (Boroditsky & Ramscar, 2002; Gentner & Gentner, 1983), including crime prevention (Thibodeau & Boroditsky, 2011). In reasoning about intergroup relations, metaphorically construing one's group members as bigger and stronger than members of antagonistic groups may propel support for coalitional violence and dominance, particularly given that physical formidability has been linked with propensities for interpersonal violence and dominance (Archer & Thanzami, 2007; Felson, 1996; Hess, Helfrecht, Hagen, Sell, & Hewlett, 2010; Sell, Tooby, & Cosmides, 2009). Conversely, representing an enemy as sufficiently small and weak may, in some circumstances, fuel inclinations to cease hostilities insofar as the prospective threat is regarded as neutralized. To the extent that either impulse derives from heuristic representations rather than careful deliberation, citizens and policy makers would be well advised to take into account biases in judgment potentially introduced by their metaphorical intuitions.

Acknowledgments

This material is based upon work supported by the US Air Force Office of Scientific Research under Award #FA9550-10-1-0511. We thank Bobak Bakhtiari for model-

ing as the purported terrorist, and our many dedicated research assistants for their online recruitment efforts in the immediate aftermath of Osama bin Laden's death.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.cognition.2012.12.002>.

References

- Archer, J. (1988). *The behavioral biology of aggression*. Cambridge: Cambridge University Press.
- Archer, J., & Thanzami, V. L. (2007). The relation between physical aggression, size and strength, among a sample of young Indian men. *Personality and Individual Differences*, 43, 627–633.
- Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, 59, 617–645.
- Boroditsky, L., & Ramscar, M. (2002). The roles of body and mind in abstract thought. *Psychological Science*, 13, 185–188.
- Buss, A. H., & Perry, M. P. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, 63, 452–459.
- Clark, J. (2010). Authentic and hubristic pride as serial homologues: The same but different. *Emotion Review*, 2, 397–398.
- Duguid, M. M., & Goncalo, J. A. (2012). Living large: The powerful overestimate their own height. *Psychological Science*, 23, 36–40.
- Felson, R. B. (1996). Big people hit little people: Sex differences in physical power and interpersonal violence. *Criminology*, 34, 433–452.
- Fessler, D.M.T., & Holbrook, C. (in press). Friends shrink foes: The presence of comrades decreases the envisioned physical formidability of an opponent. *Psychological Science*.
- Fessler, D. M. T., Holbrook, C., & Snyder, J. K. (2012). Weapons make the man (larger): Formidability is represented as size and strength in humans. *PLoS ONE*, 7(4), e32751. <http://dx.doi.org/10.1371/journal.pone.0032751>.
- Frederick, D. A. & Peplau, L.A. (2007, January). The UCLA body matrices II: Computer-generated images of men and women varying in body fat and muscularity/breast size to assess body satisfaction and preferences. *Poster presented at the annual meeting of the Society for Personality and Social Psychology*.
- Gentner, D., & Gentner, D. (1983). Flowing waters and teeming crowds: mental models of electricity. In D. Gentner & A. Stevens (Eds.), *Mental models*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference* (4th ed.). Boston: Allyn & Bacon.
- Hess, N., Helfrecht, C., Hagen, E., Sell, A., & Hewlett, B. (2010). Interpersonal aggression among Aka hunter-gatherers of the central African Republic. *Human Nature*, 21, 330–354.
- Huddy, L., & Khatib, N. (2007). American patriotism, national identity, and political involvement. *American Journal of Political Science*, 51, 63–77.
- Johnson, M. (1987). *The body in the mind: The bodily basis of meaning, imagination, and reason*. Chicago: University of Chicago Press.
- Kelly, R. (2005). The evolution of lethal intergroup violence. *Proceedings of the National Academy of Sciences*, 102, 24–29.
- Lakoff, G. (1990). The invariance hypothesis: Is abstract reason based on image schemas? *Cognitive Linguistics*, 1, 39–74.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.
- Obama, B. H. (2011, May 2). Obama's remarks on bin Laden's killing. *The New York Times*. Retrieved from <<http://www.nytimes.com/2011/05/02/world/middleeast/02obama-text.html?pagewanted=all>>.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40, 879–891.
- Robinson, J. P., Wrightsman, L. S., & Andrews, F. M. (Eds.). (1991). *Measures of personality and social psychological attitudes*. San Diego: Academic Press.
- Schubert, T. (2005). Your highness: Vertical positions as perceptual symbols of power. *Journal of Personality and Social Psychology*, 89, 1–21.
- Schubert, T. W., Waldzus, S., & Giessner, S. R. (2009). Control over the association of power and size. *Social Cognition*, 27, 1–19.

- Sell, A., Tooby, J., & Cosmides, L. (2009). Formidability and the logic of human anger. *Proceedings of the National Academy of Sciences*, *106*, 15073–15078.
- Thibodeau, P. H., & Boroditsky, L. (2011). Metaphors we think with: The role of metaphors in reasoning. *PLoS ONE*, *6*, e16782. <http://dx.doi.org/10.1371/journal.pone.0016782>.
- Wrangham, R. W., & Peterson, D. (1996). *Demonic males: Apes and the origins of human violence*. Boston: Houghton Mifflin.
- Yap, A., Mason, M. F., & Ames, D. R. (2012). The powerful size others down: The link between power and estimates of others' size. *Journal of Experimental Social Psychology*.
- Zanolie, K., van Dantzig, S., Boot, I., Wijnen, J., Schubert, T. W., Giessner, S. R., et al. (2012). Mighty metaphors: Behavioral and ERP evidence that power shifts attention on a vertical dimension. *Brain and Cognition*, *78*, 50–58.