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Gruesomeness conveys formidability: Perpetrators of gratuitously grisly acts are conceptualized as larger, stronger, and more likely to win

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Abstract

While associated with extreme terrorist organizations in modern times, extensive accounts of grisly acts of violence exist in the archeological, historical, and ethnographic records. Though reasons for this dramatic form of violence are multifaceted and diverse, one possibility is that violence beyond what is required to win a conflict is a method by which violent actors communicate to others that they are formidable opponents. The formidability representation hypothesis predicts that formidability is cognitively represented using the dimensions of envisioned bodily size and strength. We tested the informational ramifications of gruesome acts using two vignette studies depicting individuals who either did or did not grievously damage the corpse of a deceased foe. Participants rated the individual's height, bodily size, and strength, as well as his aggressiveness, motivation, and the capacity to vanquish opponents in future conflicts. Results indicate that, as predicted, committing gruesome acts of violence enhances perceptions of formidability as measured both by envisioned bodily size and strength and expectations regarding the outcomes of agonistic conflicts. Moreover, the gruesome actor was perceived as more aggressive and more motivated to overcome his enemies, and this mediated the increase in conceptualized size and strength. These results both provide further evidence for the formidability representation hypothesis and support the thesis that overtly grisly violence is tactically employed, in part, because it conveys information about the perpetrator's formidability.

KEYWORDS

formidability, signaling, terrorism, threat assessment, violence

1 | INTRODUCTION

Impaled. Dismembered. Beheaded. The archeological, historical, and ethnographic records are replete with evidence not only of violence, but of violence that is overtly grisly and goes beyond simply ending the threat posed by an antagonist (Alfsdotter & Kjellström, 2019; Dawes, 2013; Dolce, 2017; Thrasher & Handfield, 2018; Watson & Phelps, 2016; Rosaldo, 1980). Today, Internet searches readily return photos and videos of the acts of terrorist organizations, crime syndicates, and repressive regimes, all of whom not only kill their victims, but conspicuously damage them in a gruesome fashion. These actions appear to be intended to intimidate opponents. Here, we explore (a) the communicative facet of gruesome acts of violence, and (b) the thesis that the formidability of a potential antagonist is cognitively represented using the dimensions of bodily size and strength. We examine how observers impute dispositional and motivational attributes on the basis of gruesome acts and demonstrate that representations of relative formidability translate into expectations regarding the outcomes of agonistic conflicts.

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When faced with a potential social interaction, accurately assessing the other party is essential for effective decision-making. The ability to quickly and efficiently compute information about potential asymmetries in the event of conflict leads to an evolutionarily stable strategy that optimizes outcomes for both the likely winner and the likely loser of a confrontation. Evolutionary game theory predicts that organisms should be selected to compete aggressively for a resource if the fitness benefit of gaining that resource is greater than the cost of acquiring it (Maynard Smith & Parker, 1976). Acquiring the resource through fighting brings with it the risk of injury or death. Assessing the potential cost of escalating a confrontation requires estimating whether one's opponent is more powerful, or more motivated to fight, and therefore more likely to win a fight if one occurs. Natural selection has shaped organisms to be able to accurately assess asymmetries in power or aggressive motivation, and therefore make accurate predictions about winning or losing fights before deciding whether or not to escalate a contest.

Across the animal kingdom, body size, and strength or power (as estimated through observable muscle mass or weaponry such as fangs, claws, or horns) are reliable predictors of winning physical contests (Archer, 1988; Arnott & Elwood, 2009). Accordingly, size is often used as a proxy for resource holding potential, or the ability to win an all-out fight (Archer, 1988; Parker, 1974). However, these are not the only factors that can influence the likelihood of winning a contest. For example, the willingness to initiate or escalate a contest (aggressiveness) and the value of the resource to the organism (motivation) can each influence both the expectations and the actual outcome of contests in humans and other animals (Barlow, Rogers, & Fraley, 1986; Hofmann & Schildberger, 2001; Pietraszewski & Shaw, 2015; Westneat & Fox, 2010). Moreover, such outcomes in humans also depend on a wide variety of factors, including martial skill, the presence of allies, access to weaponry, and so on.

With multiple variables playing a role in the outcome of a potential contest, decision-making becomes complex. To simplify and expedite decision-making, relevant information about a conspecific can be summarized in a single heuristic representation, essentially constituting a running tally of relative strengths and weaknesses. As variously articulated by Fessler, Holbrook, and Snyder (2012), the formidability representation hypothesis (FRH) holds that the tactical and motivational assets and liabilities of a potential antagonist (i.e., the determinants of the antagonist's *formidability*) are cognitively represented in terms of the conceptualized size and strength of the opponent. Size and strength are phylogenetically ancient proxies for fighting success, and consequently, humans can quickly and accurately assess relative differences in size and strength (Durkee, Goetz, & Lukaszewski, 2018; Sell et al., 2008). Importantly, the FRH does not concern online visual assessments of this sort and is orthogonal to the theoretical possibility that conceptual representations of individuals might to some (presumably very minor) extent influence perception via top-down influence. Instead, the FRH pertains to heuristic conceptual representations that can guide decision-making in conflictual situations. Representations of relative size and strength are particularly plausible conceptual dimensions to employ in this regard, as these physical attributes have reliably predicted the outcome of agonistic conflict both throughout vertebrate evolution and throughout the developmental experience.

Here, we hypothesize that, whether or not perpetrators are conscious of the communicative consequences, committing gruesome acts of violence enhances observers' assessments of the perpetrator's formidability. If formidability is represented along the dimensions of envisioned bodily size and physical strength, and if gruesome acts of violence reveal attributes of the actor that enhance formidability, then perpetrators of such acts should be conceptualized as physically larger and stronger than equivalent actors who do not engage in gruesome behavior.

Consonant with the FRH, multiple variables that influence formidability have been shown to affect the envisioned size and strength of an antagonist in humans, including the antagonist's possession of a weapon (Fessler et al., 2012), effective group leadership (Holbrook & Fessler, 2013), the presence of allies (Fessler & Holbrook, 2013a), group synchrony (Fessler & Holbrook, 2014, 2016), and membership in a group stereotyped as dangerous (Holbrook, Fessler, & Navarrete, 2016; Wilson, Hugenberg, & Rule, 2017). Likewise, information about the self that influences formidability has also been shown to affect the envisioned size and strength of an antagonist, including own physical strength (Fessler, Holbrook, & Gervais, 2014), parenthood (Fessler, Holbrook, Pollack, & Hahn-Holbrook, 2014), physical incapacitation (Fessler & Holbrook, 2013b), perceptions of one's group as being capable of victory (Holbrook, López-Rodríguez, Fessler, Vázquez, & Gómez, 2017), and feelings of social power (Duguid & Goncalo, 2012; Yap, Mason, & Ames, 2013). Hence, it appears that humans possess psychological mechanisms that summarize formidability in terms of envisioned size and strength across a wide variety of threat-related variables.

The deployment of signals is frequently advantageous in situations of potential conflict, as the costs of signaling are often lower than the costs of conflict, hence signals that resolve the contest without conflict are profitable (Logue et al., 2010; Maynard Smith & Price, 1973). The FRH has previously been used to show that multiple aspects of behavior can be understood as communicating attributes of the actor relevant to the assessment of formidability. For example, conspicuous voluntary recreational risk-taking indexes an indifference to one's own physical welfare; in turn, this attribute makes one a dangerous opponent and a valuable ally, as those who are willing to place themselves in harm's way are more likely to enter conflicts and more difficult to deter with threats. Correspondingly, individuals who engage in recreational physical risk-taking are envisioned to be larger, stronger, and more prone to violence (Fessler, Holbrook, Tiokhin, & Snyder, 2014; Fessler, Tiokhin, Holbrook, Gervais, & Snyder, 2014). Similarly, overtly displaying markers of coalitional affiliation in situations of potential coalitional conflict not only precludes feigning neutrality, but also advertises to onlookers that the actor invites a contest. Correspondingly, individuals who display such markers are envisioned to be larger, stronger, and more aggressive (Fessler, Holbrook, & Dashoff, 2016).

Our current studies employ a simple design: We ask participants to read a vignette in which a target individual is present when an

opponent dies, then either does or does not mutilate the dead opponent's remains. Examining the psychological characteristics that observers impute on the basis of gruesomely violent actions, we query participants regarding dispositional and motivational characteristics of the target individual that are linked to formidability. Addressing the core of the FRH, we also ask participants to estimate the target individual's bodily features. Lastly, to demonstrate that envisioned physical size and strength indeed encapsulate formidability estimates, we ask participants to predict the likelihood that the target individual would win an agonistic conflict, allowing us to compare such predictions with envisioned bodily proportions.

Because we are interested in the communicative component of grisly acts in isolation, our experimental stimuli specify that the perpetrator commits the gruesome behavior after his foe is dead rather than during conflict. Indeed, in both of our studies we are careful to make clear that, despite being enemies, the protagonist is not responsible for his opponent's death. Hence, any differences in participants' assessments of this target individual across conditions cannot owe to direct evidence of his physical attributes, lethality or ability to dominate an opponent. Likewise, we take pains not to present any information that can be used to infer the physical attributes of the protagonist or his martial prowess. Participants' inferences regarding the outcome of a subsequent agonistic conflict involving the target individual, therefore, constitute a direct application of their assessment of his formidability.

Summarizing the above, we investigated the hypothesized informational value of gruesome acts by testing the following discrete predictions:

H1: *Relative to the control condition, the gruesome action will enhance the target individual's perceived formidability, represented in terms of envisioned size and strength.*
H2: *Relative to the control condition, the gruesome action will enhance the target's perceived trait aggressiveness.*
H3: *Relative to the control condition, the gruesome action will enhance the target's perceived motivation to overcome adversaries.*
H4: *Relative to the control condition, the gruesome action will enhance the target's perceived likelihood of winning a future agonistic conflict.*

We also explored the possibility that the representation of the target individual's formidability in terms of envisioned size and strength will mediate the effect of condition on the perceived likelihood of winning an agonistic conflict.

2 | STUDY 1

2.1 | Methods

2.1.1 | Participants and vignettes

Participants ($N = 350$) from the United States were recruited from Amazon's Mechanical Turk (MTurk) crowdsourcing platform. Eligibility was contingent upon being 18 years or older, having completed at least 100 tasks, and having a 96% or higher approval rate. Participants were asked two content-based questions to ensure that they carefully read and understood the passages. After excluding individuals who missed either of the content-based questions, a final sample of 335 adults (159 female; $M_{age} = 35.99$; standard deviation [SD] = 11.22) was analyzed.

After obtaining informed consent, participants rated their own martial skills from 1 (*not very good*) to 10 (*extremely good*) with the following question: "Relative to the typical person of your gender, how good at physical fighting would you be if you were attacked?" Because formidability has been shown to be assessed in relation to one's own formidability, we were interested in seeing whether participants with higher self-rated formidability would rate the target relatively lower in formidability. After this, participants were randomly assigned to read one of two versions of a vignette about a man who is attacked while gathering mushrooms in the forest but is spared when his assailant dies in an accident. Mushroom gathering requires neither great strength nor large body size, and, unlike activities such as hunting, does not entail skills that could translate to agonistic conflicts. In addition, the target individual was described as encountering this adversary by chance, to avoid implicitly suggesting that the protagonist was inherently aggressive and/or welcoming of conflict. The two versions of the vignette varied in that they either did or did not include a grisly mutilation. The mutilation entailed no martial skills, as it was committed postmortem and did not require strength or size to conduct. All participants read the same first two paragraphs, as follows:

> *It is a cool autumn day near a rural mountain range. The area is historically known for violent conflicts between neighboring ethnic groups. However, it has been several years since the last major violent incident. The area has abundant natural resources, including substantial areas of undeveloped forest. People often go into the forests to hunt, fish, and gather wild mushrooms.*
>
> *One day, a man is gathering mushrooms in the wooded forest near the base of the mountains. Suddenly, he hears the cracking of a branch. He turns to see a hunter from a neighboring group. The hunter quickly realizes that the mushroom gatherer belongs to a different ethnic group. The hunter raises his rifle, aims it directly at the mushroom gatherer, and fires. There is a bright flash and lots of smoke. The hunter drops the rifle, staggering backwards and looking at a red stain spreading across his chest; he falls to the ground. Frightened, the mushroom gatherer crouches behind a rock and watches, but the hunter does not move. Realizing that the rifle must have misfired, he creeps toward the hunter, who lies immobile with his mouth agape and eyes open and unblinking. The*

mushroom gatherer bends down and puts two fingers to the other man's neck—no pulse. He notices a pocketknife in the man's shirt pocket. He picks it up and flicks open the blade.

Non-gruesome conclusion:

He inspects it before tossing it on the ground. Finally, he stands up and heads for home.

Gruesome conclusion:

He inspects it and then proceeds to gouge out the man's eyes and cut out his tongue. He then tosses the hunter's eyes and tongue on the ground along with the pocketknife. Finally, he stands up and heads for home.

2.1.2 | Measures

After reading the vignette and answering the content-based questions, participants were asked a series of questions about the mushroom gatherer.

2.1.3 | Trait aggression and motivation

Participants rated the target's trait aggressiveness using a modified version of the physical aggression subscale from Buss and Perry's (1992) Aggression Questionnaire (AQ). Statements from the AQ were rephrased to apply to the target instead of the self. For example, "If he had to resort to violence to protect his rights, he would." An aggressiveness score was calculated by averaging and normalizing the scores on the physical aggression subscale of the modified AQ (α = .94). While aggressiveness is one psychological factor that contributes to formidability, motivation to dominate opponents is also important. Accordingly, we also asked participants to estimate the mushroom gatherer's motivation, using a scale from 1 (*not very much*) to 10 (*extremely motivated*).

2.1.4 | Envisioned physical traits

As per the FRH, to gauge how participants envisioned the protagonist's physical attributes, we asked them to indicate how tall they thought the mushroom gatherer was in feet and inches, as well as perceived overall size and physical strength on separate six-point arrays (see Figure 1). Height, size, and strength measures were standardized and averaged to create a composite physical formidability measure (α = .76).

2.1.5 | Predicted agonistic success

Participants predicted how likely the protagonist would be to win a fistfight, using a scale from 1 (*not very likely*) to 10 (*extremely likely*).

The AQ was presented first, followed in random order by the height, motivation, and fistfight item; the two visual arrays were presented last, in a fixed order.

2.2 | Results

Statistical analyses for the main variables are reported in Table 1.

2.2.1 | Gruesomeness and envisioned physical formidability

As predicted by H1, the target's envisioned physical formidability was greater in the gruesome condition (M = 0.09; SD = 0.83) than in the control condition (M = −0.10; SD = 0.77), t(330) = 2.21; p = .028.

2.2.2 | Gruesomeness and perceived aggressiveness

As predicted by H2, the target's perceived aggressiveness was greater in the gruesome condition (M = 0.63; SD = 0.69) than in the control condition (M = −0.66; SD = 0.88), t(311) = 14.82; p < .001.

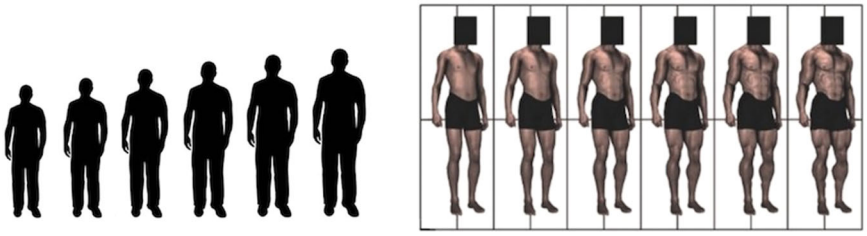

FIGURE 1 Six-point arrays used by participants to estimate the envisioned size (left) and strength (right). From Fessler et al. (2012); modified with permission from Frederick and Peplau (2007) [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Mean estimated formidability, aggressiveness, and motivation (Study 1)

	Gruesome		Control			Confidence interval		
Measure	*M*	*SD*	*M*	*SD*	*p*	Lower	Upper	Cohen's *d*
Formidability (*Z* score)	0.09	0.77	−0.10	0.83	.028	0.02	0.37	0.24
Win fistfight	6.92	1.95	5.38	1.96	<.001	1.12	1.96	0.79
Aggressiveness (*Z* score)	0.63	0.69	−0.66	0.88	<.001	1.11	1.45	1.63
Motivation	7.86	1.65	7.13	1.68	<.001	0.37	1.08	0.44

Abbreviations: *M*, mean; *SD*, standard deviation.

2.2.3 | Gruesomeness and perceived motivation

As predicted by H3, the target was perceived to be more motivated in the gruesome condition ($M = 7.86$; $SD = 1.65$) than in the control condition ($M = 7.13$; $SD = 1.68$), $t(332) = 3.99$; $p < .001$.

2.2.4 | Perceived aggressiveness mediates the effect of condition on formidability

Using the "psych" package in R (Revelle, 2017) we conducted bias-corrected, nonparametric bootstrapping analysis (based on 5,000 resamples) to test if aggressiveness mediated the relationship between condition (gruesome or non-gruesome) and envisioned formidability. The dependent variable was envisioned formidability, the independent variable was condition, and the mediating variable was perceived aggressiveness. The total effect of the scenario on formidability was significant (total effect [*TE*] = 0.12; standard error [*SE*] = 0.05; $p = .028$) and the direct effect without aggressiveness was not (direct effect [*DE*] = −0.11; $SE = 0.07$; $p = .10$). Consistent with the FRH, aggressiveness mediated the relationship between condition and envisioned formidability (indirect effect [*IE*] = 0.23; $SE = 0.05$; 95% confidence interval [CI] = [0.13, 0.33]; $p < .001$; $r^2 = .10$; Figure 2).

2.2.5 | Perceived motivation mediates the effect of condition on formidability

Motivation is another factor that could influence assessments of formidability. Therefore, we tested if motivation mediated the relationship between condition and envisioned formidability. The dependent variable was envisioned formidability, the independent variable was condition, and the mediating variable was perceived motivation. The total effect of the scenario on formidability was significant ($TE = 0.12$; $SE = 0.05$; $p = .028$) and the direct effect without motivation was not ($DE = 0.08$; $SE = 0.05$; $p = .13$). Consistent with the FRH, motivation mediated the relationship between condition and formidability ($IE = 0.04$; $SE = 0.02$; 95% CI = [0.01, 0.07]; $p < .001$; $r^2 = .10$).

2.2.6 | Aggressiveness versus motivation as a mediator of the effect of condition on formidability

In a mediation model including both perceived aggressiveness and motivation as mediators, aggressiveness ($DE = 0.21$; 95% CI = [0.11, 0.31]), but not motivation ($DE = 0.02$; 95% CI = [−0.01, 0.05]), mediated the relationship between condition and envisioned formidability, and the bootstrapped indirect effect remained significant ($IE = 0.22$; $SE = 0.05$; 95% CI = [0.13, 0.32]; $p < .001$; $r^2 = .10$).

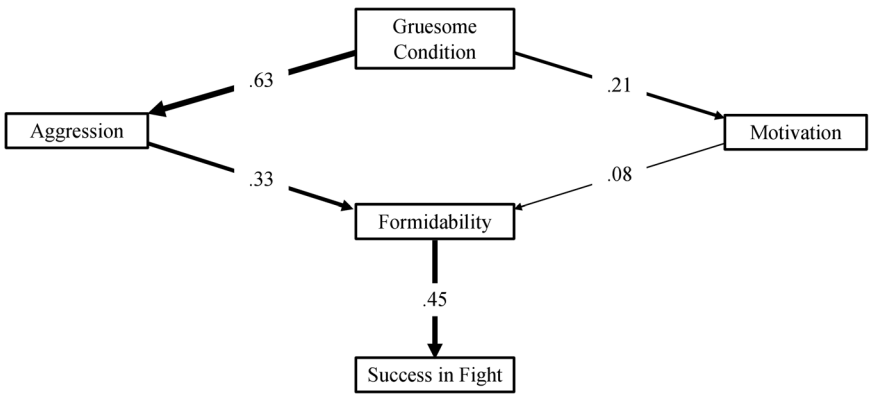

FIGURE 2 Path analysis figure with standardized regression coefficients for the relationship between the measured variables. Perceived aggressiveness and motivation to overcome enemies predict envisioned formidability, which in turn predicts perceived success in a fistfight

2.2.7 | Gruesomeness and winning a fistfight

Consistent with the FRH and as predicted by H4, the target was rated as more likely to win a fistfight in the gruesome condition (M = 6.92; SD = 1.95) than in the control condition (M = 5.38; SD = 1.96), $t(333) = 7.21$; $p < .001$.

2.2.8 | Envisioned formidability mediates the effect of condition on winning a fistfight

We tested whether envisioned formidability mediated the relationship between condition (gruesome or non-gruesome) and the likelihood of winning a fistfight. The dependent variable was the likelihood of winning a fistfight, the independent variable was condition, and the mediating variable was formidability. The total effect of the scenario on winning a fistfight was significant (TE = 0.37; SE = 0.05; $p < .001$) as was the direct effect (DE = 0.31; SE = 0.04; $p < .001$). Envisioned formidability mediated the relationship between condition and the perceived likelihood of winning a fistfight (IE = 0.05; SE = 0.03; 95% CI = [0.01, 0.11]; $p < .001$; $r^2 = .34$).

2.2.9 | Self-rated fighting ability and envisioned physical formidability

Across conditions, self-rated fighting ability did not predict lower ratings of target formidability ($\beta = -.015$; SE = 0.019; $F(1,333) = 0.602$; $p = .439$).[1]

2.3 | Discussion

Consistent with our predictions, a hypothetical protagonist who was described as committing a gruesome act was perceived to be larger, stronger, more aggressive, more motivated, and more likely to win a fistfight than an otherwise identical protagonist who did not perform such acts. Importantly, this difference occurs despite the complete absence of cues in the vignette of strength, size, or of initiating the conflict intentionally. Rather, these differences appear to derive entirely from the gruesome treatment of the corpse. As entailed by the notion that grisly acts reveal aspects of the perpetrator's character relevant to formidability assessment, our exploratory mediational analysis showed that perceived aggressiveness mediated the relationship between condition and envisioned formidability (for similar findings, see Holbrook et al., 2016). While the protagonist's inferred motivation to overcome opponents was not significant when included in a model alongside trait aggression, it did show mediation when considered in a model by itself, suggesting that our measure of motivation was treated by participants as a proxy for aggressiveness. However, the wording we used to assess impressions of the protagonist's motivation in Study 1 was imprecise with regard to what sort of motivation was under consideration. The question only asked how motivated the mushroom gatherer was instead of specifically asking about motivation with regard to overcoming enemies, a potential limitation addressed in Study 2.

The core prediction of this study was that a gruesome actor would be perceived as more formidable. The FRH predicts that formidability is represented using a mind's-eye image of the target individual varying along the dimensions of size and strength, and that this representation is used in forecasting the target individual's future performance in agonistic interactions. Supporting this, we found that envisioned formidability mediated the relationship between gruesomeness and perceived likelihood of winning a future fistfight—a direct measure of formidability. This finding lends further support to the FRH and reifies our core hypothesis about the relationship between gruesomeness and formidability.

The lack of an effect across conditions of self-rated fighting ability on envisioned formidability suggests that features of the self may contribute less to third-party than to second-party formidability assessments. Indeed, prior work exploring the effects of features of the self on assessments of formidability was designed such that the participant is confronted with a threatening stimulus or is asked to imagine being in such a situation (e.g., Fessler, Holbrook, Pollack, et al., 2014). In contrast, participants in this study play the role of a distant observer of events in which they are not involved. Thus, this study may not have been optimally designed to address questions about the role of features of the self in assessments of formidability. Another possibility is that sex influences the relationship between self-rated formidability and envisioned formidability (see Supporting Information Material for an analysis of sex differences). Because it was ancillary to our main interest and our study design was not optimized for it, the item concerning self-reported fighting ability was not included in Study 2.

Not all forms of aggression involve direct confrontation. If we are correct that observers interpret grisly acts as indexing dispositional and motivational features that contribute to overall formidability, and that formidability is represented using envisioned size and strength, then the deployment of a representation of enhanced formidability should occur regardless of whether the behavior being forecasted involves direct or indirect confrontation. Importantly, the FRH predicts that, ceteris paribus, proficiency in modes of attack which are entirely unrelated to physical size and strength should be conceptualized in terms of physical formidability. Accordingly, in Study 2 we added a measure concerning the use of poison to kill an enemy, while also retaining the fistfight item to allow for direct replication of Study 1. Many wild mushrooms are poisonous, and hence a mushroom gatherer would presumably be well positioned to poison others. To avoid the possibility of this mushroom-gathering confound, and to rule out the possibility that the results of Study 1 were somehow contingent on stereotypes of mushroom gatherers, we

[1]Using a one-tailed t test, we found a significant interaction between condition and self-rated fighting ability ($\beta = .063$; SE = 0.038; $F(3,331) = 1.684$; $p = .047$; $r^2 = .02$). Because previous studies on this topic involved threats to the self, the observed effect in the gruesome condition may suggest that the gruesome actor is being perceived as more threatening to the observer.

describe the protagonist in Study 2 as a fisherman. Both mushroom gathering and fishing can take place in the same setting, and neither connotes exceptional physical size or strength, allowing us to use the same vignette and test the direct effect of gruesome actions.

3 | STUDY 2

3.1 | Methods

Participants (N = 350) from the United States were recruited for Study 2 from Amazon's MTurk crowdsourcing platform. Eligibility was contingent upon being 18 years or older, having completed at least 100 tasks, and having a 96% or higher approval rate. After excluding individuals who missed either of the content questions, 321 participants (175 female; M_{age} = 36.88; SD = 11.81) were included in the analysis. Following the collection of informed consent, participants read the vignette and answered questions about the protagonist. As in Study 1, height, size, and strength measures were standardized and averaged to create the physical formidability measure (a = .70), and an aggressiveness score was calculated by averaging and normalizing the scores on the physical aggression subscale of the modified AQ (a = .93). Participants answered how likely it is that the fisherman would be capable of successfully poisoning his enemies without their knowledge. The motivation question was modified to specifically refer to the target individual's motivation "to overcome his enemies." A new question was added that asked about the likelihood of the fisherman successfully poisoning his enemies. We predicted that the fisherman in the gruesome condition would be rated as more likely to successfully poison his enemies than the fisherman in the control condition (H5). The AQ was presented first, followed in random order by height, motivation, fistfight item, and poison item; the two visual arrays were presented last, in a fixed order.

3.2 | Results

Statistical analyses for the main variables are reported in Table 2.

3.2.1 | Gruesomeness and envisioned physical formidability

As predicted by H1 and in line with Study 1, the target's envisioned physical formidability was greater in the gruesome condition (M = 0.12; SD = 0.77) than in the control condition (M = −0.14; SD = 0.77); $t(318)$ = 3.07; p = .002.

3.2.2 | Gruesomeness and perceived aggressiveness

Consistent with H2 and Study 1, the target's perceived aggression was greater in the gruesome condition (M = 0.57; SD = 0.75) than in the control condition (M = −0.61; SD = 0.89); $t(304)$ = 12.77; p < .001.

3.2.3 | Gruesomeness and perceived motivation

As predicted by H3, the target was perceived to be more motivated to overcome his enemies in the gruesome condition (M = 8.49; SD = 1.95) than in the control condition (M = 6.29; SD = 2.24); $t(308)$ = 9.38; p < .001.

3.2.4 | Perceived aggressiveness mediates the effect of condition on formidability

As in Study 1, we found that aggressiveness mediated the effect of gruesomeness on envisioned formidability. The total effect of the scenario on formidability was significant (TE = 0.17; SE = 0.06; p = .002) and the direct effect without aggressiveness was not (DE = −0.04; SE = 0.06; p = .49). As predicted by the FRH, aggressiveness mediated the relationship between condition and formidability (IE = 0.22; SE = 0.04; 95% CI = [0.14, 0.30]; p < .001; r^2 = .12).

3.2.5 | Perceived motivation mediates the effect of condition on formidability

Using the more specific question about motivation, we found that motivation to overcome enemies mediated the effect of

TABLE 2 Mean estimated formidability, aggressiveness, motivation, and poison (Study 2)

	Gruesome		Control			Confidence interval		
Measure	*M*	*SD*	*M*	*SD*	*p*	Lower	Upper	Cohen's *d*
Formidability (*Z* score)	0.12	0.77	−0.14	0.77	.002	0.10	0.43	0.34
Win fistfight	7.30	1.68	5.87	1.90	<.001	1.04	1.83	0.80
Aggressiveness (*Z* score)	0.57	0.75	−0.61	0.89	<.001	0.99	1.40	1.43
Motivation	8.49	1.95	6.29	2.24	<.001	1.74	2.66	1.05
Poison enemies	7.50	2.04	5.91	2.30	<.001	1.11	2.07	0.73

Abbreviations: *M*, mean; *SD*, standard deviation.

gruesomeness on envisioned formidability. The total effect of the scenario on formidability was significant (*TE* = 0.17; *SE* = 0.06; *p* = .002) and the direct effect without motivation was not (*DE* = 0.01; *SE* = 0.06; *p* = .89). As would be predicted by the FRH, motivation mediated the relationship between condition and formidability (*IE* = 0.16; *SE* = 0.04; 95% CI = [0.09, 0.24]; *p* < .001; r^2 = .12).

3.2.6 | Aggressiveness versus motivation as a mediator of the effect of condition on formidability

In a mediation model including both perceived aggressiveness and motivation to overcome enemies as mediators, both aggressiveness (*DE* = 0.15; 95% CI = [0.06, 0.23]) and motivation to overcome enemies (*DE* = 0.11; 95% CI = [0.04, 0.19]) mediated the relationship between condition and envisioned formidability, and the bootstrapped indirect effect was significant (*IE* = 0.26; *SE* = 0.04; 95% CI = [0.18, 0.35]; *p* < .001; r^2 = .16; Figure 3).

3.2.7 | Gruesomeness and winning a fistfight

Consistent with the H4 and the results of Study 1, the target was rated as more likely to win a fistfight in the gruesome condition (*M* = 7.30; *SD* = 1.68) than in the control condition (*M* = 5.87; *SD* = 1.90); *t*(310) = 7.14; *p* < .001.

3.2.8 | Envisioned formidability mediates the effect of condition on winning a fistfight

As in Study 1, we tested if envisioned formidability mediated the relationship between condition and likelihood of winning a fistfight. The total effect of the scenario on winning a fistfight was significant (*TE* = 0.37; *SE* = 0.05; *p* < .001) as was the direct effect (*DE* = 0.29; *SE* = 0.05; *p* < .001). Envisioned formidability mediated the relationship between condition and the perceived likelihood of winning a fistfight (*IE* = 0.08; *SE* = 0.03; 95% CI = [0.03, 0.14]; *p* < .001; r^2 = .36).

3.2.9 | Gruesomeness and successfully poisoning enemies

Consistent with H5, the target was rated as more likely to successfully poison his enemies without their knowledge in the gruesome condition (*M* = 7.50; *SD* = 2.04) than in the control condition (*M* = 5.91; *SD* = 2.30); *t*(310) = 6.54; *p* < .001.

3.2.10 | Formidability mediates relationship between gruesomeness and poisoning

We evaluated the mediating effect of envisioned formidability on the relationship between condition and the likelihood of the fisherman successfully poisoning his enemies—a nonphysical and nonconfrontational form of lethality. The total effect of the scenario on poisoning was significant (*TE* = 0.34; *SE* = 0.05; *p* < .001) as was the direct effect (*DE* = 0.31; *SE* = 0.05; *p* < .001). As predicted, the envisioned formidability of the fisherman mediated the relationship between condition and the likelihood of him successfully poisoning his enemies (*IE* = 0.04; *SE* = 0.02; 95% CI = [0.01, 0.07]; *p* < .001; r^2 = .16).

3.3 | Discussion

Study 2 replicated the findings of Study 1 and provided additional support for our hypothesis that gruesome actions enhance cognitive representations of the perpetrator's formidability as conceptualized according to bodily size and strength. Consistent with the FRH, we found that perceptions of trait aggressiveness and motivation to overcome enemies each mediated the effects of the gruesomeness manipulation on estimations of formidability as measured by envisioned size and strength. Note that the significant mediation effect of motivation in a model controlling for covarying aggressive tendencies departs from the nonsignificant effect of motivation observed when controlling for aggressiveness in Study 1, a difference which most likely owes to our rewording of the question in Study 2 to more clearly specify individual motivation to overcome one's enemies.

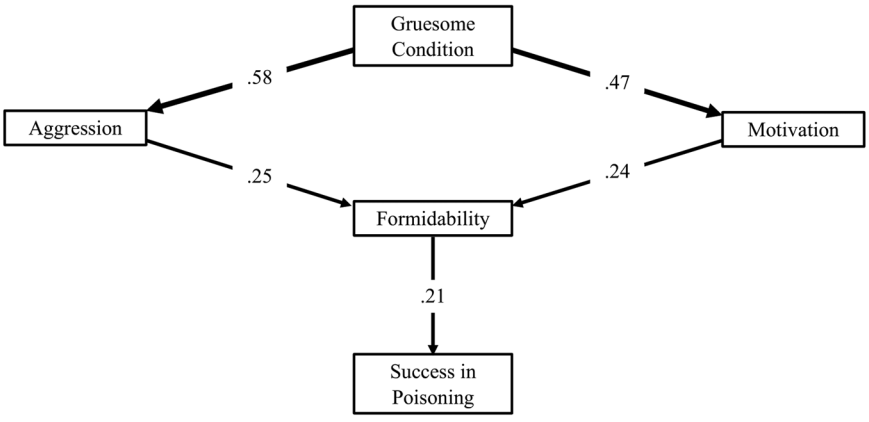

FIGURE 3 Path analysis figure with standardized regression coefficients for the relationship between the measured variables. Perceived aggressiveness and motivation to overcome enemies predict envisioned formidability, which in turn predicts perceived success in poisoning enemies

Supporting this, we found that motivation also mediated the effects of gruesomeness on the estimation of formidability in a supplementary study (see Supporting Information Materials). Finally, in Study 2, we also tested the FRH prediction that, ceteris paribus, physical formidability can be utilized to conceptualize modes of lethality that are unrelated to physical size or strength. We observed that the target individual in the gruesome condition was seen as more likely to successfully poison his enemies, and envisioned physical formidability mediated the relationship between condition and the ability to successfully poison an enemy.

4 | GENERAL DISCUSSION

Formidability is the product of physical, social, technological, and psychological factors—a strong fighter dominates a weak fighter; a fighter with many allies dominates a lone antagonist; a well-armed individual dominates a poorly armed opponent; and, critically, an aggressive, motivated fighter dominates a meeker or less motivated foe. Across two studies, we found that knowing that an individual engaged in gruesome acts enhances people's estimation of that individual's formidability, and that this perceived ability to triumph in agonistic conflict was conceptualized using mental representations of physical size and strength which were, in turn, closely linked with psychological assessments of the target character's aggressiveness and degree of motivation. Together, these findings bolster the growing body of evidence indicating that determinants of formidability are summarized into a heuristic representation of the physical attributes of the target individual. Likewise, our results support the conclusion that grisly acts may be committed, in part, because they serve a strategic communicative function. Gruesome violence indicates dispositional and motivational features of the perpetrator that enhance others' estimates of the actor's formidability, thereby decreasing the frequency, and thus the costs, required by the actor to achieve dominance through conflict.

We utilized precise vignettes manipulating gruesome acts in isolation. While this approach provided tight experimental control, in real-world circumstances gruesomeness (or lack thereof) would covary with other factors relevant to assessments of relative formidability. Future research should employ more realistic combinations of factors to assess the relative impact of gruesomeness on formidability assessments. In addition, we focused on a single type of gruesome act; future work should compare various grisly acts (e.g., disembowelment, genital mutilation) to better assess generalizability. Finally, the reliance on counterfactual text vignettes in the present studies constitutes another limitation. Follow-up research employing imagery would likely evoke a stronger response to gruesome behavior in a more valid manner, particularly given that gruesome behavior is typically observed in contemporary societies via images and videos shared by news organizations and websites. These images are often created by terrorist organizations to inspire fear in enemies and recruit new members. One reason this technique might be used, consciously or otherwise, is that the conceptualized formidability of the terrorists is enhanced in the minds of those who witness these brutal and gruesome behaviors. Notwithstanding the aforementioned limitations and future directions, the replicable effects of the relatively mild manipulations of gruesomeness utilized in our present studies suggest that the effects should be detectable—and perhaps even larger—in more realistic scenarios involving vivid experiences of gruesome violence.

The present studies are only a first step toward understanding the potential functional aspects of gruesomeness. While our studies affirm that gruesome violence promotes assessments of formidability, and that this happens, in part, due to enhanced perceptions of aggressiveness and motivation to overcome enemies, they do not describe all of the pathway(s) by which this occurs. For example, gruesome and excessive violence against an opponent can indicate either an inability to regulate aggression, or an insensitivity to the added costs (energy, time, etc.), or both. Either of these attributes should increase others' assessments of an actor's formidability, as both make it difficult to deter or negotiate with such a foe. In addition to studying other possible pathways through which gruesome behavior enhances formidability, future studies should investigate the extent to which gruesomeness compounds the influence of actions that are already lethal on conceptualized formidability. In our studies, the gruesome act was committed on a deceased foe, allowing us to disentangle gruesome actions from lethal violence. However, our design did not allow us to investigate possible differences between non-gruesome violence (e.g., shooting the foe in the heart) and gruesome violence (e.g., shooting the foe in the heart and gratuitously gouging out their eyes). This is an important question to investigate in future research.

Grievous violations of the body envelope are an inherently powerful stimulus, as they unambiguously indicate death or mortal wounds (Barrett & Behne, 2005; White, Fessler, & Gomez, 2016). As such, observers of a corpse that suffers such damage can be expected to experience more powerful emotional responses, including emotionally driven perceptions of the perpetrator as a threat. Perpetrators might directly leverage this effect as a cue to enhance assessments of their formidability—which may or may not be objectively accurate. It may also be the case that perpetrators of grisly acts take advantage of recursive theory-of-mind reasoning, in that observers can infer that perpetrators know that observers may react with outrage, hence engaging in such provocatively gruesome action constitutes an active challenge to observers—and an actor who challenges foes is likely to be more dangerous than an actor who avoids conflict. Moreover, norm violations can inherently enhance assessed formidability, as norms render behavior predictable, and an unpredictable foe is more dangerous than a predictable one. The above possibilities are not mutually exclusive, and gruesome violence may enhance perceived formidability via multiple pathways simultaneously.

In addition to the need to adjudicate among the possible ways in which gruesomeness conveys formidability, future work could also examine the role of communicative intent, as some of these pathways involve signals while others involve cues. In evolutionary biology, a

signal is a method of communication shaped by natural selection that is built to send specific information; in contrast, a cue transmits information purely as a by-product of some other attribute (Laidre & Johnstone, 2013). Cues can evolve into signals if the evolutionary fitness benefits to the sender of conveying the information, or to the recipient of understanding what the information indicates, are great enough. Many of the signals of formidability mentioned in Section 1 may have first arisen as cues that happen to transmit particularly valuable information relevant to the survival of the sender, the recipient, or both. One way to disentangle whether gruesome violence serves as a signal or a cue would be to manipulate the presence of an audience and the identity of the audience. Because the advantages of communicating information are enhanced when a larger number of individuals receives that information, the presence of an audience will often enhance behaviors that serve as signals; in contrast, because cues convey information only incidentally, an audience will have no effect on behaviors that are merely cues.

Another important route of investigation will be the degree to which similar behavior exists in other animals, particularly in nonhuman primate species. If enemy body mutilation is present in other species, it could prove to be a useful point of comparative analysis for gruesome behavior in humans. Some instances of postmortem aggression have been documented in other primates, particularly chimpanzees (Anderson, Gillies, & Lock, 2010; Stewart, Piel, & O'Malley, 2012). Buhl et al. (2012) documented a case where high-ranking rhesus macaques killed a mid-ranking adult and proceeded to drag and bite the corpse. While it is difficult to interpret this, it is worth noting that the rate of aggression was calculated to be over 20 times greater than baseline levels of aggression in the same group. This postmortem aggression was followed by inspection of the body by lower-ranking individuals. Because researchers are not usually present during lethal aggression, the response of nonhuman primates to deaths of conspecific adults is largely unknown (Fashing et al., 2011). Further research on the extent and nature of postmortem aggression in nonhuman primates could shed light on the functional nature of these behaviors as signals or cues.

A key factor that was not addressed by our studies is the identity of the victim. In our studies, the victim was a member of a hostile group who accidentally died while trying to kill the target individual. Gruesome acts of violence committed against an enemy warrior might communicate a different message about the perpetrator's formidability than gruesome acts of violence against a civilian or an animal. For example, committing a grisly act against a member of a powerful enemy coalition, knowing it could incite fierce retaliation, might cause the perpetrator to be perceived as more formidable than if the act was committed against a neutral bystander. Along these lines, future work should assess differences between gruesomeness in intragroup as well as intergroup contexts. Though we are not aware of empirical evidence comparing the degree of gruesome violence during war and during "everyday violence," we would predict that gruesome violence is more common in times of war, that is, fighting between the two coalitions. In modern times, the gratuitous desecration of corpses or particularly gruesome murders are sometimes filmed by the perpetrators for the purpose of dissemination (e.g., violence perpetrated by ISIS or drug cartels). If committing a gruesome act against a member of an enemy coalition sends a stronger signal or acts as a more powerful cue of formidability than the same action against a random civilian or nonhuman animal, then this may, in part, explain the greater use of gruesome behavior in war or coalitionary fighting than in everyday violence. In short, despite the antiquity and broad distribution of gruesome acts, much remains to be understood about the psychology of gruesomeness.

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DATA AVAILABILITY STATEMENT

All pre-registrations, materials, data, and code used to generate the analyses are available on the Open Science Framework, https://osf.io/2ghav/?view_only=fd49b9a70cad42929076d524a57c3941.

ETHICS STATEMENT

All studies reported in this paper and the accompanying Supporting Information Materials were approved by the University of Chicago Institutional Review Board.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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