

# UCLA

## UCLA Previously Published Works

### Title

Sizing up Helen: Nonviolent physical risk-taking enhances the envisioned bodily formidability of women

### Permalink

<https://escholarship.org/uc/item/402059nk>

### Author

Fessler, Daniel M.T.

### Publication Date

2014-10-01

Peer reviewed

## Sizing Up Helen\*

### Nonviolent Physical Risk-Taking Enhances the Envisioned Bodily Formidability of Women

Daniel M.T. Fessler,<sup>a,1</sup> Colin Holbrook,<sup>a</sup> Leonid B. Tiokhin,<sup>a</sup> and Jeffrey K. Snyder<sup>a</sup>

<sup>a</sup> Department of Anthropology and Center for Behavior, Evolution, & Culture

University of California, Los Angeles

Los Angeles, CA 90095-1553 USA

*\*Helen Gibson (1892–1977) was an actress, trick rider, and daredevil. Performing acts of breathtaking skill and bravery, Gibson is widely recognized as the first professional stuntwoman.*

**ACCEPTED FOR PUBLICATION IN *JOURNAL OF EVOLUTIONARY PSYCHOLOGY***

<sup>1</sup> To whom correspondence should be addressed:

Department of Anthropology

341 Haines Hall

University of California, Los Angeles

Los Angeles, CA 90095-1553 USA

Tel.: 310 794-9252

Fax: 310 206-7833

E-mail: [dfessler@anthro.ucla.edu](mailto:dfessler@anthro.ucla.edu)

## **Abstract**

Men are more prone than women to both commit physical violence and engage in nonviolent activities entailing the risk of injury or death. The Crazy Bastard Hypothesis (Fessler et al. 2014a) addresses this conjunction, arguing that nonviolent physical risk-taking communicates information about the actor's agonistic formidability, as individuals who are indifferent to the possibility of harm are more likely to enter conflicts, and more difficult to repel, than those who are more sensitive to harm. Reflecting the use of bodily size in representations that summarize formidability, previous work demonstrates that risk-prone men are envisioned to be larger than are risk-averse men. Though less violent than men, particularly in highly competitive environments, women too sometimes benefit from engaging in violence. Correspondingly, observers should draw similar inferences regarding formidability when assessing physically risk-prone women. Results from both a large online experiment in the U.S. and a follow-up study using a modified dependent measure designed to reduce demand characteristics reveal that a woman described as risk-prone is envisioned to be larger – and thus more formidable – than is a woman described as risk-averse. Nonviolent physical risk-taking is thus available to women as an avenue for communicating formidability when it is advantageous to do so.

Keywords: risk-taking; threat assessment; signaling; formidability; women

## **Introduction**

### *Overview*

How does knowing that a woman engages in dangerous activities affect others' perceptions of her? Here, we evaluate one facet of such assessments, namely the envisioned bodily size associated with female risk-takers. At first glance, these two facets of the individual – risk-taking and envisioned size – might seem unrelated. However, building on a growing corpus of evidence, we will argue that i) the bodily size that an observer envisages an actor to possess summarizes the observer's assessment of the actor's formidability in agonistic contexts, and ii) voluntary nonviolent risk-taking indexes high formidability. Hence, in addition to communicating information about a variety of other aspects of the actor, risk-taking serves a signaling function that is directly relevant to the possibility of physical violence. This signaling affordance, we will propose, is available to both male and female actors; that it is utilized predominantly by the former derives primarily from the greater importance of agonistic intrasexual competition in males. Below, we develop this theoretical framework in more detail, then review recent work that supports (i) (the proposition that envisioned bodily size serves as a summary representation useful in agonistic contexts). Complementing recent studies using male targets that support (ii) (the proposition that nonviolent risk-taking communicates information relevant in agonistic contexts), we then demonstrate parallel results in new studies employing female targets.

### *Sex Differences in Participation in Violent and Nonviolent Risk-Taking*

Across a wide variety of contexts and cultural settings, men voluntarily engage in more activities that entail a risk of physical injury or death than do women (see Wilson & Daly 1985;

Wilson et al. 2002; Fessler 2010; Killgore et al. 2010; Cobey et al. 2013; Fessler et al. 2014a). A variety of evolutionary explanations potentially apply to this phenomenon. Central to many accounts is the observation that, in ancestral populations, our species' confluence of sex-biased parental investment (which generates an effectively polygynous mating system) and extended social and reproductive careers (which cause the consequences of reputation and rank to ramify over multiple reproductive events) would have led to higher fitness stakes in male than in female intrasexual competition (Wilson & Daly 1985). As a consequence, sexual dimorphism in evolved motivational mechanisms leads men to be both more violent than women (Wilson & Daly 1985; Wilson et al. 2002; Archer 2009) and more willing to take nonviolent physical risks in order to signal properties of interest to others, including to potential mates – a functional objective revealed by the exacerbating effects of the presence of an audience on both such types of behavior (Smith & Bliege Bird 2000; Hawkes & Bliege Bird 2002; Hawkes 1991; Bliege Bird & Smith 2005; Kelly & Dunbar 2001; Farthing 2005; Wilke et al. 2006; Baker & Maner 2009; Frankenhuis et al. 2010; Stenstrom et al. 2011; Sylwester & Pawłowski 2011; Ronay & von Hippel 2010). Recently (Fessler et al. 2014a), we sought to add to existing explanations, arguing that, independent of questions of genetic or phenotypic quality, one attribute signaled by voluntary nonviolent physical risk-taking is simply the propensity to take risks. This attribute is relevant to both assessments of the threat that an individual poses as an adversary in violent conflict and assessments of the value that the individual holds as an ally in such confrontations – as well as the liabilities that having such an ally would entail. The propensity to take risks is relevant in all of these regards because individuals who are relatively indifferent to the possibility of injury or death will be more willing to enter agonistic interactions, and more difficult to deter or repel, than individuals who are more sensitive to this possibility. Such

attributes are likely to be relatively stable features of an individual, hence observing an individual's level of risk-proneness today is informative as to his or her behavior in agonistic conflicts tomorrow. Extending Wilson and Daly's (1985) Young Male Syndrome thesis, our Crazy Bastard Hypothesis (Fessler et al. 2014a) thus presents the novel explanation that one function of voluntary nonviolent physical risk-taking is the signaling of proneness to risk life and limb due to this feature's contribution to success in agonistic contests; the signal is inherently honest by virtue of the intrinsic connection between the action taken (risking life and limb) and the property conveyed (willingness to risk life and limb). In short, the Crazy Bastard Hypothesis holds that nonviolent physical risk-taking is a means of advertising a component of fighting capacity, and, in ancestral populations, fighting capacity was a greater determinant of fitness in males than in females; as a consequence, contemporary men, heirs to the psychology of ancestral men, are more inclined than women to voluntarily engage in such behavior.

As a first step in testing the Crazy Bastard Hypothesis, we previously demonstrated that, when presented with vignettes describing various habitual behaviors, observers indeed view a risk-prone man as more formidable (and more dangerous) than a risk-averse man (Fessler et al. 2014a). This work leaves open, however, the question of how voluntary physical risk-taking shapes observers' perceptions of women. First, while agonistic conflict is both more common and more lethal among men, it is not absent among women, and, correspondingly, plausibly influenced female fitness in the ancestral past (Burbank 1992; Cross & Campbell 2014). Accordingly, observers should not be indifferent to indices of formidability displayed by women, and, conversely, women should not be blind to the affordances of various actions to serve as signals in this regard. Importantly, there is nothing sex-specific about the logic whereby voluntary physical risk-taking communicates formidability – the inferences that can be drawn

about an individual's formidability from observations of risk-proneness apply equally to men and women. We should therefore expect that, while women may avail themselves of this signaling opportunity far less often than men, nonetheless, paralleling assessments of male targets, observers should see physically risk-prone women as more formidable than their risk-averse counterparts. Here, we test this prediction.

### *The Role of Envisioned Bodily Size in Threat Assessment*

Our previous examinations of the information communicated by voluntary physical risk-taking (Fessler et al. 2014a) leveraged a corpus of work that reveals that the mind employs bodily size and muscularity as the dimensions of a cognitive representation that summarizes diverse factors contributing to the threat that an individual, or coalition, poses to the perceiver. Viewed in an evolutionary light, this pattern is explicable as follows: In situations of potential agonistic conflict, individuals must rapidly decide whether to fight, flee, appease, or negotiate. In species with limited behavioral repertoires, size and strength are key determinants of the outcome of agonistic conflicts, hence we can expect such species to have the cognitive capacity to assess and compare these attributes of the self and the foe. In species with more complex behavioral repertoires, individuals face the challenge that it is difficult to evaluate and compile the contributions of many different factors relevant to the fight-or-flight decision. The complexity of this task can be reduced, however, through the use of a single summary representation that serves as a running tally – the decision-maker can sequentially consider each factor in turn, adjust the representation accordingly, then, when all relevant factors have been evaluated, consult the final representation. Generally, as new adaptive challenges arise, natural selection does not craft novel adaptations de novo, but rather modifies existing adaptations. As

we articulated in our original formulation of this approach (Fessler et al. 2012), we have theorized that, as behavior became more complex, natural selection employed the ancestral capacity to represent relative bodily size and strength as the basis for a derived trait wherein a summary representation captures multiple features of the self and the other. A single representation, employing the dimensions of envisioned bodily size and strength, is thus used to encapsulate assessments of features of the two parties that are predictive of i) the outcome of agonistic conflict should it occur; ii) the costs of conflict that hinge on the extent to which assets are at risk; and iii) the likelihood that the opponent will attack (see Fessler et al. in press [a] for overview). Lastly, this phylogenetic process is paralleled by, and reinforced by, an ontogenetic one, since, if only by virtue of interactions with caregivers, all infants and children learn that the larger, stronger individual prevails in conflicts – indeed, preverbal infants expect larger agents to dominate smaller agents (Thomsen et al. 2011).

In a series of recent papers, we report experiments addressing each of the three facets of threat assessment delineated above. First, consonant with the notion that the dimensions of envisioned size and strength are used to represent the likely outcome of agonistic conflict (i.e., the parties' relative fighting capacities), a man's measured chest compression strength is negatively correlated with the physical formidability that he conceives of an opponent as having (Fessler et al. in press [b]); conversely, being physically incapacitated (by being bound to a chair, or standing on an unstable platform) causes a man to envision a foe as bigger and stronger, and himself as smaller (Fessler & Holbrook 2013a). Photographs that reveal that someone possesses a gun, or a tool that could be used as a weapon, increase estimations of his size and strength (Fessler et al. 2012). Standing close to one's friends – who could back one in conflict if need be – causes men to conceive of a foe as less physically formidable (Fessler & Holbrook 2013b),



and, likewise, because participation in synchronized behavior serves as a cue of coordination and coalitional solidarity, walking a short distance in synch with an unfamiliar male partner diminishes a man's estimation of the physical formidability of a foe (Fessler & Holbrook in press). Learning that a violent coalition does, or does not, possess capable leaders elicits corresponding alterations in observers' estimations of the bodily formidability of a representative coalition member (e.g., contemplating Osama bin Laden's death changes Americans' conceptualizations of the bodily attributes of a member of the Al Qaeda terrorist organization) (Holbrook & Fessler 2013). These results parallel findings from other research groups, as Yap et al. (2013) have demonstrated that experimentally manipulating participants' perceived social power using recalled experiences and assigned leadership roles correspondingly alters their estimates of the size and weight of another person, while Duguid and Goncalo (2012) have shown that inducing the feeling of power using similar manipulations leads participants to overestimate their own height and underestimate another's height.

Second, consonant with the notion that the dimensions of envisioned size and strength are used to represent the costs of conflict due to the extent to which assets are at risk, using vignettes depicting a menacing stranger, we demonstrated that, compared to non-parents, parents – individuals who, if injured, suffer the added fitness decrement of diminished ability to provide for and protect their children – conceptualize a foe as more physically formidable (Fessler et al. 2014b). Because the fitness costs to women of sexual assault are in part contingent on the probability that such assault would result in conception (with corresponding loss of female choice over genitor, diminished investment from other men, etc.), women who are in the high-fertility phase of the menstrual cycle have more assets at risk when confronted by a possible sexual assailant. In a cross-sectional study in which participants assessed the bodily attributes of

a purported violent criminal, we found that women whose position in the menstrual cycle at the time of participation placed them at higher conception risk judged the man to be more physically formidable than did those making the same assessment during periods of lower fertility (Fessler et al. in press [a]).

Third, note that the Crazy Bastard Hypothesis holds that voluntary physical risk-taking signals a greater likelihood of engaging in conflict by virtue of lesser concern for one's physical safety. The key issue here is the likelihood that the foe will attack. Independent of questions of risk-taking, we have collected two bodies of evidence indicating that the dimensions of envisioned size and strength are used to represent this likelihood. First, using vignettes in which the protagonist's name provided a cue of ethnicity, we have shown that knowing that a target individual belongs to an ethnic group that is stereotyped as violent leads observers to conceptualize the target as more physically formidable (Holbrook et al. under review). Second, in contexts in which intergroup conflict may occur, overtly displaying coalitional affiliation reveals both a willingness to engage in conflict and the objective determinants of the likelihood of doing so, as such displays both invite conflict and commit the actor to participate should conflict break out. Correspondingly, using both manipulated photographic stimuli and vignettes, we have demonstrated that individuals who advertise their membership in coalitions (e.g., by painting one's face in support of one's team at a football game) are envisioned to be more physically formidable than those who do not (Fessler et al. n.d.).

### *Assessments of Risk-Prone and Risk-Averse Male Targets*

To summarize our core line of reasoning, the Crazy Bastard Hypothesis holds that an evolved threat-assessment mechanism generates a cognitive representation wherein the threat

posed by a foe is summarized using the dimension of the envisioned bodily size of the antagonist: reflecting the phylogenetic antiquity and ontogenetic ubiquity of the importance of size in dyadic conflicts, people have a mind's eye image of the foe that grows or shrinks in proportion to the assessed threat. Nonviolent physical risk-taking reveals that the actor is relatively indifferent to the risk of injury or death. By virtue of the fact that they are therefore more likely to attack, and more difficult to deter, than more risk-averse individuals, risk-prone individuals should be assessed as more formidable, and thus viewed in the mind's eye as larger, than risk-averse individuals. We previously tested the Crazy Bastard Hypothesis using a series of vignette experiments, conducted in the U.S. and in rural Fiji, in which we demonstrated that knowing that a man voluntarily takes nonviolent risks with his physical safety leads participants to view him as larger and stronger compared to parallel estimations of the bodily attributes of a man who avoids such risks (Fessler et al. 2014a). This is not explicable in terms of any actual correlation between somatic properties and behavior, as a separate survey that we conducted in the U.S. revealed no correlation between a man's actual physical dimensions and his propensity to take such risks. Likewise, this pattern cannot be explained in terms of cultural schemas that praise recreational physical risk-taking (e.g., the valorization of extreme sports, etc.) because the same pattern occurs when the risk-taking described takes the form of either mundane subsistence activities (e.g., climbing tall coconut trees in Fiji), or negligent driving behaviors (e.g., running a red light in the U.S.) of which observers disapprove. Taken together, the above corpus thus suggests that the perception that physically risk-prone men are larger reflects the assessment that such men would constitute more dangerous adversaries, and more valuable allies, in the event of violent conflict. We turn, therefore, to the question of whether the same processes apply when

assessing physically risk-prone or risk-averse women. To investigate this, we conducted two large internet experiments in the U.S.

## **Study 1**

### *Participants & Methods*

813 adults were recruited from 40 metropolitan areas across the U.S. via the Volunteers section of Craigslist.org to participate in an unpaid online study concerning social intuitions. Participants were screened prior to analysis for age (i.e., over 18 years), incomplete sessions, and implausible answers to the height question (i.e., estimating the target as over 7 feet tall). This left a sample of 699 individuals, (485 female) with a mean age of 33.5 years ( $SD = 13.29$ ), 74.2% White, 10.5% Hispanic, 3.9% Black, 5.9% Asian, 5.5% mixed or Other.

Participants were randomly assigned to read one of two original vignettes, describing a female target who was either physically risk-prone or risk-averse, as follows:

#### Risk-Prone

Danielle<sup>1</sup> is known as a daredevil. In her free time, she sky-dives, bungee jumps, and gambles. Danielle loves risks; once, she climbed a steep rocky cliff without safety gear, even though her friends repeatedly told her that it wasn't safe.

Another time, she played Russian roulette with a real gun.

#### Risk-Averse

Danielle is known as a cautious gal. In her free time, she watches movies, fixes old cars, and jogs. Danielle hates risks; once, she refused to hike up a path on a hillside, even though she was wearing safety gear and her friends repeatedly told

her that it was safe. Another time, she stayed home all day because she heard a gunshot outside.

Participants were then asked to estimate the height of the individual described, in feet and inches, followed by a visual array from which participants selected the image that most closely resembled the protagonist. The array was composed of five copies of a computer-generated image of a woman of average proportions and ambiguous ethnicity, the copies differing only in relative size (see Fig. 1).

(INSERT FIG. 1 APPROXIMATELY HERE)

### *Results*

A one-way MANOVA assessing the estimations of height (in inches) and size (via the 5-point array) revealed a significant main effect of condition,  $F(2, 696) = 17.15, p < .001, \eta^2_p = .05$ . As predicted, participants envisioned the risk-prone woman as taller in inches ( $M = 65.85; SD = 2.56$ ) than the risk-averse woman ( $M = 64.83; SD = 2.79$ ),  $F(1, 697) = 25.20, p < .001, \eta^2_p = .04$ . The risk-prone woman was also envisioned as larger using the 5-point array ( $M = 3.23; SD = .88$ ) than the risk-averse woman ( $M = 2.87; SD = .89$ ),  $F(1, 697) = 28.18, p < .001, \eta^2_p = .04$ .

We next assessed the potential influence of participant sex on estimated physical formidability. In a model including both condition and participant sex as predictors of estimated height and size, we observed no Risk Condition X Sex interaction,  $p = .42$ . However, in a MANOVA pooling both risk conditions, there was a significant main effect of sex,  $F(2, 696) = 10.38, p < .001, \eta^2_p = .03$ . Male participants envisioned the target woman as taller in inches ( $M = 65.99; SD = 2.98$ ) than did female participants ( $M = 65.04; SD = 2.56$ ),  $F(1, 697) = 18.66, p <$

.001,  $\eta^2_p = .03$ . Male participants also envisioned the target woman as larger using the 5-point array ( $M = 3.11$ ;  $SD = .93$ ) than did female participants ( $M = 3.02$ ;  $SD = .90$ ), but this difference did not attain statistical significance,  $p = .20$ .

## **Study 2**

### *Methods & Participants*

The images in the array employed in Study 1 differed only in size, and were presented in a linear sequence of increasing size. As a consequence of the overt importance of size in the array, this dependent measure might have entailed demand characteristics – participants may have inferred that our goal was to measure the relationship between risk-proneness and conceptualized size, and may therefore have behaved in accord with our predictions merely to be compliant. To address this limitation, we replicated Study 1, employing the same vignettes, but substituting in the dependent measures arrays of diverse silhouettes. The heterogeneous assortment of clothing and hair styles, postures, and physiques were intentionally selected so as to mask our goal of providing the opportunity to respond on the basis of body size; likewise, the images were not displayed in a linear size sequence so as to reduce overt attention to this aspect (see Fig. 2). Multiple versions of each array were created by randomly varying both the relative size and the left-to-right sequence of the silhouettes. Participants were randomly assigned to view one of these arrays.

(INSERT FIG. 2 APPROXIMATELY HERE)

627 adults were recruited and screened as in Study 1, leaving a sample of 539 individuals, (417 female) with a mean age of 32.7 years ( $SD = 12.35$ ), 77.9% White, 6.5% Hispanic, 3.5% Black, 6.1% Asian, 6.0% mixed or Other.

### *Results*

A one-way MANOVA assessing the estimations of height (in inches) and size (via the 4-point array) revealed a significant main effect of condition,  $F(2, 536) = 5.01, p < .01, \eta^2_p = .02$ . As predicted, participants envisioned the risk-prone woman as taller in inches ( $M = 66.61; SD = 3.00$ ) than the risk-averse woman ( $M = 65.83; SD = 2.93$ ),  $F(1,537) = 9.20, p < .01, \eta^2_p = .02$ . The risk-prone woman was also envisioned as larger using the image array ( $M = 2.46; SD = .97$ ) than the risk-averse woman ( $M = 2.27; SD = .93$ ),  $F(1,537) = 5.51, p < .02, \eta^2_p = .01$ .

We next assessed the potential influence of participant sex on estimated physical formidability. In a model including both condition and participant sex as predictors of estimated height and size, we observed no Risk Condition X Sex interaction,  $p = .87$ . In addition, unlike in Study 1, a MANOVA pooling both risk conditions revealed no significant main effect of sex,  $p = .29$ .

### **Discussion**

Directly paralleling the results of our previous investigations of assessments of male targets (Fessler et al. 2014a), two studies of U.S. internet users reveal that women described as voluntarily engaging in activities that pose a risk of injury or death are envisioned as physically larger than are women described as studiously avoiding such activities. In neither study was there an interaction between participant sex and experimental condition, hence men and women draw the same conclusions regarding the attributes of a female target as a function of her risk-

proneness. Against the backdrop of an emerging corpus of work indicating that conceptualized physical formidability serves as a summary representation that captures a diverse range of factors contributing to the threat that a person poses as an adversary in agonistic conflict (and the value that they hold as an ally in such contests), this finding can be understood as indicating that i) voluntary nonviolent physical risk-taking serves to signal attributes of the individual relevant to others' threat assessments, and ii) this process is essentially independent of the sex of the target individual being assessed.

The studies reported here are subject to a number of caveats. First, the risk-prone vignette made reference to using a gun, and our previous studies indicate that, consonant with the core thesis underlying this work, armed individuals are perceived as larger (Fessler et al. 2012), hence the effects documented here could owe to the mention of a firearm. Second, some of the recreational activities described in the vignettes are valorized in at least some U.S. subcultures, a potentially relevant consideration given that it appears that prestige is also represented using envisioned size (see Holbrook et al. under review), i.e., it is possible that estimations of bodily size reflect positive social valuation rather than assessed threat. Third, our risk-prone vignette could have accidentally semantically primed concepts of height by virtue of its reference to sky-diving, bungee jumping, and steep rocky cliffs. While the present studies do not allow us to definitively rule out these two possibilities, they are unlikely given that, in our previous investigations using male targets, the results that we obtained from vignettes nearly identical to those employed here directly paralleled results obtained using stimuli that suffered none of these limitations, including vignettes describing risk-taking or risk-avoidance in the context of mundane subsistence and driving activities (Fessler et al. 2014a).



While they spanned a range of ages and geographical locales within the U.S., our present samples were limited to U.S. internet users, a population that likely differs from other groups around the world in many important attributes (Henrich et al. 2010). This constrains the degree to which it is possible to conclude that the observed patterns reflect a species-typical feature of the evolved human mind. While a nontrivial limitation, this concern is mitigated somewhat by our prior finding, using male targets, that the same inferential patterns occur in U.S. internet users and rural Fijian villagers (Fessler et al. 2014a).

North American gender schemas depict nonviolent physical risk-taking as a stereotypically male activity (e.g., Morrongiello & Hogg 2004), hence, given sexual dimorphism in body size, it is possible that our participants viewed the risk-prone female target as more masculine, and thus, by association, as physically larger. While the present data do not allow us to eliminate this explanation, it is unlikely to be principally responsible for our findings given that a) all of the images that we employed in the dependent-measure array for Study 1, and some of the images employed in Study 2, depict prototypically feminine physiques, and b) in other work, we have demonstrated that the linkage between envisioned body size and relative formidability persists even after controlling for perceptions of the target's degree of masculinity (Holbrook et al. under review).

Lastly, it is possible that our participants' assessments reflect their prior observations regarding actual correlations between physical size and risk-proneness in women. In our previous investigation of the relationship between individuals' own height and their nonviolent physical risk-proneness (Fessler et al. 2014a), using the Domain-Specific Risk-Taking Scale (DOSPERT; Blais & Weber 2006), we found that, among female participants only, a positive correlation occurred between self-reported height and self-reported risk-taking in the domain of

health and safety (representative item: “Sunbathing without sunscreen”). We therefore cannot rule out the possibility that our current results reflect participants’ prior knowledge of a positive correlation between female height and risk-proneness. Importantly, however, militating against this explanation is the fact that we previously found no significant correlation between women’s self-reported heights and their risk-taking in the recreational domain of the DOSPERT (representative item: “Bungee jumping off a tall bridge”), the domain that, on the face of it, would seem to be most relevant to both signaling agonistic capacity and the specific actions described in our vignettes.

In sum, while mindful of the need to take alternative possibilities into account, we believe that our results provide preliminary evidence that the same patterns of inference applied to male targets also apply to female targets, namely that physically risk-prone individuals constitute dangerous enemies and valuable allies in the event of agonistic conflict, and are therefore envisioned as physically formidable.

If the above conclusion is correct, then voluntary nonviolent physical risk-taking affords the same signaling opportunities for female actors that it does for males. The fact that women engage in such behavior at far lower rates than men is therefore consistent with the Crazy Bastard Hypothesis, which holds that these demographic patterns reflect the greater importance for men of communicating information relevant to agonistic conflict: women can signal in the same manner as men if they wish to do so, but, for women in ancestral populations, the costs will have generally outweighed the benefits, and hence contemporary women, heirs to the motivational systems of ancestral women, are generally less inspired to engage in such behavior than are men. However, this cost/benefit ratio is not absolute, and depends in large part on the frequency and intensity of female involvement in violent contests. In ecologies in which women

participate in violence at elevated rates (due, perhaps, to intense competition for scarce resources, mates, etc. – see Campbell et al., 1998), we can expect that women will be more attracted to the signaling affordances of voluntary nonviolent physical risk-taking, and thus will engage in more of the ostentatious efforts at putting themselves in danger that, in less violent societies, are largely the exclusive province of men. Consonant with this prediction, in the West, economic deprivation is positively correlated with both female-female violence (Campbell et al., 1998) and female accidental injuries and death from physically risky activities (reviewed in Thomas et al. 2007). Hence, while yet to be tested directly, this prediction is but one of the many promising avenues opened by the Crazy Bastard Hypothesis.

### **Acknowledgments**

This work was supported by the U.S. Air Force Office of Scientific Research under Award #FA9550-10-1-0511. We thank our many research assistants for help recruiting participants.

### **Footnotes**

<sup>1</sup> Despite our admiration for Helen Gibson, after whom this paper is named, the protagonist in the vignettes was labeled Danielle in order to directly parallel vignettes employed in Fessler et al. (2014a), in which the protagonist was named Dan (readers can draw their own conclusions as to what inspired the latter choice).

### **References**

ARCHER, J. (2009): Does sexual selection explain human sex differences in aggression?  
*Behavioral and Brain Sciences*, 32, 249-266 (doi:10.1017/S0140525X09990951).

- BAKER, M. D., & MANER, J. K. (2009): Male risk-taking as a context-sensitive signaling device. *Journal of Experimental Social Psychology*, 45, 1136-1139 (doi:10.1016/j.jesp.2009.06.006).
- BLAIS, A.-R., & WEBER, E. U. (2006): A domain-specific risk-taking (DOSPERT) scale for adult populations. *Judgment and Decision Making*, 1, 33-47.
- BLIEGE BIRD, R., & SMITH, E. A. (2005): Signaling theory, strategic interaction, and symbolic capital. *Current Anthropology*, 46, 221-248 (doi: 10.1086/427115).
- BURBANK, V. K. (1992): Sex, gender, and difference: Dimensions of aggression in an Australian Aboriginal community. *Human Nature*, 3, 251-278.
- CAMPBELL, A., MUNCER, S., & BIBEL, D. (1998). Female-female criminal assault: An evolutionary perspective. *Journal of Research in Crime and Delinquency*, 35(4), 413-428. (doi: 10.1177/0022427898035004003)
- COBEY, K. D., STULP, G., LAAN, F., BUUNK, A. P., & POLLET, T. V. (2013): Sex differences in risk taking behavior among Dutch cyclists. *Evolutionary Psychology*, 11, 350-364.
- CROSS, C. P., & CAMPBELL, A. C. (2014). Violence and Aggression in Women. In: T. K. Shackelford & R. D. Hansen (Eds.), *The Evolution of Violence*. New York: Springer, pp. 211-232.
- DUGUID, M. M., & GONCALO, J. A. (2012): Living large: The powerful overestimate their own height. *Psychological Science*, 23, 36-40 (doi: 10.1177/0956797611422915).
- FARTHING, G. (2005): Attitudes toward heroic and nonheroic physical risk takers as mates and as friends. *Evolution and Human Behavior*, 26, 171-185 (doi:10.1016/j.evolhumbehav.2004.08.004).

- FESSLER, D. M. T., & HOLBROOK, C. (2013a): Bound to lose: Physical incapacitation increases the conceptualized dimensions of an antagonist in men. *PLoS ONE*, 8, e71306 (doi:10.1371/journal.pone.0071306).
- FESSLER, D. M. T., & HOLBROOK, C. (2013b): Friends shrink foes: The presence of comrades decreases the envisioned physical formidability of an opponent. *Psychological Science*, 24, 797-802 (doi: 10.1177/0956797612461508).
- FESSLER, D. M. T., HOLBROOK, C., & FLEISCHMAN, D. S. (in press) [a]: Assets at risk: Menstrual cycle variation in the envisioned formidability of a potential sexual assailant reveals a key component of threat assessment. *Adaptive Human Behavior & Physiology*.
- FESSLER, D. M. T., TIOKHIN, L., HOLBROOK, C., GERVAIS, M., & SNYDER, J. K. (2014a): Foundations of the Crazy Bastard Hypothesis: Nonviolent physical risk-taking enhances conceptualized formidability. *Evolution and Human Behavior*, 35, 26-33 (doi: 10.1016/j.evolhumbehav.2013.09.003).
- FESSLER, D. M. T., HOLBROOK, C., & GERVAIS, M. (in press) [b]: Men's physical strength moderates conceptualizations of prospective foes in two disparate societies. *Human Nature* (doi: 10.1007/s12110-014-9205-4).
- 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, e32751 (doi:10.1371/journal.pone.0032751).
- FESSLER, D. M. T., & HOLBROOK, C. (in press): Marching into battle: Synchronous walking diminishes the conceptualized formidability of an antagonist. *Biology Letters*.

- FESSLER, D. M. T., HOLBROOK, C., & DASHOFF, D. (n.d.): Dressed to kill? Visible markers of coalitional affiliation enhance conceptualized formidability. *Manuscript in preparation*.
- FESSLER, D. M. T. (2010). Madmen: An evolutionary perspective on anger and men's violent responses to transgression. In: M. Potegal, G. Stemmler, & C. D. Spielberger (eds) *Handbook of Anger: Constituent and Concomitant Biological, Psychological, and Social Processes*. New York: Springer, pp. 361-381.
- FESSLER, D. M. T., HOLBROOK, C., POLLACK, J. S., & HAHN-HOLBROOK, J. (2014b): Stranger danger: Parenthood increases the envisioned bodily formidability of menacing men. *Evolution and Human Behavior*, 35, 109-117 (doi: 10.1016/j.evolhumbehav.2013.11.004).
- FRANKENHUIS, W. E., DOTSCHE, R., KARREMANS, J. C., & WIGBOLDUS, D. H. J. (2010): Male physical risk taking in a virtual environment. *Journal of Evolutionary Psychology*, 8, 75-86 (doi: 10.1556/JEP.8.2010.1.6).
- HAWKES, K., & BLIEGE BIRD, R. (2002): Showing off, handicap signaling, and the evolution of men's work. *Evolutionary Anthropology*, 11, 58-67 (doi: 10.1002/evan.20005).
- HAWKES, K. (1991): Showing off: Tests of an hypothesis about men's foraging goals. *Ethology and Sociobiology*, 12, 29-54.
- HENRICH, J., HEINE, S. J., & NORENZAYAN, A. (2010): The weirdest people in the world? *Behavioral and Brain Sciences*, 33, 61-83 (doi:10.1017/S0140525X0999152X).
- HOLBROOK, C., & FESSLER, D. M. T. (2013): Sizing up the threat: The envisioned physical formidability of terrorists tracks their leaders' failures and successes. *Cognition*, 127, 46-56 (doi: 10.1016/j.cognition.2012.12.002).

- HOLBROOK, C., FESSLER, D. M. T., & NAVARRETE, C. D. (under review): Stature or danger: Racist stereotypes moderate the conceptual links between threat, social status, and physical size. *Manuscript under review*.
- KELLY, S., & DUNBAR, R. I. M. (2001): Who dares, wins: Heroism versus altruism in women's mate choice. *Human Nature*, 12, 89-105 (DOI: 10.1007/s12110-001-1018-6).
- KILLGORE, W. D. S., GRUGLE, N. L., KILLGORE, D. B., & BALKIN, T. J. (2010): Sex differences in self-reported risk-taking propensity on the evaluation of risks scale. *Psychological Reports*, 106, 693-700.
- MORRONGIELLO, B. A., & HOGG, K. (2004): Mothers' reactions to children misbehaving in ways that can lead to injury: implications for gender differences in children's risk taking and injuries. *Sex Roles*, 50, 103-118.
- RONAY, R., & VON HIPPEL, W. (2010): The presence of an attractive woman elevates testosterone and physical risk taking in young men. *Social Psychological and Personality Science*, 1, 57-64 (doi: 10.1177/1948550609352807).
- SMITH, E. A., & BLIEGE BIRD, R. L. (2000): Turtle hunting and tombstone opening: public generosity as costly signaling. *Evolution and Human Behavior*, 21, 245-261 (doi: 10.1016/S1090-5138(00)00031-3).
- STENSTROM, E., SAAD, G., NEPOMUCENO, M. V., & MENDENHALL, Z. (2011): Testosterone and domain-specific risk: Digit ratios (2D: 4D and *rel2*) as predictors of recreational, financial, and social risk-taking behaviors. *Personality and Individual Differences*, 51, 412-416 (doi:10.1016/j.paid.2010.07.003).

- SYLWESTER, K., & PAWŁOWSKI, B. (2011): Daring to be darling: Attractiveness of risk takers as partners in long-and short-term sexual relationships. *Sex Roles*, 64, 695-706 (doi: 10.1007/s11199-010-9790-6).
- THOMAS, J., KAVANAGH, J., TUCKER, H., BURCHETT, H., TRIPNEY, J., & OAKLEY, A. (2007). *Accidental injury, risk-taking behaviour and the social circumstances in which young people (aged 12-24) live: a systematic review*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. Retrieved from <http://eprints.ioe.ac.uk/5259/1/Thomas2007AccidentalInjury.pdf>
- THOMSEN, L., FRANKENHUIS, W. E., INGOLD-SMITH, M. C., & CAREY, S. (2011): Big and mighty: Preverbal infants mentally represent social dominance. *Science*, 331, 477 (doi: 10.1126/science.1199198).
- WILKE, A., HUTCHINSON, J. M. C., TODD, P. M., & KRUGER, D. J. (2006): Is risk taking used as a cue in mate choice? *Evolutionary Psychology*, 4, 367-393.
- WILSON, M., DALY, M., & POUND, N. (2002). An evolutionary psychological perspective on the modulation of competitive confrontation and risk taking. In: D. W. Pfaff, A. P. Arnold, A. M. Etgen, S. E. Fahrback, & R. T. Rubin (eds), *Hormones, Brain and Behavior, Vol. 5*. San Diego: Academic Press, pp. 381-408.
- WILSON, M., & DALY, M. (1985): Competitiveness, risk taking, and violence: The young male syndrome. *Ethology & Sociobiology*, 6, 59-73.
- YAP, A. J., MASON, M. F., & AMES, D. R. (2013): The powerful size others down: The link between power and estimates of others' size. *Journal of Experimental Social Psychology*, 49, 591-594 (doi: 10.1016/j.jesp.2012.10.003).



Figure 1. Participants in Study 1 were asked to select the image from this array that best resembled the woman described in the vignette (risk-prone or risk-averse) to which they were assigned.



Figure 2. Participants in Study 2 were randomly assigned to view one of four silhouette arrays, and were instructed to select the image from the array that best resembled the woman described in the vignette (risk-prone or risk-averse) to which they were assigned. Responses were coded according to the relative size of the silhouette selected.

