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Sex differences in indirect aggression Psychological evidence from young adults

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Abstract

Many studies have found differences in the types of aggression used by males and females, at least in children and adolescents. Boys tend to use direct physical or verbal aggression, whereas girls tend to use more indirect forms of aggression that prominently feature gossip. Evolutionary theories of sex differences in indirect aggression propose selection pressures that would have acted on older teenagers and adults. Evidence for sex differences in indirect aggression in adults, however, is equivocal. Virtually all studies of adults have found a sex difference in physical aggression, but most have failed to find sex differences in the use of the more indirect forms of aggression. Almost all of these studies have measured indirect aggression using self-reports of aggressive behavior. We investigated sex differences in the psychology of indirect aggression by exposing young adult women and men to the same aggression-evoking stimulus. As evolutionary models predict, we found that women had a stronger desire than men to aggress indirectly, even after controlling for perceptions of social norms and approval. Future work on both evolutionary and social norm models of indirect aggression is warranted.

Keywords: Gossip; Social norms; Relational aggression; Social aggression; Reputation

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1. Introduction

Early research on sex differences in aggression seemed to show that men were overwhelmingly more aggressive than women, a perception that was challenged when social psychologists began to study nonovert forms of aggression (e.g., Bjorkqvist & Niemela, 1992; Galen & Underwood, 1997; Lagerspetz, Bjorkqvist, & Peltonen, 1998). This later work found striking sex differences in aggression types, at least in children and adolescents. Boys typically engage in aggression that involves a direct physical and/or verbal assault (i.e., hitting and yelling), whereas girls use less overt forms of aggression such as negative gossip. Owens, Shute, and Slee (2000a, 2000b), for example, showed that girls' aggressive tactics included gossip, ostracism, breaking confidences, and criticism of a victim's clothing, appearance, or personality. These tactics had "devastating" effects on victims. Aggressors' motives included retaliation, acquiring or maintaining a position in a group, getting attention, creating excitement, alleviating boredom, and avoiding victimization. Jealousy over physical appearance, grades, friends, and boys frequently triggered this aggression (Owens et al., 2000b). Girls rate such aggression as more hurtful than boys, suggesting their heightened sensitivity to it (Galen & Underwood, 1997). Most research has emphasized three overlapping constructs for these types of aggression: relational, social, and indirect aggression. Each of these terms probably describes the same set of phenomena (Archer & Coyne, 2005). Following Bjorkqvist et al., we will refer to all these forms of nonovert aggression as indirect aggression.

Witchcraft accusations, found in numerous societies, have close parallels to indirect aggression. Witchcraft accusations can be very damaging to the reputations of the accused and have other features in common with indirect aggression (e.g., Bleek, 1976; Fry, 1992). According to anthropologists, witchcraft commonly occurs when conflict develops in close local relationships (Nash, 1973). Among the Tibetan Nyinba, for example, witchcraft accusations are believed to be caused by intracommunity conflicts (Levine, 1982). Several other authors have also emphasized the political dimensions of witchcraft accusations (e.g., Marwick, 1965; Mitchell, 1956; Turner, 1954; all cited in Bleek, 1976). Consistent with possible sex differences in indirect aggression, it has been pointed out that accused witches are often women (Bleek, 1976; Levine, 1982), though to our knowledge, there is no quantitative documentation that women engage in witchcraft accusations more than men.

Some of the most influential theories of sex differences in aggression, both indirect and physical, are the "social learning" models (e.g., Bandura, 1973). These theories differ on what, exactly, is learned (specific behaviors, attitudes, perceptual biases, response biases, or scripts or programs for behavior) and how it is learned (either by personal experience or by imitating others). In the "social script" model, children learn aggressive "schemas" or "scripts" that guide and pattern aggressive behavior. According to this model, behaviors suggested by the scripts are filtered through self-regulating beliefs, and one important category of such beliefs is *normative beliefs* (Huesmann & Guerra, 1997; Huesmann, Guerra, Miller, & Zelli, 1992). Huesmann and Guerra discuss normative beliefs as "self-regulating beliefs about the *appropriateness* of social behaviors" (1997, p. 417, emphasis added). They state that (1997, p. 409)

> Normative beliefs may or may not be consistent with the prevailing social norms, although there should be considerable overlap between an individual's normative beliefs and the normative beliefs of relevant peers, social groups, and societal institutions. We propose that these beliefs also serve to regulate behavior, regardless of whether they are backed by internal or external sanctions. . .

According to these models, aggressive behavior and normative beliefs approving aggression should be strongly correlated. In particular, gender differences in aggression should parallel "gender differences in endorsement of aggression" (Huesmann & Guerra, 1997, p. 409).

A competing group of models garnering increasing attention are the "evolutionary strategic" models (e.g., Archer, 2001; Buss & Shackelford, 1997; Campbell, 1999; Daly & Wilson, 1988; Hess, 2006), which posit that aggression strategies are adaptations. In these models, sex differences in aggression result from sex differences in the selective environments of males and females, usually sex differences in parental investment (Andersson, 1994; Daly & Wilson, 1988; Symons, 1979; Trivers, 1972). When males invest less in offspring than females, it pays males to compete with other males for mates, often using physical aggression. Campbell (1999) extended this argument to indirect aggression: because maternal care is more important to female inclusive fitness than paternal care is to male inclusive fitness, women cannot afford the high costs of physical aggression when conflicts arise, so they instead engage in low-level direct combat and indirect aggression like negative gossip (see also Archer & Coyne, 2005). Elaborating on a comment by Proveda (1975), Hess (2006) explained why females are more vulnerable than males to negative gossip, and are thus more inclined to use it against female competitors; Hess also argued that indirect aggression is a better within-community competitive strategy than physical aggression, and female exogamy might expose women to more within-community competition than men (cf. Geary, 1998).

The evolutionary strategic models propose that there are sex differences in evolved psychology that produce the observed sex differences in indirect aggressive behavior. These models rely heavily on sex-specific selective forces, such as sex differences in parental investment, that would have been experienced by reproductive-aged teenagers and adults, not children. Unfortunately, a recent meta-analysis of sex differences in indirect aggression (Archer, 2004, p. 311) concludes that "there was no sex difference in young adults" at least "among young adults from western nations in mixed-sex occupational settings. However, the limitations of cross-sectional data for drawing conclusions about developmental change need to be borne in mind, as does the limited database." If there are no sex differences in the psychology of indirect aggression among young adults, these evolutionary models are untenable.

2. Study

Almost all studies of sex differences in indirect aggression have used self-, peer-, teacher-, or parent-reported aggressive behavior in the real world. Although real-world behavior is obviously informative, it is influenced by many forces external to the individual that might obscure sex differences in psychology. Failures to find sex differences in indirect aggressive behavior could, for example, be due to sex differences in exposure to aggression-causing

circumstances, or higher social penalties for physical aggression that force men to use indirect aggression.

This study aimed to complement behavioral studies of indirect aggression by investigating whether sex differences in the *psychology* of indirect aggression exist among young adults, using an experimental design that would allow us to expose both sexes to the same aggression-evoking stimulus. If no sex differences were found, this would seriously undermine the existing evolutionary strategic models of indirect aggression. If sex differences were found, further investigation of these models would be warranted. We studied college students, a population in which only weak evidence of a female-biased difference in indirect aggressive behavior has been found (In the meta-analysis of Archer, 2004, the mean effect size $d=-.09$ for 19 studies in college populations, a small effect—Cohen, 1988).

We also wished to assess whether social norms and approval could explain any observed sex differences in aggression psychology. Based on evolutionary models of indirect aggression, we predicted that women would experience a stronger desire than men to indirectly aggress against competitors, even after controlling for social norms and approval. Indirect aggression involves a number of different tactics that could conceivably be used in different circumstances, and that might even exhibit differing patterns of use by the sexes. We therefore studied only one tactic: attacking an opponent with information. We term this tactic an *informational attack* (Hess, 2006).

2.1. Method

Young adults (255 UCSB undergraduates recruited in classes and on campus) read an aggression-evoking scenario in which a classmate of the same sex as the participant is overheard at a party telling the participant's teaching assistant that the participant has not been working on their joint project and has shown up to project meetings with a hangover. Both accusations are false. In fact, the participant has been doing all the work because the classmate was vacationing in Baja California. The classmate was described as being loud, obnoxious, and as someone who makes useless comments in class. To minimize the physical threat posed by the classmate, he or she was described as being unusually short.

Participants then indicated how they would like to respond to the classmate's false accusations. Because behavioral studies of adults had often failed to find a sex difference in indirect aggression, we first measured retaliatory responses using a forced choice paradigm, which can detect small sex differences. Because responses are mutually exclusive, it is difficult to independently assess the psychology of indirect vs. physical aggression. We therefore also measured retaliatory sentiments using 10-point Likert scales that are less sensitive to sex differences, but that allow participants to freely rate multiple, nonmutually exclusive retaliatory responses. Here, participants rated how much they felt like making two informational and two physical retaliatory responses. This within-subjects variable (TACTIC) included measurements for GOSSIP, gossiping to other people at the party that the classmate "is clueless and spews useless comments during lecture," which would harm the classmate by damaging his or her reputation; TELL, telling the teaching assistant that the classmate took a vacation, which would harm the classmate by possibly causing the teaching assistant to

punish him or her; PUNCH, punching the classmate right now; and IFPUNCH, threatening the classmate that if he/she did that again, the participant would punch him or her. WEATHER, responding with an innocuous comment about the weather, assessed how inclined participants were to "turn the other cheek." Though adult sex differences in physical aggression are well established (e.g., Archer, 2004), we included items on physical aggression as a partial check of the validity of our study.

We also measured variables designed to control for normative and other social influences on gossiping and violent behavior. Existing instruments designed for children (e.g., Huesmann & Guerra, 1997) include many items of the form, "It is okay for *X* to hit/scream at *Y* when *Z*," where *X* and *Y* might be "a boy" and "a girl," and *Z* is the situational context of the question, for example, a girl insults a boy. Some instruments also assess what third parties like peers or parents would think. We planned to expose participants to a particular situational context, so we decided to just ask about this situation. Because participants were college students, and because the norm theory strongly emphasizes the concept "appropriateness," instead of using the word "okay," we asked how "appropriate" it was to gossip (APGOSSIP), to tell (APTELL), or to punch (APPUNCH). The theory also emphasizes the attitudes of third parties, so we asked what impression people would have of the participant if he or she gossiped (IM1GOSSIP) or punched (IMPUNCH). These variables were measured on 10-point Likert scales. Telling on the classmate to the teaching assistant is not a public act, so we did not ask about impressions of telling; furthermore, we assumed that social norms on punching, and on threatening to punch, would be very similar, so we just asked about the appropriateness and impression of punching. Finally, we measured ANGER to check whether participants were reacting to our stimuli as intended (see Appendix A for stimuli). Analyses were simplified by having female participants read only about a female classmate, and males read only about a male. Thus, our study does not address cross-sex aggression.

Table 1
Summary statistics for study variables

	Females			Males		
Variable	*n*	Mean	S.D.	*n*	Mean	S.D.
AGE	142	20.91	4.98	112	21.45	2.79
ANGRY	141	9.29	1.13	113	8.73	1.72
Predictors						
APGOSSIP	141	4.76	2.66	111	4.11	2.52
IMGOSSIP	99	3.70	1.73	90	3.74	1.71
APTELL	141	7.73	2.29	111	7.07	2.77
APPUNCH	39	2.41	2.27	45	4.62	3.41
IMPUNCH	37	2.16	1.40	45	3.87	2.74
Responses						
GOSSIP	100	6.62	2.65	91	5.56	2.79
TELL	141	8.86	1.57	113	7.96	2.69
PUNCH	39	6.10	2.66	45	7.33	2.99
IFPUNCH	80	3.74	2.59	73	5.90	3.04
WEATHER	140	3.09	2.42	113	3.60	3.00

3. Results

Sample sizes varied because some questions were added as the study progressed, and a few participants did not answer all questions. See Table 1 for the summary statistics.

The high means for ANGER indicated that participants were reacting strongly to the scenario in the predicted fashion. Interestingly, women were also significantly angrier than men (Mann–Whitney U test, $Z=-2.0$, $p=.046$, two-tailed). The low means for WEATHER indicated that participants were disinclined to simply turn the other cheek.

3.1. Sex differences in norm variables

Although there were significant differences in the shapes and means of the male and female distributions of APPUNCH, the shapes of the male and female distributions of

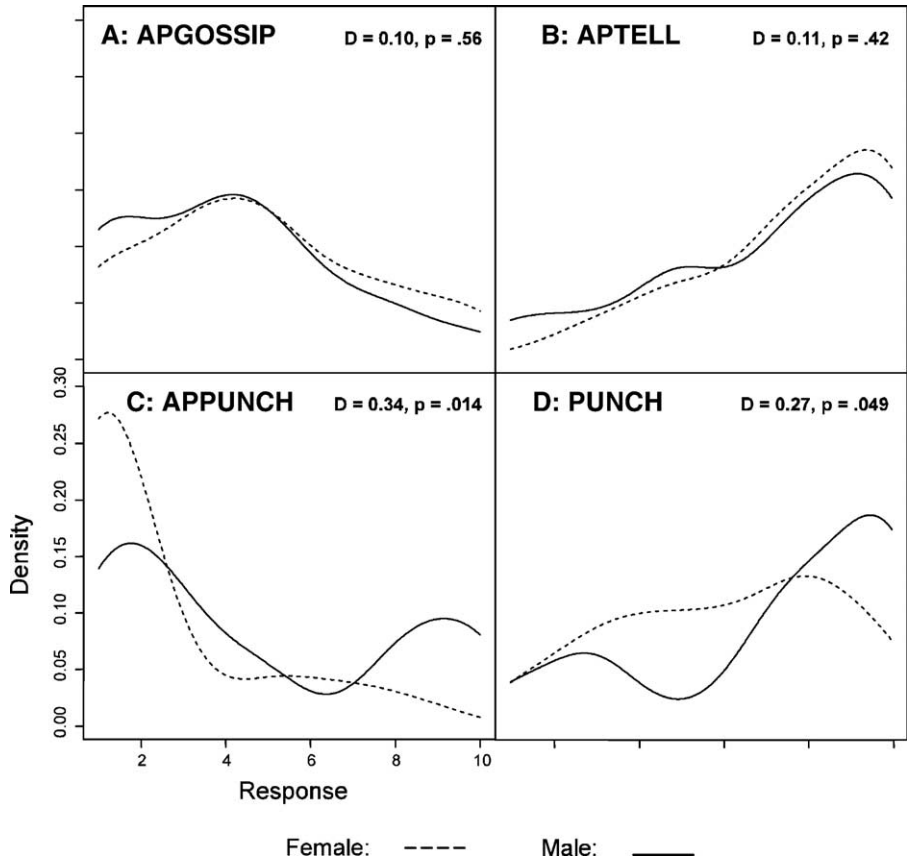

Fig. 1. Densities (smoothed histograms). (A–C) Social norms; (D) PUNCH. Bandwidth=1. Sex differences in distributions were investigated using the Kolmogorov–Smirnov test (D), which can detect differences in the shapes of the distributions (results reported in each panel). Note the apparent bimodality of male APPUNCH and PUNCH scores.

APGOSSIP and APTELL were remarkably similar (Table 1 and Fig. 1). Thus, there is little evidence for important sex differences in indirect aggression *norms*. Norm and approval variables did differ by aggression type, however. APPUNCH and IMPUNCH were highly correlated (r_s=.71, p<.001) as were APGOSSIP and IMGOSSIP (r_s=.43, p<.001), but the intercorrelations of other norm and approval variables were low-to-modest (r_s ranged from .13 to .28). Norms on one type of aggression do not explain norms on other types.

3.2. Sex, norms, approval, and retaliation: forced choice

In the forced choice, 72 women (90%) felt more compelled to retaliate reputationally and only 8 (10%) felt more compelled to retaliate physically. Men were more evenly divided; 40 (55%) felt more compelled to retaliate reputationally, and 33 (45%) physically. The between-sex difference was significant [$\chi^2(1)$=24.1, ϕ=−.40, n=153, p<.001]. The within-sex difference was significant for women (p<.001), but not men (p=.48).

Using binomial logistic regression, we investigated whether SEX was still a significant predictor of retaliation type after controlling for norms and expectations of social approval. Simply presuming that each participant would retaliate reputationally would correctly predict 67.9% of the cases. A model with SEX alone significantly increased the accuracy of prediction to 73.8%, whereas a model of the social norm and approval variables alone correctly predicted 82.1% of cases (models not reported). Adding SEX to the social norm and approval model significantly improved it, correctly predicting 88.1% of cases (Table 2). Exp(B) is the effect of a 1-unit change in the predictor variable on the odds ratio of the response. Thus, being female increased the odds ratio of retaliating informationally 14.22 times relative to being male, controlling for the social norm and approval variables.

3.3. Sex, norms, approval, and retaliation: free choice

Four retaliation sentiment items (TACTIC) allowed participants to independently rate their desire to RETALIATE using both informational and physical aggression. Our repeated measures design was unbalanced, so we used a linear mixed effects model (LME), with participant ID as a grouping factor. There was marked between-sex heterogeneity of variance, so we fit a heteroscedastic LME, with an exponential variance function. This model

Table 2
Binomial logistic regression models of FORCED (phys=0 vs. rep=1)

	B	S.E.	Wald	p	Exp(B)
Constant	−1.75	1.02	2.93	.087	0.17
APGOSSIP	0.40	0.20	4.00	.046	1.49
IMGOSSIP	0.93	0.31	8.96	.003	2.54
APPUNCH	−0.79	0.21	14.46	<.001	0.46
SEX	2.66	0.96	7.64	.006	14.22

n=84 (39 females, 45 males). The omnibus $\chi^2(df)$=59.1 (4), p<.001, Nagelkerke R^2=.71. Adding SEX to a model containing only norm variables significantly improved the model (p for χ^2 increase=.001).

performed significantly better than an LME model, which assumed homogeneous variance. We had four planned between-sex comparisons, one for each retaliation sentiment.

There was a significant main effect for TACTIC (F=88.0, p<.001), no main effect for SEX (F=1.89, p=.17), and, as predicted, a significant interaction between SEX and TACTIC (F=15.0, p<.001). We then computed our four planned between-sex contrasts. As predicted, males experienced a significantly stronger desire than females on PUNCH (M=7.33 vs. 6.10, F=10.4, p=.001) and IFPUNCH (M=5.90 vs. 3.74, F=46.2, p<.001), and females experienced a significantly stronger desire on GOSSIP (M=6.62 vs. 5.56, F=4.7, p=.03).

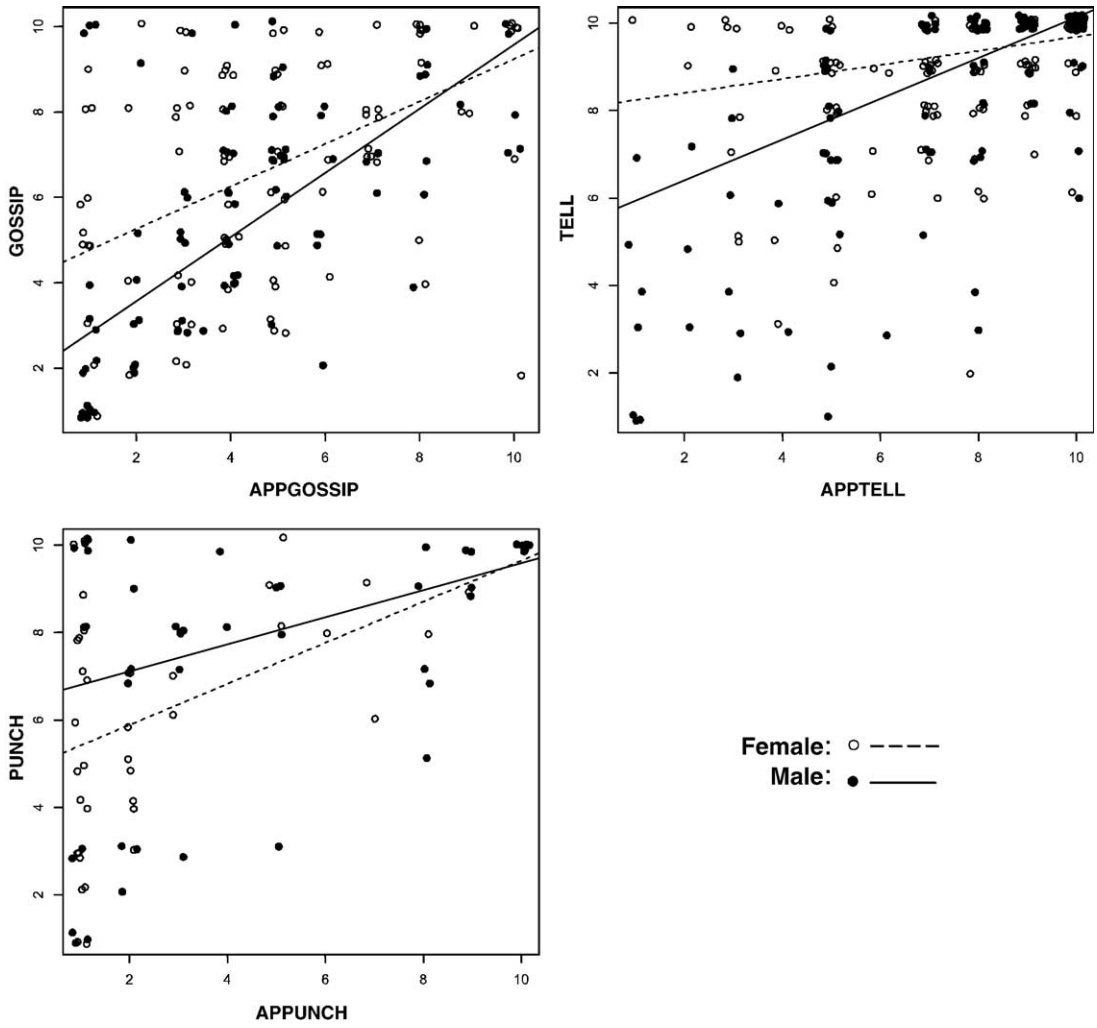

Fig. 2. Scatterplots of retaliation sentiments vs. social norm variables. Separate regression lines for each sex were fit by robust regression. The 95% CIs of the regression lines all excluded the origin (1, 1), but none excluded (10, 10) (tests not shown). A small amount of jitter has been added to better display overlapping points.

Contrary to predictions, females and males did not significantly differ on TELL (M=8.86 vs. 7.96, F=1.2, p=.27). The effect size for sex differences in GOSSIP was d=−0.39; 95% confidence interval (CI), −0.64 to −0.15.

We then explored post hoc within-sex comparisons. Within sex, women felt the strongest desire to retaliate by telling, followed, in order, by negative gossiping, punching, threatening to punch, and avoiding a confrontation (WEATHER). Men felt the strongest desire to retaliate by telling, followed, in order, by punching, threatening to punch, gossiping, and avoiding a confrontation. After adjusting alpha for multiple comparisons, females' desire to TELL (M=8.9) was significantly greater than their desire to GOSSIP (M=6.6), F=54.1, p<.001. Interestingly, despite their overwhelming choice of informational over physical retaliation in the forced choice paradigm, women still felt a strong desire to immediately PUNCH the classmate (M=6.1), a desire that was not significantly less than their desire to GOSSIP (M=6.6), F=1.27, p=.26. Men's desire to PUNCH the classmate (M=7.3), in contrast, was significantly higher than their desire to GOSSIP (M=5.6), F=14.5, p<.001.

Retaliation sentiments varied considerably among individuals. We tested whether our norm and approval variables explained a significant fraction of this variance, and whether these

Table 3
Retaliation sentiments vs. social norms and SEX

			Bootstrapped values		
Model variables	N (f, m)	B	Bias	S.E.	CI (BCa)
Model 1: GOSSIP	99, 89				
Intercept		2.93	−0.044	0.59	**1.77 to 4.11**
APGOSSIP		0.50	0.010	0.10	**0.31 to 0.67**
IMPGOSSIP		0.34	−0.003	0.13	**0.11 to 0.60**
SEX (male)		−0.96	0.004	0.36	**−1.62 to −0.29**
Model 2: TELL	140, 111				
Intercept		7.02	−0.014	0.79	**5.27 to 8.34**
APPTELL		0.26	0.001	0.09	**0.11 to 0.45**
SEX (male)		−3.28	0.039	1.09	**−5.29 to −0.94**
APTELL*SEX		0.38	−0.004	0.12	**0.13 to 0.60**
Model 3: PUNCH	37, 45				
Intercept		5.09	0.077	0.68	**3.72 to 6.46**
APPUNCH		0.34	−0.004	0.10	**0.16 to 0.56**
IMPUNCH		0.17	−0.022	0.15	−0.08 to 0.53
SEX (male)		0.13	0.111	0.92	−1.83 to 1.85
Model 4: IFPUNCH	37, 45				
Intercept		2.24	−0.057	0.47	**1.47 to 3.18**
APPUNCH		0.71	0.006	0.15	**0.34 to 0.93**
IMPUNCH		−0.02	0.011	0.17	−0.29 to 0.33
SEX (male)		0.22	−0.026	0.67	−0.88 to 1.84

Regression coefficients estimated by robust regression. Standard errors and 95% CIs estimated with 1000 bootstrap replications. Significant values are in bold. SEX coefficients are treatment contrasts, which indicate the change from the base level (here, females). Hence, "SEX (male)" is the change for males relative to females. Interaction terms included only if significant.

variables could account for all the effects of SEX. The marked asymmetry and heteroscedasticity of the residuals (Fig. 2) ruled out the straightforward use of traditional parametric models.

Leverage analyses also indicated that outliers might be having a modest impact on some models. We therefore used iterated reweighted least squares (IWLS) to fit a robust regression model with Tukey's bisquare M-estimator; this procedure is less sensitive to outliers than ordinary least-squares regression (Venables & Ripley, 2002). Because errors were nonnormal and heteroscedastic, and the asymptotic approximations used by this procedure to estimate S.E.'s may not be trustworthy in smaller samples (Fox, 1997), we used bootstrapping to estimate S.E.'s and CIs (Efron & Tibshirani, 1993). In our case, this procedure was conservative, yielding larger S.E.'s than traditional parametric tests (Table 3).

The social norm variables were by far the strongest predictors of each of the retaliation variables. After controlling for them, however, there were still significant sex differences. Women were more inclined than men to retaliate informationally (GOSSIP and TELL). The significant interaction in model 2 between SEX and APTELL indicated that women's desire to tell was less influenced by the norm variable than was men's. After dichotomizing APTELL around the median, the mean desire to tell for women and men who thought it was appropriate to tell was essentially equal (female M=9.62 vs. male M=9.64), whereas the mean desire to tell for women who thought it was inappropriate to tell was higher (M=8.2) than it was for men (M=6.9); women who thought it inappropriate to tell still felt like telling. After controlling for norms, men were no more likely than women to retaliate, or threaten to retaliate, physically.

4. Discussion

As has been found in most studies of children and especially adolescents, but in contrast to most studies in adults, there were clear sex differences in informational attacks in this sample of young adults. In the forced choice paradigm, women overwhelmingly felt more compelled to retaliate by attacking the classmate's reputation, whereas men were more evenly divided. Substantiating these results, in the free-choice paradigm, women also expressed a stronger desire to retaliate with gossip (but not by telling) compared to men. These are some of the clearer indications to date of sex differences in the psychology of indirect aggression among young adults (d=−0.39 here vs. −0.09 in behavioral studies of college students). Consistent with "social script" models, social norms and approval accounted for most of the variance in retaliation. Contrary to these models, there were few important sex differences in indirect aggression norms, and, as predicted by evolutionary models of indirect aggression, sex differences in desire to retaliate informationally remained after controlling for social norm and approval variables.

Partially validating these results, we replicated the robust finding that men express a stronger desire than women to retaliate physically. After controlling for social norms and approval for PUNCH and IFPUNCH, SEX was no longer significant, as the social norm theory predicts. It should be noted, however, that the fictional classmate's

attack was reputational, not physical (and our sample sizes for these variables were much smaller).

Just as sex differences in physically aggressive behavior should peak at the ages at which males would have been competing for mates in the EEA, sex differences in indirect aggressive *behavior* should peak at the ages at which females would have been competing for mates in the EEA. Worldwide, women tend to marry at younger ages than men—in less well-developed regions, the average age at first marriage for women is 21.4 years, and for men, 24.9 years (UN, 2000). In the 15- to 19-year-old age category, over five times as many women are married (14.7%) as men (2.6%) (unweighted averages across 199 and 191 countries and regions, respectively; data from UN, 2000). Female intrasexual aggression should therefore peak earlier than male intrasexual aggression. Consistent with this, the female bias in indirect aggression is greatest among 11- to 17-year olds, and the male bias in physical aggression is greatest among 18- to 30-year olds (Archer, 2004). Nonetheless, most women compete for mates into their 20s. If sex differences in the psychology of indirect aggression in adults are replicated, they will have to be reconciled with the relative lack of evidence for sex differences in indirectly aggressive behavior in adults.

4.1. Conceptualizing retaliation norms: targets of, constraints on, or justifications for behavior?

Even though they did not explain sex differences in indirect aggression, social norm and approval variables nonetheless explained most of the variance in physical and informational retaliation sentiments. Hence, we explore them further here. There were three interesting results. First, the broad norm distributions (Fig. 1) were surprising because our population was relatively homogenous. (During the study, the student population was 63% white and 94% Californian; UCSB, 2000–2001.) Except for female APPUNCH scores, the only aspect of the norm data that supports the conception of social norms as uniform, society-wide pre- or proscriptions of behaviors is that each distribution had a more-or-less well-defined peak that *might* correspond to a society-wide norm. The considerable individual variance in norms might reflect strategic adoption and promotion of norms by individuals with varying interests (Nietzsche, 1887). Thus, the development of social norms regulating aggression may itself require an evolutionary strategic explanation (e.g., Hagen & Hammerstein, 2005). If high variance is found in domains other than aggression, this also has implications for cultural group selection models that emphasize the ability of conformism to generate low within-group variance relative to between-group variance in norms (e.g., Soltis, Boyd, & Richerson, 1995).

Second, the distributions of male PUNCH and APPUNCH scores appeared to be bimodal (Fig. 1). This evokes the Hawk–Dove game (Maynard-Smith, 1982), which is bimodal by construction. The relative densities of the two modes in the male distribution would then conceivably be evidence of the frequency dependence of Hawk and Dove (not necessarily based on genetic polymorphism). (That Hawk–Dove consists of only two strategies could be justified by arguing that in certain types of conflict, a "half-hearted" Hawk would incur the costs with little chance of gaining the benefits.) Male bimodality also evokes the work of Nisbett & Cohen (1996) on the "culture of honor," which found that U.S. Southerners

responded more strongly to reputational threats than Northerners. Perhaps these two peaks represent subcultures in our study population.

Third, although individuals might simply be trying to match their behavior to prevailing social norms, or conversely, expressing norms which conveniently match their desires, our data suggest that norms are imperfectly constraining an underlying disposition to retaliate. If norms were only guides to, or justifications for, emotions, then deviations from the norm should be biased neither for nor against an inclination to retaliate. We propose, on the other hand, that there is an underlying bias to retaliate, imperfectly constrained by a norm, so deviations from the norm should be in the direction of the underlying predispositions. In Fig. 2, the regression lines are all significantly tilted upward (i.e., 0<slope<1, tests not reported). Individuals who reported that punching was extremely inappropriate, for instance, were nonetheless expressing a significant desire to PUNCH. Above and beyond this upward tilt, the distribution of male (but not female) GOSSIP residuals were skewed toward retaliation–gossip desires that did not match the norm were biased toward increased gossiping. Bootstrapping revealed that this skew of male residuals (0.96) was significantly greater than 0 (95% CI, 0.46–1.46).

4.2. Study limitations

Participants were students aged 18 to 25 years; the results may not generalize to other age groups. In particular, 31% of our participants were 18 or 19 years old, just outside the 11–17 years age group showing the most sex differences in indirect aggression (Archer, 2004). As a predictor of informational attacks, however, AGE was not significant as a main effect or in interactions with other variables (tests not reported). Nonetheless, the sex differences we found might not exist in populations of older individuals. In addition, given the relatively modest effect of SEX, additional norm or approval variables might reduce or eliminate its residual effects in our models.

It is possible that sex differences in indirect aggression are explained, not by sex differences in social norms and approval regulating gossiping, but by sex differences in social norms and approval regulating physical aggression. Unfortunately, we could not test this hypothesis because including APPUNCH or IMPUNCH in the model of GOSSIP reduced the sample size by more than half, such that the original sex difference was no longer significant (and thus we could not test whether adding APPUNCH or IMPUNCH would eliminate the significance of SEX). This is another limitation of our study.

5. Conclusion

In two different measurement paradigms (forced and free-choice), young adult women reported a significantly stronger desire than men to retaliate with gossip (but not by telling) against a reputational attack, even after controlling for social norms and approval. This supports the evolutionary strategic models that predict sex differences in indirect aggression among adults (Campbell, 1999; Geary, 1998; Hess, 2006). Although it is obviously premature

to conclude that there are innate sex differences in informational retaliation sentiments, the results of this study suggest that further investigations of both evolutionary strategic and social norm models of indirect aggression are warranted.

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Appendix A. This is the female version of the stimulus (male version identical except for name and pronouns)

A.1. Scenario

It's Friday night of week 5 and you are at a party in IV. The party is at your friend's apartment, and there are about 30 people there, many of whom you know because they are from your major. There are undergraduates, graduate students, and even one of your TAs. Melissa, another person in your major, is also there. In addition to being clueless, Melissa is unusually short. She has a loud voice and a tendency to spew useless comments during class lectures. Unfortunately, she is also your partner on a project in one of your classes. You were randomly assigned to work on a project with her because your friend that was supposed to be your partner dropped the class. The party has been going on for some time, and everyone is relaxed, talking, eating, drinking, listening to music. At one point during the party, you head down the hall toward the patio. On the way out, you overhear that obnoxious voice. Melissa is talking to your TA outside. You listen. Melissa tells the TA that she is having problems getting you to contribute to the project, and that she is really annoyed. She also says that you have shown up to project meetings with a hangover more than once, and she wonders whether you have a drinking problem. This is totally untrue. You have never been to a meeting with a hangover, and you have been doing the majority of the work. In fact, you had to do all the library work yourself because Melissa decided to take a surprise vacation. You learned about this surprise trip when you got a message on your voice mail last week—a message that you saved. Melissa's message was that she was at the airport and on the way to Cabo San Lucas for a week. She said she would really appreciate it if you could just get the library work done and turn it in because she would not be back in time to help. So you are standing there in the hallway, somewhat shocked by the lies that Melissa is telling the TA. Then Melissa and the TA walk in from outside. Your TA looks at you, then looks

down at the beer you have in your hand, and walks away rather quickly. Melissa watches the TA scurry down the hall, and then turns and smiles at you and says "Hey! How are things going? Hasn't the weather been great lately?"

A.2. Dependent variable statements

Indicate how much you agree with the following statements by circling one of the numbers below each question.

[Each item was followed by a 10-point Likert scale, where 1=I disagree strongly, and 10=I agree strongly].

I feel like punching Melissa right now.

I feel like telling people at the party that Melissa is clueless and spews useless comments during lecture.

I feel like telling the TA that Melissa took a vacation.

I feel like telling Melissa right now that if she talks like that about me again, I'll punch her.

I feel like saying "Yeah the weather has been nice".

I feel angry.

At a gut level, which of the following two things do you feel more compelled to do? (whether or not you would actually do it?) Please circle ONE: attack Melissa physically ~or~ attack Melissa's reputation

[Items followed by 10-point Likert scales where 1=Extremely inappropriate, and 10=Extremely appropriate]

How appropriate would it be for you to gossip about Melissa?

How appropriate would it be for you to punch Melissa?

How appropriate would it be for you to tell on Melissa?

[Items followed by 10-point Likert scales, where 1=Extremely negative, and 10=Extremely positive]

If you told people at the party that Melissa is clueless and spews useless comments during lecture, what kind of impression would it give people of you?

If you punched Melissa, what kind of impression would it give people of you?

References

Andersson, M. (1994). *Sexual selection*. Princeton: Princeton University Press.

Archer, J. (2001). A strategic approach to aggression. *Social Development*, *10*, 267–271.

Archer, J. (2004). Sex differences in aggression in real-world settings: A meta-analytic review. *Review of General Psychology*, *8*, 291–322.

Archer, J., & Coyne, S. M. (2005). An integrated review of indirect, relational, and social aggression. *Personality and Social Psychology Review*, *9*, 212–230.

Bandura, A. (1973). *Aggression: A social learning analysis*. Engelwood Cliffs, NJ: Prentice Hall.

Bjorkqvist, K., & Niemela, P. (Eds.). (1992). *Of mice and women: Aspects of female aggression*. San Diego: Academic Press, Inc.

Bleek, W. (1976). Witchcraft, gossip and death: A social drama. *Man*, *11*, 526–541.

Buss, D. M., & Shackelford, T. K. (1997). Human aggression in evolutionary psychological perspective. *Clinical Psychology Review*, *17*, 605–619.

Campbell, A. (1999). Staying alive: Evolution, culture, and women's intra-sexual aggression. *Behavioral and Brain Sciences*, *22*, 203–252.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). Hillsdale, NJ: Erlbaum Associates.

Daly, M., & Wilson, M. (1988). *Homicide*. New York: A. de Gruyter.

Efron, B., & Tibshirani, R. (1993). *An introduction to the bootstrap*. New York: Chapman & Hall.

Fox, J. (1997). *Applied regression analysis, linear models, and related methods*. Thousand Oaks, CA: Sage.

Fry, D. P. (1992). Female aggression among the Zapotec of Oaxaca Mexico. In K. Bjorkqvist, & P. Niemela (Eds.), *Of mice and women: Aspects of female aggression* (pp. 187–199). San Diego: Academic Press, Inc.

Galen, B. R., & Underwood, M. K. (1997). A developmental investigation of social aggression among children. *Developmental Psychology*, *33*, 589–600.

Geary, D. C. (1998). *Male, female: The evolution of human sex differences*. Washington, DC: American Psychological Association.

Hagen, E. H., & Hammerstein, P. (2005). Evolutionary biology and the strategic view of ontogeny: Genetic strategies provide robustness and flexibility in the life course. *Research in Human Development*, *2*, 87–101.

Hess, N., (2006). Informational warfare: The evolution of female coalitions and gossip. PhD Dissertation, UCSB.

Huesmann, L. R., & Guerra, N. G. (1997). Children's normative beliefs about aggression and aggressive behavior. *Journal of Personality and Social Psychology*, *72*, 408–419.

Huesmann, L. R., Guerra, N. G., Miller, L., & Zelli, A. (1992). The role of social norms in the development of aggressive behavior. In A. Fraczek, & H. Zumkley (Eds.), *Socialization and aggression*. New York: Springer-Verlag.

Lagerspetz, K., Bjorkqvist, K., & Peltonen, T. (1988). Is indirect aggression typical of females? Gender differences in aggressiveness in 11- to 12-year-old children. *Aggressive Behavior*, *14*, 403–414.

Levine, N. E. (1982). Belief and explanation in Nyinba women's witchcraft. *Man*, *17*, 259–274.

Marwick, M. G. (1965). *Sorcery in its social setting: A study of the Northern Rhodesian Cewa*. Manchester: University Press.

Maynard Smith, J. (1982). *Evolution and the theory of games*. Cambridge, MA: Cambridge University Press.

Mitchell, C. (1956). *The Yao village*. Manchester: Manchester University Press.

Nash, D. (1973). A convergence of psychological and sociological explanations of witchcraft. *Current Anthropology*, *14*, 545–546.

Nietzsche, F. W. (1887). *Genealogy of Morals, translated by Walter Kaufmann, 1969*. New York: Vintage.

Nisbett, R. E., & Cohen, D. (1996). *Culture of honor: The psychology of violence in the south*. Boulder, CO: Westview.

Owens, L., Shute, R., & Slee, P. (2000a). "Guess what I just heard!": Indirect aggression among teenage girls in Australia. *Aggressive Behavior*, *26*, 67–83.

Owens, L., Shute, R., & Slee, P. (2000b). "I'm in and you're out...": Explanations for teenage girls' indirect aggression. *Psychology, Evolution, and Gender*, *2*, 19–46.

Proveda, T. G. (1975). Reputation and the adolescent girl. *Adolescence*, *10*, 127–136.

Soltis, J., Boyd, R., & Richerson, P. J. (1995). Can group-functional behaviors evolve by cultural group selection: An empirical test. *Current Anthropology*, *36*, 473–494.

Symons, D. (1979). *The evolution of human sexuality*. Oxford: Oxford University Press.

Trivers, R. L. (1972). Parental investment and sexual selection. In B. G. Campbell (Ed.), *Sexual Selection and the Descent of Man 1871–1971* (pp. 136–179). Chicago: Aldine.

Turner, V. W. (1954). *Schism and continuity in an African society: A study of Ndembu Village Life*. Manchester: University Press.

UCSB. (2000–2001). Campus profile. Retrieved June 29, 2005 from http://bap.ucsb.edu/IR/00-01/cp2000.pdf.

UN. (2000). World Marriage Patterns 2000. Retrieved June 29, 2005 from http://www.un.org/esa/population/publications/worldmarriage/worldmarriage.htm.

Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics with S* (4th ed). New York: Springer.