

Sexual-perception processes in acquaintance-targeted sexual aggression

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This study analyzes data from seven published studies to examine whether three performance-based indices of men's misperception of women's sexual interest (MSI), derived from a self-report questionnaire, are associated with sexual-aggression history, rape-supportive attitudes, sociosexuality, problem drinking, and self-reported MSI. Almost 2000 undergraduate men judged the justifiability of a man's increasingly unwanted advances toward a woman on the Heterosocial Perception Survey-Revised. Participants self-reported any sexual-aggression history, and some completed questionnaires assessing rape-supportive attitudes, sociosexuality, problem drinking, and self-reported MSI. A three-parameter logistic function was fitted to participants' justifiability ratings within a non-linear mixed-effects framework, which provided precise participant-specific estimates of three sexual-perception processes (baseline justifiability, bias, and sensitivity). Sexual-aggression history and rape-supportive attitudes predicted: (a) reduced sensitivity to women's affect; (b) more liberal biases, such that the woman's affect had to be more negative before justifiability ratings dropped substantially; and (c) greater baseline justifiability of continued advances after a positive response. Sexual-aggression history and attitudes correlated more strongly with sensitivity than baseline justifiability; remaining variables showed the opposite pattern. This work underscores the role of sexual-perception processes in sexual aggression and illustrates the derivation of performance-based estimates of sexual-perception processes from questionnaire responses.

KEYWORDS

mixed-effects modeling, performance-based assessment, sexual aggression, sexual perception

1 | INTRODUCTION

Male-initiated sexual aggression toward female acquaintances is a serious problem on college campuses: approximately 20% of college women report experiencing an attempted or completed rape during their college years (Fisher, Cullen, & Turner, 2000; Krebs, Lindquist, Warner, Fisher, & Martin, 2007). Historically, theoretical models of acquaintance-initiated sexual coercion and aggression (e.g., Malamuth, Sockloskie, Koss, & Tanaka, 1991) have implicated primarily distal influences, such as a history of childhood sexual victimization and

adolescent delinquency, or more proximal trait-like influences, such as a preference for impersonal sex (i.e., sociosexuality) and hostile attitudes toward women (e.g., rape-supportive attitudes). More recently, theorists have also articulated a role for more state-like or contextualized proximal influences on the likelihood of sexual coercion and aggression, such as heavy alcohol consumption and misperception of women's sexual-interest cues (e.g., Abbey, Jacques-Tiura, & LeBreton, 2011). We focus in the current work on misperception of sexual interest (MSI), which classically refers to erroneous perception of the magnitude of another person's sexual interest (Abbey, 1987).

In particular, we evaluate whether multiple novel indices of men's MSI are associated with: (a) attitudinal and self-reported behavioral indices of risk for exhibiting sexually coercive and aggressive behavior, as well as (b) more permissive attitudes toward casual but not necessarily coercive sex (i.e., sociosexuality) and drinking problems.

Two established literatures that measure MSI differently provide support for further examination of the role that MSI may play in acquaintance-initiated sexual aggression. The first literature demonstrates that men who self-report more frequent misperception of a woman's friendly behavior as sexual interest also self-report engaging in more coercive and aggressive behavior (see Abbey et al., 2011, for a review). Rape-supportive attitudes, problematic drinking, and sociosexuality also are linked indirectly to sexual aggression via self-reported MSI (Abbey et al., 2011). Thus, self-reported MSI is implicated both theoretically and empirically in male-initiated sexual aggression toward female acquaintances.

The second literature demonstrates that performance-based indices of MSI also are related to the risk of exhibiting sexual aggression. Performance-based in this context means that the operation of MSI processes is inferred from participants' "performance" on a cognitive task, relative to relevant normative data, rather than directly reported by participants. In one line of inquiry, for example, male participants viewed numerous full-body photographs of women who nonverbally communicated dating-relevant affect that ranged from extremely rejecting to extremely sexually interested and for which highly reliable normative data were available from college women and experts in sexual perception. Participants either: (a) categorized women's affect (sexually interested, friendly, sad, or rejecting); (b) decided whether a woman would respond favorably or unfavorably to a sexual advance; or (c) judged women's sexual interest on a rating scale (Farris, Viken, & Treat, 2010; Farris, Viken, Treat, & McFall, 2006; Treat, Church, & Viken, 2017; Treat, Farris, Viken, & Smith, 2015; Treat, Hinkel, Smith, & Viken, 2016; Treat, Viken, Farris, & Smith, 2016).

In all six studies, men who more strongly endorsed rape-supportive attitudes, a well-established correlate of a self-reported history of sexual aggression (Murnen, Wright, & Kaluzny, 2002), showed reduced *sensitivity* to women's affect. *Sensitivity* reflects participants' ability to distinguish among categories or levels of women's dating-relevant affect. Higher-risk men's *lower* sensitivity values, therefore, indicated that they were more likely than their peers to confuse women's affective cues for one another (Macmillan & Creelman, 2004). For example, a higher-risk man would be more likely to perceive a woman expressing friendliness to be sexually interested, and a woman expressing sexual interest to be friendly.

In some studies, men who more strongly endorsed rape-supportive attitudes also showed a *bias* when judging women's affect (Farris et al., 2006; Treat, Farris et al., 2015; Treat, Viken, Farris, & Smith, 2016). *Bias* refers to the amount of women's affect that must be present to trigger a particular affective judgment (Macmillan & Creelman, 2004). When a small amount of sexual interest is needed to trigger perception of a woman as sexually interested, for example,

the perceiver would be described as having a *liberal bias* for judging sexual interest. In contrast, a perceiver who requires clear-cut indicators of sexual interest would be described as having a *conservative bias* for judging sexual interest. When bias emerged as a predictor of risk for sexual aggression, higher-risk men showed a more liberal bias when judging women's sexual interest (i.e., they required less evidence than their peers that the woman was communicating sexual interest before they concluded that she was sexually interested).

Overall, therefore, men at greater risk of exhibiting sexual aggression are more likely to show elevated MSI, whether assessed via self report (frequency of misperception) or in a more performance-based fashion (sensitivity and bias in judging affect). Theoretically, each of these aspects of MSI might increase the likelihood of subsequent aggression via more proximal mechanisms, including greater misperception of later sexual non-consent cues, dismissal of later non-consent cues as token resistance, and perception of later non-consent cues as purposefully inciting frustration and thus justifying violence (Farris, Treat, Viken, & McFall, 2008).

We develop and evaluate a new measurement strategy for assessing MSI in the current study, given limitations associated with these two established approaches. Concerns regarding self-reported MSI include social desirability and the validity of self-reported misperception, particularly among higher-risk men who are expected to have difficulty accurately perceiving women's dating-relevant affect. To report accurately the frequency with which he misinterprets women's sexual interest, a man must be aware of the occasions on which he misinterpreted women's sexual interest, and this will not always be true. Concerns regarding performance-based measures of MSI include the unwieldy nature of routine administration of computer-driven assessments to large numbers of participants, as well as the resulting difficulties in obtaining enough participants in any single study to examine potential MSI links to a low base-rate problem, such as a self-reported history of sexual aggression. Thus, our novel assessment of sexual perception is based on responses to a questionnaire that can be completed quickly on paper. In spite of the flexibility and ease of use of the measure, indices of multiple perceptual processes can be derived from participant responses, including *sensitivity* and *bias*. This allows estimation of associations between these performance-based indices and four measures of risk for future sexual aggression (self-reported sexual aggression history, rape-supportive attitudes, sociosexuality, and problem drinking).

We build on the Heterosocial Perception Survey (HPS; McDonel, 1986; McDonel & McFall, 1991), which presents three written vignettes in which a man is alone with a woman and wants to have sex with her for the first time (see Appendix A). At the end of each situation in the original measure, the participant reads five descriptions of increasingly intimate sexual advances by the man paired with increasingly negative responses by the woman (e.g., the man puts his hand on her thigh and she moves it away; the man puts his hand on her breast and she moves the hand away and says "No, don't."; note that the original five items are numbered three through seven in Appendix A). After reading each of the five descriptions, participants

judge the justifiability of the man's continued sexual advances, given the woman's reaction, on a 101-point scale (0 = absolutely no justification in continuing; 100 = completely justified in continuing). McDonel and McFall (1991) showed that the sum of the 15 justifiability ratings positively predicted rape proclivity and rape-supportive attitudes, as expected.

Our revised version of the HPS (the HPS-R) adds two items prior to the original five items for each of the three vignettes (note that the two new items are numbered one and two in Appendix A). Thus, participants make a total of 21 justifiability ratings on the HPS-R. To maintain the increasingly intimate nature of the man's advances and the increasingly negative response by the woman, the two new items present lower-level advances by the man, and the woman responds positively to the first (the man puts his arm around the woman, and she moves closer to him) and non-negatively to the second (the man kisses the woman, and she lets him). We anticipated that most male participants would provide large justifiability ratings (50–100) to at least the first of these two new items, show declining justifiability ratings for the next several items, and make ratings near zero for the final two items.

Three MSI aspects can be quantified from participants' 21 justifiability ratings: *baseline justifiability*, *bias*, and *sensitivity*. Figure 1 depicts an exaggerated version of the expected risk-linked pattern of results. We use non-linear mixed-effects modeling to estimate the operation of these sexual-perception sub-processes from participant responses to the HPS, as detailed in the results section.

Baseline justifiability refers to the perceived justifiability of continued sexual advances when the woman responds positively (i.e., to item 1, where the woman moves closer to the man when he puts his arm around her). We expected that *baseline justifiability* would be greater among high-risk than low-risk men, given high-risk men's greater levels of sociosexuality and other disinhibitory characteristics (see Abbey et al., 2011). In other words, higher-risk men should perceive continued advances to be more justified when receiving

encouraging signals from a woman. Note that higher-risk men show a greater *baseline justifiability* than lower-risk men (80 vs. 60) in the hypothetical findings presented in Figure 1.

Bias refers to the negativity of the woman's response (i.e., a continuous version of the item value, from one to seven) when a participant's justifiability ratings drop substantially—that is, by 50% of the participant's *baseline justifiability*. For example, if a participant's *baseline justifiability* is 80 and his *bias* is 4, this would mean that his justifiability ratings dropped to 40 (half of 80) when responding to the fourth item, in which the woman moves the man's hand away when he puts it on her breast. Larger values of *bias* indicate more *liberal* responding, as sexual advances are perceived to be quite justified even when the woman's response is quite negative. In contrast, smaller values of *bias* indicate more *conservative* responding, as justifiability ratings drop substantially before the woman's response became so negative. Given our prior performance-based work (Farris et al., 2006; Treat, Farris et al., 2015; Treat, Viken, Farris, & Smith, 2016), we anticipated that the higher-risk men might show a more *liberal bias* than lower-risk men—that is, higher-risk men should require *more* evidence than their peers that a woman is communicating rejection before they conclude that further advances are unjustified. In Figure 1, higher-risk and lower-risk men show *bias* values of 4 and 3, respectively (e.g., lower-risk men's justifiability ratings drop to 30 from their *baseline justifiability* of 60 when the woman's negative affect is at 3).

Finally, *sensitivity* refers to the participant's ability to distinguish the woman's changing affective cues, as shown by the rapidity with which a participant's justifiability ratings decline as the woman's response becomes more negative. A *sharper* decline in justifiability ratings across items indicates higher *sensitivity*, whereas a more *gradual* decline indicates lower *sensitivity*. We expected that higher-risk men would show lower *sensitivity*, consistent with prior performance-based findings (Farris et al., 2006, 2010; Treat, Farris et al., 2015; Treat et al., 2017; Treat, Hinkel, Smith, & Viken, 2016; Treat, Viken, Farris, & Smith, 2016). Figure 1 illustrates higher-risk men's more gradual reduction in justifiability ratings than lower-risk men.

Overall, the current study evaluates whether risk status (both attitudes and self-reported history) is more strongly linked to *sensitivity* than to *bias*, consistent with our prior work. In contrast, we anticipated that sociosexuality and problematic drinking would be more strongly linked to *baseline justifiability*, given the association between sociosexuality and sexual approach, and the confluence of sociosexuality and drinking in predicting sexual behavior in college students (Bailey et al., 2000; Bailey, Kirk, Zhu, Dunne, & Martin, 2000; Claxton, DeLuca, & van Dulmen, 2015). We address these questions in a sample of over 1,900 college men drawn from seven studies in which participants completed both the revised HPS and the Sexual Experiences Survey (SES), a well-established, behaviorally specific, self-report measure of perpetrating sexual coercion and aggression (Abbey, Parkhill, BeShears, Clinton-Sherrod, & Zawacki, 2006; Koss, Gidycz, & Wisniewski, 1987). In a subset of the seven studies, participants also completed well-established measures of rape-supportive attitudes, sociosexuality, and problematic drinking (Bailey et al., 2000; Payne, Lonsway, & Fitzgerald, 1999; Saunders, Aasland, Babor, de la Fuente, & Grant,

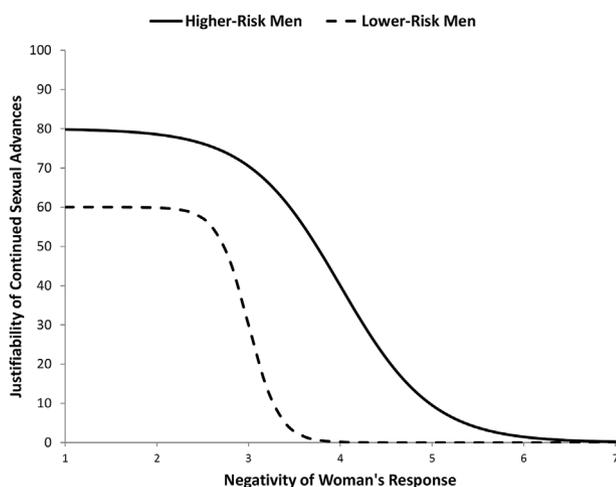


FIGURE 1 Illustration of hypothetical differences in justifiability ratings by higher-risk and lower-risk men

1993). Thus, we are able to examine whether performance-based indices of MSI, as obtained from responses to a self-report questionnaire (the HPS-R), can be predicted by attitudinal and self-reported behavioral indices of risk for exhibiting sexually coercive and aggressive behavior, as well as more permissive attitudes toward casual but not necessarily coercive sex (i.e., sociosexuality), drinking problems, and self-reported MSI.

2 | METHODS

2.1 | Participants

Participants ($n = 1981$) were drawn from seven studies in which the revised HPS was administered: (1) Treat, Viken, Farris, and Smith (2016); $n = 176$; (2) Treat, Farris et al. (2015); $n = 337$; (3) Farris et al. (2006); $n = 274$; (4) Treat, Viken, and Summers (2015); $n = 226$; (5) Farris et al. (2010); $n = 497$; (6) Treat, Viken, Kruschke, and McFall (2011); $n = 221$; and (7) Treat, Hinkel, Smith, and Viken (2016); $n = 250$. In all seven studies, participants completed the Heterosocial Perception Survey-Revised (HPS-R), the Sexual Experiences Survey (SES), and a one-item Misperception of Sexual Interest (MSI). A subset of studies included the Illinois Rape Myth Acceptance-Short Form (IRMA-SF), the Sociosexuality Scale (SS), and the Alcohol Use Disorders Identification Test (AUDIT). Questionnaires were completed following any study-specific cognitive tasks. We combined participants from the seven studies into a single sample. All participants were undergraduate males who received partial course credit for completing the original study at a large midwestern university. Given our population interests, we retained participants who reported their age to be between 18 and 24, and their sexual orientation to be heterosexual or bisexual. Average age was 19.44 ($SD = 1.27$). A total of 81.7% identified as Caucasian/White, 7.8% as Asian-American/Asian, 4.4% as Hispanic, and 3.3% as African-American/Black. All participants provided informed consent, and approval for each of the original projects was obtained from the Institutional Review Boards of Indiana University and the University of Iowa.

2.2 | Measures

2.2.1 | Heterosocial Perception Survey-Revised (HPS-R)

In a revision of McFall and McDonel's (1991) original HPS, participants read three scenarios in which a man is with a woman and is interested in having sex with her for the first time (see Appendix A). The three scenarios vary primarily in how long and how well the man has known the woman. At the end of each scenario, the participant reads seven descriptions of a sexual advance initiated by the man, as well as the woman's response. Both the intimacy of the sexual advance and the negativity of the woman's response increase across the seven descriptions. The participant rates the justifiability of continued sexual advances, given the woman's reaction, on a 101-point scale (0 = absolutely no justification in continuing; 100 = completely justified

in continuing). The participant makes a justifiability rating for each of the seven sexual advance levels for each of the three scenarios, for a total of 21 justifiability ratings. The internal consistency of responses to this measure in the current study was good ($\alpha = 0.89$). The primary dependent variables in the study (*baseline justifiability, sensitivity, and bias*) are derived from the HPS.

2.2.2 | Sexual Experiences Survey (SES)

The SES is a behaviorally specific self-report measure of perpetrating sexual coercion and aggression with reasonable reliability and validity (Abbey et al., 2006; Koss et al., 1987). Participants in the first six studies completed the original 10-item SES (Koss et al., 1987). Participants in the final study completed a 17-item version that included slight variations on the original 10 items (Abbey et al., 2006); only responses to the latter items were used when scoring the measure. Participants were placed into one of five categories (Koss et al., 1987) on the basis of their most severe perpetration behavior.

2.2.3 | Illinois Rape Myth Acceptance-Short Form (IRMA-SF)

The IRMA-SF is a 20-item questionnaire that assesses endorsement of rape-supportive attitudes and has shown adequate reliability and validity (Payne et al., 1999). Participants respond on a 7-point Likert scale ranging from "not at all agree" to "very much agree." Scores range from 20 to 140. The internal consistency of responses to this measure in the current study was good ($\alpha = .85$).

2.2.4 | Sociosexuality Scale (SS)

The SS is a 15-item questionnaire with adequate reliability and validity that assesses attitudes toward casual, impersonal sex (Bailey et al., 2000). Bailey et al. (2000) drew or adapted these 15 items from prior scales developed by Simpson and Gangestad (1991) and Eysenck (1976). Note that Penke and Asendorpf (2008) have developed a more recent sociosexuality measure, but it was not yet available when the first studies were conducted for the current project. Participants responded on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." Scores range from 15 to 75. The internal consistency of responses to this measure in the current study was good ($\alpha = 0.80$).

2.2.5 | Alcohol Use Disorders Identification Test (AUDIT)

The AUDIT is a 10-item measure with adequate reliability and validity that assesses the quantity and frequency of alcohol consumption, as well as symptoms of alcohol-related abuse and dependence (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001; Saunders et al., 1993). Responses to each item receive scores from 0 to 4 and are summed, providing a total score that can range from 0 to 40. The internal consistency of responses to this measure in the current study was good ($\alpha = 0.83$).

2.2.6 | Misperception of Sexual Interest (MSI)

Participants indicated how frequently they “misperceived a person's friendliness as a sexual advance (i.e., the person was being friendly but you assumed the person was sexually attracted to you).” Participants could respond either never, once, twice, 3 times, 4 times, 5–10 times, 11–30 times, or more than 30 times (Abbey, 1987); these responses were recoded to 0–7 for analysis.

2.2.7 | Personal Information Questionnaire

Participants reported their age, sex, sexual orientation, and race/ethnicity.

3 | RESULTS

3.1 | Sample description

Participants were classified on the basis of their most severe self-reported perpetration behavior; 77.6% reported no sexual coercion or aggression; 12.9% reported unwanted sexual contact; 5.1% reported sexual coercion; 2.2% reported attempted rape; and 2.2% reported completed rape. The average IRMA-SF score was 39.19 (SD = 13.49). IRMA-SF showed a moderate positive association with SES, $r(984) = 0.278, p < .001$. The average SS score was 43.09 (SD = 9.25). SS correlated positively with SES, $r(511) = 0.313, p < .001$, and IRMA-SF, $r(511) = 0.143, p < .001$. The average AUDIT score was 9.67 (SD = 6.43). AUDIT scores correlated positively with SES, $r(508) = 0.167, p < .001$, and SS, $r(509) = 0.384, p < .001$, but not with IRMA-SF, $r(509) = .024, ns$. Approximately one-fifth of the sample (19.2%) reported having never misperceived a woman's friendliness as sexual interest, 48.0% reported between one and three misperception experiences, and 32.8% reported four or more such experiences. MSI correlated positively with SES, $r(1958) = 0.187, p < .001$, IRMA-SF, $r(974) = 0.152, p < .001$, SS, $r(499) = 0.357, p < .001$, and AUDIT, $r(498) = 0.314, p < .001$.

3.2 | Fitting three-parameter logistic function

A three-parameter logistic decay function was fit to all participants' HPS justifiability ratings simultaneously using the non-linear mixed-effects (nlme) package in R (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2016): $y = \frac{a}{1 + e^{-c(\text{item} - b)}}$. *Baseline justifiability* (a) quantified the justifiability of continued sexual advances when the woman responded positively; values could range from 0 (meaning continued advances were not at all justified) to 100 (meaning continued advances were completely justified). *Bias* (b) indexed the woman's affect (i.e., a continuous version of the item value, from 1 to 7) when the justifiability rating had declined to 50% of the baseline justifiability. Bias values near two indicated that justifiability ratings declined substantially after the woman exhibited a neutral response (she “lets” the man kiss her), whereas bias values near three or four indicated that the substantial decline occurred after the woman exhibited a negative

response (she moves his hand from her thigh or she moves his hand from her breast and says “No, don't”, respectively). Sensitivity (c) quantified the ability to distinguish the levels of the woman's affect (i.e., the steepness of the decline in ratings as the women's reactions became more negative). Because a decay function was fit to the data, sensitivity values become more negative as the ability to distinguish women's affective levels increases, with values closer to -5 indicating very high levels of sensitivity (i.e., a steep decline in ratings) and values closer to -2 indicating very low levels of sensitivity (i.e., a gradual decline in ratings). Both the fixed-effects and random-effects structures included intercepts for the three parameters. Although all three parameters are estimated from the trajectory of lower justifiability as the woman's responses become more negative, they are influenced by different components of that trajectory: the baseline justifiability when the woman responds positively (a); the degree of negativity associated with a substantial drop from that baseline (b); and the slope of the decrease from baseline once the drop has started (c). Note that these three parameters are conceptually distinguishable. Thus, for instance, participants with the same bias can have differing sensitivities (rates of descent), but all will cross 50% of baseline justifiability at the same level of negativity. Similarly, participants with the same sensitivity will have different bias estimates if they start the descent from baseline at different levels of negativity.

Fixed-effects estimates of the three parameters characterize the sexual-perception processes for the full sample. Baseline justifiability was estimated to be 75.57, indicating that participants on average judged continued sexual advances to be quite high when the woman responded positively. Bias was estimated at 2.77, meaning that the perceived justifiability of continued advances had dropped in half (from ~ 76 to ~ 38) when the woman's affect was between neutral (with a value of 2, where the woman “lets” the man kiss her) and the lowest level of negative (with a value of 3, where the woman moves the man's hand away when he puts it on her thigh). Sensitivity was estimated to be -4.25 , consistent with a very steep decline in justifiability ratings as the woman's affect became more negative. Baseline justifiability showed small-to-moderate associations with bias and sensitivity, $r(1979) = 0.22, .29, ps < .001$; bias and sensitivity correlated strongly, $r(1979) = 0.53, p < .001$. BIC and log-likelihood values for the model were 331,474.0 and $-165,699.8$, respectively.

We re-fitted the model estimating random effects for only baseline justifiability and sensitivity, given the strong association between bias and sensitivity, as well as the small variance estimates for bias (but not for baseline justifiability or sensitivity). The BIC and log-likelihood values for this simpler model were 333,972.5 and $-166,954.4$. Both fit indices indicated that the full model fit substantially better than the simpler model. Thus, parameter estimates from the full three-parameter model were used in all subsequent analyses.

3.3 | Predictors of sexual-perception parameters

SES Category was examined as a discrete predictor of baseline justifiability, bias, and sensitivity in three univariate GLMs. The left

panel of Figure 2 depicts model-predicted justifiability ratings for the five SES Category groups, and Table 1 presents descriptive statistics for group-specific parameter estimates. SES Category predicted baseline justifiability, $F(4,1972) = 16.20$, $p < .001$, $\eta^2 = .032$, which increased descriptively from 73.6 among those reporting no history of sexual coercion or aggression to 95.8 among those reporting a history of completed rape. Bonferroni-corrected pairwise comparisons indicated that those reporting no history of coercion or aggression showed reliably lower baseline justifiabilities than all other groups; those reporting unwanted contact, coercion, or attempted rape showed similar moderate baseline justifiabilities; and those reporting attempted or completed rape showed similar high baseline justifiabilities.

SES Category also predicted bias, $F(4,1972) = 15.41$, $p < .001$, $\eta^2 = .030$, with values increasing descriptively (apart from one minimal discrepancy) from 2.7 among those reporting no history of coercion/aggression to 2.9 among those reporting a completed rape. Those reporting no history of coercion or aggression showed lower, or more conservative, biases than all but those reporting coercion; those reporting unwanted contact or coercion showed similar biases; those reporting coercion or attempted rape showed similar values; and those reporting attempted or completed rape showed similar, but less conservative, biases.

Finally, SES Category also predicted sensitivity, $F(4,1972) = 32.60$, $p < .001$, $\eta^2 = .063$. Sensitivity declined from a value of -4.4 among those reporting no history of coercion and aggression to -2.2 among

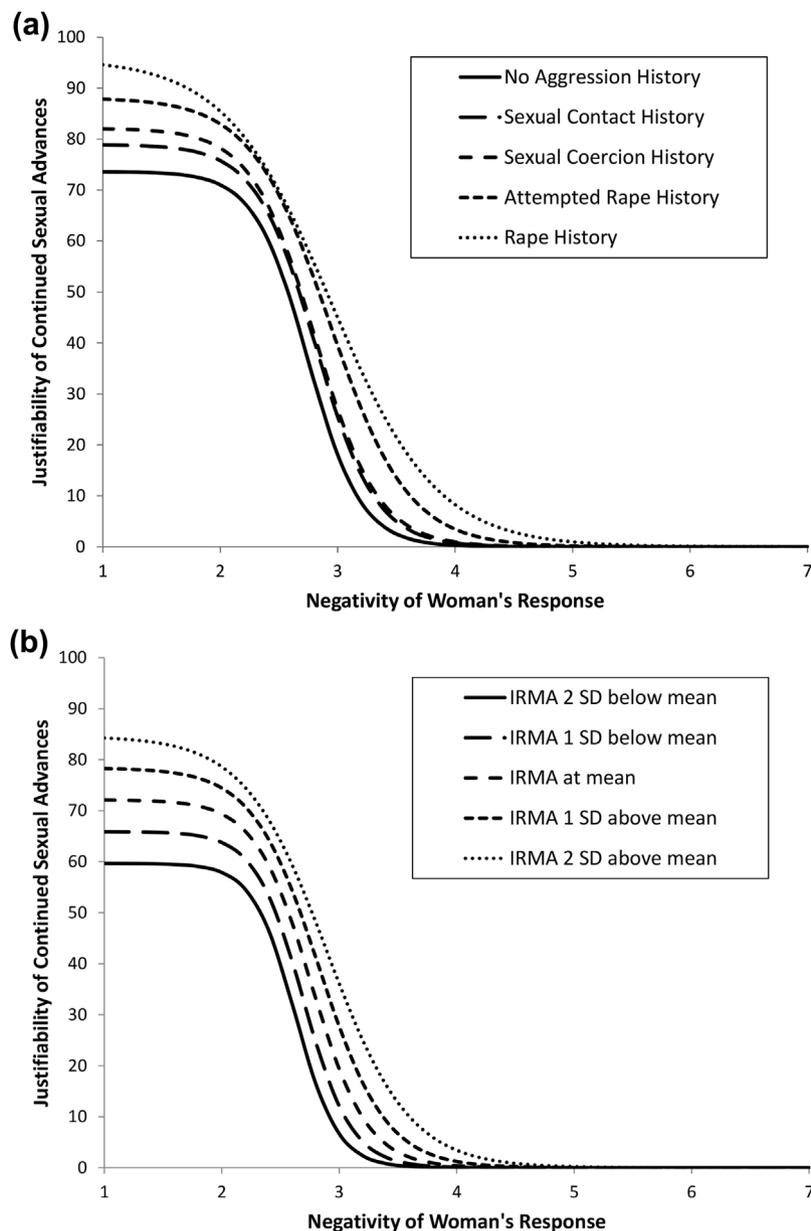


FIGURE 2 Model-predicted justifiability ratings for Sexual Aggression History groups (SES; panel a) and Rape-Supportive Attitudes (IRMA-SF; panel b). Note: SES = Sexual Experiences Survey. IRMA-SF = Illinois Rape Myth Assessment – Short Form. SD = standard deviation

TABLE 1 Descriptive statistics for sexual-perception parameters from Heterosocial Perception Survey – Revised as a function of SES category

SES Category	N	Sexual-perception parameters (HPS-R)					
		Baseline justifiability (a)		Bias (b)		Sensitivity (c)	
		M (SD)	95% CI	M (SD)	95% CI	M (SD)	95% CI
No sexual coercion/aggression	1,534	73.6 (24.4)	[72.4, 74.8]	2.7 ^{ac} (0.2)	[2.7, 2.8]	-4.4 (1.6)	[-4.5,-4.4]
Unwanted sexual contact	255	78.9 ^a (23.2)	[76.0, 81.9]	2.8 ^{bc} (0.2)	[2.8, 2.8]	-3.9 ^{ab} (1.8)	[-4.1,-3.7]
Sexual coercion	100	82.1 ^a (22.7)	[77.4, 86.9]	2.8 ^{abc} (0.4)	[2.8, 2.9]	-3.7 ^{abc} (2.1)	[-4.0,-3.4]
Attempted rape	44	88.1 ^{ab} (26.6)	[81.0, 95.3]	2.9 ^d (0.3)	[2.8, 3.0]	-3.0 ^{bcd} (2.1)	[-3.5,-2.5]
Completed rape	44	95.8 ^b (23.7)	[88.7, 103.0]	2.9 ^d (0.3)	[2.9, 3.0]	-2.2 ^{cd} (1.8)	[-2.7,-1.8]

HPS-R, Heterosocial Perception Survey-Revised; N, sample size; CI, confidence interval; SES, Sexual Experiences Survey. Parameter means sharing the same subscript do not differ significantly (Bonferonni comparison, $p < .05$).

those reporting a completed rape. Those reporting no history of coercion or aggression showed more negative values (i.e., higher sensitivity) than all other groups; those reporting unwanted contact or coercion showed similar moderate values (i.e., moderate sensitivity); and those reporting attempted or completed rape showed similar higher values (i.e., low sensitivity).

IRMA-SF was examined as a continuous predictor of baseline justifiability, bias, and sensitivity in three univariate GLMs. The pattern of results was the same as for SES Category. IRMA-SF positively predicted baseline justifiability, $F(1,987) = 69.59$, $p < .001$, $\eta^2 = .066$; bias, $F(1,737) = 85.40$, $p < .001$, $\eta^2 = .080$; and sensitivity, $F(1,987) = 184.62$, $p < .001$, $\eta^2 = .158$. The right panel of Figure 2 depicts model-predicted justifiability ratings for a range of IRMA scores.

SS positively predicted baseline justifiability, $F(1,511) = 56.84$, $p < .001$, $\eta^2 = .100$; bias, $F(1,511) = 18.87$, $p < .001$, $\eta^2 = .036$; and sensitivity, $F(1,511) = 7.07$, $p < .01$, $\eta^2 = .014$. The AUDIT positively predicted baseline justifiability, $F(1,509) = 21.29$, $p < .001$, $\eta^2 = .040$; bias, $F(1,509) = 5.21$, $p < .05$, $\eta^2 = .010$; and sensitivity, $F(1,509) = 0.66$, ns , $\eta^2 = .001$. Self-reported MSI positively predicted baseline justifiability, $F(1,1962) = 75.34$, $p < .001$, $\eta^2 = .037$; bias, $F(1,1962) = 12.90$, $p < .001$, $\eta^2 = .007$; and sensitivity, $F(1,1962) = 18.50$, $p < .001$, $\eta^2 = .009$.

4 | DISCUSSION

The current study evaluated predictors of three components of performance on a modified version of the Heterosocial Perception Survey. We predicted that risk status (both attitudes and self-reported history) would be more strongly linked to *sensitivity* than to *bias*, consistent with our prior work. In contrast, we predicted that sociosexuality and problematic drinking would be more strongly linked to *baseline justifiability*. The severity of college men's self-reported history of sexually coercive or aggressive behavior reliably predicted individual differences in all three sexual-perception processes. First, men who reported no history of sexual coercion or aggression perceived the justifiability of continued advances to decline sharply in the face of women's resistance and distress (i.e., showed

higher levels of sensitivity), whereas men who reported perpetrating either attempted or completed rape showed more gradual declines in their ratings (i.e., showed lower levels of sensitivity). Second, men who reported a history of attempted or completed rape judged the baseline justifiability of continued sexual advances when a woman responded positively to a sexual advance to be greater than their peers. Third, those reporting aggression histories showed more liberal biases than their peers, such that the woman's response had to be more negative before their justifiability judgments dropped substantially (to 50% of their baseline justifiabilities).

Notably, the observed sexual-perception links to perpetration history were demonstrated in a large sample of almost 2,000 college men, of whom 88 (4.4%) endorsed perpetrating an attempted or completed rape, which substantially enhances the confidence we can place in our conclusions. Not surprisingly, given marked social desirability issues surrounding self-reported illegal behavior, sexual-perception associations with rape-supportive attitudes were even stronger than associations with a self-reported history of sexual aggression, with effect sizes over twice as large for attitudes as for aggression history (see Table 2 for the magnitude of associations of each of the three sexual-perception processes with each predictor). Of course social desirability concerns also presumably affect endorsement of rape-supportive attitudes, which may have reduced the magnitude of the observed relationships.

The observed risk-linked modulation of sexual-perception processes provides further support for theories that incorporate misperception of women's sexual interest (MSI) as a proximal predictor of sexual aggression (Abbey et al., 2011; Farris et al., 2008). It is easy to imagine how risk-linked operation of all three processes might increase the likelihood of subsequent coercive or aggressive behavior: Decreased sensitivity might make it more difficult to distinguish a woman's later consent and non-consent cues, a higher baseline justifiability might encourage more rapid and intimate sexual advances, and a more liberal bias might delay recognition of and appropriate responses to a woman's declining interest. Importantly, the current findings, although based on responses to a 21-item questionnaire, are consistent with prior performance-based work documenting a role for sexual misperception in sexual coercion and aggression (Farris et al.,

TABLE 2 Magnitude of associations (η^2) between risk correlates and three sexual-perception parameters from Heterosocial Perception Survey – Revised

Sexual-aggression risk correlates	Sample size	Sexual-perception parameters (HPS-R)		
		Baseline justifiability (a)	Bias (b)	Sensitivity (c)
SES category	1,977	.032	.030	.063
IRMA-SF	989	.066	.080	.158
Sociosexuality	513	.100	.036	.014
AUDIT Total	511	.040	.010	.001
Self-reported MSI	1,963	.037	.007	.009

HPS-R, Heterosocial Perception Survey–Revised; SES, Sexual Experiences Survey; IRMA-SF, Illinois Rape Myth Assessment–Short Form; AUDIT, Alcohol Use Disorders Identification Test, MSI, Misperception of Sexual Interest.

2006, 2010; Treat, Farris et al., 2015; Treat et al., 2017; Treat, Hinkel, Smith, & Viken, 2016; Treat, Viken, Farris, & Smith, 2016). In particular, sexual-aggression risk in the current study is associated with both decreased sensitivity and a potentially maladaptive bias. As in prior studies, the current association with sensitivity is moderate in magnitude, whereas the link with bias is smaller in magnitude.

Sociosexuality and problem drinking, established risk factors for sexually coercive and aggressive behavior, also reliably predicted sexual-perception processes. The pattern of relationships differed from those observed for rape-supportive attitudes and sexual-aggression history, however. Whereas sexual-aggression risk status was related more strongly to sensitivity than to the other two sexual-perception processes, both sociosexuality and problem drinking were related more strongly to baseline justifiability than to the other two sexual-perception processes. The latter findings are consistent with expectations, given the strong relations among sociosexuality, problem drinking, and sexual approach (Bailey et al., 2000; Claxton et al., 2015). Similarly, the frequency with which men self-reported that they had misperceived women's friendliness as sexual interest (i.e., self-reported MSI) was associated only with higher baseline justifiability. Overall, the current findings are fully consistent with Abbey et al.'s (2011) theoretical model of sexual aggression, which proposes that sociosexuality, problematic drinking, and misogynistic attitudes increase risk for sexually coercive and aggressive behavior, in part via elevated misperception of women's sexual interest. Although the current results are limited to college undergraduates and may not generalize to other groups, the current procedures could be applied in other settings and with other populations.

Overall, the current findings underscore the theoretical utility of more nuanced conceptualization and performance-based measurement of sexual-perception processes. As in prior studies, sexual-aggression history and rape-supportive attitudes are linked more strongly to sensitivity than to bias or baseline justifiability. Moreover, different patterns of relationships with sexual-perception processes emerge for other risk factors and self-reported MSI. In particular, self-reported MSI appears to assess primarily baseline justifiability, rather than the sensitivity process that is linked more closely to the clinical phenomenon of interest. Ideally, multiple indices are needed to assess the separable sensitivity- and bias-like aspects of sexual perception.

Performance-based assessment of these perceptual processes is also desirable, as it is less subject to presentation biases and does not rely on valid introspective access to the operation of the processes. The latter issue is particularly important, given that theoretical models propose and empirical data support the view that higher-risk men perceive women's sexual interest less accurately and perhaps are less likely to recognize when they have made an unwanted sexual advance as a result (Abbey et al., 2011; Farris et al., 2008). This constellation of theoretical and methodological issues suggests that HPS-based indices of sexual-perception processes might usefully supplement self-reported MSI in future work.

Partitioning the variability in sexual-perception judgments into sensitivity and bias components also has potential practical implications for how we understand and approach remediation of risky or deficient processing. Efforts to redress sensitivity deficits likely would involve feedback and instructional components to enhance the ability to distinguish affective cues. Two experimental manipulations have been shown to enhance men's reliance on women's nonverbal affective cues (a sensitivity-like process) when judging women's current sexual interest in full-body photographs: 1) extensive practice with trial-by-trial corrective feedback based on expert judgments of women's sexual interest (Treat, Viken, Farris, & Smith, 2016); and 2) explicit instruction about the particular relevance of women's affective cues (versus clothing style, attractiveness, etc.) to women's momentary sexual interest (Treat et al., 2017). Future research might explore the potential utility of providing feedback or explicit instruction on participants' justifiability ratings as well. Feedback might usefully entail viewing the average justifiability ratings of a normative sample of college men, as some evidence suggests that higher-risk men erroneously assume that their perceptions and judgments regarding sexual interactions with women are shared with peers (e.g., Bohner, Siebler, & Schmelcher, 2006). In contrast, strategies designed to reduce bias typically entail manipulating or increasing the salience of the consequences of more liberal versus conservative response patterns. For example, we might try to decrease a more liberal bias by increasing the salience of the potential negative consequences of making unwanted sexual advances and suggesting that adopting a more conservative approach would decrease their risk of being perceived to be coercive or aggressive toward women.

To date, researchers have relied on a participant's responses to hundreds of photo stimuli in a single task to assess sensitivity and bias aspects of sexually relevant perceptions and judgments, but the current work suggests that responses to a 21-item questionnaire also can be decomposed into conceptually similar subcomponents. Non-linear mixed-effects methods, as instantiated by the *nlme* package in R (Pinheiro et al., 2016), provide a powerful strategy for obtaining precise individual-specific estimates of the characteristics of a psychometric function (e.g., a three-parameter logistic function, in the current case) from fairly minimal participant-specific data. The mixed-effects approach to obtaining participant-specific estimates of the parameters of psychologically meaningful non-linear functions seems well-suited to addressing clinically relevant questions with adequate levels of precision but with a more modest number of observations per participant. The mixed-effects approach may allow more computational, process-oriented analyses of other self-report data as well, providing a stronger link to underlying theory than more traditional scale means or other conventional summary scores.

Moreover, the questionnaire-based approach has clear advantages relevant to practical utility, as the assessment can be completed much more rapidly and on paper, if necessary. More flexible implementation and dissemination of an assessment strategy is a distinct advantage when studying a low base-rate clinical phenomenon. Not surprisingly, a small proportion of male participants endorsed perpetration of attempted or completed rape (4.4%), even when guaranteed anonymity. Thus, in lab-based studies, these men typically must be combined for analysis with men who report a history of perpetrating unwanted sexual contact or sexual coercion, even though theoretically we would expect that perpetration severity is related to variation in perceptual processes. The current study capitalized on the availability of responses to the HPS-R across seven lab-based studies to demonstrate that severity of a self-reported perpetration history indeed shows a monotonic/graded relationship with all three sexual-perception processes.

Sexual-perception research with the HPS-R might profitably pursue several avenues. First, the items to which participants respond could be revised by eliminating items describing extremely negative responses from the woman, which produce limited response variability. Items that produce more variable intermediate responding could be added, as this might enhance the independence of sensitivity and bias estimates. Second, the HPS-R items currently vary both in terms of the negativity of the woman's response and in terms of the intimacy of the man's advance. This approach enhances the plausibility of the items, of course, but it may be useful to uncouple these two item dimensions in future work, in the interest of isolating sensitivity to the negativity of the woman's response. Alternatively, participants might be asked first about the justifiability of continued sexual advances and second about the negativity of the woman's response. This approach would allow isolation of perceived negative affect while retaining the justifiability judgment, which is desirable in part because it encompasses decision-making processes as well as perceptual processes. Third, a series of nomothetic studies should examine the influence of a variety of participant-specific, couple-specific, and context-specific

experimental manipulations on sexual-perception processes, including alcohol consumption by the participant and by the man and the woman in the vignettes, the man and woman's attractiveness and sexual history, cognitive training designed to enhance the accuracy of men's perceptions of women's sexual interest, etc. Exploration of other potential individual-differences correlates of the sexual-perception parameters, such as gender and the participant's sexual history, also would be of interest.

5 | CONCLUSIONS

The current work underscores the potential role of sexual-perception processes in male-initiated sexual coercion and aggression toward female acquaintances, a serious behavioral-health problem on college campuses in the US. Consistent with contemporary theoretical models and existing empirical data, men who reported a perpetration history or who endorsed more rape-supportive attitudes, relative to their peers, showed moderate-magnitude reductions in their sensitivity to women's increasingly negative responses to unwanted sexual advances. Higher-risk men also showed more liberal response biases than their peers, such that the woman's affect had to be significantly more negative before they judged the justifiability of unwanted sexual advances to have dropped substantially. Unique to the present work, precise participant-specific estimates of three sexual-perception processes were obtained from a non-linear mixed-effects analysis of responses to 21 items on a brief questionnaire. Thus, this work illustrates the conceptual, methodological, and analytic aspects of one approach to deriving performance-based estimates of the operation of cognitive processes from responses to a self-report questionnaire. More comprehensive performance-based processing assessments obtained in the lab may show greater internal validity and afford more complex and precise inferences. Nonetheless, the present results suggest that well-developed questionnaire-based methods can be sufficiently rigorous while also being far briefer and more readily administered to large samples.

CONFLICTS OF INTEREST

Neither author has any conflicts of interest to report.

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APPENDIX A: HETEROSOCIAL PERCEPTION SURVEY-REVISED (HPS-R)

We are interested in learning more about your attitudes and feelings about women. Below, we ask you to read and think about several stories involving a man and a woman, and then we ask you a number of questions about how you interpret their behavior. Sometimes it is very difficult to interpret a woman's behavior, even when you are involved in an intimate relationship with her. We want to know more about how misunderstandings between men and women occur. The situations below deal with a situation in which a man is with a woman and is interested in having sex with her for the first time. In each question, a scene is described, followed by a description of a sexual advance made by a man toward a woman. The woman's response to the man's sexual advance is described. We would like you to interpret the meaning of the woman's behavior, by deciding whether the man should continue to make sexual advances. In each scene you should assume that the man and the woman have never had sex before. Using the numbered scale below, please assign a rating to each sequence of behavior described for a situation.

0	10	20	30	40	50	60	70	80	90	100
Absolutely no justification in continuing			Some justification in continuing				Completely justified in continuing			

Situation One. A man is on a date with a woman whom he has known for about two weeks. They went to a movie, and then to the woman's apartment and ordered a pizza. They are sitting on the sofa. How justified is it to continue to make sexual advances if:

1. The man puts his arm around the woman, and she moves closer to him.
2. The man kisses the woman, and she lets him.
3. After kissing for several minutes, the man puts his hand on her thigh, and she moves it away.
4. The man puts his hand on her breast, and she moves the hand away and says, "No, don't."
5. The man starts to unbutton her blouse, and she moves his hand away, says, "No, don't," and starts to get up from the sofa.
6. The man has removed the woman's pants and the woman jumps up from the sofa and says "That's enough, I think it's time that you left."
7. The man has removed the woman's clothes and the woman tries to wrestle away from him and threatens to scream if he doesn't stop.

Situation Two. A man has been going out with a woman for three months. The relationship is getting serious, and the two have planned a special date for the weekend. The man buys the woman flowers and takes her to an expensive restaurant. They go back to her apartment and sit on the sofa. How justified is it to continue to make sexual advances if:

Situation Three. A man is at a party and sees a woman that he knows slightly from one of his classes. He walks up to her and says "hi" and they begin to talk about the class. They talk for an hour and have consumed a considerable amount of beer. The woman says that she ought to be leaving. The man offers to give her a ride home and she accepts. She invites him in for a cup of coffee. They are sitting on the sofa. How justified is it to continue to make sexual advances if: