Emotion
2018, Vol. 18, No. 7, 917–924

1528-3542/18/$12.00 http://dx.doi.org/10.1037/emo0000367

Perceptions of Valence and Arousal Uniquely Contribute to Perceptions of Ambiguous Group Membership From Faces

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Although previous research has considered the role of emotional valence in the perception and communication of group membership, the influence of perceived emotional arousal remains relatively unexplored. Here, we examined how valence and arousal simultaneously contribute to perceptions of sexual orientation and political affiliation at 3 distinct levels of analysis: within perceivers, between perceivers, and between targets. We found that valence distinguished targets best, reflecting socioemotional stereotypes, whereas arousal largely accounted for individual differences among perceivers, suggesting that perceptions of group membership partly depend on how each perceiver evaluates targets' level of arousal. Valence and arousal therefore provide distinct information during social categorization, highlighting the importance of considering different levels of analysis to achieve a more complete understanding of person perception.

Keywords: arousal, emotional expression, group processes, social perception, valence

A body of research has suggested that emotional valence and group membership are intrinsically intertwined. Emotional expressions can lead people to construe faces as belonging to particular races and sexes (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007; Hugenberg & Bodenhausen, 2004), and reciprocally, belonging to a particular race or sex can facilitate the perception of specific emotions (Hess, Adams, & Kleck, 2005; Hugenberg & Bodenhausen, 2003). Thus, people overgeneralize the relations between emotions and social categories (see Adams, Hess, & Kleck, 2015; Zebrowitz, Kikuchi, & Fellous, 2010).

Indeed, people's race, sex, and emotions tend to be perceived from features of appearance that are relatively obvious. Yet there are many social groups whose markers are not as plain or clear. Well-researched examples of this include sexual orientation and political affiliation. In fact, a number of studies have shown that men's and women's sexual orientation can be perceived from minimal cues in their appearance at rates significantly greater than chance guessing and that people also perceive others' political affiliation significantly better than chance (see Tskhay & Rule, 2013, for review). As with race and sex, emotional expressions appear to contribute to these judgments.

Tskhay and Rule (2015a) found that individuals use positive and negative emotions to communicate their sexual orientation and political affiliation to others and that perceivers' awareness of these associations leads them to use ephemeral emotion cues (e.g., happiness, anger) to categorize people along these dimensions. Specifically, when participants evaluated men as happy, they also perceived them to be gay; and when they evaluated them as angry, they perceived them to be straight. Participants likewise perceived happy individuals as Democrats and angry individuals as Republicans. Although these findings demonstrate the role of emotional *valence* in perceptions of ambiguous group membership, the contribution of emotional *arousal* to such judgments remains unknown. We therefore examined how valence and arousal simultaneously contribute to perceptions of sexual orientation and political affiliation in the current work.

Valence and Arousal

Valence and arousal represent two correlated dimensions within the circumplex model of emotions (Feldman, 1995; Russell, 1980; Russell & Barrett, 1999). In contrast to valence, which specifies the positivity and negativity of emotions, arousal indexes the intensity of emotions. These concepts readily translate to perceptions of emotional expression from faces as well, wherein each emotional display varies in valence and arousal. Specifically, faces express positive and negative emotions at various levels of intensity. For example, although people perceive most smiles as positive (vs. negative or mischievous), they vary in how "strong" the smile is: Duchenne smiles are more intense (high on arousal) than are polite smiles (low on arousal; Harker & Keltner, 2001).

Critically, perceptions of valence and arousal from faces may be broken down even further across different levels of analysis: perceptions that can be attributed to the perceiver, to the target, and to the unique relationship between each perceiver and each target. To illustrate, imagine that researchers ask a set of participants to evaluate targets on one or more dimensions—here, valence and arousal. In this scenario, ratings of valence and arousal can be partitioned into the variance attributable to the participants (e.g., some participants may evaluate all stimuli as more positive), the variance attributable to the targets (e.g., some targets may be

This article was published Online First September 4, 2017.

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This work was supported by the Social Sciences and Humanities Research Council of Canada Grant to Nicholas O. Rule. The authors would like to thank the members of the Social Perception and Cognition Lab who helped with data collection.

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perceived as more positive by all participants), and the idiosyncratic variance specific to evaluations of each target by each participant (e.g., one participant, who tends to rate everyone positively, perceives a particular target negatively, whereas another participant, who tends to rate everyone negatively, perceives the same target as especially positive).

Past research has demonstrated that valence and arousal can play separate roles at these different levels of analysis. For example, variation in targets' valence communicates their sexual orientation and political affiliation (Tskhay & Rule, 2015a), but variation in perceivers' arousal affects how they respond to others' smiles (Ambadar, Cohn, & Reed, 2009; Krumhuber & Kappas, 2005). Moreover, people's own arousal levels may influence how they respond to positive and negative stimuli (Löw, Lang, Smith, & Bradley, 2008; Russell & Barrett, 1999), suggesting that the relevance of a given stimulus to a perceiver may partially explain how they respond to that stimulus (Bernstein, Young, Brown, Sacco, & Claypool, 2008; Pickett, Gardner, & Knowles, 2004; Wolitzky-Taylor, Horowitz, Powers, & Telch, 2008). Further supporting this, some evidence has suggested that ostracized individuals discriminate between emotional displays in a different way than do people who are not ostracized (Bernstein et al., 2008; Sacco & Hugenberg, 2012; Sacco, Wirth, Hugenberg, Chen, & Williams, 2011). Despite the focus of the past studies on participants' own motivations and internal feelings, they suggest that the evaluations of arousal from faces may in fact vary between perceivers. Existing evidence has therefore suggested that valence and arousal can have distinct effects at different levels of analysis, though this proposition has yet to be empirically evaluated.

Indeed, most social perception research to date has focused on only one level of analysis, overlooking the effects that valence and arousal can incur between participants, between targets, and within an individual. Although this former research has been incredibly informative for understanding social categorization, the underlying processes of how individuals sort others into groups seem to be more nuanced than was previously thought. Accordingly, we examined how perceptions of targets' valence and arousal influence categorizations of their sexual orientation and political affiliation between targets, between perceivers, and within perceivers to elicit the differential effects of the two dimensions of emotion evaluation across these three levels of analysis.

Valence and Arousal in Social Categorization

Past research has found that the valence of targets' affective expressions influenced how they were categorized as gay or straight and as Democrat or Republican (Tskhay & Rule, 2015a). There, the valence of the targets' expressions primarily affected categorizations: Men expressing positive emotion were construed as gay and Democrat, whereas men expressing negative emotion were construed as straight and Republican. We expected to replicate these findings at the target level here. But because people also associate masculinity, dominance, and power (perceptions high on arousal) with both male heterosexuality and political conservatism, they may also construe targets that they perceive as high in arousal as "straight" and targets that they perceive as low in arousal as "gay" (Hayes, 2011; Rule & Ambady, 2010; Rule et al., 2011; Tskhay & Rule, 2015a, 2015b).

The data reported by Tskhay and Rule (2015a) data considered only consensual judgments averaged across perceivers. Yet, and as mentioned above, social categorizations could also depend on individual differences in how people attribute arousal to targets. Some individuals may consider most other people to be relatively dominant, attribute greater arousal to them, and thus show a general tendency to think that they are straight or Republican. Other individuals might tend to see others as effeminate and submissive, however, perceiving them as low arousal and thereby tending to categorize them as gay or Democrat. In other words, participants disposed to perceive others as high in arousal should show a bias toward classifying most targets as straight and Republican, whereas people inclined to attribute less arousal to others may be biased to categorize most targets as gay and Democrat. Moreover, one might find more fine grained effects within the perceivers' individual judgments, such that participants will label the targets that they perceive as particularly high on arousal (i.e., beyond their mean general tendency) as straight and Republican and categorize the targets that they perceive as particularly low on arousal (i.e., below their mean general tendency) as gay and Democrat. We therefore expected that individual dispositions toward perceptions of more or less arousal would, respectively, correspond to a general tendency to construe targets as straight and Republican versus gay and Democrat between individuals and that the specific targets that one evaluates as highly aroused would be more likely categorized as straight and Republican regardless of one's overall proclivity for judging targets' arousal one way or another.

Thus, we propose that valence might be most relevant for differentiating between targets because individual differences in perceptions of arousal "wash out" to make way for valence-based socioemotional stereotypes. Perceptions of arousal, on the other hand, might be more relevant at the individual level, thereby manifesting in both individuals' biases to perceive all targets in a particular way and their distinct perceptions of individual targets. Differentiating between valence and arousal in social categorization could therefore help to disentangle the nuances in how people perceive others and the role that the different dimensions characterizing emotion play in these perceptions. In sum, we predicted that valence would contribute to person perception more on the target level, whereas arousal would explain the variance between individual perceivers and how they idiosyncratically perceive particular targets (i.e., the target–perceiver interaction).

Current Work

We tested these hypotheses by examining how perceptions of valence and arousal from faces affect inferences of ambiguous group membership at three different levels of analysis: between targets, between perceivers, and within perceivers. Given that people generally associate positive emotions with gay men and Democrats and associate negative emotions with straight men and Republicans (Tskhay & Rule, 2015a), we expected that perceptions of positive versus negative affect would predict categorizations of sexual orientation and political affiliation at the target level of analysis where individual differences in perceptions of arousal would be lost due to aggregation. Thus, we also expected valence to account for a greater proportion of variance at the target level. In contrast, because arousal signals greater dominance, ag-

gression, and power (Knight, Guthrie, Page, & Fabes, 2002; Rule et al., 2011; Schupp et al., 2004) and because evaluations of arousal may be individual-specific, we expected that perceivers who generally perceive all targets as expressing high arousal would perceive a greater proportion of targets as straight and Republican than would those who generally perceive targets as expressing low arousal. We therefore expected shared (group-level) stereotypes about valence to account for less variance between individuals than would individual differences in perceptions of arousal. Finally, we examined how valence and arousal combinatorially affect perceptions of group membership within each participant when controlling for their idiosyncratic general evaluation tendencies (Tskhay & Rule, 2015a).

To test this, we extricated the relative contributions of valence and arousal in the social categorization of sexual orientation and political affiliation by estimating a cross-classified generalized mixed effects (multilevel) model in which we specified random intercepts for both targets and perceivers and random slopes for the regression of perceived group membership on valence and arousal. This model, outlined in principle by Judd, Westfall, and Kenny (2012), effectively partitions the variance across targets, participants, and the relationship between each target and each participant. This allowed us to distinguish between valence and arousal concerning how each relates to the targets' group memberships while simultaneously controlling for their respective contributions. Furthermore, the random intercepts for each judgment and random slopes for the effects allowed us to generalize the effects beyond the particular sample of participants and targets to draw conclusions about the role of emotion in social categorization more broadly.

Study 1

In Study 1, we examined how perceptions of valence and arousal predicted perceptions of sexual orientation from naturalistic photos of men's faces by asking participants to report the valence, arousal, and sexual orientation that they associated with each face. We modeled how valence and arousal related to perceptions of sexual orientation on three levels of analysis: between targets, between perceivers, and within perceivers.

Method

Participants. We requested 100 American participants on Amazon's Mechanical Turk. Although a total of 159 Mechanical Turk Workers initially engaged in the study, only 103 participants finished it (n = 67 female, n = 35 male, n = 1 transgender; M_{age} = 36.66 years, SD = 12.80; 83 White, 8 Asian, 6 Black, 2 Hispanic, 4 other race). We determined the intended sample size via power analyses based on the average effect size in social psychology (r = .21; Richard, Bond, & Stokes-Zoota, 2003; Vazire, 2010), assuming the variance-partitioning components suggested by Westfall, Kenny, and Judd (2014) for a crossed random effects model; given these parameters and all of the exclusions, we achieved 99% statistical power with the present sample. Participants received monetary compensation for their time.

Stimuli. We borrowed the stimuli from previous work examining perceptions of male sexual orientation in which the original photos were downloaded from online dating websites posted in major U.S. cities (Rule & Ambady, 2008). This database consisted of 90 photos of Caucasian men seeking either a male (n = 45) or female (n = 45) relationship partner. None bore any facial adornments (e.g., beards, glasses, piercings), and the faces had been removed from their original image backgrounds, converted to grayscale, and standardized to an identical height. Targets' sexual orientations were never disclosed to the participants.

Procedure. The participants viewed each of the 90 men's faces in random order, rating their valence from 1 (*Very Negative*) to 7 (*Very Positive*) and arousal from 1 (*Not at All Arousing*) to 7 (*Very Arousing*) using 7-point scales in a single block. Critically, we instructed the participants to evaluate the emotion experienced by the person in the picture, rather than to reflect on the emotions that they themselves may be experiencing in response to viewing them. Immediately after, we presented the participants with the same faces in a different random order and asked them to categorize the targets as either gay or straight.

Analytic strategy. We were interested in the contribution of valence and arousal to perceptions of sexual orientation within perceivers, between perceivers, and between targets. We therefore partitioned the variance in ratings according to targets, perceivers, and the idiosyncratic relation between each participant and each stimulus (i.e., the within-perceiver level). In the next sections, we explicate the estimated models, focusing on the checks of our assumptions and models at each level.

Assumptions check. We empirically examined our assumption that most of the variance in valence ratings would reside at the target level and that most of the variance in arousal ratings would reside at the perceiver level by estimating the proportions of variance at each level using intraclass correlation coefficients.

Between-targets level. The target level of analysis represents the participants' shared perceptions of each target (i.e., their consensus). We therefore averaged the valence and arousal ratings across all participants and computed the proportion of all participants categorizing each target as gay. To estimate the relative contribution of valence and arousal to perceived sexual orientation, we regressed the proportion of participants categorizing the targets as gay onto the consensus valence and arousal ratings, computing robust standard errors.

Between-perceivers level. To account for perceiver biases (i.e., participants' idiosyncratic perceptions in rating the targets), we averaged each participant's ratings of valence and arousal across all targets. Additionally, we estimated the proportion of targets that each participant categorized as gay. We regressed these proportions onto participants' aggregate perceptions of valence and arousal, also including quantified measures of the participants' race (1 = White, −1 = Not White), sex (1 = Male, −1 = Female), and age (grand-mean-centered),[1] again estimating robust standard errors.

[1] All results remained consistent when participants' sexes, races, and ages were not considered in the models as covariates. Notably, the models that included the demographic variables significantly improved the model fit compared to models not including these covariates (Study 1: $\Delta\chi^2$ = 71.89, $p < .001$; Study 2: $\Delta\chi^2$ = 1,101.40, $p < .001$), meaning that the proportion of variance explained by the participants' demographic characteristics significantly exceeded chance. We therefore retained the demographic variables in the models, albeit without any specific a priori predictions.

Within-perceiver level. We examined the variance in each rating due to the individual target and the individual perceiver using a cross-classified generalized linear mixed model with a logit link to account for our dichotomous dependent variable. Thus, we estimated a model in which we regressed participants' sexual orientation categorization for each target onto their valence and arousal ratings for that target while controlling for any potential effects of their demographic characteristics (i.e., participant age, race, and sex, as quantified earlier). Notably, we specified a random intercept model and estimated random slopes when regressing the valence and arousal ratings onto perceptions of sexual orientation within each participant (as recommended by Judd et al., 2012), allowing us to generalize beyond the current sample of targets and stimuli. We estimated the model in R using the lme4 statistical package (Bates, Maechler, & Bolker, 2012) and report unstandardized regression coefficients accompanied by their standard errors, significance tests (z tests), and probability levels (p values).[2]

Results

Assumptions check. Prior to examining how perceptions of valence and arousal related to sexual orientation categorizations, we examined the proportion of variance in the valence and arousal ratings attributable to targets versus perceivers. As expected, the targets accounted for a greater proportion of the variance in the valence ratings than the perceivers did, and the perceivers accounted for a greater proportion of the variance in the arousal ratings than the targets did (see Table 1). Thus, we confirmed that valence and arousal reside at different levels of analysis, with valence largely describing differences between targets and arousal largely describing differences between perceivers.

Between-targets level. Consistent with our predictions, targets rated as more positive were evaluated as more likely to be gay than were targets rated as more negative (see Table 2). Ratings of arousal did not significantly relate to perceptions of targets' sexual orientation.

Between-perceivers level. We observed no significant relationship between perceptions of sexual orientation and valence or arousal between perceivers. However, a significant sex difference emerged, such that men categorized targets as gay more often than women did.

Within-perceiver level. Finally, we observed a significant negative relationship between arousal and perceptions of sexual orientation within perceivers when controlling for the between-targets and between-perceivers variances described earlier, showing that participants categorized the targets they rated higher on arousal as straight as opposed to gay. Valence ratings did not predict perceptions of sexual orientation, and sex positively predicted perceived sexual orientation again (i.e., men were more likely to categorize the faces as gay).

Table 1
Intraclass Correlation Coefficients Representing the Proportion of Variance in Perceptions of Valence and Arousal Attributable to Targets and Perceivers in Studies 1 and 2

	Study 1		Study 2	
Variable	Target	Perceiver	Target	Perceiver
Valence	.37	.16	.34	.20
Arousal	.12	.36	.08	.42

Discussion

Participants in Study 1 evaluated men displaying more positive expressions as more likely to be gay and men displaying more negative expressions as more likely to be straight, replicating past work (Tskhay & Rule, 2015a). Arousal did not predict sexual orientation between targets but did significantly predict perceptions of sexual orientation within perceivers, such that participants were more likely to categorize the targets that they had evaluated higher on arousal as straight.

Thus, both valence and arousal contributed to perceptions of sexual orientation in different ways. Consistent with stereotypes about affect, gender, and sexual orientation (e.g., Becker et al., 2007; Tskhay & Rule, 2015a), valence predicted categorizations of targets as gay or straight. Similarly, participants categorized targets that on average received higher arousal ratings as straight, and participants who perceived specific targets as higher arousal were more likely to categorize them as straight. Perceptions of sexual orientation may therefore be understood in terms of distinct contributions of valence and arousal at different levels of analysis. In Study 2, we investigated whether this applies to other social categories.

Study 2

The results of Study 1 showed that valence and arousal separately contribute to perceptions of sexual orientation, fitting stereotypes about the association between emotion and sexual orientation (e.g., Tskhay & Rule, 2015a). To generalize beyond just this one set of social categories, we aimed to examine how perceptions of valence and arousal contribute to the evaluation of another perceptually ambiguous distinction: political affiliation. Specifically, we hypothesized that people would associate positive valence with Democrats and negative valence with Republicans (as in past work; Tskhay & Rule, 2015a) and that they would categorize targets that they rate as high in arousal as Republicans, owing to the stereotype of politically conservative people as more dominant (Rule & Ambady, 2010; Samochowiec, Wänke, & Fiedler, 2010; see also Wilson & Rule, 2014). We therefore expected valence and arousal to provide dissociated contributions to perceptions of political affiliation at different levels of analysis, as we observed for sexual orientation in Study 1.

[2] Consistent with the approach in previous work (see Tskhay & Rule, 2013, for review), participants differentiated between the gay and straight men in Study 1 ($b = 0.52$, $SE = 0.09$, $z = 5.74$, $p < .001$) and between the Democrats and Republicans in Study 2 ($b = 0.12$, $SE = 0.05$, $z = 2.47$, $p = .01$) better than chance. We do not discuss these effects further, because they were not central to the current investigation.

Given that we conducted our main analysis in the context of a multilevel cross-classified model, we do not report standardized beta coefficients and the confidence intervals around them.

Table 2
Perceptions of Sexual Orientation as a Function of Valence, Arousal, and Participant Demographic Characteristics Between Targets, Between Perceivers, and Within Perceivers in Study 1

	Between targets		Between perceivers		Within perceivers	
Source	*b* (*SE*)	*t*(87)	*b* (*SE*)	*t*(96)	*b* (*SE*)	*z*
Valence	0.038 (0.018)	2.15*	−0.009 (0.028)	0.35	−0.030 (0.025)	1.20
Arousal	−0.007 (0.032)	0.22	−0.037 (0.020)	1.84	−0.046 (0.023)	2.00*
Participant age	—	—	0.001 (0.001)	0.69	0.004 (0.008)	0.63
Participant race[a]	—	—	−0.003 (0.023)	0.13	0.064 (0.142)	0.65
Participant sex[b]	—	—	0.051 (0.018)	2.75**	0.266 (0.118)	2.26*

Note. Data are unstandardized regression coefficients (with standard errors) and corresponding test statistics. Dashes indicate the absence of the variable in the model.
[a] 1 = White, −1 = Not White. [b] 1 = Male, −1 = Female.
* $p < .05$. ** $p < .01$.

Method

Participants. We requested 100 American Workers from Amazon's Mechanical Turk. Although 166 participants engaged the study, only 108 participants completed it ($n = 67$ female, $n = 41$ male; $M_{age} = 33.90$ years, $SD = 10.91$; 72 White, 12 Black, 7 Hispanic, 3 Asian, 14 other race). This sample size thus represented more than 99% power based on the same parameters as in Study 1. Participants received monetary compensation for their time.

Stimuli. Stimuli consisted of 118 standardized photos of Democrat and Republican political candidates from the 2004 and 2006 U.S. Senate elections used by Rule and Ambady (2010), half of which were Democrats ($n = 15$ female) and half of which were Republicans ($n = 5$ female).

Procedure. The procedure was the same as that described in Study 1 except that participants categorized each target as either a Democrat or Republican instead of gay or straight in the final block.

Analytic strategy. Analyses paralleled those of Study 1, with perceived political affiliation as the dependent variable in place of sexual orientation. Notably, we performed all analyses including and excluding the trials on which the participants reported recognizing specific targets (.08% of total trials). Target recognition had a negligible effect on the model parameter estimates, and the pattern of significance remained the same when excluding trials with recognized targets; we therefore report the results from the models with all data.

Results

Assumptions check. As in Study 1, we first examined the variance attributable to targets versus perceivers for ratings of valence and arousal. Valence again accounted for a greater proportion of the variance between targets than arousal did, whereas arousal accounted for more of the variance between perceivers than valence did (see Table 1).

Between-targets level. As seen in Table 3, targets with more positive expressions were categorized as Democrats, and targets with more negative expressions were categorized as Republicans, replicating past work (Tskhay & Rule, 2015a).

Between-perceivers level. Neither valence nor arousal significantly predicted variations between participants' perceptions of political affiliation.

Within-perceiver level. Controlling for the variance between targets and perceivers, we found that participants categorized the faces that they individually rated higher on valence and arousal as Democrats.

Discussion

Perceptions of valence and arousal related to sexual orientation distinctly in Study 1: Perceptions of valence varied between targets, whereas perceptions of arousal varied within perceivers. We

Table 3
Perceptions of Political Affiliation as a Function of Valence, Arousal, and Participant Demographic Characteristics Between Targets, Between Perceivers, and Within Perceivers in Study 2

	Between targets		Between perceivers		Within perceivers	
Source	*b* (*SE*)	*t*(115)	*b* (*SE*)	*t*(95)	*b* (*SE*)	*z*
Valence	0.048 (0.013)	3.68***	−0.019 (0.016)	1.18	0.123 (0.035)	3.55***
Arousal	0.050 (0.028)	1.76	0.008 (0.013)	0.65	0.086 (0.037)	2.33*
Participant age	—	—	−0.000 (0.000)	1.27	−0.001 (0.001)	1.91
Participant race[a]	—	—	0.017 (0.013)	1.32	0.023 (0.067)	0.34
Participant sex[b]	—	—	−0.002 (0.012)	0.18	0.047 (0.064)	0.74

Note. Data are unstandardized regression coefficients (with standard errors) and corresponding test statistics. Dashes indicate the absence of the variable in the model.
[a] 1 = White, −1 = Not White. [b] 1 = Male, −1 = Female.
* $p < .05$. *** $p < .001$.

found similar relationships for perceptions of political affiliation in Study 2. Participants perceived more positive faces as Democrats collectively (i.e., at the target level) and individually (i.e., within their individual judgments). These relationships somewhat diverged from our findings in Study 1, in which valence significantly predicted the variance between targets only in aggregate. Here, valence continued to differentiate perceptions of political affiliation within the participants' individual judgments as well. One explanation could be that people may have personal biases associating different political parties or specific politicians with positivity and negativity. Indeed, Wilson and Rule (2014) found that participants attributed greater likability and trustworthiness to candidates from their own political party. Future work should thus consider the role that participants' own political affiliation may play in the direction and magnitude of emotion that they associate with targets.

Yet, consistent with our hypotheses, arousal predicted perceptions of political affiliation only within perceivers. Specifically, participants idiosyncratically categorized the targets they perceived as high arousal as Democrats. The direction of this relationship was unexpected, because we predicted that these targets would be perceived as Republicans due to the associations between dominance, arousal, and perceptions of political affiliation documented in previous work (e.g., Knight et al., 2002; Rule & Ambady, 2010; Rule et al., 2011; Samochowiec et al., 2010; Schupp et al., 2004). However, Wilson and Rule (2014) found that, although people consensually perceived Republicans as more dominant, this association did not persist when accounting for individual differences in the perceivers' political beliefs. The previous and current findings therefore illustrate that attributions (of both traits and emotions) may differ across levels of analysis, underscoring the utility of examining the relative contributions of targets and perceivers separately. The present results thus help to demonstrate the relevance of valence and arousal to social categorization, suggesting that they may relate to perceptions of group membership differently both within and across various social categories.

General Discussion

Examining the relative contributions of valence and arousal to perceptions of ambiguous group membership, we found that valence primarily predicted participants' consensus perceptions of targets, whereas arousal was a more critical predictor of each individual's idiosyncratic perceptions. Overall, these findings suggest that valence and arousal may occupy distinct roles in social categorization and highlight the importance of considering how different characteristics may influence person perception at specific levels of analysis.

It is important to note that the association between emotion and social categorization did not differ just across levels of analysis but also between domains of judgment. Valence (but not arousal) significantly predicted the variance in perceptions of sexual orientation and political affiliation between targets. However, perceptions of target arousal affected participants' categorizations of the individual targets as gay and straight, whereas both valence and arousal significantly predicted their idiosyncratic judgments of Democrats and Republicans. Thus, the pattern by which valence and arousal related to perceptions of sexual orientation and political affiliation was particular to the two judgment types, though there were some pronounced commonalities as well. Specifically, valence reliably distinguished between targets (replicating past work; Tskhay & Rule, 2015a), and arousal generally best predicted variability within perceivers. Moreover, despite differences in their specific configurations, the results of both Studies 1 and 2 demonstrated a division between valence and arousal at different levels of analysis.

The differences in how valence and arousal related to judgments of sexual orientation versus political affiliation notwithstanding, the results were largely as anticipated, with one exception. Consistent with recent work and with stereotypes about male sexual orientation (e.g., Tskhay & Rule, 2015a), participants associated gay men with positive valence and straight men with greater arousal. Yet, although negative valence was associated with being perceived as a Republican (as expected; Tskhay & Rule, 2015a), targets perceived as high arousal were perceived as Democrats within perceiver's individual judgments of the targets—contrary to our predictions. Given past observations that Republicans are often perceived as more dominant (Rule & Ambady, 2010) and that dominance may positively correlate with arousal (Knight et al., 2002; Rule et al., 2011; Schupp et al., 2004), we anticipated that perceptions of arousal would predict perceptions of targets as Republicans. Instead, we found that arousal positively related to the perception that targets are Democrats. We speculate that this may result from people's using emotion cues differently when evaluating sexual orientation versus political affiliation. Although people may use dominance and masculinity stereotypes to evaluate sexual orientation, these stereotypes may be less relevant to perceptions of political affiliation (see Tskhay & Rule, 2015a).

Most important, the present findings impact theoretical understanding of the role of emotional information in social categorization in several ways. First, the current work demonstrates that both valence and arousal may influence perceptions of ambiguous group membership. Much previous person perception work has used ratings of positivity and negativity to control for the effects of emotion on perceptions of group membership (e.g., Rule, Ambady, Adams, & Macrae, 2008). As demonstrated here, however, arousal can also affect how people categorize others into groups. Thus, researchers might want to consider both valence and arousal in designing and planning their research. Next, these findings also highlight the utility of examining perception at different levels of analysis by showing that valence might emerge at the target level only as a reflection of group stereotypes (Hugenberg & Bodenhausen, 2003, 2004; Tskhay & Rule, 2015a), whereas arousal seems to be a more consistent predictor between perceivers (see Cunningham, Van Bavel, & Johnsen, 2008; Phelps & LeDoux, 2005). Future researchers might therefore benefit from considering the potential for important nuances at different levels within their data, specifically considering that valence and arousal may relate to phenomena of interest in distinct ways.

Despite the gains afforded by these findings, they are not without limitations. For example, although we found that people incorporate arousal into their perceptions of group membership, we did not demonstrate why this might be the case. Future researchers might therefore want to expand on this work by identifying the variables that predict individuals' idiosyncratic perceptions of targets' arousal. For example, previous research found that more masculine gay men perceived other gay men as more inclined

toward feminine sexual roles (Tskhay, Re, & Rule, 2014). As such, individuals' own sense of masculinity may affect how they perceive others' arousal. Similarly, individual differences in the endorsement of political beliefs may influence the traits that people attribute to targets that they believe share those beliefs (Wilson & Rule, 2014). Thus, closer inspection of how valence and arousal may interact with individual differences across the levels of analysis considered here may lead to meaningful new insights about specific aspects of how particular perceptions occur, as well as more general processes involved in person perception. Further to this, it may be the case that some perceivers are simply more attuned to arousal in targets or are better at making social judgments. Despite either being a true possibility, the current data do not provide much insight into these possibilities, allowing for further inquiry in the future.

Another limitation of the present research is that the target images were downloaded from dating websites and online political campaigns. Targets in these photos may have therefore been motivated to enact more positive expressions to attract potential mates and votes (e.g., Lau, 1982). Although this is a limitation, and future research should certainly expand on the current findings by recruiting additional samples of targets from other sources, the current studies provide naturalistic examples of how people may communicate online. In the case of sexual orientation, for example, nonsmiling men (whose sternness may appear more intense than that of smiling men) may have been trying to convey masculinity (Hess et al., 2005), particularly because individuals who appear consistent with their sex role tend to be perceived as more attractive (DeBruine et al., 2006) and because people often strive to appear counterstereotypical in their personal advertisements (Bailey, Kim, Hills, & Linsenmeier, 1997). Similarly, it is relatively safe to assume that most politicians were trying to express a more positive disposition to attract the votes. This presents additional nuances due to targets' motivation. Unfortunately, the current work cannot directly examine the targets' goals and motives in mugging for their online photos, leaving these questions open for future work.

Finally, it is important to mention that our instructions may have been confusing to the participants because we asked them to evaluate arousal using a scale anchored at *Not at All Arousing* and *Very Arousing*. Thus, some readers may have concerns about whether we actually evaluated their perceptions of the targets' arousal (as we instructed the participants) versus the participants' own felt arousal. Despite this artifact in our procedure (and a fair criticism), we do not believe that this potential ambiguity is severely detrimental to our main results for three reasons. First, and as stated in the Method section of Study 1, we instructed the participants to focus on the targets and provide evaluations of the targets, implicitly discouraging self-reflection when judging arousal. Second, because the estimated model partitioned the target and participant variance, we can be certain that individual feelings of arousal were statistically isolated in the analyses. Finally, despite our instructions, we did not observe significant arousal effects at the participant level, suggesting that arousal was evaluated as more relevant to idiosyncratic perceptions of targets rather than the participants' overall internal feeling states. That said, future research should certainly consider replicating the current results using a paradigm that fully squelches this ambiguity to fully determine what biasing influence the possible mismatch between the instructions and scale anchors might have had.

In sum, the present findings suggest that perceptions of both valence and arousal impact how people perceive others' sexual orientation and political affiliation. Of importance, we found that valence and arousal were critical to perceptions of group membership but in distinct ways. Whereas valence captured variance in social categorization between targets, arousal better characterized the variability within individual perceivers. Thus, the current work suggests a new enterprise that examines the contribution of emotions to social perception at different levels of analysis.

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Received August 31, 2015
Revision received July 17, 2017
Accepted July 20, 2017 ■