

Social norm perception in groups with outliers

Jennifer E. Dannals & Dale T. Miller

Stanford University

15372 words

Author's Note: We thank the audiences of the Society for Personality and Social Psychology, the Society for Judgment and Decision Making, the Interdisciplinary Network for Group Researchers, the Behavioral Decision Research in Management conference & the Transatlantic Doctoral Consortium for their comments and feedback on earlier versions of this work.

We are also grateful to Lindred Greer for feedback on an earlier version of this work and to Taylor Philips, Sean Malahy, Julian Zlatev, Nir Halevy, Max Weisbuch and our anonymous reviewers for excellent comments and advice. We further thank Michelle Peretz, Schinria Islam, Ryan Dwyer, Lauren Agnew, Christine Hart, Anna Barker, Aakash Gupta, Julian Zlatev, Joshua Morris, Alex Depaoli, Arthur Jago, Nathaniel Nakashima, Jacob Model, Sean Malahy and Tony Vashevko for lending their visages to study stimuli. Please direct all correspondence to Jennifer E. Dannals at 655 Knight Way, Stanford, CA 94305.

Abstract

Social outliers draw a lot of attention from those inside and outside their group and yet little is known about their impact on perceptions of their group as a whole. The present studies examine how outliers influence observers' summary perceptions of a group's behavior and inferences about the group's descriptive and prescriptive norms. Across four studies ($N = 1739$) we examine how observers perceive descriptive and prescriptive social norms in groups containing outliers of varying degrees. We find consistent evidence that observers overweight outlying behavior when judging the descriptive and prescriptive norms, but overweight outliers less as they become more extreme, especially in perceptions of the prescriptive norm. We find this pattern across norms pertaining to punctuality (Studies 1-2, 4) and clothing formality (Study 3) and for outliers who are both prescriptively and descriptively deviant (e.g. late arrivers), as well as for outliers who are only descriptive deviants (e.g. early arrivers). We further demonstrate that observers' perceptions of the group shift in the direction of moderate outliers. This occurs because observers anchor on the outlier's behavior and adjust their recollections of non-outlying individuals, making their inferences about the group's average behavior more extreme.

Keywords: Group Perception; Social Norms; Outliers; Heuristics and Biases

Abstract Word Count: 193/250

Social norm perception in groups with outliers

Every village has its idiot. Every class has its clown. Society's representations of groups frequently classify a majority as "normal" and a small minority as deviants or social outliers. Because individuals tend to pay more attention to extremes than commonalities (Berger, 2011), outliers are a notable part of one's daily experience. They attract our attention, highlighted apart from the rest as moral do-gooders (Monin, Sawyer, & Marquez, 2008) or bad apples (Felps, Mitchell, & Byington, 2006), feeding water cooler gossip with what they wear (Bellezza, Gino, & Keinan, 2014), how they act (van Kleef, Homan, Finkenauer, Gündemir, & Stamkou, 2011), and what they achieve (Whyte, 1955).

People frequently envision outliers as individuals who "march to the beat of their own drum," freestanding social structures set apart from a group or society. As a consequence, when research examines outliers, it tends to look at them in isolation (Kunda & Oleson, 1997) or in contrast to other group members (Marques, Yzerbyt, & Leyens, 1988). But outliers do not exist in isolation. Rather, outliers are statistically deviant parts of a group or category. And yet, little research examines how our perception of the group as a whole might change when the group contains an outlier. Furthermore, what little research has focused on outliers offers conflicting accounts of how individuals incorporate outliers into their perceptions of the group, with some research suggesting that perceivers are likely to be influenced by outliers because of their salience (Tversky & Kahneman, 1974), and other research suggesting that perceivers are likely to ignore outliers because they are derogated or sub-typed (Marques, Yzerbyt, & Leyens, 1988).

In this paper, we focus on how an outlier in a small group can influence observers' perceptions of group norms, the range of typical or appropriate group behavior and opinions. We

adopt this focus on social norm perception for three reasons. First, previous research suggests that individuals tend to learn descriptive norms, what people typically do in a situation, by observing the behavior of those in their social network, making social norm perception a reasonable context for examining how outliers might affect group perception (Kashima, Wilson, Lusher, Pearson, & Pearson, 2013). Second, much of the research on the appraisal of outliers by observers defines outliers in relation to social norms (Bellezza et al., 2014; van Kleef, et al. 2011; Marques et al., 1988). Third, though research has recognized that social norms exert a powerful force on individual behavior (Miller & Prentice, 2016; Paluck, Shepherd & Aronow, 2016), little research examines how individuals infer a group's social norm from the distribution of its members' behavior (Tankard & Paluck, 2016). By adopting this focus on social norm perception, we hope to offer insight into the cognitive processes that underlie social norm perception in small groups or teams.

In the service of clarity, consider the following situation as a prototypical example of the context for our investigation. Imagine Lily has just been hired by a small company and wants to fit in with her new co-workers. On her first day, she observes how others on the team behave in order to find out what's within the range of acceptability. We propose that when individuals, like Lily, observe a distribution of group behavior without outliers they will more or less accurately perceive the average behavior and the social norm. However, because individuals are attentive to extremes, we suggest that when individuals view a distribution of group behavior containing an outlier, they may be influenced by the outlying behavior when summarizing the distribution of group behavior and thus overweight¹ it. We further propose that individuals will distinguish between outliers based on their extremity, being more influenced by moderate

¹ The term overweight is used to describe the outcome – recollections of the group will be more influenced by the outlier's behavior than by the behavior of a non-outlying behavior – rather than the process.

outliers than extreme outliers. In the remaining sections of the introduction, we elaborate on each of these claims in turn.

Perceiving Groups

Lily's task on her first day can be simplified as perceiving and summarizing a distribution of behavior. Assessing whether her judgments of the group norm accurately reflect behavior requires a normative benchmark. The most conservative benchmark for assessing the impact of an outlier in a descriptive norm is $1/N$, proportional influence.² To the degree that individuals perceive the distribution of behavior (the mean, median or mode) as more in line with the outlying behavior, they are overweighting (being over-influenced by) the outlier's behavior in their representation of the group. For example, Lily would be overweighting a casually dressed outlier in a room full of suit-wearers to the extent she inferred the group to be more casually dressed than they actually were. When examining prescriptive norms, what most individuals in a group judge to be appropriate or acceptable, a similar benchmark applies. In a situation where the majority enact behavior A and only an outlier enacts behavior B, we will consider observers' judgments of acceptability or appropriateness to overweight outliers to the extent that these judgments shift away from behavior A in the direction of behavior B more than is proportional, i.e. $1/N$.

Research suggests that individuals are adept at judging the average behavior of a group and thus may also be adept at perceiving descriptive social norms. Previous research in ensemble coding or summary perception suggests that individuals possess a remarkable ability to

² Questions inquiring about the descriptive norm frequently ask what "most" peers do or ask participants to bracket common behavior in their peer group (Cialdini, Reno & Kallgren, 1990; Prentice & Miller, 1993). As these questions indicate, the descriptive norm corresponds to a sense of the central tendency of the group. An accurate representation of the descriptive norm thus requires participants to accurately represent the distribution of behavior in the group and to correctly determine how the majority of individuals or how an average individual behaves (Bicchieri, 2006). The mean is the most sensitive to outlier presence and thus the most conservative benchmark to test for *overweighting* because it already gives the most weight to the outlier (see Study 1 stimuli).

encode accurately and rapidly sets (ensembles) of stimuli (Alvarez, 2011; Whitney, Haberman & Sweeny, 2014). This is true of basic visual stimuli such as item size (Ariely, 2001; Chong & Treisman, 2003), orientation (Alvarez & Oliva, 2009; Dakin & Watt, 1997), speed (Watamaniuk & Duchon, 1992), and location (Alvarez & Oliva, 2008). It is also true of social stimuli such as the emotion (Haberman & Whitney, 2009), gender (Haberman & Whitney, 2007) and identity of a group of faces (de Fockert & Wolfenstein, 2009), as well as the direction of a moving crowd (Sweeny, Haroz, & Whitney, 2013). Research in ensemble coding has consistently shown that the visual system rapidly and automatically encodes summary statistics of a set of observed stimuli, even when recollections of the individual pieces of stimuli is far less accurate (Whitney, Haberman & Sweeny, 2014). Research further suggests that after individuals view a series of numbers, they can accurately judge the probability of numbers from the same distribution occurring in the future (Goldstein & Rothschild, 2014).

Though research on ensemble coding generally focuses on stimuli most commonly used in the fields of vision and cognitive neuroscience, we suggest that people will display similar adeptness when summarizing the behavior of individuals in small groups. Social norm perception likely requires more time and conscious focus than the perception of visual ensembles (see the General Discussion for a greater examination of differences), but the first stage of norm perception likely depends on our ability to quickly survey an array of stimuli and infer features of its distribution. Supporting this conjecture, research suggests that people can guess with fair accuracy the distribution of their peers' attitudes on a variety of issues as well as how frequently they engage in a variety of behaviors (Nisbett & Kunda, 1985). Collectively, this research suggests that individuals are generally capable of accurately summarizing group behavior.

Overweighting Outliers in Perceptions of the Descriptive Norm

We hypothesize that individuals are likely to be less accurate when summarizing group behavior if the group contains an outlier, because outliers grab attention, which leads them to be overweighted in perceptions of group norms. According to the availability heuristic, when individuals are uncertain how often something occurs, they search their recollections for related occurrences and use the ease of recall to infer the actual frequency (Tversky & Kahneman, 1974). The availability heuristic, or the related anchoring and adjustment heuristic (Tversky & Kahneman, 1974), can thus lead one salient exemplar to influence the perception the larger group or category. The use of these heuristics when recalling a distribution of behavior across a group that includes outliers may lead to a similar error in which outliers influence the perception of the group by distorting perceptions of other group members.

Imagine that after her first day of work Lily tries to recall when most people arrived in the morning in order to plan her arrival the next day. Using saliency or ease of recall as a cue to reconstruct the distribution she can be expected to better remember an individual who arrived earlier than the others in the group due to this person's unique behavior. Because of this, she may believe that people generally arrived earlier in the day than they in fact did and thus that the average time of arrival for the group is earlier than it was. This suggests that outliers may be overweighted in group perceptions because they bias recollection of *normally behaving* group members, making the whole group appear slightly more extreme. We therefore hypothesize:

H1: Individuals will overweight outliers in their inferences of the descriptive norm of a small group.

Weighting of Moderate versus Extreme Outliers in Descriptive Norms

A central question in the present research is whether outliers of varying extremity have similar or different impacts on perceptions of group descriptive norms. We use the terms

moderate and extreme outliers to refer to individuals whose behavior differs in extremity but not in the kind. The two types of outliers we consider only differ in how deviant their behavior is in relation to other group members or to perceivers' expectations.

Research suggests a number of reasons why extreme outliers may have less impact on small group perception than more moderate outliers. First, consider the finding that individuals dislike and derogate deviant in-group members because they perceive deviant group members to be a threat to group cohesion and identity (Marques et al., 1988). When assessing the group norm, then, Lily might give less weight to the behavior of an extreme outlier than to that of a more moderate outlier because of her anticipation that the rest of the group is likely either to temper the behavior of the extreme outlier or to exclude him or her from the group.

Another reason why extreme outliers may influence group perception less than more moderate outliers derives from the categorization process. First, individuals tend to be more influenced by moderate, plausible numerical anchors than by more extreme, implausible values (Chapman & Johnson, 1994). In addition, though individuals will incorporate moderate counter-stereotypical exemplars into their stereotypes, they tend to ignore or sub-categorize more extreme counter-stereotypical exemplars because they wish to maintain the strength of their stereotype (Kunda & Oleson, 1997). Based on these findings, one might expect perceivers to be more likely to subcategorize an extreme than a moderate outlier (i.e., assume he or she is drawn from a different distribution), leading extreme outliers to have less influence on group perceptions. In fact, Haberman & Whitney (2010) find that individuals automatically discount or ignore extremely sad faces when summarizing a group of mostly happy emotional expressions, suggesting that even on a visual level, individuals selectively construct social categories based on

extremity. As these diverse cases all suggest, individuals tend to accord less weight to extreme relative to more moderate behavior in their summary judgments. We therefore hypothesize:

H2: Individuals will give relatively less weight to extreme outliers as compared to moderate outliers in their inferences of the descriptive norm of a small group.

Inferring Prescriptive Norms in Groups with Outliers

Thus far, we have discussed how outliers affect the general perception of small group behavior. However, representations of small group norms take two different forms. The first, the focus of our discussion so far, is the descriptive norm, observers' representations of what individuals do. The second is the prescriptive or injunctive norm, observers' representations of what behavior is acceptable or appropriate (Eriksson, Strimling, & Coultas, 2015; Miller & Prentice, 2016). Though one cannot with certainty infer a prescriptive norm from descriptive behavior alone (Bicchieri, 2006), many behaviors have trans-situational prescriptive relevance such that when individuals enter a new situation they know that certain behaviors or attitudes will hold prescriptive importance (Kahneman & Miller, 1986). For example, when entering a new workplace, individuals might expect observed dress formality or punctuality to hold prescriptive relevance.

The relationship between perceptions of what members of a group do and what they think is appropriate may well depend on the presence and extremity of an outlier. For example, imagine Lily observes a co-worker who arrives fifteen minutes later than her colleagues versus one who arrives thirty minutes later than her colleagues. Because prescriptive norms represent not simply what is done but what is appropriate, they often are derived from a more stringent evaluation of a distribution of behavior. While all behavior in a group is descriptively relevant, only some of it may be viewed as prescriptively acceptable. For example, as outliers become

more extreme they may be discounted more in the assessment of the prescriptive than the descriptive norm. The co-worker arriving fifteen minutes late may be viewed as deviant group member, but not as so extreme as to be entirely prescriptively irrelevant. The employee arriving thirty minutes late, on the other hand, may be more likely to be considered prescriptively irrelevant by Lily and other group members because his behavior seems beyond the pale of acceptability. We therefore hypothesize:

H3: Individuals will overweight outliers in their inferences of the prescriptive norm of a small group.

H4: Individuals will give less weight to extreme outliers as compared to moderate outliers in inferences of the prescriptive norm. Moreover, this effect will be stronger in individuals' perceptions of the prescriptive than the descriptive norm.

Current Research

In this paper we report four studies that test the four hypotheses stated above. In Study 1, we report results from a paradigm that examines perceptions of the appropriate time of arrival for group members. Using a numeric norm such as arrival time allows us to compare participants' perceptions of the distribution of group arrival times to the actual distribution of arrival times. In Study 2, we strengthen our findings by ruling out the possibility that the impact of extreme behavior in Study 1 was due to participants interpreting outliers as evidence of there being no group norm. We do this by showing that groups with a single outlier are seen differently than groups with comparably high variance but no outlier. In Study 3, we extend our findings using a different norm and a modified paradigm focusing on the appropriate style of dress in a new group. In Study 4, we return to the norm of punctuality and examine how individuals update their perceptions of the norm following a second day's observation. Across the four studies we

find strong support for our hypotheses. Individuals' perceptions of groups are accurate when the groups contain no outliers but are systematically distorted when they do. Specifically, observers tend to overweight outlying behavior but do so less as the behavior becomes more extreme, particularly in judgments of prescriptive norms.

Study 1

In Study 1 we examine how observers infer a group norm pertaining to punctuality. By varying the distribution of arrival times, our stimuli vary the presence and extremity of the outlier in the group but keep the mean arrival times in the groups identical across all conditions. This permits the use of the statistical average of the stimuli as the normative benchmark to aid in evaluating the relative effect of outliers. In addition, by using punctuality as the norm we can distinguish between descriptive outliers whose behavior is prescriptively congruent, arriving earlier than expected, and those whose behavior is prescriptively incongruent (deviant), arriving later than expected. This permits the test of our hypotheses for outliers who deviate in both directions from the group norm (Morrison & Miller, 2008)³.

Method

Participants. Six hundred and sixty-eight participants were recruited from Amazon's Mechanical Turk. In line with Simonsohn (2014), we sought here, and across all subsequent studies, to recruit at least 75 participants per cell, in order to power each study commensurate with our interest in the phenomenon, given that the true effect size was unknown. Participants who did not pass our video attention check (entering a code; $n = 9$) or who indicated difficulty playing the video (asked directly; $n = 12$), were removed from analyses, resulting in a final

³ We assume for the purposes of this paper that the global prescriptive norm for punctuality dictates that being earlier is more acceptable than being late. Popular sayings such as "If you're on time, you're already late" reinforce this perspective.

sample $N = 647$, (56.4% women, median age = 30, $SD = 10.18$). All analyses reported are performed on this pruned sample of participants but are similar to those performed on the full sample of participants. In all studies reported here we report all measures, conditions, data exclusions, and the reasoning behind the sample size used.

Procedure and measures. All participants watched a video, lasting 1 minute and 32 seconds, showing eight individuals walking through a door (see times for each condition in Table 1). On the page, above the video, participants read the following description:

You will now watch a video of a work team arriving in the morning. Team members arrive at a variety of times, each displayed at the bottom of the video as the team member arrives. As you watch, please think about when a new member of this team would think it was appropriate to arrive.

The time of arrival for each individual was displayed in digital format as a repeated moving ticker across the bottom of the screen. The distribution of times in the video was manipulated to either have or not have one outlier, though the mean time of arrival for the group remained constant. We chose to use a video rather than simply displaying a table of times in order to enhance verisimilitude and better mimic the cognitive pressures and processes at play when participants observe a real small group. A timer on the page required individuals to remain on the page for a minimum of 1 minute and 30 seconds.

Once they finished watching the video, participants completed the attention check described above and then completed an innocuous word search as a distractor task for three minutes. This task was used to approximate the cognitive load participants would be under in a more naturalistic environment where they might be performing daily tasks while interacting with the target group. After completing the task, participants completed the dependent measures in a randomized order.

Perceived group behavior. Participants were asked to indicate their recollection of the arrival time of each of the group members (8 items, 1 per individual in the group)⁴.

Descriptive norm. These 8 items serve as our measure of the descriptive norm. For each condition, we held the average arrival time of the group stimuli constant. Thus, the average of participants' *perceived* arrival times should not differ across conditions, unless outliers distort these perceptions as we hypothesize.

Accuracy. We also used responses to the eight items mentioned above to measure the accuracy of participant recall of the group members' individual arrival times in the video. To do this, we first collapsed⁵ across early and late outliers by multiplying all responses from the early outlier conditions by -1. We then subtracted the objective arrival time for each arrival in the video from participants' responses. Positive values thus represented the target's arrival time being judged closer than it was to that of the outlier; negative values represented the target's arrival time being judged more distant than it was from the outlier. A value of zero represented perfect accuracy.

Prescriptive norm. Participants were asked to indicate the range of times in which most (defined for participants as ~50%) of the group (1) would feel comfortable arriving, (2) would think it acceptable to arrive, and (3) would think it was appropriate to arrive, with the order of question randomized. Each of these statements was accompanied by two items that focused on the lower and upper bounds of the range. Participants were given a slider from 7:30am to

⁴ Participants were also asked to indicate when most of the group tended to arrive in the morning. They did this by responding to two items focusing on the lower ("The earliest most members would arrive is:") and upper ("The latest most members arrive is:") bounds of the range. Participants were given a slider from 7:30 to 8:45 to indicate each response. All analyses remain the same when these responses are averaged with the recollection of the arrival time of the full distribution.

⁵ Before doing this, we first checked to verify that early and late outliers did not have different effects.. See Supplemental Materials.

8:45am to indicate each response. These items created a six-item measure of the prescriptive norm ($\alpha = 0.71$).

Results

Because the objective average time of arrival was constant across all conditions (8:10am), we centered all dependent variables on 8:10am, so that negative values reflected earlier recollections (i.e. -2 represented 2 minutes early) and positive values later recollections (i.e. +2 represented 2 minutes late). Participants offered generally meaningful values given that 0 reflected the average arrival time of the video and thus the normatively accurate answer (for descriptive statistics by condition see Supplemental Materials).

In all of our analyses, the independent variable, the extremity of the outlier, is operationalized as the number of minutes early or late, relative to the next closest arrival, (e.g. 14 minutes later resulted in +14)⁶.

H1: Overweighting outliers in descriptive norm judgments. We first examined our hypothesis (H1) that outliers would be overweighted in perceptions of the descriptive norm. We reasoned that if participants were overweighting outliers, the distribution of arrival times reported would be biased in the direction of the outlier (recall that the average time of arrival was objectively equal across conditions). Because each participant in the study offered their recollection for each of the 8 group members separately, we model this as a multilevel model using a random effect term for participant id in a mixed model fitted using lme4 (Bates, Maechler, Bolker & Walker, 2014) and lmerTest (Kuznetsova, Brockhoff & Christensen, 2015) in R statistics software.

⁶ These analyses remain the same if the independent variable is treated as a factor (see Supplemental Materials).

Do individuals overweight outliers in descriptive norms? We found a significant linear pattern such that perceptions of the descriptive norm were pulled in the direction of the outlier ($b = 0.04$, $SE = 0.01$, $t(644) = 5.57$, $p < 0.001$, see Figure 1, Panel A). This suggests a pattern of overweighting in which the presence of a late outlier led participants to recall the distribution of arrival times as later than it was, and the presence of an early outlier led participants to recall the distribution as earlier than it was.

Are recollections of non-outlying group members shifted towards the outlier? If, as hypothesized (H1), outliers would be overweighted because their saliency would distort recollections of non-outlying group members, we would expect recollections of those closest to the outlier to be the most distorted. To test whether arrivals closest to the outlier, in conditions with an outlier, were most inaccurately recalled, we ran a mixed-effects multilevel model using an interaction of outlier extremity and a dummy-coded value of 1 to 7 for each of the 7 arrivals (7 being closest to the outlier in time) to predict participant accuracy in recalling the time of arrival for the 7 non-outlying group members.

We found that participants were significantly less accurate in recalling the arrival time of the group members the closer they arrived to the outlier's arrival time and the more extreme the outlier's arrival, ($b = 0.02$, $SE = 0.003$, $t(3874) = 6.086$, $p < 0.001$, see Figure 2). In other words, participants recalled the group members arriving closer to the outlier than they actually had in the video. In the most extreme case, this resulted in participants recalling the group member who was closest to the outlier in arrival time as arriving nearly 6 minutes closer to the outlier's arrival time than had been shown in the video. Thus, participant's perception of the descriptive norm overweighted the outlier's behavior because they perceived the behavior of other group members as more similar to the outlier's behavior than they were.

H2: Weighting of extreme and moderate outliers in descriptive norms. Our second hypothesis stated that overweighting of outliers in descriptive norms would be moderated by the extremity of the outlier, with moderate outliers being overweighted more than extreme outliers. To test this hypothesis, we returned to the linear model described above and added two additional terms, one quadratic and one cubic, to capture curvilinear weighting of outliers. We reasoned that if extreme early and late outliers were given relatively less weight than moderate early and late outliers we should find a significant cubic effect.

Are moderate outliers weighted more than extreme outliers? We found that the linear pattern of overweighting was qualified by a significant cubic curvilinear effect (to model one curve for early and one curve for late outliers), such that extreme outliers shifted the descriptive norm comparatively less than moderate outliers ($b = -41.00$, $SE = 11.01$, $t(642) = -3.72$, $p < 0.001$, see Figure 1, Panel A), thus confirming Hypothesis 2.

Because we found no significant differences in participant responses to early versus late outliers (see Supplemental Materials), we verified this pattern by collapsing early and late outliers – multiplying early responses by -1, see collapsed means and standard deviations in Supplemental Materials – and using a method recommended by Nelson & Simonsohn (2014) for testing curvilinear effects. This method calls for fitting a quadratic regression line, identifying the apex of the curve, and then fitting two straight lines on either side of this apex (see Figure 1, Panel C). The application of this method supported our two predictions: (1) participants perceived groups with outliers to have more extreme norms as the outlier's lateness or earliness approached 20 minutes⁷ ($b = 0.15$, $SE = 0.04$, $t(642) = 4.28$, $p < 0.001$); (2) this effect flattened

⁷ This number, and the 17 minutes of the prescriptive norms analysis, should be interpreted with caution. Though it is the apex of the quadratic regression line in this analysis, the specific number found is a function of the paradigm used here and thus is less generalizable than the broader notion of curvilinearity.

to non-significance as the outlier's behavior became more extreme ($b = -0.03$, $SE = 0.03$, $t(642) = -0.81$, $p = 0.42$). This results indicates that participants did not shift the perceived descriptive norm significantly once the outlier was more than 20 minutes away from the most similar group member. Put differently, as outliers become more extreme, they are given less weight proportional to their extremity. We next investigate how outliers affected perceptions of the groups' perceived prescriptive norm.

H3 & H4: Perceptions of the prescriptive norm. Perceptions of the prescriptive norms were significantly correlated with perceptions of the descriptive norms, but distinguishable ($r = 0.31$, $t(637) = 8.09$, $p < 0.001$). After verifying that early and late outliers did not differ in pattern, we collapsed early and late outliers and analyzed prescriptive norms according to the same Nelson and Simonsohn procedure listed above (for non-collapsed analyses see Supplemental Materials and visualization in Figure 1, Panel B).

Are outliers overweighted in prescriptive norms? According to our third hypothesis, prescriptive norms should show a pattern of overweighting outliers similar to that in descriptive norms. As expected, we found that the perceived prescriptive norm shifted significantly in the direction of the outlier when the outlier arrived up until 17 minutes later or earlier than the nearest arrival ($b = 0.23$, $SE = 0.05$, $t(635) = 4.90$, $p < 0.001$, see Figure 1, Panel D).

Are extreme outliers weighted less than moderate outliers in prescriptive norms? According to our fourth hypothesis, extreme outliers should receive less weight than moderate outliers in prescriptive norms and this effect should be stronger than that observed in descriptive norms. When the outlier arrived more than 17 minutes, as compared to less than 17 minutes, away from the nearest arrival they had significantly less impact on prescriptive norm

perceptions, ($b = -0.11$, $SE = 0.05$, $t(635) = -2.32$, $p = 0.021$, see Figure 1, Panel D). Extreme outliers were thus given less weight than moderate outliers in judgments of the prescriptive norm.

We then compared the coefficient of this effect to the non-significant decrease found in descriptive norms. The attenuated overweighting was marginally stronger in prescriptive than descriptive norms ($z = 1.83$, $p = 0.067$). This suggests that, as predicted, the curvilinear pattern was stronger for prescriptive norms than descriptive norms, indicating that extreme outliers receive less weight in prescriptive than descriptive norms.

Exploratory analysis of accuracy in outlier recall. In addition to tests of our hypotheses, we performed an exploratory analysis to determine how accurately individuals recalled the outlier's time of arrival. We used a linear regression to compare how accurately participants remembered the last arrival in the control condition video compared to outlier's arrival in the other conditions. We found that individuals were less accurate in recalling the final individual's time in the outlier conditions than in the control video and became less accurate as the outlier became more extreme. Closer inspection revealed that participants' inaccuracy in the perception of outliers was due to their significant *underestimation* of the outlier's extremity, ($b = -0.15$, $SE = 0.03$, $t(644) = -5.47$, $p < 0.001$). Individuals recalled the outlier's arrival time as significantly *less* extreme than it was.

Discussion

In Study 1, participants perceived the descriptive and prescriptive norm to be a few minutes later than the actual group average when observing a group with a late outlier and a few minutes earlier when observing a group with an early outlier. Even when seven of the eight group members arrive early, participants in the late outlier condition report it acceptable and appropriate to arrive later, and vice versa for the early outlier conditions. Importantly, these

effects occurred despite the fact that the average time of arrival across conditions for the observed group remained the same, 8:10am, as did the central tendencies (i.e. median, mode) of the arrival time distribution.

Further examination of participants' perception of the distribution of arrival times offered insight into how participants were influenced by the outlier. Participants' perceptions of the social norm shifted in part because they perceived group members arriving at the times most proximal the outlier as more proximal to the outlier than they were. Participants remembered the team members closest to the outlier as arriving roughly five minutes closer to the outlier than they in fact did in. Though the video shows group members most proximate to the outliers as arriving between 8:08 and 8:12 across the different conditions, participants recall them arriving closer to 8:15-8:17 in the late outlier condition and closer to 8:03-8:05 in the early outlier condition. This pattern suggests that the extremity of the outlier's behavior may function as a cognitive anchor, leading participants to implicitly adjust the arrival time of individuals proximal to the outlier. It's important to note that this shift in recollections happened both when the outlier was moderate and when the outlier was more extreme. When the outlier arrived 34 minutes later than the closest group member, the latter was still recalled as arriving roughly 6 minutes later than they actually did, a similar magnitude to the shift when the outlier was 22 or 14 minutes late. This suggests that outliers of all extremity can function as a cognitive anchor, though the effect of this anchor does not increase as extremity increases.

Extreme outliers did not function similarly to moderate outliers in all aspects. As hypothesized (H4), we found that participants gave less weight to the extreme outlier than the moderate outlier when perceiving the prescriptive norm. Participants judged it less acceptable to arrive late when there was an extremely late outlier than when there was a moderately late outlier

and less acceptable to arrive early when there was an extremely early outlier than when the outlier was moderately early. In fact, participants perceived no difference between the prescriptive norms of groups with extreme outliers and groups with no outlier at all.

How might extreme outliers be viewed differently than moderate outliers? Here the insight provided by Study 1 is limited. Exploratory analyses suggest that participants tend to underestimate the extremity of the outlier, but this may be because they expect the group to punish the outlier and bring them more in line with the group or because they expect the outlier to regress to the mean because the outlying behavior was a fluke. In addition, when combined with overestimating the extremity of the normal group members, this could alternatively suggest that participants tend to make the group more homogenous when recounting the arrival times, by moving the outlier and the other closest arrivals closer together in arrival time. This pattern is similar to those observed when individuals' ensemble code highly variable groups of dots (Burr & Ross, 2008) or chaotic moving crowds (Sweeny, Haroz, Whitney, 2013) or to the finding that perceptions of individual recollections can be biased by the average of a set (Brady & Alvarez, 2011). We return to the question of how extreme versus moderate outliers may be perceived differently in Study 3.

Study 2

The procedure of Study 1 was designed to ensure that the central tendency of group arrival times across conditions was equivalent; however, the statistical variance of the distribution did vary. Though the variance of the core group of 7 non-extreme arrivals is similar across conditions, the variance of the full group of 8 arrivals varies because the outlier's arrival time varies in extremity across conditions. In Study 2, we disentangle variance from the presence of an outlier. This helps to control for the effect of variance in group behavior which

might suggest to perceivers that the norm regarding punctuality is “looser” in groups with extreme than moderate outliers (Gelfand, Raver, Nishii, Leslie, & Lun, 2011).

We address this possibility in Study 2 by showing participants one of two videos that varied in whether they included an outlier but were equivalent in the variance depicted in group behavior. Following the viewing of the video, participants were asked how likely it was that a new late arriver would be punished by the group. Willingness to punish deviant group members functions as a proxy for the strength of the perceived prescriptive norm within the group (Brauer & Chaurand, 2010). By examining if anticipated punishment for a future late group member varies across conditions, we can test if the presence of an outlier, by increasing group variance, conveys a weak social norm. This tests a fifth hypothesis:

H5: Small groups containing an outlier will have stronger social norms than small groups with no outlier but equivalent variance in group behavior.

Method

Participants. Participants were recruited from Amazon’s Mechanical Turk to complete the survey. The same manipulation checks employed in Study 1 were used to ensure that the video stimuli were transmitted effectively. Two-hundred-and-two participants completed the survey and 7 were removed due to failing the attention checks. In addition, due to an error in the survey, the timer that served to ensure participants did not advance until the duration time of the video had elapsed did not function. We pruned those who advanced before the video could have concluded (90 seconds) as well as those who spent more than three median absolute deviations (168.76 seconds) on the survey page, resulting in 29 people cut and a final sample size of one-hundred-and-sixty-six participants (93 women, median age = 30.5, $SD = 9.96$). The results remain similar when these restrictions are not applied.

Procedure and measures. Participants were randomly assigned to one of two conditions. In the outlier condition, participants viewed the same video that Study 1 used to depict an extreme late outlier, wherein the outlier arrives 22 minutes after the next closest arrival. In the general variance condition, participants viewed a group arriving with no outlier but generally high variance in arrival time (see Table 2 for the specific arrival times for each observed group member). The general variance video was designed to depict statistical variance that matched as closely as possible that in the outlier video. After they had finished watching the video, participants read the following:

Imagine Sam is a new member of the group you saw in the video. Sam tends to arrive around 8:25 am. Given what you saw about this team, what are the chances that the following things would happen?

Participants next completed the dependent measures, which focused on perceptions of the strength of the norm in the group observed. We chose to focus on the perceived strength of the prescriptive norm rather than its content because prior research has established that high variance in behavior leads to perceptions of a weak social norm. Participants answered a total of 5 questions that formed a scale to assess their perception of the strength of the prescriptive norm in the video ($\alpha = 0.90$). Participants indicated the percent chance (from 0 to 100) that group members (1) would be annoyed at Sam, (2) would complain about Sam in private, (3) would complain to a superior about Sam's behavior and, further, that Sam (4) would be officially reprimanded or (5) would be fired for this behavior. We chose the name Sam to be gender-neutral (though we acknowledge that participants may have been more likely to view Sam as male, c.f. Eagly & Kite, 1987).

Results

Confirming our fifth hypothesis, participants who imagined Sam joining the group to which the late outlier belonged believed that Sam was significantly more likely to face punishment for arriving at 8:25am ($M = 42.5$, $SD = 23.11$) than participants who imagined Sam joining the group with no outlier but the equivalent general variance ($M = 33.3$, $SD = 24.43$, $t(163) = -2.48$, $p = 0.014$). Because examination of the dependent variable revealed mild non-normality in the distribution, we performed a two-sample Wilcoxon Rank Sum test to ensure the robustness of our findings. The difference described above was significant by this test as well, ($w = 2590$, $p = 0.011$).

Discussion

The results of Study 2 show that the effects of an extreme outlier found in Study 1 were not due to the greater group variance created by outlier's presence. Specifically, Study 2 found that participants expected a future deviant would receive greater punishment when they belonged to a group with an extreme outlier than when the future deviant belonged to a group that had no extreme outlier but similar variance in behavior. These results augment those of Study 1 and together suggest that outliers shift the normative range of arrival, but they do not weaken perceptions of norm strength in the same way that variance does. This is not to say that the presence of an outlier does not weaken the norm at all, only that perceiving a group with an outlier is not psychologically equivalent to perceiving a group with high variance.

Study 3

Study 3 sought to establish that the effects of outliers on group perception observed in Studies 1 and 2 were not specific to punctuality-related norms. It did so by examining how individuals perceive both the average and the appropriate style of dress in a group containing informally dressed outliers. Time was well-suited for conservative tests of our hypotheses

regarding overweighting because it allowed for a study design that controlled for the statistical mean arrival time. For other behaviors this is more difficult because the normative benchmark (the true values of the distribution) are less precisely defined. Nonetheless, we sought to verify the pattern from Study 1 in the context of a different norm, even if this norm did not allow for as clear a normative benchmark for comparisons.

Because of the lack of normative benchmark, we will not directly examine the overweighting and relative weighting of outliers (H1 & H2) but will examine how the impact of outliers differs in the case of perceptions of prescriptive norms versus descriptive norms (H3 & H4). Study 3 also examines how individuals make sense of the outlying behavior in order to understand more fully the differences observed in participant perceptions of moderate versus extreme outliers.

Method

Participants. Participants ($N = 465$) were recruited from Amazon's Mechanical Turk. The majority of participants were female (282 identified as women, 182 as men, 1 as non-binary), and the median age was 30 ($SD = 9.63$). No participants were excluded from analyses.

Procedure and measures. Participants were randomly assigned to one of three conditions in the online survey. After providing informed consent, all participants read the following introduction:

In this study you will view a series of images of a work team, photographed outside their office. Team members dress in a variety of ways. (We've removed identifying features of the team members for the purpose of this study.) As you watch, please think about how a new member of this team would think it was appropriate to dress. (A timer on each page will allow you to advance after observing for at least 10 seconds.)

After reading this, participants viewed a series of eight images, in a randomized order, for a minimum of ten seconds each. Each image depicted a different male⁸ standing in front of a light colored wall. Seven of the eight images of group members remained constant across the three conditions: all participants always viewed four men wearing a suit and tie and three men wearing a suit with no tie (see Figure 3). In the control condition, the eighth group member was another man in a suit with no tie (see Figure 4). In the moderate outlier condition, the eighth group member was instead wearing a dress shirt with dark jeans and sneakers (see Figure 5). In the extreme outlier condition, the eighth group member was wearing athletic shorts and a t-shirt (see Figure 6).

Each image was accompanied with a statement such as “John wore this.” There were a total of ten names that were randomly assigned to accompany each of the eight photos⁹.

After viewing all 8 images participants completed an innocuous word search as a distractor task for two minutes. This task was used to approximate the cognitive load participants would be under in a more naturalistic environment where they might be performing daily tasks while interacting with the target group. After completing the task, participants completed the dependent measures in a randomized order.

⁸ After pretesting images of male and female targets in formal attire, we determined that there was much less agreement for what qualified as formal versus casual attire for female as compared to male targets. Because we wanted to examine how the distribution of attire affected perceptions of appropriate dress, we needed to use images that were unequivocally moderate or extreme outliers in work dress. We therefore focused only on male target images in order to decrease extraneous variance in participant perceptions of what constituted formal versus casual dress.

⁹ We had names accompany the photos to permit a test of our hypothesis that outliers would be more salient than other individuals in a group and thus their characteristics (see Supplemental Materials), such as their name would be more memorable than those of other group members. The names – John, James, Sean, Arthur, Joshua, Andrew, Matthew, Anthony, Daniel, Kevin – were thus chosen for their ubiquity and roughly equivalent length.

Descriptive norm. Paralleling Study 1, participants were asked to indicate their recollection of each of the group members' formality using a scale that ranged from 1 (Very Casual, e.g. jeans and t-shirt) to 7 (Very Formal, e.g. formal suit) for a total of 8 items, 1 per group member. The average of these items provided the measure of the descriptive norm.

Prescriptive norm. Participants were also asked to indicate the range of style in which most of the group would feel comfortable dressing, the range in which most of the group would think it was acceptable to dress, and the range in which most of the group would think it was appropriate to dress. Each of these statements was accompanied by two items indicating the lower and upper bounds of the range on a seven-point spectrum from 1 (Very Casual, e.g. jeans and t-shirt) to 7 (Very Formal, e.g. formal suit). This created a six-item measure of the prescriptive norm ($\alpha = 0.77$).

Free response. For a better understanding of how participants made sense of the outlier's style of dress, we included a free response question after the other dependent measures. The question included an image of the outlier or an image of one of the normally dressed individuals in the control condition, and asked participants to explain in 2-3 sentences why they believe the individual was dressed that way.

Two independent coders blind to participant condition and hypotheses coded each free response for two characteristics. The coders first rated the degree to which each response expressed that the target was an unusual group member ($ICC = 0.70$). The coders then rated the degree to which each response indicated that the day the photo was taken was an unusual day ($ICC = 0.71$). Both ratings were made on a scale from 1-5 with 1 representing a typical group member or a typical day, and 5 representing an atypical group member or an atypical day. For example, responses like "I think this person was probably dressed this way because they

mentally don't catch on to social cues. I have experience with these kinds of people and unless you specifically tell them what to wear they won't get it” received a high score for atypical person but a low score for atypical day. Alternatively, responses such as, “He had just been called into a meeting on his day off while he was at the gym so he had to dump the kid with his sister as quickly as possible and then race into work” received a high score for atypical day, but a low score for atypical person.

Results

Because the objective average formality shifts across conditions in this study, we cannot make strong tests of our hypotheses regarding overweighting and relative weighting of outliers (H1 & H2). Instead we first assess whether responses in Study 3 follow similar patterns to Study 1 and then examine what explanations individuals offer for moderate versus extreme outliers.

H1 & H2: Perceptions of the descriptive norm. Because we had only three conditions and because clothing is not numeric like time, we chose to analyze the independent variable as a three-level factor rather than a continuous variable, though analyses remain the same when analyzed continuously. We regressed descriptive norms on two planned contrasts of the outlier extremity factor, one linear and one quadratic, and found that outlier extremity linearly predicted descriptive norms ($b = -0.38$, $SE = 0.05$, $t(462) = -8.17$, $p < 0.001$) but did not show any curvilinear relationship ($b = 0.02$, $SE = 0.03$, $t(462) = 0.69$, $p = 0.49$, see Figure 7). In addition, pairwise t-tests with a Holm correction for multiple tests confirmed that participants viewed a group containing a moderate outlier as significantly less formal than a group containing no outlier ($p < 0.001$) and viewed a group with an extreme outlier as significantly less formal than both the group with a moderate outlier ($p < 0.001$) and the control group with no outlier ($p < 0.001$).

H3 & H4: Perceptions of the prescriptive norm. We regressed prescriptive norms on the same two planned contrasts and found that outlier extremity both linearly predicted prescriptive norms ($b = -0.16$, $SE = 0.05$, $t(462) = -3.14$, $p = 0.002$) and curvilinearly predicted prescriptive norms ($b = 0.06$, $SE = 0.03$, $t(462) = 2.08$, $p = 0.038$, see Figure 7). We further analyzed pairwise t-tests with a Holm correction and found that participants predicted that members in a group containing no outlier would think their peers should dress significantly more formally than would members in a group containing either a moderate outlier ($p = 0.005$) or an extreme outlier ($p = 0.008$). Participants predicted that the prescriptive norms of groups with either a moderate outlier or an extreme outlier would not differ ($p = 0.73$).

Probing H2 & H4: Attribution differs between moderate and extreme outliers.

Participants' explanations for style of dress in the control condition suggested that the target group member was generally seen as a typical member of the group ($M = 1.33$, $SD = 0.61$) and the day of observation as a typical day for the individual ($M = 1.34$, $SD = 0.74$). In contrast, participants tended to view the moderate outlier as a highly atypical group member ($M = 3.13$, $SD = 1.36$) but the day as only a somewhat atypical day ($M = 1.94$, $SD = 1.2$). The pattern was different for participants viewing the extreme outlier. Compared to those viewing the moderate outlier, they judged the extreme outlier to be a less atypical group member ($M = 2.46$, $SD = 1.2$) but the day to be a more atypical day ($M = 2.86$, $SD = 1.15$).

To further explore the differences in attribution made for moderate and extreme outliers' style of dress, we regressed attributions of dispositional atypicality (i.e. is this an atypical group member?) on the same outlier extremity contrast codes used previously – one linear and one curvilinear. We found that extremity of the outlier increased individuals' attributions of dispositional atypicality ($b = 0.56$, $SE = 0.06$, $t(458) = 9.07$, $p < 0.001$) but this effect was

qualified by a significant curvilinear pattern ($b = -0.41$, $SE = 0.04$, $t(458) = -11.29$, $p < 0.001$), indicating that individuals made more attributions of dispositional atypicality for moderate outliers than for extreme outliers. We next regressed attributions of situational atypicality (i.e. is this an atypical day?) and found that as outlier extremity increased, individuals increased their attributions of situational atypicality linearly ($b = 0.76$, $SE = 0.06$, $t(457^{10}) = 12.81$, $p < 0.001$) but not curvilinearly ($b = 0.05$, $SE = 0.03$, $t(457) = 1.46$, $p = 0.14$) indicating that extreme outliers were more likely to be judged as representing fluke observations than unusual group members.

Discussion

The results of Study 3 indicate that when a somewhat casually dressed person is part of a more formally dressed group, observers remember the outlier better than other group members and perceive the other members of the group as being more casually dressed themselves and more accepting of casual dress in group members. When the outlier is extremely casually dressed, an attenuated version of this effect occurs for the perceived prescriptive norm but remains un-attenuated for the perceived descriptive norm.

The pattern for both the prescriptive and descriptive norms was largely similar to but slightly different from the pattern of results from Study 1. Consistent with Study 1, perceived descriptive and prescriptive norms shifted in the direction of the outlier. Furthermore, extreme outliers had relatively less effect on prescriptive norms than on descriptive norms. There were two main differences in the results of the two studies. In Study 1, as the outlier became more extreme, perceptions of the descriptive norm began to asymptote, while in Study 3 they

¹⁰ Degrees of freedom in each of these regressions vary and are lower than the total sample because coders could not classify 4-5 of the free responses. Reasons for this included insufficient responses (left blank), nonsensical responses, or irrelevant responses (e.g. "This is James. I remember him.")

continued in their linear pattern. Further, in Study 1 perceptions of the prescriptive norm significantly regressed toward to the control condition whereas in Study 3 perceptions of the prescriptive norm flattened.

Why might differences in the pattern of results emerge in Studies 1 and 3? We suspect they emerge because of a difference in the stimuli used in the two studies that was necessitated by the nature of content differences in the norms used. In Study 1, because arrival time was the focal behavior we were able to keep the objective average of the group constant across outlier conditions. By shifting the focal behavior to formality of dress in Study 3, for reasons explained earlier, we were not able to do this and the average of the group increased with the outlier's extremity. This difference resulted in a shift in the meaning of equal weighting vs. overweighting in the two Studies. Specifically, in Study 1, were participants to weight equally the moderate and extreme outlier, because the means of their groups were similar, this would result in no differences between moderate and extreme outlier conditions. On the other hand, in Study 3, were participants to weight equally the two types of outliers, because the means of their groups were different, this would result in a significant shift in the direction of the outlier between the two conditions. Importantly, what did replicate across the two studies was relative difference between descriptive and prescriptive norms; namely, extreme outliers are given less weight in perceptions of the prescriptive as compared to perceptions of the descriptive norms.

The open-ended results of Study 3 also deepen our understanding of why extreme outliers are more likely to be excluded from perceptions of prescriptive norms than descriptive norms. People are more likely to attribute the behavior of extreme than moderate outliers to an unusual or atypical circumstances. We propose that that it is this assumed unreliability of the extreme outlier's behavior that leads participants to exclude him or her when assessing the prescriptive

norm. Thus, individuals who wear jeans will be incorporated into perceptions of the prescriptive norm if they are viewed as always wearing jeans, but not if they are viewed as only wearing jeans because their suits were all dirty.

Study 4

Studies 1-3 focused on observers' impressions of group members based on a single encounter. Perceptions of group norms often rely on more than a single encounter, thus Study 4 extended the information provided observers to two encounters. Specifically, it examined whether the impact that outliers have on perceptions of their group based on an initial encounter would persist even when their behavior in a second encounter is more normative.

In Study 3 we found that extreme outliers are given less weight than moderate outliers in part because they are viewed as unreliable observations. This would suggest that if individuals were to observe the outlier behaving normally the next day, they should give even less weight to the outlier's previous behavior now that there is confirmation of its unreliability. However, previous research suggests that first impressions are remarkably strong (Kelley, 1950; Nickerson, 1998; Rabin & Schrag, 1999). This suggests that individuals may not dismiss the outlier as quickly as would be rational, because the outlying first impression continues to hold disproportionate weight in the general perception of the group. We therefore hypothesized:

H6: Even after individuals perceive the outlier behaving more normally the next day, the effect of the initial outlying behavior will persist on group perception.

Methods

Participants. Participants were recruited from an online national pool in order to vary the participant sample from the previous studies that recruited participants from Amazon's Mechanical Turk. Four-hundred-and-eighty participants completed the survey. As in previous

studies, we presented participants with two measures to assess whether they viewed the video properly. First, participants were required to enter a code that appeared at the end of the video and those who did not or who entered an incorrect code were removed from analyses ($n = 27$). Second, we asked participants at the end of the survey to indicate if they had difficulty playing the video and those who did were removed ($n = 13$). These removals resulted in a final sample of four-hundred-and-forty individuals, with a majority of women ($n = 307$) and a median age of 32 ($SD = 13.37$). All analyses reported are performed on the pruned sample of participants but remain similar with the additional participants included.

Procedure and measures. The study was a three (outlier extremity: control vs. moderate vs. extreme) by two (number of days observed: one vs. two) design. Because Study 1 established a similar pattern of results for early and late outliers, we included only late outliers in this study in order to conserve resources.

For participants assigned to view only one day of group arrival times, the procedure was the same as that in Study 1. For the other half of participants, instead of proceeding to the distractor task and dependent measures after they finished watching the first video, they were directed to a new page that contained another video with the following message:

Imagine that the previous day of work is now over and it's the next day and people are arriving again. As you watch, please continue thinking about when a member of the team would think it was appropriate to arrive.

These participants then watched a second video. The second video was identical across the three extremity conditions. It never showed an outlier and generally was similar to the control video (see Table 3 for specific arrival times shown in this video). This meant that the individual who was seen to be an outlier in the first video was seen in the second video to arrive at a time closer to the group's average time of arrival.

Once they viewed the second video, participants completed a 3-minute distractor task, after which they completed the dependent measures. These were identical to Study 1, with one notable exception. Because half of the participants watched two different videos, containing sixteen different arrival times, we deemed it unreasonable to ask them to report their recollection of each individual group members' arrival time. Instead, to assess perceptions of the descriptive norm we simply asked them to indicate when they thought most (defined as “~50%”) group members arrived in general. This perception was measured with two items that focused on the lower (“The earliest most members would arrive is:”) and upper (“The latest most members arrive is:”) bounds of the range. Participants were given a slider from 7:30 to 8:45 to indicate each response. We averaged these two values to represent the general perception of the distribution of arrivals.

Results

Our analyses addressed two questions. First, we examined whether the effects observed in Study 1 replicated in those conditions where participants observed the group for only one day of arrivals. Second, we examined whether observing a second day of arrivals altered participants' perceptions of the group norm.

H1-H4: Replicating Study 1. To analyze our results, we treated outlier extremity as a factor and contrast-coded it with one linear and one quadratic contrast. Participants' responses in the single observation condition replicated Study 1's findings, (see Supplemental Materials for descriptive statistics). The later the outlier arrived on Day 1, the later participants assessed the descriptive norm to be ($b = 1.77$, $SE = 0.52$, $t(434) = 3.38$, $p < 0.001$, see Table 4, Model 1). This was qualified by a marginal curvilinear trend ($b = -0.93$, $SE = 0.52$, $t(434) = -1.79$, $p =$

0.07, see Table 4, Model 1), most likely because the effect of outlier extremity on descriptive norms does not increase as the outlier becomes more extreme (see Study 1 Discussion). Our patterns for prescriptive norms similarly replicated those from Study 1. Participants showed a marginally significant linear trend ($b = 0.87$, $SE = 0.51$, $t = 1.71$, $p = 0.088$, see Table 4, Model 4) towards overweighting the outlier. Pairwise t-tests with a Holm correction for multiple analyses verified a significant difference between the control condition and the moderate outlier condition ($p = 0.002$). In addition, participants showed diminished weighting of more extreme outliers in their judgment of the prescriptive norm, replicating the curvilinear pattern ($b = -1.51$, $SE = 0.51$, $t = -2.99$, $p = 0.003$, see Table 4, Model 4).

H6: Effect of multiple days. To test whether observing the group for a second day caused any significant changes in the perceptions of the descriptive and prescriptive norm, we interacted two orthogonal dummy codes, one linear and one curvilinear, with a dummy coded variable representing whether participants viewed one or two days of the group's arrivals. For descriptive norms, as predicted, we found no significant interactions of number of days of observation with either the linear, ($b = 0.14$, $SE = 1.05$, $t(432) = 0.14$, $p = 0.89$), or curvilinear effect of outlier extremity, ($b = 0.60$, $SE = 1.04$, $t(432) = 0.58$, $p = 0.56$, see Table 4, Model 3). However, for prescriptive norms we found a marginal interaction of the curvilinear effect of outlier extremity and number of days of observation ($b = -1.86$, $SE = 1.01$, $t(426) = -1.84$, $p = 0.066$, see Table 4, Model 6). Specifically, when participants observed two days of arrivals their perceptions more strongly showed a linear pattern ($b = 1.47$, $SE = 0.71$, $t(426) = 2.08$, $p = 0.038$) than a curvilinear pattern, ($b = -0.57$, $SE = 0.72$, $t(426) = -0.79$, $p = 0.43$, see Table 4, Model 6).

Discussion

The results from this study offer insight into how the effects found in Studies 1-3 might play out over time. Having observed an individual arrive moderately late on the first day, participants persist in perceiving the group norm for arrival time to be later even if they observed that first-day outlier arrive closer to the rest of the group on the second day. This suggests that not only is observing an outlier capable of biasing inferences about groups on the basis of a single encounter, but it is capable of sustaining biased perceptions of the group norm even when the initial outlier ceases to be an outlier in subsequent encounters. This result comports with prior research on the strength of first impressions (Kelley, 1950; Nickerson, 1998; Rabin & Schrag, 1999).

We found an interesting marginal pattern in prescriptive norm perception over time. Participants who observed an extreme outlier on Day 1, but for whom the outlier then normalized on Day 2, viewed the group norm as more extreme than participants who viewed only the extreme outlier on Day 1. Why might viewing a normal group, in which the outlier has regressed to the mean, cause individuals to perceive a *later* arrival time as more acceptable? Perhaps individuals view the Day 2 arrival time of the Day 1 outlier through the lens of her earlier behavior. On Day 2 the same actor associated with the extreme arrival on Day 1 arrives at 8:18am. Though the target's Day 2 time is not particularly extreme – it would likely raise little notice had it occurred on Day 1 – it may seem more extreme or noticeable in light of the target's extremely late arrival on Day 1. After only Day 1, participants may view the extreme behavior as unreliable, as shown in free responses in Study 3, but on Day 2 the outlier is still the last to arrive perhaps signaling that the extreme behavior from Day 1 is a more reliable signal of the norm. If this is true, we speculate that an extreme outlier, partially regressed to the group mean, may be treated by an observer as more of a moderate outlier. To explore this possibility,

in Figure 8, we graph the results again, but this time, for conditions in which two days of arrivals are observed, we average the extremity of the outlier on Day 1 and Day 2. Participant judgments of the prescriptive norm suggest that they may average the distributions across time in forming their perception of the group. This suggests that first impressions hold sway, but will eventually regress to the mean if behavior stabilizes for long enough.

General Discussion

How are people's representations of a small group's social norms influenced by outliers? Across four studies we showed that the impact of outliers on perceptions of their group's norm depends on their extremity. Moderate outliers shift observers' perception of the descriptive and prescriptive norm disproportionately towards the outlier. Extreme outliers have a different effect on perceptions of the group. As outliers become more extreme, observers are more likely to discount their behavior, shifting their perceptions of the norm, especially the prescriptive norm, back towards the behavior of the rest of the group. We documented this pattern across two behavioral social norms – style of dress and punctuality – and examined how this process might play out over time.

Why Are Outliers Overweighted?

We hypothesized that the greater cognitive availability of outliers would lead them to be overweighted in perceptions of the group's social norm. Our rationale for this hypothesis draws on research and theory on the anchoring and adjustment heuristic. Anchoring and adjustment is traditionally viewed as a subtype of the broader availability heuristic wherein individuals infer frequency from cognitive availability (Chapman & Johnson, 1999). In the classic studies of anchoring and adjustment, experimenters make a numerical anchor salient to participants and then ask participants to make a numerical target judgment (Tversky & Kahneman, 1974). While

participants adjust from the anchor, recognizing it as incorrect or irrelevant, they do so insufficiently, resulting in their responses shifting towards the anchor.

We propose that individuals' perceptions of outliers reflect a similar form of anchoring and insufficient adjustment. Although individuals may perceive the outlier as non-representative of the central tendency of the group as a whole, we propose they nevertheless fail to adjust sufficiently from him or her when trying to estimate the group's behavior. We can see anchoring and adjustment at work in participants' recollections of the individual arrival times of each group member. Individuals anchor on the salient arrival time of the outlier, and then adjust the arrival time of the group member nearest the outlier thereby rendering the outlier's arrival time less extreme. Individuals also adjust recollections of the outliers' arrival, by moving the outlier closer to the other group members' time of arrival, possibly reflecting a motivation to recall group behavior as more consistent across group members than it was (Hamilton & Sherman, 1996).

Why Are Extreme Outliers Given Less Weight than Moderate Outliers?

We propose that there are at least three explanations for why extreme outliers are given less weight than moderate outliers in inferences about the group norm. While these accounts all predict the different weighting of moderate and extreme outliers of extreme outliers, they implicate different, though not mutually exclusive, psychological processes.

The first account suggests that individuals who observe an extreme outlier may tend to discount his or her relevance to the group norm because they see his or her behavior as unreliable—or a fluke. For example, individuals might believe that the extreme outlier in Study 1 is late because of a flat tire on the way to work. When observers attribute an instance of extreme lateness to a flat tire, they can legitimately discount this as a relevant data point for the group norm both because it is non-diagnostic of the group norm and because it likely is an

infrequent occurrence. The inferences found in Study 3 support this process explanation. Participants were more likely to infer that extreme, as compared to moderate, outliers were dressed differently because it was an unusual day, implying that their informal dress was non-diagnostic.

A second explanation for the different impact of moderate and extreme outliers focuses on the inferences perceivers draw about the social status of the two types of outliers. As outliers become more extreme, observers might be more likely to infer something negative about the outlier's character and standing in the group, perhaps that he or she is lazy or inconsiderate. Judgments such as these would be in line with the black sheep effect (Marques et al., 1988), whereby group members become disliked and derogated when they violate group norms. Discounting of the outlier following this type of inference, would occur not because perceivers believe his or her behavior is infrequent but because they believe the behavior is indicative of a norm violator who will be rejected rather than emulated by other group members. That individuals are more likely to assign black sheep status to the target as his or her behavior becomes more extreme would fit the curvilinear pattern observed in Studies 1 and 3. The persuasiveness of this explanation is diminished, however, by the pattern of attributions that participants in Study 3 gave for the extreme outlier's behavior. Participants in Study 3 were more likely to categorize the extreme outlier as having an unusual day but categorize more moderate outliers as unusual individuals. If discounting an extreme outlier is driven by attributions of lower group status, then individuals should be more likely to attribute the outlier's behavior to a dispositional feature, (e.g. "This is a bad group member") than to a situational feature (e.g. "He rode his bike to work").

A third explanation for the greater impact on perceived group norms of moderate than extreme outliers focuses on the tendency not to negatively differentiate extreme outgroup members from their peers but to positively differentiate them. More specifically, observers might infer that the extreme outlier is a disproportionately good group member, or a group leader. Several lines of research (Abrams, Randsley de Moura, Marques, & Hutchison, 2008; Halevy, Berson, & Galinsky, 2011; van Kleef et al., 2011) suggest that individuals infer that those breaking social norms are more powerful because individuals higher in power or leadership are afforded greater license to transgress social norms. Individuals, therefore, might infer from the extreme late outlier's behavior that he or she is a group leader because only the group leader could get away with, or would have an excuse for, such behavior. Participants who make such attributions would be discounting the extreme behavior not because they believe it is counter-normative, but because they believe it is representative of a norm for a different (higher status) reference group. While possible, this account too seems less plausible in light of the pattern of participants' attributions found in Study 3.

Accuracy in Group Perceptions

As noted earlier, the methods and goals of the present research correspond in a number of respect with those that characterize ensemble-coding research in the visual sciences. However, they also differ in important respects that inform our theoretical insights regarding accuracy in group perception. First, ensemble coding studies tend to use a shorter span of exposure to the target stimuli than the present research. Participants typically view the stimuli from anywhere from 200 ms (Whiting & Oriet) to 2 seconds (Ariely, 2001), but it is always a brief span of time. In contrast, our participants view the target group for much longer: each target actor appears on the screen for at least 9 seconds. Participants in ensemble coding experiments also routinely

complete many more trials of the task did the present participants. In addition, research in ensemble coding tends to use a different normative benchmark for accuracy of decisions. Participants are usually asked to make a binary choice with the accuracy of their responses being compared to chance. Researchers conclude that individuals are accurately detecting a signal when they perform at rates better than chance. The standard of accuracy in the present research was much more demanding. Participants in our studies had to recall a set of 8 arrival times.

The differences in method found between the ensemble coding research and the present research reflect the different goals guiding the two types of research. Ensemble coding research aims to understand the near instantaneous visual appraisal of sets of objects or people. As such, the short time span of studies mirrors the processing speed of the visual system. In contrast, understanding a group's social norms can take months of time and the present studies serve as only a starting point in which we examine the smallest unit possible — only 8 group members — in the simplest situation — all data points visible and clearly construed. Given that perceiving a social norm is more deliberative process than visual perception, we assumed that participants would require more time to infer a social norm than they would to encode the crowd's motion, just as they may typically spend more time and cognitive effort considering how to fit in with a group as compared to evaluating the group's gender composition (Haberman & Whitney, 2007).

This extra time provided participants in the present research might have facilitated the errors in judgment found. Participants may have represented the group accurately at the moment of perception, with outlier-driven inaccuracy only emerging when they later recalled the group behavior in order to form impressions of the group and its social norms. Furthermore, the inaccuracy observed in the present study does not preclude the possibility that participants' judgments were still above the equivalent of chance accuracy. Researchers rarely use the

benchmarks of chance versus perfect accuracy in the same study. This makes sense. It would seem inappropriate to use chance accuracy as a comparison when the task for participants is guessing the number of murders in Detroit. Conversely, it would seem inappropriate to use perfect accuracy as a comparison when participants are tasked with comparing a circle to the mean of a series of circles that they previously had seen for a fraction of a second. This pattern, however, leaves unexplored an area between 50 and 100% accuracy which future researchers should examine perception to understand better how these different processes interact to produce subtle distortions in accuracy.

Limitations and Future Directions

This paper serves only as a starting point for understanding how people infer descriptive and prescriptive norms. There are several features of the process that we leave unexplored in this paper and open for future research. First, though we demonstrate our findings across two norms, these two norms are hardly representative of the norms one may encounter every day. For some norms, such as strong social mores, individuals may rarely update their perceptions. For others, such as those relating to behavior rarely directly observed, individuals may have to base their judgments on summaries of hearsay from friends or media reports. In these latter cases, it would be interesting to see, what, if any, counterweight individuals place on less direct sources of information versus direct observation of descriptive behavior.

Furthermore, even in the case of the currently explored norms questions remain. For example, individuals may be more likely to discount even moderate outliers when an obvious explanation – such as a widely reported traffic accident or a weather anomaly – could explain the late arrival. Our results from Study 3 suggest that individuals spontaneously construct stories in explanation of the outlying behavior, and this should only increase when obvious explanations

are readily available. In addition, in this paper we examine only small groups. As groups become larger and the variance in group behavior increases, it is possible that outlying behavior is tolerated more and carries less impact in the gestalt representation. Further, the degree of extremity that is categorized as moderate versus extreme is likely somewhat dependent upon the perceived cohesion and number of the other group members. In a group with 20 normal group members, 15 minutes late may seem more extreme than in our cases where the extremity is balanced by only 7 normal arrivals. In the same way, if the 20 group members are highly variable, one more very late arrival may carry less weight when the group is already encoded as having a weak norm.

Similarly, this paper investigates only the presence of single outliers. It would be interesting to determine when multiple outliers are present whether their effects are additive or diminishing. Furthermore, the coexistence of outliers of varying extremity may produce counterintuitive normalization; in a group with an extreme outlier, a moderate outlier becomes less outlying. With greater exploration of these situations, we can improve not only our understanding of social norms but also our understanding of group perception and social interactions.

Conclusion

Our paper extends theory and research on group perception and social norms by offering insight into how individuals view groups with outliers. Though outliers are an infrequent occurrence, by understanding how we incorporate outlying behavior into our understanding of groups, social psychology may gain insight into a variety of important phenomena. One interesting example of this is social change. When individuals advocate for a change of the *status quo* they are likely to be perceived as outliers in their group, in terms of both attitudes and

behavior. However, in order for these individuals to shift the either outsiders' or insiders' perception of the group's position, they must continue to be considered a part of the group. For example, a dovish Republican must still be perceived as a conservative, and a fiscally conservative Democrat must still be perceived as a member of the Democratic Party, in order for them to have an impact on how their party is perceived. In light of the current research outliers hoping to shift the mean perception of their group may be advised to take moderate positions, lest they be discounted with other extremists.

References

- Abrams, D., Randsley de Moura, G., Marques, J. M., & Hutchison, P. (2008). Innovation credit: When can leaders oppose their group's norms? *Journal of Personality and Social Psychology, 95*(3), 662-678.
- Alvarez, G. A. (2011). Representing multiple objects as an ensemble enhances visual cognition. *Trends in Cognitive Sciences, 15*(3), 122-131.
- Alvarez, G. A., & Oliva, A. (2008). The representation of simple ensemble visual features outside the focus of attention. *Psychological Science, 19*(4), 392-398.
- Alvarez, G. A., & Oliva, A. (2009). Spatial ensemble statistics are efficient codes that can be represented with reduced attention. *Proceedings of the National Academy of Sciences, 106*(18), 7345-7350.
- Ariely, D. (2001). Seeing sets: Representation by statistical properties. *Psychological Science, 12*(2), 157-162.
- Asch, S. E. (1951). Effects of group pressure upon the modification and distortion of judgments. In H. Guetzkow (Ed.), *Group Leadership and Men* (177-190). Pittsburg, PA: Carnegie Press.
- Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). lme4: Linear mixed-effects models using Eigen and S4. *R package version, 1*(7).
- Bellezza, S., Gino, F., & Keinan, A. (2014). The red sneakers effect: Inferring status and competence from signals of nonconformity. *Journal of Consumer Research, 41*(1), 35-54.
- Berger, J. (2011). Arousal increases social transmission of information. *Psychological Science, 22*(7), 891-893.
- Bicchieri, C. (2006). *The grammar of society: The nature and dynamics of social norms*. Cambridge: Cambridge University Press.

- Brady, T. F., & Alvarez, G. A. (2011). Hierarchical encoding in visual working memory: Ensemble statistics bias memory for individual items. *Psychological Science*, 22(3), 384-392.
- Brauer, M. & Chaurand, N. (2010). Descriptive norms, prescriptive norms, and social control: An intercultural comparison of people's reactions to uncivil behaviors. *European Journal of Social Psychology*, 40, 490-499.
- Burr, D. & Ross, J. (2008). A visual sense of number. *Current Biology*, 18(6), 425-428.
- Chapman, G. B., & Johnson, E. J. (1994). The limits of anchoring. *Journal of Behavioral Decision Making*, 7(4), 223-242.
- Chapman, G. B., & Johnson, E. J. (1999). Anchoring, activation and the construction of values. *Organizational Behavior and Human Decision Processes*, 79(2), 115-153.
- Chong, S. C. & Treisman, A. (2005). Representation of statistical properties. *Vision Research*, 43(4), 393-404.
- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58(6), 1015-1026.
- Crandall, C. S. (1988). Social contagion of binge eating. *Journal of Personality and Social Psychology*, 55(4), 588-598.
- Dakin, S. C. & Watt, R. J. (1997). The computation of orientation statistics from visual texture. *Vision Research*, 37(22), 3181-3192.
- Eagly, A. H., & Kite, M. E. (1987). Are stereotypes of nationalities applied to both women and men?. *Journal of Personality and Social Psychology*, 53(3), 451-462.
- Eriksson, K., Strimling, P., & Coultas, J. C. (2015). Bidirectional associations between

- descriptive and injunctive norms. *Organizational Behavior and Human Decision Processes*, 129, 59–69.
- Felps, W., Mitchell, T. R., & Byington, E. (2006). How, when, and why bad apples spoil the barrel: Negative group members and dysfunctional groups. *Research in Organizational Behavior*, 27, 175–222.
- de Fockert, J., & Wolfenstein, C. (2009). Rapid extraction of mean identity from sets of faces. *The Quarterly Journal of Experimental Psychology*, 62(9), 1716–1722.
- Gelfand, M. J., Raver, J. L., Nishii, L., Leslie, L. M., & Lun, J. (2011). Differences between tight and loose cultures: A 33-nation study. *Science*, 332(6033), 1100–1104.
- Goldstein, D. G., & Rothschild, D. (2014). Lay understanding of probability distributions. *Judgment and Decision Making*, 9(1), 1–14.
- Haberman, J., & Whitney, D. (2007). Rapid extraction of mean emotion and gender from sets of faces. *Current Biology*, 17(17), R751–R753.
- Haberman, J., & Whitney, D. (2009). Seeing the mean: ensemble coding for sets of faces. *Journal of Experimental Psychology: Human Perception and Performance*, 35(3), 718–734.
- Haberman, J., & Whitney, D. (2010). The visual system discounts emotional deviants when extracting average expression. *Attention, Perception, & Psychophysics*, 72(7), 1825–1838.
- Hamilton, D. L., & Sherman, S. J. (1996). Perceiving persons and groups. *Psychological Review*, 103(2), 336–355.
- Halevy, N., Berson, Y., & Galinsky, A. D. (2011). The mainstream is not electable: When vision triumphs over representativeness in leader emergence and effectiveness. *Personality and Social Psychology Bulletin*, 37(7), 893–904.
- Kashima, Y., Wilson, S., Lusher, D., Pearson, L. J., & Pearson, C. (2013). The acquisition of

- perceived descriptive norms as social category learning in social networks. *Social Networks*, 35(4), 711–719.
- Kashima, Y., Woocock, J. & Kashima, E. S. (2000). Group impressions as dynamic configurations: The tensor product model of group impression formation and change. *Psychological Review*, 107(4), 914-942.
- Kelley, H. H. (1950). The warm-cold variable in first impressions of persons. *Journal of Personality*, 18(4), 431-439.
- Kunda, Z., & Oleson, K. C. (1997). When exceptions prove the rule: How extremity of deviance determines the impact of deviant examples on stereotypes. *Journal of Personality and Social Psychology*, 72(5), 965–979.
- Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2015). Package ‘lmerTest’. *R package version*, 2-0.
- Marques, J. M., Yzerbyt, V. Y., & Leyens, J.-P. (1988). The “Black Sheep Effect”: Extremity of judgments towards ingroup members as a function of group identification. *European Journal of Social Psychology*, 18, 1-16.
- Miller, D. T., & Prentice, D. A. (2016). Changing norms to change behavior. *Annual Review of Psychology*, 67(1), 6.1–6.23.
- Monin, B., Sawyer, P. J., & Marquez, M. J. (2008). The rejection of moral rebels: Resenting those who do the right thing. *Journal of Personality and Social Psychology*, 95(1), 76–93.
- Morrison, K. R., & Miller, D. T. (2008). Distinguishing between silent and vocal minorities: Not all deviants feel marginal. *Journal of Personality and Social Psychology*, 94(5), 871-882.
- Neilson, L. D., & Simonsohn, U. (2014, September 9). Thirty-somethings are shrinking and other u-shaped challenges. [Web log post]. Retrieved from <http://datacolada.org/2014/09/17/27->

thirty-somethings-are-shrinking-and-other-u-shaped-challenges/

- Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, 2(2), 175-220.
- Nisbett, R. E., & Kunda, Z. (1985). Perception of social distributions. *Journal of Personality and Social Psychology*, 48(2), 297-311.
- Perkins, H. (2003). *The social norms approach to preventing school and college age substance abuse: A handbook for educators, counselors, and clinicians*. San Francisco: Jossey-Bass.
- Paluck, E. L., Shepherd, H., & Aronow, P. M. (2016). Changing climates of conflict: A social network experiment in 56 schools. *Proceedings of the National Academy of Sciences*, 113(3), 566-571.
- Prentice, D. A., & Miller, D. T. (1993). Pluralistic ignorance and alcohol use on campus: some consequences of misperceiving the social norm. *Journal of Personality and Social Psychology*, 64(2), 243-256.
- Rousseeuw, P. J., & Leroy, A. M. (2005). *Robust regression and outlier detection*. New York, NY: John Wiley & Sons.
- Sherif, M. (1936). *The psychology of social norms*. New York, NY: Harper & Brothers Publishers.
- Sweeny, T. D., Haroz, S., & Whitney, D. (2013). Perceiving group behavior: Sensitive ensemble coding mechanisms for biological motion of human crowds. *Journal of Experimental Psychology: Human Perception and Performance*, 39(2), 329-337.
- Rabin, M., & Schrag, J. L. (1999). First impressions matter: A model of confirmatory bias. *Quarterly Journal of Economics*, 114(1), 37-82.
- Tankard, M. E., & Paluck, E. L. (2016). Norm perception as a vehicle for social change. *Social*

Issues and Policy Review, 10(1), 181-211.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases.

Science, 185(4157), 1124–1131.

Van de Bongardt, D., Reitz, E., & Sandfort, T. (2015). A meta-analysis of the relations between

three types of peer norms and adolescent sexual behavior. *Personality and Social*

Psychology Review, 19(3), 203-234.

van Kleef, G. A., Homan, A. C., Finkenauer, C., Blaker, N. M., & Heerdink, M. W. (2012).

Prosocial norm violations fuel power affordance. *Journal of Experimental Social*

Psychology, 48(4), 937–942.

van Kleef, G. A., Homan, A. C., Finkenauer, C., Gündemir, S., & Stamkou, E. (2011). Breaking

the rules to rise to power how norm violators gain power in the eyes of others. *Social*

Psychological and Personality Science, 2(5), 500–507.

Watamaniuk, S. N. & Duchon, A. (1992). The human visual system averages speed information.

Vision Research, 32(5), 931-941.

Whiting, B. F., & Oriet, C. (2011). Rapid averaging? Not so fast!. *Psychonomic Bulletin &*

Review, 18(3), 484-489.

Whitney, D., Haberman, J., & Sweeny, T. D. (2014). From textures to crowds: multiple levels of

summary statistical perception. In J. S. Werner & L. M. Chalupa (Eds.), *The new visual*

neurosciences (695-710). Cambridge, MA: MIT Press.

Tables

Table 1: Arrival Times in Each of the Seven Stimuli Videos in Study 1

	Early Outlier Videos			Control	Late Outlier Videos		
	7:37	7:47	7:54	8:04	8:04	8:03	8:01
	8:11	8:09	8:08	8:05	8:05	8:04	8:03
	8:11	8:11	8:10	8:08	8:05	8:04	8:04
	8:13	8:11	8:10	8:10	8:08	8:07	8:04
	8:16	8:13	8:12	8:10	8:10	8:09	8:07
	8:16	8:16	8:15	8:12	8:10	8:09	8:09
	8:17	8:16	8:15	8:15	8:12	8:11	8:09
	8:19	8:17	8:16	8:16	8:26	8:33	8:43
Mean:	8:10	8:10	8:10	8:10	8:10	8:10	8:10
Mode:	8:11/8:16	8:11/8:16	8:10/8:15	8:10	8:10/8:05	8:04/8:09	8:04/8:09
Median:	8:14.5	8:12	8:11	8:10	8:09	8:08	8:05.5

Note: Each column contains the arrival times for one video shown in Study 1. The outlier in each video is bolded.

Table 2: Arrival Times in Each of the Two Stimuli Videos in Study 2

	Extreme Outlier	Matched Variance
	8:03	7:53
	8:04	8:03
	8:04	8:09
	8:07	8:10
	8:09	8:10
	8:09	8:11
	8:11	8:17
	8:33	8:27
Mean:	8:10	8:10
Mode:	8:04/8:09	8:10
Median:	8:08	8:10
Std. Dev.	9.72	9.84

Table 3: Arrival Times in Each of the Stimuli Videos in Study 4

	Control	Moderate Outlier	Extreme Outlier	Next Day
	8:04	8:04	8:01	8:02
	8:05	8:05	8:03	8:05
	8:08	8:05	8:04	8:09
	8:10	8:08	8:04	8:10
	8:10	8:10	8:07	8:10
	8:12	8:10	8:09	8:11
	8:15	8:12	8:09	8:15
	8:16	8:26	8:43	8:18
Mean:	8:10	8:10	8:10	8:10
Mode:	8:10	8:10/8:05	8:04/8:09	8:10
Median:	8:10	8:09	8:05.5	8:10

Note: The outlier is bolded in the moderate and extreme outlier conditions.

Table 4: Study 4 Regression Analyses

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	DV: Descriptive Norms			DV: Prescriptive Norms		
Linear Contrast	1.77*** (0.75-2.79)	1.77*** (0.74-2.79)	1.69* (0.22-3.16)	0.87+ (-0.13-1.87)	0.88+ (-0.13-1.88)	1.47* (0.09-2.89)
Quadratic Contrast	-0.94+ (-1.96-0.07)	-0.93+ (-1.95-0.09)	-1.22+ (-2.65-0.20)	-1.51*** (-2.50-0.52)	-1.52*** (-2.52-0.53)	-0.57 (-1.98-0.84)
# of Days (0 = 2 Day, 1 = 1 Days)		0.35 (-0.83-1.53)	0.35 (-0.83-1.53)		-0.26 (-1.41-0.89)	-0.26 (-1.41-0.89)
Linear * Days			-0.15 (-2.20-1.91)			-1.22 (-3.22-0.78)
Quadratic * Days			-0.60 (-2.64-1.44)			-1.86+ (-3.84-0.12)
Constant	2.95*** (2.36-3.54)	3.13*** (2.30-3.96)	3.12*** (2.29-3.96)	0.17 (-0.40-0.75)	0.04 (-0.78-0.86)	0.03 (-0.79-0.85)
Observations	438	438	438	432	432	432
Notes:	+p<.10 *p<.05 **p<.01 ***p<.001					

Figures

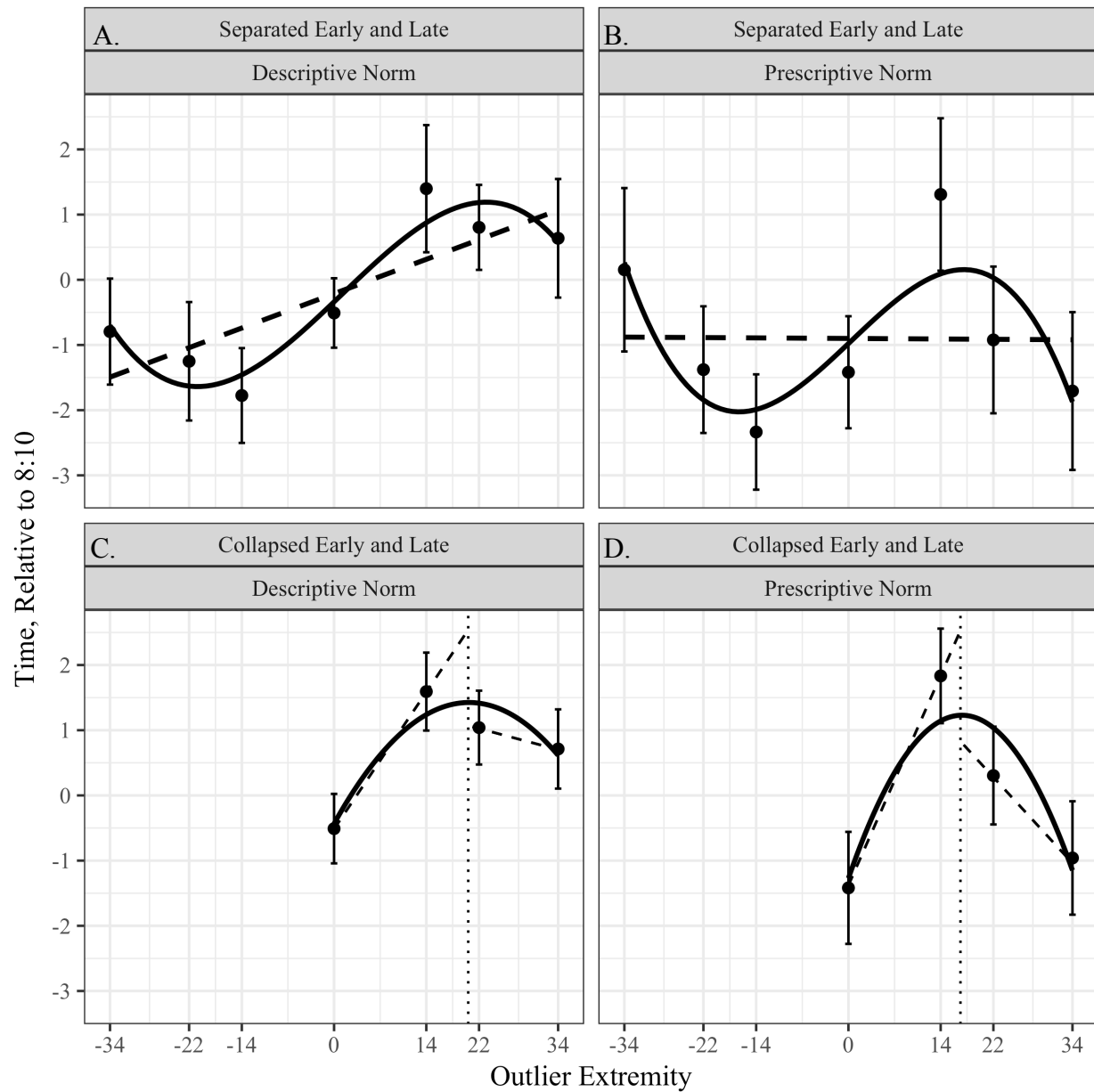


Figure 1. Perceptions of the descriptive (A, C) and prescriptive norm (B, D) as a function of the extremity of the outlier in Study 1. In panels A and B, early outliers in videos are represented as negative x values. In panels C and D, early and late outliers of equal extremity have been combined. In all graphs outlier extremity represents the number of minutes between the outlier's arrival time and the next closest arriving group member in the video stimuli. Error bars represent 95% confidence intervals.

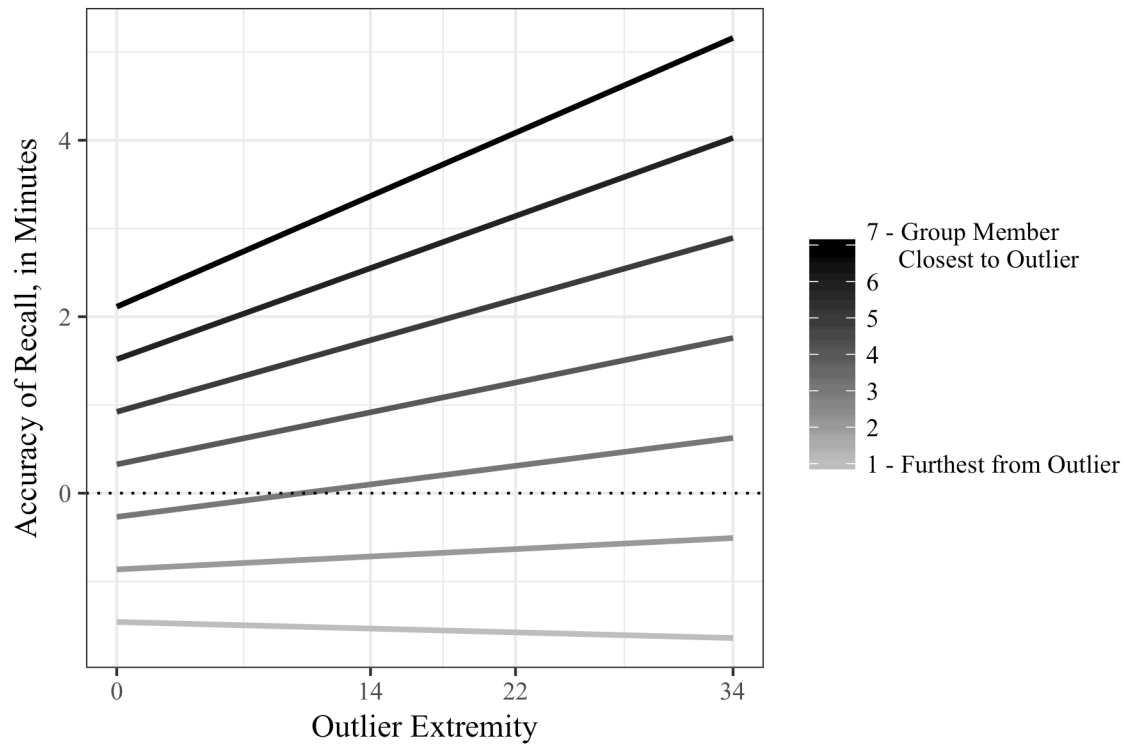


Figure 2. Accuracy of recall for each group member (excluding the outlier) as a function of the extremity of the outlier and the order of arrival. Zero on the y-axis reflects accurate recall, positive values reflect inaccuracy in the direction of the outlier, while negative values reflect inaccurate recall away from the outlier. Early and late outliers are collapsed based on outlier extremity. The lines graphed are lines of best fit based on a mixed-model multilevel model predicting accuracy from an interaction of outlier extremity and a dummy code for arrival order.



Figures 3-6. Example of the photo stimuli for the style of dress shown for the main 7 group members in Study 3, (far left and center left) followed by the photo stimuli for the moderate outlier (center right) and the photo stimuli for the extreme outlier (far right).

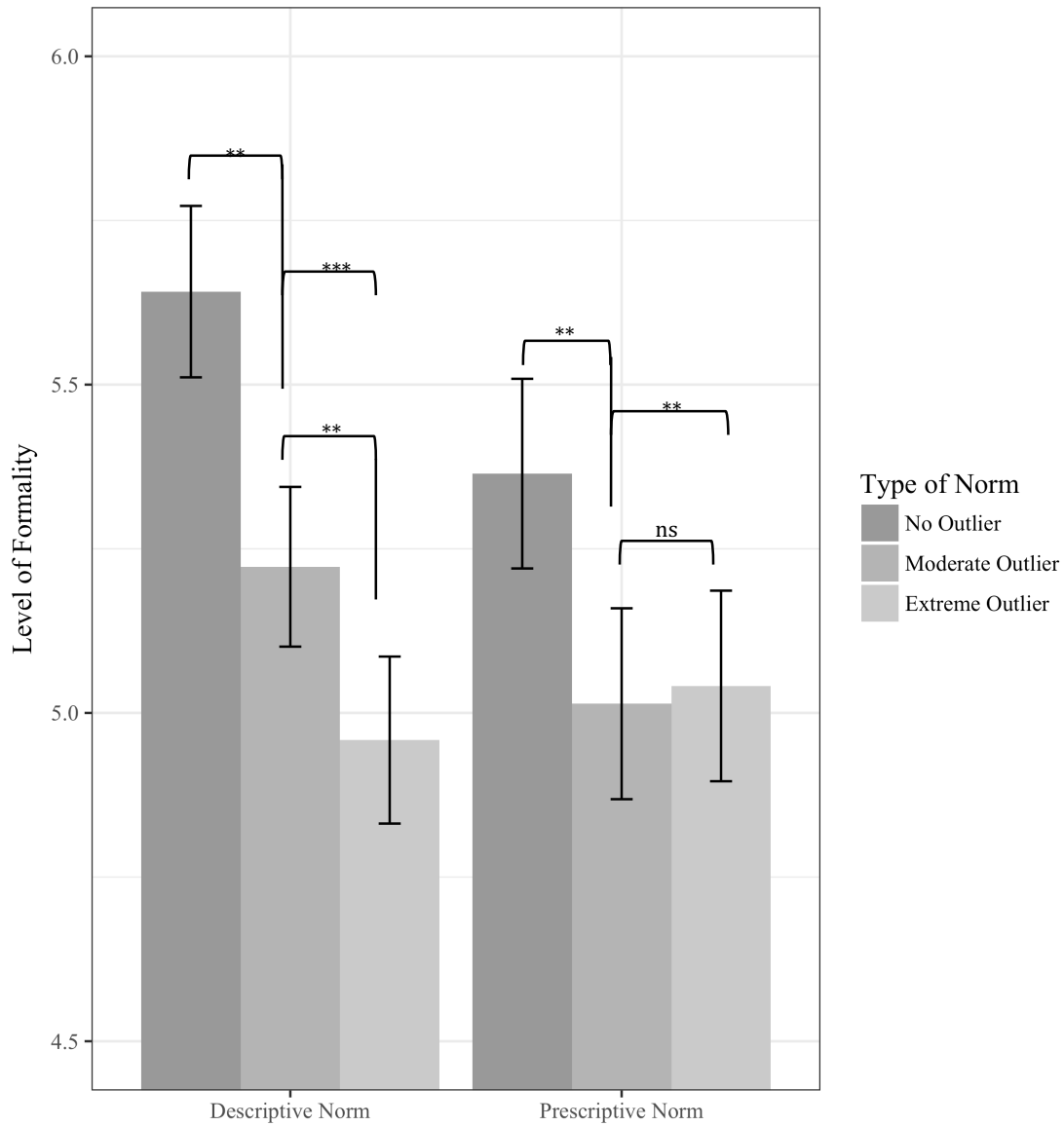


Figure 7. Participants' inferences of the descriptive and prescriptive norm in groups with no, moderate, or extreme outliers from Study 3. *** $p < 0.001$, ** $p < 0.01$ from Holm corrected t-tests. Error bars are 95% confidence intervals.

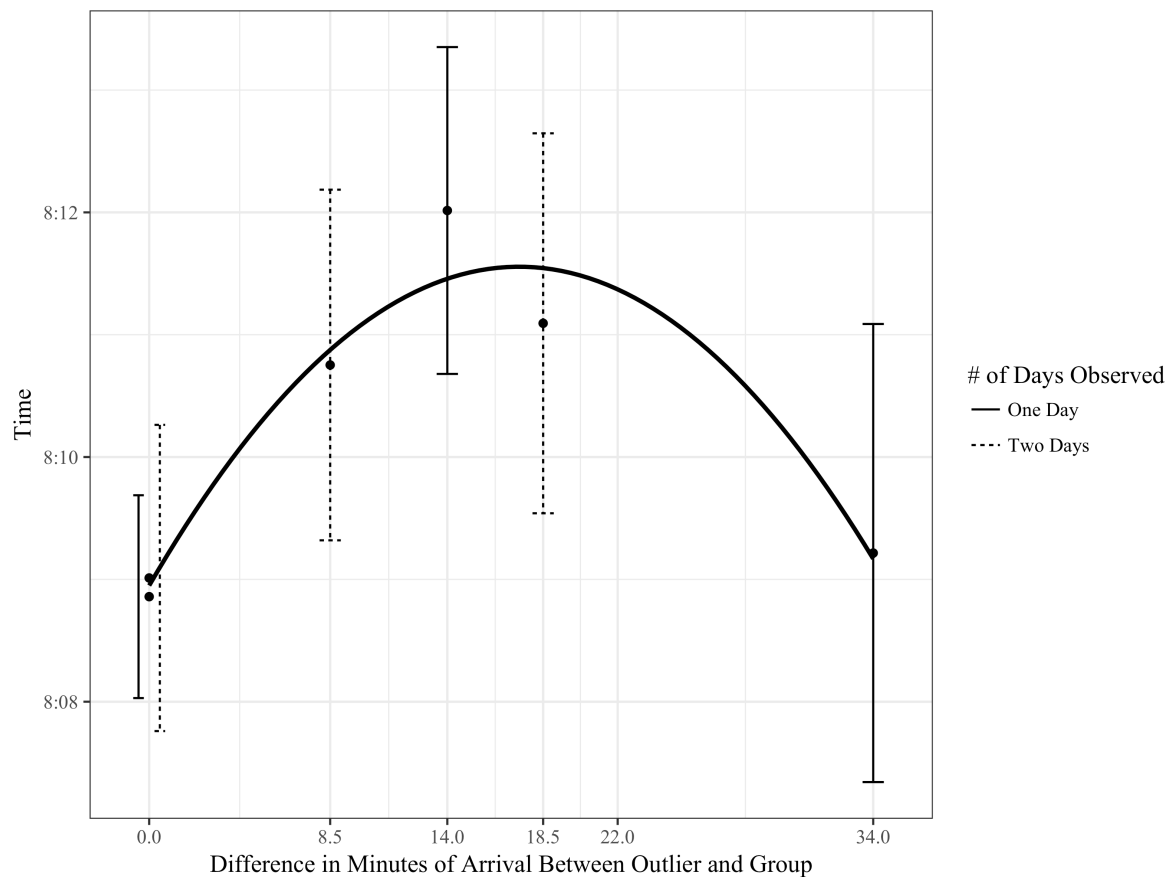


Figure 8. Participant inferences of the prescriptive norm as a function of outlier extremity. The dotted lines represent the average extremity if one averages both days: $(34 \text{ minutes later} + 3 \text{ minutes later})/2 = 18.5$; $(14 \text{ minutes later} + 3 \text{ minutes later})/2 = 8.5$.