Threat(s) and Conformity Deconstructed: Perceived Threat of Infectious Disease and its Implications for Conformist Attitudes and Behavior

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Abstract

Threat has been linked to conformity, but little is known about the specific effects of different kinds of threat. We test the hypothesis that perceived threat of infectious disease exerts a unique influence on conformist attitudes and behavior. Correlational and experimental results support the hypothesis. Individual differences in Perceived Vulnerability to Disease predict conformist attitudes; these effects persist when controlling for individual differences in the Belief in a Dangerous World. Experimentally-manipulated salience of disease threat produced stronger conformist attitudes and behavior, compared to control conditions (including a condition in which disease-*ir*relevant threats were salient). Additional results suggest that these effects may be especially pronounced in specific domains of normative behavior that are especially pertinent to pathogen transmission. These results have implications for understanding the antecedents of conformity, the psychology of threat, and the social consequences of infectious disease.

Keywords: Attitudes, Conformity, Social Cognition, Defensive Processes, Illness Cognition

Conformity pressure is a ubiquitous part of social life, and the psychology of conformity manifests in many different guises. Children are expected to conform to the directives of parents, teachers and other authority figures, and are often punished if they don't. As adults too, people are expected to adopt the beliefs and behavioral norms of their social groups, and may be socially rejected if they don't (e.g. Festinger, Gerard, Hymovitch, Kelley, & Raven, 1952; Festinger & Thibault, 1951; Schacter, 1951). Indeed, failures to conform to enduring group or cultural norms (e.g., incest taboos) are often viewed by others not merely as an embarrassing social *faux pas*, but as a contemptible moral transgression as well.

The prevalence of conformity in social life can be understood as a consequence of the fact that, although conformity can be costly (it inhibits innovation), it can be beneficial too. Many social norms provide a basis for predictable interaction and efficient decision-making; the collective benefits associated with sociality require some level of conformity to those norms. In addition, many norms provide buffers against specific risks and hazards. (Norms regarding reciprocity reduce the likelihood of being cheated in exchange relationships; norms regarding interactions with other animals reduce the likelihood of predation; norms regarding hygiene and food preparation inhibit the spread of infectious diseases, and so forth.) Normative transgressions not only put transgressors at risk, they may also increase risks to others in the local population. Given these benefits of conformity, there may have evolved fundamental psychological tendencies that dispose people toward conformity (Henrich & Boyd, 1998; Henrich & Gil-White, 2001). Consistent with this analysis, empirical research reveals that individuals are guided by heuristic processes that incline them to adopt the attitudes of popular

majorities, to obey the advice of authorities, to maintain the *status quo*, and to respond aversely to those who don't (Asch, 1956; Cialdini & Goldstein, 2004; Eidelman & Crandall, 2009; Jost & Hunyady, 2005; Kruglanski, Pierro, Mannetti, & De Grada, 2006; Milgram, 1974; Sechrist & Stangor, 2001; Wheatley & Haidt, 2005).

This natural tendency toward conformity is variable across both persons and situations. Many different variables influence conformist attitudes and behaviors (Cialdini & Goldstein, 2004; Hogg, 2010). Of particular relevance here is the perception of threat. Given that many norms provide beneficial buffers against risks and hazards, it follows that individuals may show especially strong conformist tendencies under conditions in which they feel especially vulnerable to risks and hazards. Abundant evidence supports this analysis. Right-wing authoritarianism (which is defined substantially by socially conservative attitudes and adherence to the status quo) correlates positively with individual differences in the belief that the world is a dangerous place (Altemeyer, 1988) and is increased under threatening circumstances (Feldman & Stenner, 1997; Sales, 1973). Experimental manipulations that facilitate accessibility of danger- or death-related thoughts lead to increased conformity to majority opinion (Renkema, Stapel, & Van Yperen, 2008; Griskevicius, Goldstein, Mortensen, Cialdini, & Kenrick, 2006).

Does the Threat of Infectious Disease Exert a Unique Impact on Conformity?

Threat is broad and non-specific construct. Qualitatively different kinds of threats influence human health and welfare, and these distinct kinds of threat elicit distinct neurochemical, affective, cognitive, and behavioral responses, (e.g., Cottrell & Neuberg, 2005; Neuberg, Kenrick, & Schaller, 2011; Plutchik, 1980). Previous research linking threat to conformity has not attended closely to these distinctions. It remains unknown whether different forms of threat have psychologically distinct implications for conformity. We focus here on the threat of infectious disease. There are several reasons to suspect that threat of infectious disease may exert a unique – and perhaps especially potent – influence on conformity.

One reason pertains to the antiquity and ubiquity of disease. Disease-causing parasites have been present within human populations throughout history and, as a consequence, have imposed powerful selective pressures on the evolution of human physiology and behavior (Wolfe, Dunavon, & Diamond, 2007; Zuk, 2007). A second reason pertains to the enormous impact that infectious diseases have had on human health and welfare. It has been conjectured that infectious diseases have likely claimed more lives than all wars, non-infectious diseases, and natural disasters combined (e.g. Inhorn & Brown, 1990). A third reason pertains to the mysteriousness of infectious disease. Unlike most other threats to human welfare (e.g., intergroup violence, predation by larger mammals), most disease-causing parasites are invisible. Prior to recent scientific advances (the microscope, germ theory, pharmacology) the causes of infectious disease, and means of mitigating their transmission, were inaccessible to logical analysis. Disease control therefore depended substantially on the development of behavioral norms that reduced the risk of infection, and on semi-superstitious adherence to those norms; this remains evident in contemporary foraging societies that have no access to modern healthcare, wherein most social norms operate as prescriptions to avoid illness in some way (Fabrega, 1997).

If indeed social norms historically served an essential rule in blunting the powerful threat posed by infectious diseases, it follows that the perceived threat of infectious disease may exert a similarly powerful influence on conformist attitudes and behaviors. If so, this influence may be psychologically distinct from effects associated with other threats to human welfare.

Several bodies of evidence are somewhat relevant to this hypothesis, including research on disgust -- the emotional experience most closely connected to the perceived risk of disease transmission (Oaten, Stevenson, & Case, 2009; Curtis, de Barra, & Aunger, 2011). The arousal of disgust leads to greater contempt in response to counter-normative behavior (e.g., Wheatley & Haidt, 2005); individuals who are more chronically sensitive to disgust likewise hold more politically conservative attitudes (Inbar, Pizarro, & Bloom, 2009; Terrizzi, Shook, & Ventis, 2010), and also recommend more lengthy sentences for criminals (Jones & Fitness, 2008). However, disgust is not specific to disease threat (it serves as a signal of other kinds of threats as well; Rozin, Haidt, & Fincher, 2009); consequently, these results do not bear directly on the current hypothesis. Additional evidence has emerged from cross-national studies of societal outcomes: Ecological variation in pathogen prevalence predicts societal variation in collectivistic value systems, authoritarian political structures, and societal conformity pressure (Fincher, Thornhill, Murray, & Schaller, 2008; Murray & Schaller, 2010; Murray, Trudeau, & Schaller, 2011; Thornhill, Fincher, & Aran, 2009). These effects remain significant even when controlling for additional variables. However, results found on population-level outcomes may be explained by causal mechanisms that are conceptually independent of individual-level psychological processes (e.g., genetic or cultural evolution; Schaller & Murray, 2011).

In sum, while various bodies of evidence are obliquely relevant, there is no extant evidence that directly tests the hypothesis that perceived threat of infectious disease influences individuals' conformist attitudes and behavior (and that this effect is distinct from the influence of other threats to individuals' welfare).

If such an effect exists, an additional question arises: Just how specific might this effect be to particular domains of normative behavior? The effect of disgust on moral judgments has been found across a variety of behavioral domains, some of which have no clear implications for disease transmission (e.g., shoplifting; Wheatley & Haidt, 2005). Similarly, collectivistic and authoritarian value systems (which are correlated with pathogen prevalence in cross-national analyses; Fincher et al., 2008; Thornhill et al., 2009) have pervasive implications across behavioral domains. It is plausible that disease threat may trigger conformist attitudes that are expressed broadly, even in domains of normative behavior that serve no obvious disease-buffering function. Nevertheless, if indeed the psychology of conformity serves as a functional defense against the threat of pathogen transmission, it is also plausible that the effect of disease threat on conformist attitudes may be especially pronounced within specific behavioral domains (such as food preparation and personal hygiene) that have especially clear implications for pathogen transmission. No prior research has tested this subsidiary hypothesis.

Overview of the Present Investigation

We employed two methodological strategies to examine the effects of disease threat on conformist attitudes and behavior. One strategy focused on individual differences. We assessed chronic individual differences in *perceived vulnerability to disease* (Duncan, Schaller, & Park, 2009), and tested whether individuals who felt more chronically vulnerable to infectious disease also exhibited more strongly conformist attitudes and behavior. Importantly, we also tested whether these predicted correlations remained when statistically controlling for individual differences in concerns pertaining to other (disease-irrelevant) threats. This allowed us to test whether perceived vulnerability to disease exerted a statistically unique effect in predicting conformity.

The second strategy employed the inferential rigor of experimental methods. We tested whether the experimentally-manipulated salience of infectious disease led to stronger conformist attitudes and behavior. Importantly, we included a control condition in which other threats (non-relevant to infectious disease) were made salient. This allowed us to test whether the salience of infectious disease exerted an especially potent influence on conformity.

All participants completed a set of dependent measures that assessed (a) self-reported conformist attitudes, (b) liking for people with conformist personality traits, (c) valuation of obedience, and (d) behavioral conformity to majority opinion. These measures did not distinguish between different domains of normative behavior, and so cannot test the subsidiary hypothesis that disease threat may trigger conformist attitudes most strongly within specific behavioral domains. However, before data collection was completed, we added two measures specifically designed to test this additional hypothesis. Therefore, a subset of participants also completed measures that assessed evaluative responses to people who either (a) violated norms or (b) conformed to normative pressure, in behavioral domains that either were highly relevant to disease-transmission (e.g., food preparation) or were not (e.g., motor vehicle operation). Results on these additional measures provide preliminary evidence bearing on the subsidiary hypothesis.

Methods

Participants

Participants were 217 undergraduate students (172 women, 45 men; mean age 20.2 years) at the University of British Columbia. They volunteered to earn extra credit in undergraduate psychology courses. Participants were randomly assigned to one of three experimental conditions (Disease Threat, Other Threats, Neutral). Because the Disease Threat and Other Threats conditions (and the comparison between them) were of special inferential interest, the random assignment algorithm was designed to assign a higher percentage of participants to these two conditions, relative to the Neutral condition; N's in each condition were 82, 74, and 61, respectively.

Experimental Manipulation of Disease Salience

The experimenter asked each participant a series of questions designed to elicit recollection and verbal description of circumstances from the participant's past. The specific nature of these recollected circumstances varied across experimental conditions. In the *Disease Threat* condition, participants discussed a time when they felt vulnerable to germs or disease. In the *Other Threats* condition, participants discussed a time when they feared for their physical safety. In the *Neutral* condition, participants discussed the activities that they had engaged in during the previous day.

In all conditions, experimenters elicited detailed descriptions of participants' thoughts and feelings by prompting participants with questions from a common list (e.g. “What emotions were you feeling during this situation?”). All participants spent approximately 3 - 5 minutes engaged in detailed verbal recollection and description of the intended set of circumstances. In order to ensure a continuing psychological effect of the manipulation throughout the duration the experimental session, participants were asked to recall the same event again, approximately 10 minutes later, in the context of completing the dependent variables (described below). Specifically, participants were asked to describe, in writing, "the event/events that you discussed

with the experimenter a few moments ago" and "the emotions and physical reactions... that you had in response to these events."[1]

Primary Dependent Measures

Behavioral Conformity with Majority Opinion. Participants were presented with a potential scenario in which their university might change the numerical scale on which course grades are reported on student transcripts, and were asked to indicate whether they agreed or disagreed with this potential change by putting a penny (provided by the experimenter) into one of two clear plastic cups, labelled “AGREE” or “DISAGREE”. One of the cups already contained 3 pennies, and the other already contained 25 pennies -- indicating a substantial majority opinion offered collectively by prior participants. (In fact, the pennies were placed in the cups by the experimenter prior to participant's arrival; the apparent majority preference for "AGREE" or "DISAGREE" was counterbalanced.) Conformity was indicated by whether participants placed their penny in the cup containing the majority of existing pennies.

Liking for People with Conformist Traits. Participants were presented with brief descriptions of nine same-sex individuals, and were asked to rate how much they would like to have each person as a friend. One description explicitly connoted a conformist disposition (described as conventional and traditional), and two descriptions connoted nonconformist dispositions (one described as untraditional and original, and the other as artistic and creative). Ratings were made on 7-point scales (higher values indicated greater liking). After reverse-scoring ratings for the two non-conformists, the mean of these three ratings was computed to create a single index indicating liking for people with conformist traits.

Valuation of Obedience. Participants were asked to assign monetary values to different personal qualities that children can be encouraged to learn. They were provided a hypothetical budget of $100 and instructed to allocate specific dollar amounts from this budget to each of seven specific qualities, as a means of indicating how much "I would like to encourage my children" to possess each quality. (The seven qualities listed were: Hard-working, Financially wealthy, Independent, Open-minded, Determined/Motivated, Religious, and Obedient). Our analyses focused on dollar values assigned to the trait "Obedient."[2]

Self-Reported Conformist Attitudes. Participants completed a questionnaire -- developed by the authors for the purposes of this study -- that included 6 statements endorsing conformist attitudes (e.g., “Breaking social norms can have harmful, unintended consequences”). Participants indicated the extent to which they agreed with each statement on a 6-point rating scale (1 = strongly disagree, 6 = strongly agree). A measure of self-reported conformist attitudes was computed as the mean rating across these items. (Principal components analysis of the 6 items yielded a clear one-factor solution, with only one eigenvalue > 1, accounting for 44% of variance; Cronbach’s alpha = .77.)

Ancillary Variables Assessing Domain-Specific Differences in Conformist Reactions

Part-way through the study, two additional measures were added, each of which was designed to assess the extent to which participants exhibited more conformist responses in disease-relevant (compared to non-relevant) domains of normative behavior. Therefore, a subset of 92 participants (75 women, 17 men) completed these two additional measures.

Difference in Perceived Severity of Normative Transgressions. Participants were presented with 12 scenarios in which individuals transgressed against a social norm. Five scenarios described transgressions that were overtly relevant to pathogen transmission (e.g. a

butcher changes the date of expired meat to sell it as new meat; a hotel maid fails to disinfect a hotel room but reports that she has). The remaining scenarios described transgressions in disease-irrelevant domains of behavior (e.g. a bus driver drives with an expired license; a mechanic installs a car part that he knows to be unsafe). Participants rated the seriousness of each transgression on a 9-point scale (1 = not at all serious, 9 = extremely serious). We subtracted the mean rating of non-relevant transgressions from the mean rating of disease-relevant transgressions, to compute a single index measuring the domain-specific difference in perceived severity of normative transgressions.

Difference in Perceived Correctness of Conformist Choices. Participants were presented with 6 scenarios in which individuals chose to conform to majority opinion rather than following their own intuitions. Three of these scenarios described conformist behavior in disease-relevant domains (e.g., a woman in a public restroom conforms to collective pressure to spend extra time washing her hands, despite her desire to conserve water). Three other scenarios described conformist behavior in disease-irrelevant domains (e.g., a woman conforms to collective pressure to choose a particular topic for a group project, even though she thinks it's a poor choice). On 9-point scales, participants rated the extent to which each individual took the right course of action (1 = completely the wrong course of action, 9 = completely the right course of action). We subtracted mean ratings for non-relevant scenarios from the mean ratings for disease-relevant scenarios, to create a single index measuring the domain-specific difference in perceived correctness of conformist choices.

Individual Difference Measures Pertaining to Threat

All participants completed an additional set of questionnaires that assessed chronic personality traits and demographic information. Included were two individual difference measures of particular relevance.

Perceived Vulnerability to Disease. Participants completed a 15-item questionnaire assessing Perceived Vulnerability to Disease (PVD; Duncan et al., 2009). The questionnaire has two subscales. An 8-item "Germ Aversion" subscale (PVD-GA) measures individuals' discomfort in situations that imply high likelihood of pathogen transmission (e.g. “I don’t like to write with a pencil someone else has obviously chewed on”). A 7-item "Perceived Infectability" subscale (PVD-PI) measures individuals' explicit beliefs that they are susceptible to contracting infectious diseases (e.g. “I am more likely than the people around me to catch an infectious disease”). Psychometric analyses indicate good internal reliability of both subscales; the subscales are only moderately correlated, and typically predict different psychological outcomes. Previous research suggests that the Germ Aversion subscale may be more predictive of variables obliquely related to conformity (e.g. it is positively associated with Need for Structure, and is negatively associated with the personality trait Openness to Experience; Duncan et al., 2009).

Belief in a Dangerous World. Participants completed the 12-item Belief in a Dangerous World questionnaire (BDW; Altemeyer, 1988), which assesses concerns about other (disease-irrelevant) threats to human welfare. (Example items: “There are many dangerous people in our society who will attack someone out of pure meanness, for no reason at all”; “Every day, as our society becomes more lawless and bestial, a person's chances of being robbed, assaulted, and even murdered go up and up.”) Previous research indicates good internal reliability, and good predictive validity as well (e.g. Altemeyer, 1988; Schaller, Park, & Mueller, 2003).

Results

Predictive Effects of Perceived Vulnerability to Disease

Table 1 presents zero-order correlations involving Perceived Vulnerability to Disease (PVD), Belief in a Dangerous World (BDW) and the four primary dependent measures individually.[3] These results indicate no meaningful effects of Perceived Infectability (PVD-PI), but there were statistically significant predictive implications of Germ-Aversion (PVD-GA) on 3 of the 4 individual independent variables. People who were more chronically germ-averse reported stronger conformist attitudes, greater liking for people with conformist traits, and a higher monetary value on obedience (r's = .40, .16, and .24, respectively; p's< .05). The four primary dependent measures were all positively intercorrelated; consequently, we computed an aggregate conformity score for each participant by standardizing values on each measure (conversion to z-scores) and then computing the mean z-score across the four measures. PVD-GA correlated positively with this aggregate conformity index ($r = .35$, $p < .001$).

Do these relations persist even when statistically controlling for BDW (which also correlated significantly with 3 of the 4 primary dependent measures, and with the aggregate conformity index)? We conducted separate regression analyses on the aggregate conformity index and on each of the 4 individual dependent measures, with PVD-GA and BDW entered simultaneously as predictor variables. Results of these analyses are summarized in Table 2. Notably, the unique effect of PVD-GA was significant for 2 of the 4 primary measures, and near-significant for a third. (By comparison, the unique effect of BDW was significant for 1 measure, and near-significant for two others.) An additional regression analysis revealed that PVD-GA was a significant unique predictor of the aggregate conformity index ($\beta = .26$, $p < .001$), as was BDW ($\beta = .25$, $p < .001$).

Is the predictive effect of PVD-GA especially pronounced in behavioral domains that are more pertinent to pathogen transmission? PVD-GA correlated positively with the two ancillary difference-score measures assessing the extent to which perceived severity of normative transgression and the perceived correctness of conformist choices are stronger in disease-relevant domains compared to non-relevant domains of normative behavior: r's = .18 and .21, p's = .092 and .044, respectively. (Correlations between BDW and these two measures were -.13 and .11; both p's > .20). We conducted regression analyses on each difference-score measure, with PVD-GA and BDW entered simultaneously as predictor variables. Results of these two regression analyses are summarized in Table 3. Results reveal that, when controlling for BDW, PVD-GA is a significant predictor of a tendency to judge normative transgressions more severely in disease-relevant domains, and a marginally significant predictor of a tendency to more strongly endorse conformist choices in disease-relevant domains.

Impact of the Disease Salience Manipulation

Did the experimental manipulation exert a causal influence on conformist attitudes and behavior? In order to first test whether experimental condition accounted for a significant portion of variance across measures, the four primary conformity measures (behavioral conformity, liking for people with conformist traits, valuation of obedience, self-reported conformist attitudes) were included as dependent variables in a multivariate analysis of variance (MANOVA), with experimental condition (Disease Threat, Other Threats, Neutral) as the independent variable. The multivariate test was significant, exact $F(2, 212) = 2.01$, $p = .043$, revealing an overall influence of the manipulation across the four measures. Univariate

ANOVAs on each of the four dependent variables revealed a significant effect of condition on behavioral conformity, $F(2, 214) = 4.84$, $p = .009$, a near-significant effect on liking for people with conformist traits, $F(2,214) = 2.77$, $p = .06$. (The univariate ANOVAs on conformist attitudes and valuation of obedience were non-significant, p's = .12 and .13 respectively).

These omnibus F tests were followed by a set of 3 planned contrasts which compared the means in each of the three experimental conditions. Table 4 presents means, standard deviations, and results of the pairwise contrasts on all 4 primary dependent measures. Of particular inferential interest are the pairwise contrasts on the two measures for which the omnibus univariate F test was either significant (behavioral conformity) or near-significant (liking for people with conformist traits). Behavioral conformity was highest in the Disease Threat condition; this mean was significantly higher than in the Neutral condition, and near-significantly higher than in the Other Threats condition. Liking for people with conformist traits was also highest in the Disease Threat; this mean was near-significantly higher than in the Neutral condition, and significantly higher than in the Other Threats condition. On neither of these measures did the difference between the Other Threats and Neutral conditions approach significance.

Additional pairwise contrasts also compared mean values of the aggregate conformity index. (A one-way ANOVA revealed a significant effect of experimental condition on this index, $F(2,214) = 6.16$, $p = .002$). Results revealed that the mean aggregate conformity score in the Disease Threat condition was significantly higher than in the Neutral condition ($t = 3.20$, $p = .002$), and also higher than in the Other Threats condition ($t = 2.73$, $p = .007$). (The mean aggregate conformity score was higher in the Other Threats condition than in the Neutral condition, but this difference did not approach statistically significance, $t = .60$, $p = .55$.)

To test the subsidiary hypothesis, we examined responses on the two difference-score measures assessing the extent to which conformist attitudes are exhibited more strongly in disease-relevant domains of normative behavior. Across all participants who completed these measures, mean values on both measures were significantly greater than 0 (both t's > 10, p's < .001), indicating that normative transgressions were generally perceived to be more severe in disease-relevant domains, and that conformist choices were generally perceived to be more correct in disease-relevant domains. Were these domain-specific differences greater under conditions of disease threat? Table 5 summarizes the impact of the experimental manipulation on both difference-score measures, and also summarizes the results of 3 planned pairwise contrasts. Mean values on both indices were highest in the Disease Threat condition, but a statistically significant difference between experimental conditions emerged only on the measure of domain-specific differences in perceived severity of normative transgressions: Compared to participants in the Neutral condition, participants in the Disease Threat condition showed an especially strong tendency to judge normative transgressions to be more severe in behavioral domains with clear implications for pathogen transmission ($p = .008$).

Discussion

Individual differences in perceived vulnerability to disease predicted conformist attitudes; this effect was largely independent of concerns pertaining to threats non-relevant to disease. These correlational results are corroborated by experimental results: When the threat of infectious disease was temporarily salient, people expressed greater liking for people with conformist traits and exhibited higher levels of behavioral conformity; no comparable increase in conformist attitudes and behavior followed from temporarily salience of threats that were non-

relevant to disease. These results support the hypothesis that the perceived threat of infectious disease exerts an especially potent (and perhaps psychologically unique) influence on individuals' conformist attitudes and behavior.

Additional results provided some evidence that the positive relation between disease threat and conformist attitudes may emerge especially strongly in contexts that have potentially pathogenic consequences. These results offer preliminary support for the subsidiary hypothesis that the effects of disease threat on conformity may be particularly pronounced in domains of normative behavior that are especially pertinent to disease transmission.

It is important to note that, given the nature of the experimental manipulation, the experimenter was not blind to participant's experimental condition. However, for two reasons, this methodological limitation seems unlikely to undermine the validity of the results. First, only one of the primary dependent measures involved any meaningful interaction between experimenter and participant; all other measures were questionnaire-based, with instructions provided in written form on paper rather than through interaction with the experimenter. This substantially eliminated opportunities for the experiment to influence participant responses. Second, the between-condition results (showing greater conformity in the Disease Threat condition) are conceptually replicated by results involving individual-difference measures (showing that PVD-GA uniquely predicted conformity). The latter finding cannot have been influenced by experimenter's knowledge of participant's condition. No explanation based on the experimenter knowledge can offer a complete alternative account of the results of this study.

While the overall pattern of results is fairly consistent, there was some variability in effects across different methods and measures. For instance, analyses of individual differences revealed statistically significant effects of belief in a dangerous world (BDW) on conformist measures, but there was no significant increase in conformity in the Other Threats condition compared to the Neutral condition. The former finding conceptually replicates previous research linking threat to conformity (and extends it by showing that this effect of non-disease-relevant threat is statistically distinct from the effects of disease-relevant threat), but the latter non-effect fails to replicate previous experimental findings (e.g., Griskevicius et al., 2006). There are several possible methodological reasons for this non-replication. First, our experiment employed a different experimental manipulation to arouse disease-irrelevant threat. While the manipulation check indicated that the manipulation was successful in arousing threat-relevant emotions, it may have been less motivationally potent than procedures used in previous experiments. Another methodological difference between our experiment and previous experiments lies in the measures used to assess conformity. Both Griskevicius et al. (2006) and Renkema et al. (2008) reported results showing that non-disease-relevant threats produce increased conformity, but both employed a very specific kind of outcome measure: The extent to which participants agreed with other people's opinions in their self-reported subjective liking of artistic images. Our measures were different, and more diverse. (In our experiment, only one of four primary dependent measures assessed behavioral conformity to others' opinions. It is perhaps worth noting that it was only on this measure that the mean difference between Other Threats and Neutral conditions even approached statistical significance.)

Another apparent inconsistency lies in the finding that the disease salience manipulation had a substantial (and significant) effect on the measure of behavioral conformity, but individual differences in Germ Aversion did not. This is perhaps unsurprising. Personality traits most strongly predict outcomes aggregated across multiple responses in multiple situations, and are less effective in predicting single behavioral responses in specific contexts (Epstein, 1983).

There was also some inconsistency in effects on the two measures assessing domain-specificity in conformist attitudes: The disease salience manipulation had a stronger effect on the measure assessing responses to normative transgression than on the measure assessing responses to conformist choices. This may reflect the fact that, compared to norm-consistent behavior, normative transgressions are evaluated more negatively; consequently, they are more psychologically potent and more likely to produce differentiated responses (Rozin & Royzman, 2001).

Implications and Future Directions

The results underscore the importance of treating threat not a single scientific construct, but instead as a category of psychologically distinct constructs, each with potentially unique implications. This perspective fits with that of Amoebic Self Theory (Burris & Rempel, 2010), and has also proven productive in research on the psychology of prejudice: different threats predict psychologically distinct forms of prejudice (Cottrell & Neuberg, 2005; Neuberg et al., 2011). More generally, different forms of threat may produce psychologically distinct effects on many phenomena pertaining to social cognition and social behavior. Only recently has there emerged a body of work documenting the unique impact of disease threat on psychological responses (Schaller & Park, 2011). Most of this research has focused on social cognition (e.g., person perception and prejudice; Ackerman, Becker, Mortensen, Sasaki, Neuberg, & Kenrick, 2009; Duncan & Schaller, 2009; Faulkner et al., 2004; Park, Schaller, & Crandall, 2007). Our results offer some of the first empirical evidence that disease threat has implications for attitudes and social influence as well.

Just as disease threat may exert unique effects on conformist attitudes, disease threat may also exert unique effects on the cognitive biases that are psychologically consistent with these attitudes (Eidelman & Crandall, 2009; Jost, Glaser, Kruglanski, & Sulloway, 2003). For example, recent research reveals that people treat the mere existence of something (e.g., a policy) as evidence of its goodness (Eidelman & Crandall, 2009). Extrapolating from our results, one might speculate that this "existence bias" will be exaggerated under conditions of disease threat, and that this exaggeration may occur especially when the existing policy is perceived as having immediate implications for pathogen transmission.

An individual's perception of vulnerability to infection need not be calibrated to that individual's actual vulnerability to infection. Our experimental manipulation focused on perception, not reality. Another avenue for future research is to examine the consequences of differences in actual immunocompetence. Previous research reveals that decreased immunocompetence is associated with increased disgust sensitivity and also increased ethnocentrism (Navarette, Fessler, & Eng, 2007). It is possible that individuals who are temporarily immunosuppressed (because of pregnancy, medication, etc.) may also be temporarily more disposed toward conformist attitudes and behaviors. As immunocompetence changes across the lifespan, these changes may have attitudinal consequences as well.

There may also be consequences that reverberate throughout entire populations. A disease epidemic, or even the perceived threat of an epidemic (such as the H1N1 outbreak of 2009), may lead to temporarily higher levels of conformity within populations, and may dispose individuals within those populations to respond more harshly to normative transgressions (perhaps especially in domains with immediate implications for infection). By the same reasoning, societal investments in public health (e.g., vaccination programs, disease eradication programs, and other public policies that reduce vulnerability -- or perceptions of vulnerability --

to the threat posed by infectious diseases) may result in a populace that is not only healthier, but also less beholden to the existing status quo.

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References

Ackerman, J. M., Becker, D. V., Mortensen, C. R., Sasaki, T., Neuberg, S. L., & Kenrick, D. T. (2009). A pox on the mind: Disjunction of attention and memory in the processing of physical disfigurement. *Journal of Experimental Social Psychology, 45*, 478-485.

Altemeyer, B. (1988). *Enemies of freedom: Understanding right-wing authoritarianism*. San Francisco: Jossey-Bass/Pfeiffer.

Asch, S. E. (1956). Studies of independence and conformity: A minority of one against a unanimous majority. *Psychological Monographs, 70* (9, Whole No. 416).

Bond, R. & Smith, P. B. (1996). Culture and conformity: A meta-analysis of studies using Asch's (1952, 1956) line judgment task. *Psychological Bulletin, 119,* 111-137.

Burris, C. T., & Rempel, J. K. (2010). If only I had a membrane: A review of Amoebic Self Theory. *Social and Personality Compass, 4*, 756-766.

Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Review of Psychology, 55,* 591-621.

Cottrell, C. A., & Neuberg, S. L. (2005). Different emotional reactions to different groups: A sociofunctional threat-based approach to "prejudice." *Journal of Personality and Social Psychology, 88*, 770-789.

Curtis, V., de Barra, M., & Aunger, R. (2011). Disgust as an adaptive system for disease avoidance. *Philosophical Transactions of the Royal Society B, 366*, 389-401.

Duncan, L. A., & Schaller, M. (2009). Prejudicial attitudes towards older adults may be exaggerated when people feel vulnerable to infectious disease: Evidence and implications. *Analyses of Social Issues and Public Policy, 9*, 97-115.

Duncan, L. A., Schaller, M., & Park, J. H. (2009). Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. *Personality and Individual Differences, 47,* 541-546.

Eidelman, S., & Crandall, C. S. (2009). A psychological advantage for the status quo. In J. T. Jost, A. C. Kay, & H. Thorisdottir (Eds.), *Social and psychological bases of ideology and system justification* (pp. 85-106). USA: Oxford University Press.

Epstein, S. (1983). Aggregation and beyond: Some basic issues on the prediction of behaviour. *Journal of Personality, 51*, 360-392.

Fabrega, H. (1997). Earliest phases in the evolution of sickness and healing. *Medical Anthropology Quarterly, 11*, 26-55.

Faulkner, J., Schaller, M., Park, J. H., & Duncan, L. A. (2004). Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Processes and Intergroup Behavior*, *7*, 333–353.

Feldman, S., & Stenner, K. (1997). Perceived threat and authoritarianism. *Political Psychology, 18*, 741-770.

Festinger, L., Gerard, H. B., Hymovitch, B., Kelley, H. H., & Raven, B. (1952). The influence process in the presence of extreme deviates. *Human Relations, 5*, 327-346.

Festinger, L., & Thibault, J. (1951). Interpersonal communication in small groups. *Journal of Abnormal and Social Psychology, 46*, 92-99.

Fincher, C. L., Thornhill, R., Murray, D. R., & Schaller, M. (2008). Pathogen prevalence predicts human cross-cultural variability in individualism / collectivism. *Proceedings of the Royal Society B*, *275,* 1379-1385.

Griskevicius, V., Goldstein, N. J., Mortensen, C. R., Cialdini, R. B., & Kenrick, D. T. (2006). Going along versus going alone: When fundamental motives facilitate strategic nonconformity. *Journal of Personality and Social Psychology, 91,* 281-294.

Hamamura, T. & Park, J. H. (2010). Regional Differences in Pathogen Prevalence and Defensive Reactions to the "Swine Flu" Outbreak among East Asians and Westerners. *Evolutionary Psychology, 8*, 506-515.

Henrich, J. & Boyd, R. (1998). The evolution of conformist transmission and the emergence of between-group differences. *Evolution & Human Behavior, 19,* 215-242.

Henrich, J., Gil-White, F., (2001). The evolution of prestige: Freely conferred status as a mechanism for enhancing the benefits of cultural transmission. *Evolution and Human Behavior, 22,* 1–32.

Hogg, M. A. (2010). Influence and leadership. In S. T. Fiske, D. T. Gilbert, & G. Lindzey (Eds.), The handbook of social psychology (5th ed., Vol. 2, pp. 1166-1206). New York: Wiley.

Inbar, Y. Pizarro, D. A., & Bloom, P. (2009). Conservatives are more easily disgusted than liberals. *Cognition & Emotion, 23*, 714-725.

Inhorn, M. C., & Brown, P. J. (1990). The anthropology of infectious disease. *Annual Review of Anthropology, 19*, 89-117.

Jones, A., & Fitness, J. (2008). Moral hypervigilance: The influence of disgust sensitivity in the moral domain. *Emotion, 8*, 613-627.

Jost, J. T., Glaser, J., Kruglanksi, A., & Sulloway, F. J. (2003). Political conservatism as motivated social cognition. *Psychological Bulletin, 129,* 339-375.

Jost, J. T., & Hunyady, O. (2005). Antecedents and consequences of system-justifying ideologies. *Current Directions in Psychological Science, 14*, 260-265.

Kim, H., & Markus, H. R. (1999). Deviance or uniqueness, harmony or conformity? A cultural analysis. *Journal of Personality and Social Psychology, 77,* 785-800.

Kruglanski, A. W., Pierro, A., Mannetti, L., & De Grada, E. (2006). Groups as epistemic providers: Need for closure and the unfolding of group-centrism. *Psychological Review, 113*, 84-100.

Milgram, S. (1974). Obedience to authority: An experimental view. USA: Harper & Row.

Murray, D. R., & Schaller, M. (2010). Historical prevalence of infectious diseases within 230 Geopolitical Regions: A Tool for Investigating Origins of Culture. *Journal of Cross-Cultural Psychology, 41,* 99-108

Murray, D. R., Trudeau, R., & Schaller, M. (2011). On the origins of cross-cultural differences in conformity: Four tests of the pathogen prevalence hypothesis. *Personality and Social Psychology Bulletin, 37*, 318-329.

Navarrete, C. D., Fessler, D. M. T., & Eng, S. J. (2007). Elevated ethnocentrism in the first trimester of pregnancy. *Evolution and Human Behavior, 28,* 60–65.

Neuberg, S. L., Kenrick, D. T., & Schaller, M. (2011). Human threat management systems: Self-protection and disease-avoidance. *Neuroscience & Biobehavioral Reviews, 35*, 1042-1051.

Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin, 135,* 303-321.

Park, J. H., Schaller, M., & Crandall, C. S. (2007). Pathogen-avoidance mechanisms and the stigmatization of obese people. *Evolution and Human Behavior, 28,* 410–414.

Plutchik, R. (1980). A general psychoevolutionary theory of emotion. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience* (Vol. 1, pp. 3-31). San Diego, CA: Academic Press.

Renkema, L. J., Stapel, D. A., & Van Yperen, N. W. (2008). Go with the flow: Conformity in the face of existential threat. *European Journal of Social Psychology, 38,* 747-756.

Rozin, P., Haidt, J., & Fincher, K. (2009). From oral to moral. *Science, 323*, 1179-1180.

Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review, 5*, 296-320.

Sales, S. M. (1973). Threat as a factor in authoritarianism. *Journal of Personality and Social Psychology, 28*, 44-57.

Schacter, S. (1951). Deviation, rejection, and communication. *Journal of Abnormal and Social Psychology, 46*, 190-207.

Schaller, M., & Murray, D. R., (2008). Pathogens, personality, and culture: Disease prevalence predicts worldwide variability in sociosexuality, extraversion, and openness to experience. *Journal of Personality and Social Psychology, 93,* 212-221.

Schaller, M., & Murray, D. R. (2011). Infectious disease and the creation of culture. In M. Gelfand, C. Cychiu, & Y. Hong (Eds.), *Advances in culture and psychology*, pp. 99-151.

Schaller, M., & Park, J. H. (2011). The behavioural immune system (and why it matters). *Current Directions in Psychological Science.*

Schaller, M., Park, J. H., & Mueller, A. (2003). Fear of the dark: Effects of beliefs about danger and ambient darkness on ethnic stereotypes. *Personality and Social Psychology Bulletin, 29,* 637-649.

Sechrist, G. B., & Stangor, C. (2001). Perceived consensus influences intergroup behaviour and stereotype accessibility. *Journal of Personality and Social Psychology, 80*, 645-654.

Terrizzi, J. A., Shook, N. J., & Ventis, W. L. (2010). Disgust: A predictor of social conservatism and prejudicial attitudes towards homosexuals. *Personality and Individual Differences, 49*, 587-592.

Thornhill, R., Fincher, C. L., & Aran, D. (2009). Parasites, democratization, and the liberalization of values across contemporary countries. *Biological Reviews, 84,* 113-131.

Wheatley, T., & Haidt, J. (2005). Hypnotic disgust makes moral judgments more severe. *Psychological Science, 16,* 780-784.

Wolfe, N. D., Dunavan, C. P., & Diamond, J. (2007, May 17). Origins of major human infectious diseases. *Nature, 447,* 279–283.

Zuk, M. (2007). Riddled with life: Friendly worms, ladybug sex, and the parasites that make us who we are. New York: Harcourt Inc.

Footnotes

1. Participants' written recollections provided the basis for a manipulation check. A naive coder (who was blind to participants' experimental condition and also entirely unaware of the objectives the experiment) read a subset of participants' written responses (N = 95). The coder rated the extent to which the described events would make a person feel anxious, afraid, and disgusted, and also rated the extent to which the situation appeared "to pose some sort of threat." (All ratings were on 7-point scales.) The manipulation appeared to work. Very little affect was elicited in the Neutral condition (on all 4 ratings, M's < 2.5). The Disease Threat condition elicited recollections that were rated more highly on "disgusted" (M = 4.57) than on "afraid" (M = 3.63), $p < .001$; whereas the Other Threats condition elicited recollections that were rated more highly on "afraid" (M = 4.83) than on "disgusted" (M = 1.27), $p < .001$. Importantly, there were no meaningful differences between the two threat conditions in the extent to which they elicited a sense of threat or anxiety: On ratings of threat, M's were 4.23 and 4.54 in the Disease Threat and Other Threats conditions, respectively; on ratings of "anxious," M's were 4.97 and 5.12 in the Disease Threat and Other Threats conditions, respectively.

2. In 6 cases, participants' total did not add to $100. For these 6 participants, we computed the dollars allocated to obedience as the proportion (out of 100) relative to the total dollar amount allocated across all 7 qualities.

3. Because the PVD and BDW questionnaires were administered to participants at the end of the experimental session, we were attentive to the possibility that responses on the questionnaires might be affected by the manipulation. BDW was not (BDW scores were statistically equivalent across conditions, p's > .20). PVD-GA scores were significantly higher in the Disease Threat condition than in the Other Threats condition, $p = .04$ (but were not higher than in the Neutral condition, $p > .40$). Therefore, in order to ensure that the correlation and regression results involving PVD-GA are statistically independent of the effects of the experimental manipulation, we performed additional correlation and regression analyses that statistically controlled for experimental condition. The results of these additional analyses were virtually identical (in terms of effect sizes and p-values) to those reported below.

Table 1. Correlations between individual difference variables and primary dependent variables.

		1	2	3	4	5	6	7
1.	PVD - Germ Aversion	-						
2.	PVD - Perceived Infectability	.29**	-					
3.	Belief in a Dangerous World	.34**	.14*	-				
4.	Self-Reported Conformist Attitudes	.40**	.10	.46**	-			
5.	Liking for People with Conformist Traits	.16*	-.05	.16*	.38**	-		
6.	Valuation of Obedience	.24**	.06	.19**	.43**	.19**	-	
7.	Behavioral Conformity with Majority Opinion	.10	.09	.06	.19**	.17*	.10	-

Note: ** $p < .01$, * $p < .05$, $N = 217$.

Table 2. Results of multiple regression analyses assessing the extent to which each primary dependent variable was uniquely predicted by Germ Aversion (PVD-GA) and Belief in a Dangerous World (BDW).

	PVD-GA		BDW	
Dependent variable	*β*	*p*	*β*	*p*
Self-Reported Conformist Attitudes	.28	<.001	.37	<.001
Liking for People with Conformist Traits	.12	.089	.12	.085
Valuation of Obedience	.20	.005	.12	.084
Behavioral Conformity with Majority Opinion	.09	.222	.02	.655

Note: N = 217.

Table 3. Results of multiple regression analyses assessing the extent to which Germ Aversion (PVD-GA) and Belief in a Dangerous World (BDW) uniquely predicted difference-scores assessing the tendency to exhibit more conformist responses in disease-relevant (compared to non-relevant) domains of normative behavior.

	PVD-GA		BDW	
Domain-specific Differences in:	*β*	*p*	*β*	*p*
Perceived Severity of Normative Transgressions	.31	.009	-.28	.019
Perceived Correctness of Conformist Choices	.21	.083	.01	.953

Note: N = 92.

Table 4. Means (and standard deviations) on the four primary dependent variables in each of the three experimental conditions, along with *p*-values for the corresponding planned pairwise contrasts between these means.

	Experimental Conditions			Planned Contrasts		
Dependent Variable	Disease Threat	Other Threats	Neutral	Disease Threat vs. Neutral	Disease Threat vs. Other threats	Other Threat vs. Neutral
Self-Reported Conformist Attitudes	3.34 (0.83)	3.10 (0.89)	3.11 (0.78)	$p = .108$	$p = .076$	$p = .939$
Liking for People With Conformist Traits	3.62 (0.99)	3.31 (0.93)	3.34 (0.86)	$p = .082$	$p = .034$	$p = .789$
Valuation of Obedience	9.71 (7.90)	8.25 (5.62)	7.59 (5.15)	$p = .054$	$p = .162$	$p = .561$
Behavioral Conformity to Majority Opinion	0.67 (0.47)	0.53 (0.50)	0.42 (0.50)	$p = .003$	$p = .069$	$p = .196$
N	82	74	61			

Note: The *p*-values reported in this table correspond to two-tailed tests of null hypotheses.

Table 5. Means (and standard deviations) on difference-scores assessing the tendency to exhibit more conformist responses in disease-relevant (compared to non-relevant) domains of normative behavior.

	Experimental Conditions			Planned Contrasts		
Domain-specific Differences in:	Disease Threat	Other Threats	Neutral	Disease Threat vs. Neutral	Disease Threat vs. Other Threats	Other Threats vs. Neutral
Perceived Severity of Normative Transgressions	1.67 (1.01)	1.33 (1.07)	0.91 (0.89)	$p = .008$	$p = .162$	$p = .123$
Perceived Correctness of Conformist Choices	1.58 (1.31)	1.43 (1.24)	1.32 (1.48)	$p = .464$	$p = .617$	$p = .756$
N	30	39	23			