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Estimates of Social Consensus by Majorities and Minorities: The Case for Social Projection

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Meta-analyses of research on consensus estimation have identified an asymmetry in the error patterns between majorities and minorities (Gross & Miller, 1997; Mullen & Hu, 1988). Members of the majority slightly underestimate the size of their own group, whereas members of the minority strongly overestimate the size of theirs. The present analysis shows that a single psychological assumption about projection is sufficient to explain this asymmetry. Most people, regardless of whether they are actually members of the majority or members of the minority, believe themselves to be in the majority. It is not necessary to attribute different psychological mechanisms, such as ego protection or cognitive availability, to majority and minority members. A simple quantitative model and empirical data illustrate this point.

One of the most pervasive characteristics of social judgment is that people generalize from themselves to others. They tend to believe that most other people share their own preferences, habits, or sentiments. Ross, Greene, and House (1977) presented a paradigm in which raters respond to a judgment item by either endorsing or rejecting it, and by estimating the percentage of people who would endorse it. The standard finding is that raters' own responses predict their consensus estimates (for a review, see Krueger, in press). The theoretical foundation of the paradigm is the assumption that for various cognitive and motivational reasons people project their own responses to the social groups to which they belong. The standard index of projection is the difference between the average consensus estimate made by item endorsers and the average estimate made by nonendorsers. When this difference is positive it is called the false consensus effect (FCE).[1] It expresses projection on the group level but ignores differences in consensus estimates between individual raters and between items.

What does it mean to consider any systematic differences between endorsers' and nonendorsers' consensus estimates to be false? Falsity implies inaccuracy because whenever the FCE occurs, the average estimate of at least one of the two groups is wrong regardless of the actual percentage of people who endorse the judgment item. Most early studies in the false-consensus paradigm did not explore the linkages between the FCE and estimation accuracy. In time, however, investigators began to report actual consensus rates and the estimation errors they entailed. Goethals (1986), for example, asked students if they would lend $5 to a friend. The findings, which were representative of this research paradigm, were as follows. The majority of students said they would lend (67%), and on the average they thought that 60% of students would lend. That is, although majority members believed themselves to be in the majority, they slightly underestimated the size of their own group (error = –7%). A minority of students refused to lend (33%), and on the average they thought that 42% of students would lend. This estimate implied that the minority members estimated the percentage of refusers to be 58%. In other words, minority members also believed themselves to be in the majority, and by doing so they strongly overestimated the size of their own group (58% – 33% = 25%). The FCE is the sum of the majority's and the minority's estimation errors (–7% + 25% = 18%). As Gross and Miller (1997) noted,

> the two types of data, that which constitutes the FCE and that concerning the magnitude by which consensus estimates evidence bias from reality, are inextricably linked. Therefore, any theoretical account offered to explain the FCE must also explain consensus estimation bias. (p. 243)

The goal of this article is to examine the merits of two such accounts.

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[1] The FCE is a raw measure of effect size because it ignores the within-group variances of the consensus estimates.

The Majority–Minority Asymmetry in Consensus Estimation

The data from consensus estimation studies have been analyzed in two ways. One analysis has focused on the separate estimation errors among majorities and minorities. The other analysis has ignored the raters' group status by simply focusing on the FCE. These two data-analytic strategies reflect different theoretical perspectives. According to the first perspective, majorities and minorities produce different error patterns because they think differently. This perspective implies that majorities are better (more accurate) estimators of social consensus than are minorities. We will call this perspective the *asymmetry model.* Its central assumption is that people's actual group status (majority or minority) affects the way they estimate the size of their own group. Consistent with this assumption, the asymmetry in estimation errors is the phenomenon of primary psychological interest. The FCE, which represents social projection, is considered epiphenomenonal because it is merely the sum of the errors. Mullen and Hu (1988) championed the asymmetry model when they suggested that

> the false consensus effect is in some ways largely a phenomenon of the minority. The tendency to report more consensus for one's own position than people holding another position are willing to grant would not occur if the minority generated estimates of consensus like those generated by the majority. If the majority estimated consensus in the same way that the minority estimated consensus, the false consensus effect would be even stronger than is typically the case. (p. 341)

The second perspective, which we will call the *projection model,* makes only one psychological assumption, which is that people tend to believe themselves to be in the majority regardless of whether they actually are in the majority. As an expression of this theoretical view, the estimated consensus for own response serves as the index of projection rather than the difference between endorsers' and nonendorsers' consensus estimates for endorsements (Crano, 1983). The two indices are mathematically equivalent, however; the FCE is the difference between the summed projection scores and 100% (majority estimate of its own size + minority estimate of its own size − 100). The standard majority–minority asymmetry in estimation errors can also be derived from the projection scores. Briefly, the argument is this: Most majority members believe themselves to be in the majority, and few believe themselves to be in the minority. It follows that their average estimate of the size of their own group is smaller than it would be if *all* majority members believed themselves to be in the majority. Similarly, most minority members believe themselves to be in the majority, and few believe themselves to be in the minority. It follows that their average estimate of the size of their own group is much larger than it would be if *no* minority members believed themselves to be in the majority. Although the operative psychological assumption (projection) is the same for members of both groups, the majority's error is relatively small because most members do indeed belong to the majority. Because, by definition, fewer people belong to the minority, projection will lead to larger errors.

We evaluate the arguments for and against the two models on three levels of analysis: theoretical, mathematical, and empirical. On the theoretical level, we address the plausibility of key assumptions made by each model. On the mathematical level, we ask whether, given certain assumptions, a simulation based on a random model can reproduce standard effects. On the empirical level, we reanalyze appropriate data sets to see if results converge with the conclusions drawn from theoretical and mathematical analysis.

The Asymmetry Model

The plausibility of the asymmetry model depends on the plausibility of two psychological processes that might either singly or jointly explain the majority–minority asymmetry in estimation errors: the heightened cognitive availability of rare (i.e., minority) events and motives to protect the ego. How may these processes explain why the overestimation by the minority is typically larger than the underestimation by the majority?

Cognitive availability. Minority responses are by definition rare, and the rarer they are, the more distinctive and salient they may be. Thus, the overestimation of minority size may result from biased encoding of distinctive events. "It is reasonable to expect that as the actual consensus for the minority grows smaller, both the majority and the minority tend to focus more upon the minority, making the minority more salient and cognitively more available" (Mullen & Hu, 1988, p. 335; see also Mullen & Smith, 1990). Indeed, in a variety of different experimental paradigms, respondents overestimate rare events and underestimate frequent events. In a classic demonstration, Attneave (1953) asked participants to rate the frequency of each of the 26 alphabetical letters in a typical English text. They overestimated the frequency of rare letters (e.g., U, F, Z) and underestimated the frequency of common ones (e.g., E, S, T). Memory for social (Rothbart, Evans, & Fulero, 1979) and nonsocial material (Hintzman, 1969) shows a similar pattern. Average frequency estimates are correlated with actual frequencies, but overestimation and underestimation errors occur at the lower and upper end of the scale, respectively.

Before psychological processes of salience or attention can be invoked, it needs to be recognized that statistical regression effects may account for much, if not all, of this asymmetry. Regression to the mean is a common property of measurement; yet, intuitive and professional observers of the psychological scene overlook it easily (Dawes & Mulford, 1996).[2] In social-perception studies, human judges serve as measurement instruments estimating the values of a criterion variable. For two reasons, the distribution of their averaged judgments is "flattened" when regressed on the criterion. The first reason is the ineluctable unreliability of human judgment (Fiedler & Armbruster, 1994). Any degree of random error leads to average judgments that are less extreme than their corresponding criterion values. Floor and ceiling effects exacerbate the effect. In consensus estimation studies, actual percentages typically run from close to 0% to close to 100%, thus limiting underestimation at the scale's lower end and overestimation at its upper end. The second potential reason for the regression effect is that individual judges make regressive estimates because they know that they should. As Goldberg (1991) put it, "The variance of our predictions should never be larger than that of the criterion we seek to predict. (Never, not hardly ever.)" (p. 181). Only if people violated this fundamental rule, the opposite of the standard error asymmetry could occur. If people underestimated low percentages and overestimated high percentages, they would produce a nonlinear (ogival) estimation function, and the regression line would have a negative intercept. That is, an attempt to fit a linear prediction function to the judgments would yield negative percentages for low criterion values.

Aside from the potential artificiality of the asymmetry in estimation errors, the cognitive-availability hypothesis fails to explain why minorities overestimate minority size more than majorities do. If members of the two groups are equally inclined to focus on the smaller group, only the direction of the error asymmetry can be explained but not the difference in the size of the error. Assuming the cognitive-availability hypothesis to be true, Gross and Miller (1997) suggested that minority members overestimate the size of minority groups more than majority members do because they are more self-focused. This hypothesis still awaits experimental testing.

Can the cognitive-availability hypothesis be cast as a sampling bias? According to the selective-exposure version of the availability hypothesis, people disproportionately associate with similar others (e.g., Sherman, Presson, Chassin, Corty, & Olshavsky, 1983). Consensus estimates are biased if people fail to recognize their sampling bias or are unable to correct. Again, however, selective exposure should lead both, majority and minority members, to overestimate the size of their own group. To explain the difference in the size of the error, one would have to claim that exposure to similar others is more selective among minorities than among majorities. Such a difference in exposure bias has not been demonstrated. In fact, it appears that both majority and minority members are exposed primarily to other majority rather than minority members (Bosveld, Koomen, & van der Pligt, 1994).

Ego protection. Can ego-protective motives account for the finding that minorities err more than majorities do? Gross and Miller (1997) speculated that both minorities and majorities feel threatened by their respective outgroups. Minorities may minimize and majorities may justify perceived threats by doing the same thing: overestimating minority size. When invoked in conjunction, these claims cannot explain why minorities overestimate minority size more than majorities do. To explain the difference in the size of the error, one must assume that minorities feel more threatened than majorities. Mullen and Hu (1988) made that assumption, suggesting that minorities find their own group status to be aversive, and the more so the smaller they are. To stave off this aversion "it would be a reasonable esteem-enhancing and self-validating strategy to report proportionally more consensus when ones' group is really getting smaller" (Mullen & Hu, p. 335).

The ego-protection explanation is problematic because there is no evidence that the degree of overestimation predicts self-esteem, and it is uncertain whether minority status is aversive (Deutsch, 1989). Many of the judgment items used in false-consensus research are rather dull in content. It is hard to see, for example, why being one of the few pumpernickel aficionados would be threatening and why an imagined increase in one's group size would make one feel better. This example illustrates a more profoundly implausible property of the ego-protection hypothesis: It requires two levels of contradictory knowledge. First, minority members must on some level realize that they are in the minority. That is, their initial private consensus estimates must be accurate (I am one of the few pumpernickel aficionados). Then, to protect the ego, minority members must replace these private estimates with defensive but inflated public estimates (most others are in fact pumpernickel aficionados). How does one know what group members really think about the size of their group before they report distorted estimate? Gross and Miller (1997) recognized this problem and suggested that the direction of the estimation error reveals the "subjective perception" (p. 244) of majority or minority status. From the commonly found asymmetry in estimation errors, Gross and Miller deduced that any overestimation error indicates subjective minority status and that

[2]Goldberg's (1991) trenchant description is worth quoting: "Regression is like the weather: Everybody talks about it, but few of us do anything about it. However, it is unlike the weather, because most of us fail to recognize it, even when it hits us on the nose" (p. 181).

any underestimation indicates subjective majority status. This view implied that majorities who overestimate their own size "behave like minority groups" (Gross & Miller, 1997, p. 257). We think that this argument is circular because it equates an effect with its putative cause. If one equates underestimation with subjective majority status and overestimation with subjective minority status, one postulates rather than demonstrates the raters' subjective group status. We suggest that theoretical and empirical work should seek to understand under what conditions and to what extent majorities and minorities under- or overestimate their own size. As a first step in that direction, we developed a simple quantitative model that may serve as a baseline against which empirical results may be evaluated.

The Projection Model

The common theme of the hypotheses proposed within the asymmetry model was that majorities reason about consensus more competently than minorities do. Each of these hypotheses was ad hoc in character and lacked independent empirical validation. In contrast, the starting point of the projection model is the single psychological assumption that minorities and majorities think alike. They project. Most people, regardless of their actual group status, expect their own responses to be those of the majority. The meta-analytic data supported this assumption. Both majorities (*M*s = 59%, 67%) and minorities (*M*s = 55%, 60%) believed themselves to be in the majority.[3] The assumption of common projection can be made a priori—that is, before any asymmetries are discovered empirically. The first consequence of this assumption is that consensus estimates, when averaged across majorities and minorities, cannot be perfectly accurate. Imperfect accuracy implies regression to the mean and thus produces the standard asymmetry in the direction of the estimation errors among majorities and minorities. No asymmetric thought processes need to be invoked.

By limiting accuracy, projection does not only contribute to the regression effect (the other contributing factor being random unreliability) but it can also explain the absolute size of the errors. This is the second and most crucial consequence of the assumption of projection. Consider the properties of a simple quantitative model, in which projection scores are derived as a function of four variables. First, the *subjective majority* is the percentage of raters who believe themselves to be in the majority, or, equivalently, the probability that a single rater believes to be in the majority. Second, the *subjective minority* is the complement of the subjective majority. Third, the *estimated majority* is the consensus estimate made by subjective majority members. Fourth, the *estimated minority* is the consensus estimate made by subjective minority members. This estimate need not be the complement of the estimated majority. Projection is the product of the subjective majority and the estimated majority plus the product of the subjective minority and the estimated minority. Consider the following example. Regardless of actual group membership, most raters (subjective majority = 60%) believe themselves to be members of a fairly substantial majority (estimated majority = 80%). The remaining raters (subjective minority = 40%) believe themselves to be members of an average-sized minority (estimated minority = 30%). Projected consensus for the raters' own response is the subjective majority times the estimated majority plus the subjective minority times the estimated minority (60% × 80% + 40% × 30% = 60%). Given this projection score, the estimation errors depend entirely on actual size of the group. If, for example, the actual majority is 70%, projection among the majority yields an underestimation error of 10% (i.e., 60% – 70%). Among the actual minority (30%), the same degree of projection yields an overestimation error of 30% (i.e., 60% – 30%).

For mathematical reasons alone, estimation errors are positively correlated with projection scores and negatively correlated with actual group sizes. The larger people think their own group is, the more likely they are to be overestimating its size. The larger the group actually is, the more likely people will be underestimating its size. Estimation errors are not of primary interest because they are, as difference scores, fully determined by one psychological variable, projection, and by one sociological variable, actual group size (see Zuckerman & Knee, 1995, for a related argument). In particular, the negative effect of actual group size on estimation errors says nothing about the psychological processes underlying consensus estimation.

Suppose in the numerical example the size of the actual majority happened to be 55% instead of 70%. Now the majority would be overestimating instead of underestimating its own size (+5%). The two theoretical perspectives suggest divergent conclusions. According to the asymmetry model, any change in the direction of the error signals a change in the underlying estimation process. In other words, the asymmetry model must assume a change in the raters' mental activities even though their judgmental output did not change. Gross and Miller's (1997) "Golden Section" hypothesis would suggest, for example, that by underestimating, the majority now behaves like a minority, when in fact, only their group size has changed but not the judgments made by its members. In contrast, the projection model accepts only the consensus estimates as meaningful psychological data. When actual group

[3] The two means in parentheses were drawn from Mullen and Hu's (1988) and Gross and Miller's (1997) meta-analyses, respectively. Some tests were meta-analyzed in both studies.

sizes vary, identical estimates—produced by the same psychological process—may involve overestimation or underestimation errors.

What kinds of numerical values can one realistically expect for the input variables (i.e., subjective group status and estimated group size)? We consider two specific quantitative possibilities. Both are consistent with the projection model, but they differ in their assumptions about the nature of the psychological process. According to one approach, projection reflects the rater's adherence to normative rules of induction. According to the other approach, projection is rather automatic and egocentric. The consensus estimates it produces, however, may often coincide with normative induction.

Prescriptive projection. To a degree, projection is a rational inference strategy because most people indeed belong to the majority. Therefore, a person's belief that most others respond to a social stimulus the way he or she does, is reasonable. Suppose a rater estimates the percentage of people who endorse a certain statement. If the rater is ignorant about the actual consensus of endorsement, all possible endorsement percentages may appear to be equally likely. The rater can reduce the uncertainty of the task by admitting his or her own response as an individual sample observation. Note that someone who happens to endorse the item has a different sample observation than someone who rejects the item. Under the assumption of uniform priors, it is twice as likely that one's own endorsement represents the response of the majority than the response of the minority. If the rater acknowledges this rule, projection minimizes error in the long run. According to a Bayesian analysis, consensus estimates of 66.67% for one's own response are optimal (see Dawes, 1989, or Krueger & Clement, 1994, for details on this analysis). Because this rule applies to all raters and estimates, the subjective majority is 100%, and the subjective minority is 0%.

Prescriptive projection produces a majority–minority asymmetry in estimation errors that is similar to the ones obtained in meta-analyses of empirical work. The assumption of uniform priors means that average size of the actual majority is 75% and that the average size of the minority is 25%. Therefore, majorities will underestimate the size of their group, and minorities will strongly overestimate the size of theirs. The expected FCE is 33.33%, and the absolute error is (16.67%) is the average estimation error by majorities (8.33%) times the probability that an individual response is the majority response (.75) plus the average estimation error by minorities (41.67%) times the probability that an individual response is the minority response (.25).

Descriptive projection. Prescriptive projection captures the majority–minority difference in the direction of the estimation errors, but it does not provide a satisfactory description of how people estimate consensus. In our view, the utility of the prescriptive rule is limited because it makes strong assumptions about people's insights into formal statistical reasoning. These assumptions imply fixed values for subjective majorities (100%) and estimated majorities (66.67%). We believe that most people project with little regard for formal inference rules. This view permits the more relaxed assumption that the subjective majority and the estimated majority vary across people and items. Most—but not necessarily all—raters believe themselves to be in the majority, and the estimated size of this majority may vary from rater to rater. We further assume that subjective and estimated majorities are uncorrelated. That is, the percentage of people who believe themselves to be in the majority does not predict how large they think this majority is. Finally, we need to ask what is the correlation between projection and accuracy. On the one hand, accuracy cannot be perfect when projection occurs. On the other hand, accuracy tends to be greater with projection than without it (Hoch, 1987; Krueger & Clement, 1994). The present model begins with the simple assumption that projection scores and actual group sizes are uncorrelated.

On the basis of these assumptions, the projection model enables us to predict that the typical asymmetry in estimation errors will be recovered in a random model. If such a recovery proves successful, a single psychological assumption will appear to be a satisfactory explanation of the asymmetry and doubt will be cast on the claim that majorities and minorities think differently about social consensus.

Simulation

In theory, the values of three variables (actual, subjective, and estimated majorities) range from 51% to 100%, whereas the values of the fourth variable (estimated minority) range from 0% to 49%. For simplicity, the simulation comprised the values 60%, 70%, 80%, and 90% for the first three variables, and the values 10%, 20%, 30%, and 40% for the fourth variable. All values were equiprobable, thus yielding four uniform distributions. There was no reason to believe that actual majorities have any particular size, large or small. Similarly, there was no reason to believe that subjective or estimated groups (majorities or minorities) are particularly large or small. Finally, the four variables were uncorrelated with one another. Because of this independence, the degree of projection was not correlated with the size of the actual majority, and consensus estimates were not correlated with actual group sizes. In other words, there was no correlational accuracy.

Table 1. *Intercorrelations Between Projection Scores and the Four Input Variables*

Variable	Majority: Subjective	Majority: Estimated	Minority: Subjective	Minority: Estimated
Projection	.53	.79	–.53	.26
Subjective Majority		0	–1	0
Estimated Majority			0	0
Subjective Minority				0

Table 2. *Average Results of the Simulation Compared With the Meta-Analytic Findings*

Variable	Meta-Analyses: Mullen & Hu *M*	Mullen & Hu *SD*	Gross & Miller *M*	Gross & Miller *SD*	Simulation *M*	Simulation *SD*
Projection: Estimated Size of Own Group	57.5**	11.1	59.1*	14.7	62.5	11.0
Error by Majority	–11.0	13.8	–6.6**	11.4	–12.5	15.4
Error by Minority	25.0**	14.3	23.7**	12.4	37.5	15.4
False Consensus Effect	14.0**	8.3	17.2**	10.8	25.0	21.4

Note: $*p < .05$, $**p < .01$, by two-tailed t test, for differences between meta-analytic and simulated means.

Findings

A complete crossing of the four input variables with four levels each yielded 256 (44) cases, and a projection score was computed for each. Table 1 shows the intercorrelations between the input variables and the output variable (projection). The finding that increases in estimated majorities boosted projection more than did equivalent increases in subjective majorities requires a brief comment. Recall that any given subjective majority implied the size of the subjective minority. If, for example, the subjective majority was 90%, the subjective minority was always 10%. By contrast, estimated majorities did not imply fixed estimated minorities, so that an estimated majority of 90% was paired equally often with estimated minorities of 10%, 20%, 30%, and 40%. Thus, the calculated projection scores tended to be larger for estimated than for subjective majorities of 90%. When both types of majorities were 60%, projection scores were smaller for estimated than for subjective majorities.

The means and standard deviations of the projection scores, the estimation errors, and the FCEs are presented in Table 2. On the average, majorities underestimated their own size less than minorities overestimated their own size. Most cases (65%) showed this expected pattern. Some cases (23%) involved overestimation by both groups, and in a few cases (3%) the errors of the two groups were equal. Finally, some underestimation errors by the majority (9%) were greater than the overestimation errors by the minority.[4]

[4]Because the projection model allows the possibility that raters believe themselves to be in the minority, its expected absolute error (18.75%) is slightly larger than the error predicted by the prescriptive model.

Figure 1 shows the distribution of the projection scores for each actual group size. The simulated-projection line represents the average projection score. The identity line represents perfect accuracy. Projection scores above it entail overestimation errors and scores below it entail underestimation errors. It is evident that, given projection, minorities could only overestimate the size of their own group, whereas majorities could commit either error, depending on how large their group actually was. Because projection scores were not correlated with actual group size, the estimation errors were positively correlated with projection and negatively correlated with actual group size. Projection scores above the no-projection line represent FCEs (86%), whereas scores below it represent false uniqueness effects (FUEs, 9%). As previously noted, the FCE can be obtained by adding the projection scores of the two groups and subtracting 100%. The actual majority/minority ratio does not affect this relation. The fact that the FCE can also be derived by adding the estimation errors of the majority and the minority, is incidental.

Each vertical slice of Figure 1 shows that the distribution of projection scores was close to normal and invariant across differences in actual majority size. A conversion of projection scores to FCEs does not affect the shape of the distribution. Both types of scores may be used to show that occasionally FUEs occur in spite of the assumption that projection is pervasive. According to the descriptive-projection model, these occasional FUEs are neither mysterious nor systematic. The mean projection score is the best estimate for the degree of projection in the population. The variability around this mean is unsystematic. Therefore, a few FUEs are to be expected at the low tail of the distribution. If, for

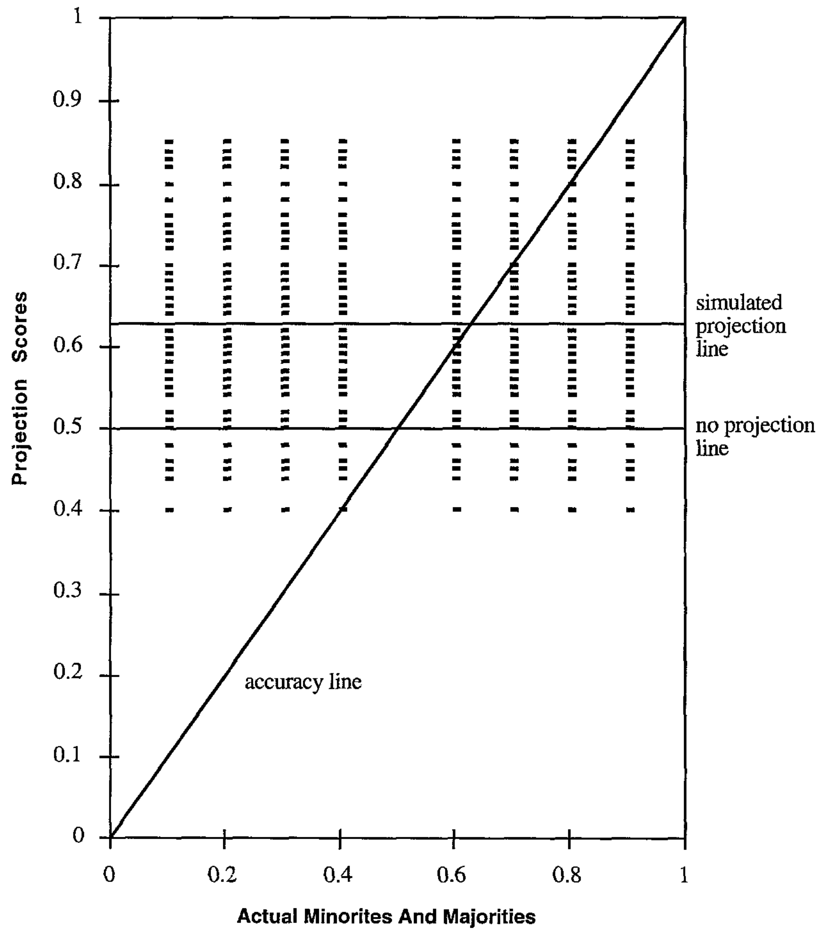

Figure 1. Projection scores plotted against actual group size.

example, the subjective majority is 60% (implying a subjective minority of 40%), the estimated majority is 60%, and the estimated minority is 10%, the resulting projection score is 40%. Irrespective of actual group sizes, a projection score of 40% means that the majority's estimate of its own size is 20% lower than the minority's estimate of the majority's size. The descriptive projection model permits these particular intersections of the four variables to occur by chance. The implication for empirical research is that a few FUEs among the many FCEs are to be expected, and that attempts to predict on which tests these FUEs will occur are futile. Because the prescriptive projection model and the asymmetry model cannot accommodate FUEs, these models may tempt the generation of ad hoc psychological explanations of why the minority underestimated its size or why the minority's overestimation error was smaller than the majority's underestimation error. To ensure that an empirically obtained FUE did not result from artifactual or random variations in the effect size of projection, such an effect requires careful replication in a theoretically relevant context (i.e., with specific judgment items or populations of raters; Schmidt, 1996).

Fit

The output of the simulation closely resembled the two relevant sets of published meta-analytic findings.[5] When the data were juxtaposed in Table 2, it became evident, however, that there were small but reliable differences. Compared with the simulation, the empirical findings involved less projection and less error, especially among minorities. It was most striking that the average of the simulated projection scores reproduced, spot-on, what Gross and Miller (1997) called the *Golden Section* (.618/.382). Gross and Miller demonstrated the astounding beauty, ubiquity, and antiquity

[5]To represent Mullen and Hu's (1988) meta-analysis, average statistics were computed from the average consensus estimates and the actual groups sizes reported in the 57 meta-analyzed tests that were published. Goethals (1986) conducted 18 tests with 39 raters, 1 test with 50 raters, and 1 test with 27 raters. Mullen (1983) conducted 1 test with 121 raters. Sanders and Mullen (1983) conducted 16 tests with 245 raters. Suls and Wan (1987) conducted 8 tests with 149 raters. Suls, Wan, and Sanders (1988) conducted 12 tests with 138 raters. To represent Gross and Miller's (1997) findings, data in their Appendix were analyzed. The Appendix listed the results of 128 tests, stemming from 11 articles and 31 groups of participants.

of the Golden Section (from Pythagoras to Donald Duck). By analogy, they suggested "that among those holding the majority viewpoint, the inclination to underestimate the true magnitude of their consensual support might first begin to occur when they comprise 61.8 percent (as opposed to 50%) of the population" (pp. 253). In other words, to Gross and Miller, the Golden Section is a property of actual group size. In our view, it is most notable that the Golden Section closely coincides with the key psychological datum—that is, the expected degree of projection. As we have mentioned, we do not believe that any particular group size makes its members think differently about social consensus.

Conditional Errors

In theory. Both the asymmetry model and the projection model postulate mental mechanisms that operate on the level of individuals rather than groups. According to the asymmetry model, individual majority members underestimate the size of their group less than individual minority members overestimate the size of their group. According to the projection model, most individuals, regardless of their actual group membership, believe themselves to be in the majority. If they are correct, their errors are small; if they are incorrect, their errors are large underestimations and large overestimations (for majority and minority members, respectively). Up to this point, it has been impossible to draw conclusions about the estimation processes of individual raters. The estimation errors obtained in the simulation and in the meta-analysis were unweighted group averages; they were unweighted in that they ignored the differences in size between majorities and minorities. According to the asymmetry model, averaging errors within groups is not a problem, but according to the projection model, it masks the estimation errors of individual members. Unweighted estimation errors may only appear to be asymmetrical because—relative to the size of their group—there are fewer incorrect majority members than there are incorrect minority members.

To clarify this point, we decomposed the simulation data into four sets: (a) Majority members who correctly believed themselves to be in the majority (correct majorities), (b) minority members who correctly believed themselves to be in the minority (correct minorities), (c) majority members who incorrectly believed themselves to be in the minority (incorrect majorities), and (d) minority members who incorrectly believed themselves to be in the majority (incorrect minorities). Table 3 (Simulated Data, top row) shows the percentage of cases falling into each category. Because actual and subjective majorities were independent, three fourths of each group believed themselves to be in the majority (middle row). When estimation errors were aggregated separately for each of the four categories, the asymmetry disappeared (bottom row). The average error among correct individuals was zero. The average absolute error among incorrect individuals was 50%. The overall aggregated group errors were easily recovered from these data. The aggregate majority error was the difference between average actual majority size (75%) and the aggregate estimate of own group size (.5625 × 75% + .1875 × .25%). The aggregate minority error was the difference between the average actual minority size (25%) and the aggregate estimate of own group size (.1875 × 75% + .0625 × .25%). In other words, the standard majority–minority asymmetry returned when estimation errors were weighted by their likelihood of occurrence, and the different weights resulted from projection. For the majority this means that the aggregate error could be recovered by simply multiplying the error of the correct majority with the probability that a majority member would be correct (0% × .75), by multiplying the error of the incorrect majority with the probability that a majority member would be incorrect (–50% × .25), and by summing the products (–12.5%). The process is the same for the minority (50% × .75 + 0% × .25 = 37.5%). In the simulation, individual majority errors were not smaller than minority errors; they were simply less frequent relative to the size of the group.

And practice. This conclusion required a replication with real data. Because we could not decompose

Table 3. *Estimation Errors as a Function of Actual and Subjective Group Status*

	Simulated Data				Empirical Data			
	Correct		Incorrect		Correct		Incorrect	
Subjective Group	**Majority**	**Minority**	**Minority**	**Majority**	**Majority**	**Minority**	**Minority**	**Majority**
Actual Group	**Majority**	**Minority**	**Majority**	**Minority**	**Majority**	**Minority**	**Majority**	**Minority**
Percent of Total	56.25	6.25	18.75	18.75	34	15	21	30
Percent of Group	75	25	25	75	62	33	38	67
Mean Estimation Error	0	0	–50	50	3.55*	–.85	–28.71**	30.72**

Note: $*p < .01$, $**p < .001$, by two-tailed paired t test ($df = 39$) against the no difference hypothesis.

the meta-analytic data as needed, we used a data set we had previously analyzed for unrelated tests of projection effects. Data consisted of item endorsements and consensus estimates for each of 40 statements (e.g., "I like poetry"; see Krueger & Clement, 1994, Experiment 1). The distribution of the mean consensus estimates (M = 50%, SD = 8%) was similar to the simulated and the meta-analytic distributions (projection: M = 55.5%, SD = 8%; FCE: M = 11%, SD = 5%). Actual consensus data, which were drawn from the Minnesota Multiphasic Personality Inventory–2 manual (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989), ranged from 20% to 80% with fairly equal intervals (M = 50%, SD = 16%), yielding a distribution that was similar to the simulation. Estimation accuracy was low regardless of whether it was computed across raters (r = .03) or across items and within raters (mean r = .07). Aggregate unweighted estimation errors fell into the familiar pattern. Majorities moderately underestimated (M = –10%, SD = 11%) and minorities strongly overestimated the consensus for their own responses (M = 21%, SD = 11%).

To control the effects of unweighted aggregation, we asked the following two questions: First, would the standard asymmetry in estimation errors occur for raters who correctly identified the group status of their own response? According to the asymmetry model, the answer should be yes. Correct majorities should underestimate and correct minorities should overestimate the consensus for their own responses even more. According to the projection model, the answer was no. By chance alone, majority members should be more likely to identify their own group status correctly than minority members. When that difference was controlled, the asymmetry should vanish. The second question was the complement of the first: Would the standard asymmetry occur for raters who incorrectly identified the group status of their own response? Again, the prediction of the asymmetry model should be yes. Incorrect majorities should strongly underestimate and incorrect minorities should even more strongly overestimate the consensus for their own responses. The projection model predicted no difference in average errors, only that majority members should be less likely to misidentify their own group status than minority members.

The data set consisted of 4,880 cases (122 raters judging 40 items). Cases with estimates of 50% were discarded because they did not create perceived majorities and minorities. Because there were no actual consensus rates above 80% or below 20%, all cases with estimates above 80% or below 20% were discarded too, leaving 3,666 cases (75%) for analysis. Table 3 (Empirical Data) shows that, consistent with the projection model, most raters expected their own responses to be those of the majority, and that this expectation was shared by majority and minority members. The left half of the Empirical Data section shows that, contrary to the asymmetry model, correct majorities overestimated the consensus for their response more than correct minorities did, $t(39) = 6.12$, $p < .001$. The right half of the Empirical Data section shows that the absolute size of the underestimation error among incorrect majorities did not differ reliably from the size of the overestimation error among incorrect minorities, $t < 1$. These results supported the projection model. As shown before with the simulated data, the standard majority–minority asymmetry could be recovered by weighting each of the four average errors by its respective probability of occurrence (i.e., the aggregate majority error = 3.55% × .62 – 28.71% × .38; the aggregate minority error = 30.72% × .67 – .85% × .33).[6]

Assumptions and Limitations

The projection model has been developed and illustrated in a decontextualized format. The assumptions have been simple, and indeed, some were negative in the sense that they were set up in an attempt to avoid prejudging psychological processes or social realities. In this spirit, we chose uniform distributions for the input variables of the simulation model. In our view, the success of the projection model relative to the asymmetry model is a matter of plausibility and parsimony. It is more plausible to assume that most people project than to assume that people privately realize the size of their group and then move to distort it. The projection model is also more parsimonious than the asymmetry model in that it requires fewer assumptions. To clarify the empirical utility of the model further, we now review some of its assumptions and limitations.

Assumptions: Projection and Imperfect Accuracy

The central assumption of the projection model, and the simulation that illustrated it, was that most people, regardless of their actual majority or minority status, believe themselves to be in the majority. The meta-analytic studies supported this. In all of the published tests reviewed by Mullen and Hu (1988), average projection scores were greater than 50%. In Gross and Miller's (1997) review, which included most of these tests and many others, virtually all tests (98%) showed projection. In our lab, we have conducted 68 tests (Krueger & Clement, 1994, 1996; Krueger & Zeiger, 1993), all of which showed projection.

The subsidiary assumption was that consensus estimates have imperfect accuracy. We computed accuracy correlations for the individual published studies meta-

[6] Because of rounding errors, this operation yields slightly reduced values.

analyzed by Mullen and Hu (1988), our own three published data sets (see those just mentioned), and the full set of tests listed by Gross and Miller (1997). Across these studies, correlations between estimated and actual consensus ranged from –.43 to .77. Note that the consensus estimates were the unweighted averages computed across majorities and minorities. In other words, inasmuch as both groups projected, accuracy could not be perfect. From the point of view of the projection model it is encouraging to see that the degree of overall accuracy did little to moderate the standard error asymmetry. The highest accuracy correlation, which was obtained by reanalyzing Gross and Miller's data, was associated with an error pattern similar to the simulated one (see Table 2).

Limitations: Projective Bias and Contextual Moderators

Recall that the prescriptive, inductive version of the projection model produced greater projection scores (M = 66.67%) than either the descriptive version of the model or the empirical data. This seems to suggest that people do not project as much as they should. Elsewhere, however, we have argued that people overproject (e.g., Krueger, 1996). In studies of the "Truly False Consensus Effect," for example, consensus estimates are positively correlated with estimation errors across items. Most individual raters overestimate consensus more when they agree than when they disagree with an item (Krueger & Zeiger, 1993).

A first limitation of the current projection model is that it is too conservative by not taking overprojection into account. To demonstrate overprojection empirically in a novel way that is akin to the present data-analytic strategy, we did the following: We asked whether the FCE occurred even when endorsers and nonendorsers agreed whether a majority of people endorsed or rejected the item. A data set (Krueger & Clement, 1994) was split it into four segments. The first segment included all cases where actual and estimated consensus were greater than 50%. Estimates were averaged for each item separately for endorsers (M = 67.93) and nonendorsers (M = 65.48). The reliable difference, $t(19) = 3.76$, $p < .01$ (by paired t test), showed that the FCE prevailed even among raters who were selected for their categorical accuracy. Even among correct majorities and correct minorities, item endorsements had the expected projective effect on consensus estimates. In other words, raters projected too much.

This result was replicated for the other three segments. The FCE was reliable for cases where actual and estimated consensus were less than 50%, M (yes) = 36.32 > M (no) = 33.38, $t(19) = 4.65$, $p < .001$; when actual consensus was greater than 50% but estimated consensus was smaller than 50%, M (yes) = 35.20 > M (no) = 33.33, $t(19) = 2.87$, $p < .01$; and when actual consensus was less than 50% but estimated consensus was greater than 50%, M (yes) = 67.31 > M (no) = 65.17, $t(19) = 2.86$, $p < .01$. The FCE did not only arise from people's tendency to assume they were in the majority most of the time. Instead, the FCE persisted even when estimated consensus by endorsers and by nonendorsers were on the same side of the 50% divide. That is, given that a rater estimated a majority (or a minority) to endorse the item, the size of the estimated majority (or minority) varied with the rater's own response to the item.

A second limitation of the projection model was that it did not include moderator variables. For simplicity, the model only assumed random variations in the degree of projection, thus ignoring any systematic sources of variation. Some people habitually project more than others (Krueger & Clement, 1996), and some items elicit greater projection than others (Marks & Miller, 1987). In meta-analytic and original empirical work, Mullen and colleagues identified two contextual variables that moderate projection (Mullen et al., 1985; Mullen, Driskell, & Smith, 1989). Projection increases when raters make consensus estimates before rather than after their own endorsements and when they judge few rather than many items (but see Cadinu & Rothbart, 1996). Gross and Miller (1997) identified the response format as a third moderator. Raters who endorsed an item projected less (M = 57%) than raters who rejected an item (M = 62%). This finding is relevant for all theories of projection because it refutes the possibility that projection may result from shared method variance in the response formats. According to that argument, projection would be artifactual if endorsers (yea-sayers) projected their own response more than nonendorsers (nay-sayers). Both Mullen (1983) and Gross and Miller (1997) considered various cognitive and motivational factors that might account for these moderator effects, but so far, direct empirical evidence for any of these has been lacking.

Why Some Majorities Are Larger Than Others

The simulation assumed that actual majorities vary in size, but it made no assumptions about systematic psychological or sociological variables that might explain this variation. Meta-analytic data show that some majorities are larger than others, and they reveal a significant predictor variable of these differences, namely the desirability of the judgment item (Mullen & Goethals, 1990). This is not surprising. Self-descriptions tend to be positive. Given a choice, most people endorse positive rather than negative items as self-descriptive (see Gross & Miller, 1997, for a review). In part, this positive response pattern may reflect self-enhancement biases, but in part this pattern may also reflect the social-normative fact that desirable characteristics are more common than undesirable characteristics (Matlin & Stang, 1978). The correlation between desirability and actual group size (i.e., the probability of item endorsement) implies that people tend to overestimate the prevalence of their negative characteristics (smoking, cheating, failing) and underestimate the prevalence of their positive characteristics (healing, helping, succeeding). As a textbook author summed it up: "People see their failings as normal, their virtues as rare" (Myers, 1996, p. 58).

The asymmetry model and the projection model offer divergent and testable explanations for this phenomenon. According to the motivational version of the asymmetry model, the experience of being in the minority is aversive by itself. The desirability of the group (i.e., the judgment item) then directly affects the direction of the estimation error. Undesirable groups (minorities) are overestimated to protect the ego, and desirable groups (majorities) are underestimated to enhance it. In other words, the asymmetry model postulates a mediational process, in which actual group size (the independent variable) affects the perceived desirability of the item or group (the mediator variable), which in turn affects estimation errors (the outcome variable). The projection model assumes a different mediational process. According to this model, the desirability of the item (the independent variable) affects actual group size (the mediating variable), which in turn affects estimation errors (the outcome variable). There is no need to postulate a direct effect of social desirability on estimation errors.

To test the two mediational hypotheses, we reanalyzed a data set (Krueger & Clement, 1994) in two ways. In the first analysis, aggregation preceded correlation. Actual consensus rates, desirability ratings, and estimation errors were averaged across raters and then correlated across items. Figure 2 (top panel) shows the results. The high correlation between item desirability and actual consensus indicated that, not surprisingly, respondents were more ready to endorse items such as "My sex life is satisfactory" than items such as "I certainly feel useless at times." Consistent with both models, actual consensus and item desirability were both negatively correlated with estimation errors. Consensus for commonly endorsed or highly desirable items was more likely to be underestimated than con-

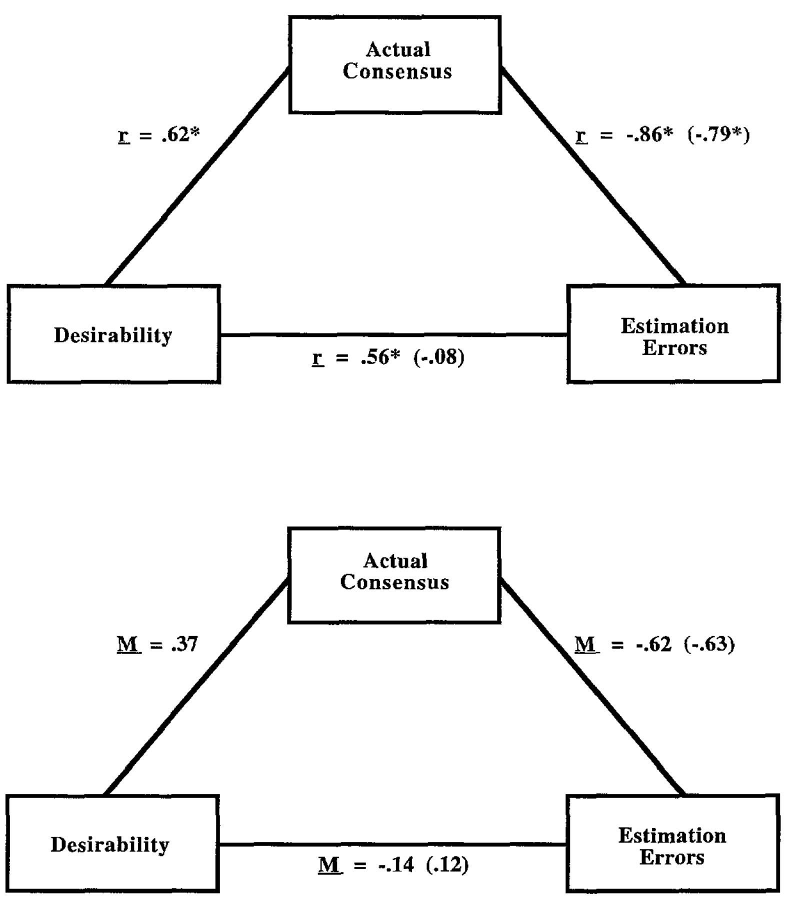

Figure 2. Correlations between actual consensus, estimation errors, and social desirability. (Top panel—across item means, *$p < .001$, $df = 38$, partial r in parentheses. Bottom panel—within raters, all $p < .001$, $df = 121$.)

sensus for rarely endorsed or undesirable items. To test the mediational process implied by the asymmetry model, the correlation between actual consensus and estimation errors was computed while controlling item desirability. If desirability mediates the correlation between actual consensus and estimation errors, the partial correlation should be smaller than the zero-order correlation. In contrast to this prediction, the partial correlation remained high. To test the mediational process implied by the projection model, the correlation between desirability and estimation errors was computed while controlling actual consensus. If actual consensus mediates the correlation between desirability and estimation errors, the partial correlation should decrease. Indeed, the partial correlation was near zero.[7]

In the second analysis, correlation preceded aggregation. The same set of zero-order and partial correlations was computed for each rater across the 40 items. Correlations were aggregated by *r–Z–r* transformations. In this analysis, no evidence for either kind of mediation was obtained (Figure 2, bottom panel). Again, however, the data clearly favored the projection model because even on the level of zero-order correlations, actual consensus predicted estimation errors far better than did item desirability. Taken together, these analyses indicate that item desirability is important in that it predicts choice behavior and thus group size. It does not directly predict whether people underestimate or overestimate the size of the group. These errors are mediated by the size of the group regardless of its social desirability.

Framing of Errors

Consistent with the projection model, a single psychological assumption was sufficient to explain systematic majority–minority asymmetries in estimation errors. It was the asymmetry model, however, that determined which estimation errors were to be examined. Both these errors were ingroup errors: underestimation of majority size by the majority and overestimation of minority size by the minority. But there are also two outgroup errors: overestimation of minority size by the majority and underestimation of majority size by the minority. Figure 3 displays two hypothetical groups with their actual sizes (top), consensus estimates (middle), and errors (bottom). The asymmetry model's focus on cells A and D may seem justified because these two cells are independent of each other. But this approach creates ambiguities of interpretation. In the design of the typical consensus-estimation study, the majority and the minority are always mutually exclusive and exhaustive with respect to the population. Whatever

Actual Group Size: Majority	Actual Group Size: Minority
80	20

		Estimates FOR: Majority	Estimates FOR: Minority
Estimates BY	Majority	A 70	B 30
	Minority	C 30	D 70

FCE = 40

Projection = 70

		Estimates FOR: Majority	Estimates FOR: Minority
Errors BY	Majority	A -10	B 10
	Minority	C -50	D 50

Figure 3. Hypothetical group sizes, consensus estimates, and errors in percent.

members may estimate the size of their own group to be is always confounded with what they estimate the size of the other group to be. Estimates of majority size determine estimates of minority size just as the actual majority size determines actual minority size. Therefore, any underestimation of majority size determines the overestimation of minority size. To say that the minority overestimates its size by 50% is equivalent to saying that the minority underestimates the size of the majority by 50%.

There is no logical reason why analysis should not focus on outgroup errors (Figure 3, cells B and C) or errors about the size of a particular target group (majority—A and C; minority—B and D). The point is that the choice of any one research frame is arbitrary from a methodological perspective, but highly consequential from a theoretical perspective. A focus on ingroup errors evokes different theoretical explanations than a focus on outgroup errors would. To say that the minority overestimates its own size leads the search for explanations in a different direction than to say that the minority underestimates the size of the majority. In the former case, ego-protective motives come to mind (as it happened to the meta-analysts), whereas in the latter case motives of social dominance come to mind (no one has taken this view yet). Because of this ambiguity, it is difficult to test whether a person's majority–minority status may have unique effects on his or her estimates of the size of the ingroup.

In multiple-group settings, this confound of ingroup and outgroup estimates can be minimized. The size of one of several minorities does not fully determine the size of the majority. The more groups there are, the

[7]Regression analyses conducted to test the contrasting mediational processes (see Baron & Kenny, 1986) supported these analyses.

more individual group sizes can fluctuate. The ethnic diversity of the United States is a case in point. As a multi-ethnic society, the population of the United States comprises one majority and several minorities. Ethnic groups are more typical social psychological groups than are the majorities and minorities in the standard consensus-estimation study. Members of ethnic groups are reasonably identifiable, they interact with one another (however selectively), and they tend to be aware of the size of their own group relative to other groups. In contrast, as Gross and Miller (1997) noted, "the groups studied in the false consensus research … do not exist in any real interactive sense" (p. 241). Pumpernickel and croissant lovers may be committed to different kinds of dough, but their preferences need not imply a deep sense of social identity (unless, of course, they happen to be German or French).

We suspected that the high degree of accuracy, which is to be expected in a multiple-group setting, would make the tests of both models more stringent. If correlational accuracy is perfect, there is little room for the hypothesized biases to occur. Given this caveat, the two models still make discrepant predictions. According to the asymmetry model, the majority–minority asymmetry in estimation errors should occur such that each minority would be overestimating its own size more than the majority would be underestimating its own size. According to the projection model, FCEs could occur for each target group. That is, estimates of group size would be larger among ingroup than outgroup members. This prediction was consistent with the earlier demonstration in the standard paradigm that showed that FCEs still occurred even when item endorsers (ingroup members) and nonendorsers (outgroup members) agreed on which of the two groups was the majority.

Relevant data came from a nationwide telephone survey (Morin, 1995). White ($n = 802$), Black ($n = 474$), Hispanic ($n = 252$), and Asian ($n = 352$) Americans were contacted through a random digit dial procedure, and each respondent was asked to estimate the percentage of the American population falling into each of these four ethnic categories. As the data in Table 4 show, average estimates of group size were highly accurate for all four groups of respondents in that the rank orders of the mean percentage estimates were perfectly correlated with actual group sizes. The prediction of the asymmetry model was not supported. The majority underestimated its own size (–24.1%) more than any of the minorities overestimated their own size ($M = 10\%$). Consistent with the projection model, however, there were FCEs for three of the four target groups. Whites estimated the White group to be larger than did Blacks or Hispanics. Blacks and Hispanics estimated their own groups to be larger than did outgroup members. Asians produced a false uniqueness effect in that they saw their group as smaller than outgroup members saw it.

Note that these data could be packaged as if they were collected in the standard two-group design. Reading the table sequentially for each target group, one could distinguish between estimates made by ingroup members and estimates made by members of the pooled outgroup. Given this perspective, Whites' estimates concerning Whites indicate the underestimation error expected of majorities. As a pooled minority outgroup, Blacks, Hispanics, and Asians underestimated the size of the majority even more, which implies that they, as a composite minority, strongly overestimated their own size (Table 4, bottom row). Similarly, Blacks, as an individual minority, overestimated the size of their own group more than the composite majority (Whites, Hispanics, and Asians) underestimated its own size. The result was similar for the Hispanic target group, but reversed for Asians.

The national survey data served the dual purpose of replicating projection effects among socially relevant groups and of liberating the analysis of projection ef-

Table 4. *Actual and Estimated Sizes of Four American Ethnic Groups in Percent*

	Target Group			
Variable	White	Black	Hispanic	Asian
1992 Census Data	74.0	11.8	9.5	3.1
Respondents				
Whites	**49.9**	23.8	14.7	10.8
Blacks	45.5	**25.9**	16.3	12.2
Hispanics	46.7	22.7	**20.7**	10.8
Asians	54.8	20.5	14.6	**8.3**
Mean Estimate by Outgroups	49.0	22.3	15.2	11.3
False Consensus Effect	.9	3.6	5.5	–3.0
Error by Ingroup	–24.1[a]	14.1[a]	11.2[a]	5.2[a]
Mean Error by Outgroup	25.0[a]	–10.5[a]	–5.7[a]	–8.2

Note: Response percentages are averages of the estimates made by those polled. Hispanics can be of any race. Percentages do not total 100 because the present ethnic categorization is not exhaustive. Numbers in boldface are estimates of ingroup size. The data in rows 1 to 5 are from "Reality Check: Attitudes and Anxieties About Race," by R. Morin, October 8, 1995, *The Washington Post,* p. A1. Copyright © 1995, *The Washington Post.* Reprinted with permission.
[a]Indicates replication of the common asymmetry of errors.

fects from the constraints of the standard distinction of two mutually exclusive and exhaustive groups. Projection (when indexed by FCEs) was observed for most target groups, although the high accuracy of the group size estimates worked against judgmental distortions. These FCEs could not be explained away as the sum of estimation errors made by majorities and minorities.

Conclusions

Theoretical, mathematical, and empirical analyses led to the same conclusions. First, the majority–minority asymmetries in estimation errors could be explained by making the single psychological assumption that most people project. It was not necessary to invoke separate cognitive or motivational mechanisms for majorities and minorities. Second, the majority–minority asymmetry in estimation errors was a group effect masking the errors of individuals. The absolute error of the minority group was larger than the absolute error of the majority group only because the proportion of minority members who incorrectly believed themselves to be in the majority (projection) was greater than the proportion of majority members who incorrectly believed themselves to be in the minority. Third, the desirability of the judgment items did not independently predict the direction or the size of the estimation errors. Cognitive and motivational interpretations of errors in consensus estimation may need to be suspended until more compelling experimental evidence becomes available. Because the projection model was simpler and more parsimonious than the asymmetry model, the burden lies with the asymmetry model to demonstrate the operation of cognitive availability biases or egoprotective mechanisms.

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