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Research Article

The *N*-Effect

More Competitors, Less Competition

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ABSTRACT—*This article introduces the* N*-effect—the discovery that increasing the number of competitors (*N*) can decrease competitive motivation. Studies 1a and 1b found evidence that average test scores (e.g., SAT scores) fall as the average number of test takers at test-taking venues increases. Study 2 found that individuals trying to finish an easy quiz among the top 20% in terms of speed finished significantly faster if they believed they were competing in a pool of 10 rather than 100 other people. Study 3 showed that the* N*-effect is strong among individuals high in social-comparison orientation and weak among those low in social-comparison orientation. Study 4 directly linked the* N*-effect to social comparison, ruling out ratio bias as an explanation of our results and finding that social comparison becomes less important as* N *increases. Finally, Study 5 found that the* N*-effect is mediated by social comparison. Limitations, future directions, and implications are discussed.*

Modern life often seems like a rat race. But does one's motivation to run the maze, to compete, depend on how many other "rats" are in the race? When there is only one gold medal, for instance, increasing the number of contestants from 10 to 100 reduces each contestant's probability of winning and may therefore lead contestants to reduce their competitive efforts. We propose, however, that mere knowledge of the number of competitors can independently affect competitive motivation even when the chances of success remain constant. In this article, we introduce the *N-effect*—the discovery that increasing the number of competitors (*N*) decreases the motivation to compete.

Although our primary objective is to introduce a new phenomenon and link it to the social-comparison process, our findings also make two important theoretical contributions: First, they advance a new direction in social-comparison research, which has traditionally examined how subjective factors amplify competition (Festinger, 1954; Tesser, 1988), but has recently begun to explore how objective, contextual, factors also influence the motivation to compete (e.g., Garcia & Tor, 2007; Garcia, Tor, Bazerman, & Miller, 2005; Garcia, Tor, & Gonzalez, 2006). The *N*-effect continues in this direction, revealing the impact of a ubiquitous contextual factor—the number of competitors—on social comparison and, thus, on competitive motivation. Second, our findings reveal a boundary condition of social facilitation. Although competitive motivation increases in the presence of a few other individuals (Zajonc, 1965), we show that it diminishes when the few become many competitors.

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SOCIAL COMPARISON AND THE COMPETITIVE LANDSCAPE

Social-comparison processes fuel the motivation to compete (Festinger, 1954; Garcia et al., 2006; Johnson & Stapel, 2007). People (*actors*) who compare themselves with others (*targets*) on an important dimension begin to behave competitively toward those others (e.g., Garcia & Tor, 2007; Hoffman, Festinger, & Lawrence, 1954; Poppe & Valkenberg, 2003). Traditionally, researchers emphasized three factors that influence social-comparison-based competitive behavior: (a) importance of the performance dimension (Festinger, 1954; Tesser, 1988), (b) commensurability of the target with the actor (Goethals & Darley, 1977), and (c) the closeness of the relationship between the target and actor (Tesser, 1988). These factors are all subjective, varying among similarly situated actors.

Recent studies, however, have illuminated the important role of objective, contextual, features of the competitive landscape in shaping social-comparison processes (Garcia et al., 2005, 2006; Garcia & Tor, 2007), showing, for instance, that competitive behavior occurs more frequently when rivals are in proximity to a *standard*, an acknowledged measure of comparison (e.g., the ubiquitous #1 ranking or a qualitative threshold), than when

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they are not (Garcia et al., 2006; Garcia & Tor, 2007). For example, two rivals ranked 3 and 4 on the Fortune 500 list or ranked 500 and 501 (just off the Fortune 500 list) exhibit more social-comparison concerns and become less willing to maximize joint gains than two rivals ranked 103 and 104 (Garcia et al., 2006). In the same vein, the present analysis identifies the impact of *N*—another ubiquitous contextual factor—on competitive motivation and performance, and links this effect to social-comparison concerns.

Among a few competitors, actors can compare their performance with that of any given target, a situation that fuels the motivation to compete (Festinger, 1954). We posit, however, that when *N* is large, social-comparison concerns—which are, after all, an interpersonal, information-based process (Festinger, 1954)—become diffused by the sheer number of competitors. Although actors can experience or anticipate social comparisons between themselves and a few others, it becomes less viable and informative for them to compare themselves, or anticipate comparisons, with a great multitude of targets. For this reason, we hypothesize that in large-*N* environments, social comparison becomes less important, and competitive motivation diminishes.

THE PRESENCE OF OTHER INDIVIDUALS AND MOTIVATION

The *N*-effect is relevant to the extant literature on the presence of other individuals and motivation. For instance, *social-loafing* findings (Latané, Williams, & Harkins, 1979) reveal that individual effort generally decreases when an individual task is transformed into a collective group task. Nevertheless, feedback on individual performance can increase motivation in collective tasks (e.g., Williams, Harkins, & Latané, 1981), and heightened social-comparison and competence concerns can reduce loafing as well (Kerr & MacCoun, 1984).

The social-facilitation literature (Zajonc, 1965) also shows that the presence of others can affect motivation via social-comparison concerns. In this case, motivation and effort increase through coaction effects (Zajonc, Heingartner, & Herman, 1969) when individual—rather than collective—tasks are performed in the presence of a few others.

We suggest that, like facilitation, the *N*-effect is manifested in individual tasks. However, unlike facilitation, which is manifested in comparisons between individuals acting alone and those acting among a few other people, the *N*-effect occurs in already-competitive settings, when an environment with only a few competitors is compared with or transformed to one with many competitors. We propose that in these situations—in which social facilitation and social comparison already are present—an increase in *N* has the opposite effect of reducing social-comparison concerns and thereby decreasing the motivation to compete.

STUDIES 1A AND 1B: TEST-TAKING EVIDENCE

We first probed for the *N*-effect in two data sets possessing a high degree of external validity: the SAT and the Cognitive Reflective Test (CRT). We examined SAT scores at the state level,[1] and corroborated this evidence by examining an individual-level set of CRT scores,[2] which are highly correlated with SAT and intelligence measures (Frederick, 2005). We predicted that denser test-taking environments—where more test takers are present in a testing venue—diminish competitive motivation and consequently reduce both SAT and CRT scores.

Data Sets

Study 1a: SAT State-Level Data

Key Variables. We constructed a data set based on the publicly available state-level SAT results for 2005. These results were published by the College Board for all 50 states. In addition to calculating combined SAT scores, we created a test-taker density variable for each state by dividing the total number of test takers in that state by the total number of test-taking venues in that state in 2005. Hence, the density variable provides a state-level average of test-taker *N*.

Control Variables. In an attempt to minimize potential confounds, we controlled for relevant variables at the state level: the percentage of high school students who took the SAT in 2005, the 10-year trend for performance on the SAT, the percentage of test takers who reported having parents with at least a college degree, and the percentage of test takers who were self-identified as ethnic minorities. We also controlled, by state, for important demographic variables: funding of state and local governments for elementary and secondary education (U.S. Department of Education, National Center for Education Statistics, n.d.); per capita income in 2004 (data obtained from U.S. Department of Commerce, Bureau of Economic Analysis, n.d.); and population density derived from population estimates (U.S. Census Bureau, n.d.). Finally, we controlled for the percentage of high school students who took the ACT (the other main college-entrance exam) in 2005 and the average ACT score for each state that year.

Study 1b: CRT Data

We obtained a data set of CRT scores for a sample of 1,383 University of Michigan undergraduates (711 female, 633 male, 39 of unreported gender). These scores were collected over a 3-year period that involved a total of 22 test-taking opportunities. Students took the CRT in a controlled test-taking

[1]The College Board denied our request for individual-level data, but state-level data are publicly available.

[2]We thank Shane Frederick for this helpful data set.

environment that was the same across all 22 test-taking opportunities; the CRT was always administered as part of a series of varied questionnaires on a "questionnaire day."

Results and Discussion

Study 1a: SAT Scores

As predicted, we found a significant inverse correlation between density and SAT score ($N = 50$, $r = -.68$, $p < .05$); the denser the test-taking environment, the lower the SAT score. We also conducted a partial correlation to control for the control variables, and the inverse correlation between SAT score and density remained significant ($N = 50$, $df = 39$, $r = -.35$, $p < .05$). Thus, the more people there were, on average, at the test-taking venue, the lower the SAT score.

Study 1b: CRT Scores

In a parallel analysis, we correlated the total number of participants who showed up for one of the 22 CRT test-taking opportunities with the average score at that particular session. We observed a strong inverse correlation between the number of participants and CRT score ($N = 22$, $r = -.56$, $p < .01$); this inverse correlation remained when we controlled for gender ($N = 22$, $df = 19$, $r = -.48$, $p < .05$). Hence, the more participants there were in a particular CRT test-taking session, the lower the CRT score for that session.

Discussion

The SAT results, although striking, are subject to potential confounds, most notably, distraction and self-selection. Denser test-taking environments may produce greater distraction, which in turn could diminish performance. However, the College Board goes to great lengths to standardize the test-taking environment within each venue; in high-volume centers, students are typically distributed across many classrooms. Thus, variable distraction during the test is unlikely to account for the results. Similarly, self-selection might explain the data if better test takers were to self-select to lower-density states, but there is little reason to believe this is the case. We nevertheless acknowledge the limitations of the SAT real-world data, which were available only at the state level.

It is important to note, however, that the CRT scores were available at the individual level, in a comparatively homogeneous University of Michigan sample, and thus afforded a better-controlled analysis that still provided clear evidence for the *N*-effect. In this case, moreover, the test-taking environment was standardized, and self-selection was irrelevant. Thus, both the SAT and the CRT analyses supported the *N*-effect, which we next examined experimentally under conditions of controlled random assignment.

STUDY 2: DIMINISHED EXPERIMENTAL PERFORMANCE

Study 2 tested the *N*-effect in a task involving finishing an easy but timed quiz as fast as possible without compromising accuracy. We predicted that participants who were told they were competing against 10 people would be more competitive than those who were told they were competing against 100 people, and would therefore complete the quiz significantly faster.

Participants

Seventy-four University of Michigan undergraduates (33 female, 41 male) were recruited while studying alone at university libraries. Because the quiz was timed, only native English speakers were recruited.

Procedure

Two experimenters asked potential participants if they would be willing to take part in a short experiment. One of the experimenters then handed participants a two-page packet (a cover page followed by a short quiz page) and explained that they would be taking a timed quiz and that their goal was to finish the quiz as fast as possible without compromising accuracy. Participants were told that they were competing against either 10 or 100 other participants and that those whose completion times were in the top 20% would receive $5. The short quiz contained four general-knowledge multiple-choice questions (e.g., "Who is the Secretary General of the UN?") and four true/false statements (e.g., "Michigan is shaped like a shoe").

Once the first experimenter gave participants the packets and instructions, the second experimenter, blind to the experimental condition, informed participants that he would begin timing them with a stopwatch. Afterward, participants wrote down their e-mail addresses, in case they scored in the top 20%. Participants in the top 20% were later paid $5.

Results and Discussion

Analyses of completion times revealed that the interactions of condition with accuracy and gender were not significant (Fs < 1). Participants in the 10-person condition completed the quiz significantly faster ($M = 28.95$ s, $SD = 7.69$) than those in the 100-person condition ($M = 33.15$ s, $SD = 10.06$), $F(1, 73) = 4.09$, $p < .05$. Study 2 thus provides a between-subjects, direct, behavioral demonstration of the *N*-effect, showing that increased *N* diminished competitive motivation on an individual task. Moreover, because the effect was generated by mere knowledge of *N*, it cannot be explained by mechanisms that require the actual presence of other competitors (e.g., arousal or coaction effects). Notably, however, mere information is known to suffice for social-comparison processes (Suls & Wheeler, 2000). Moreover, a posttest involving a separate sample of students tentatively supported a social-comparison account of the

N-effect, indicating that social-comparison concerns would play a significantly greater role in the 10-person condition than in the 100-person condition.[3]

STUDY 3: SOCIAL-COMPARISON ORIENTATION AND THE *N*-EFFECT

Study 3 further probed the role of social comparison in the *N*-effect, using a social-comparison orientation (SCO) scale (Gibbons & Buunk, 1999) to reveal interpersonal differences in the effect. We predicted that high-SCO individuals would be more likely to exhibit the *N*-effect than low-SCO individuals.

Participants

Forty-seven undergraduate students (24 female, 23 male) from a Midwestern university participated in an on-line study. Invitations to participate were sent to 250 randomly selected e-mail addresses from the undergraduate student directory, but a few e-mails "bounced back." The response rate was approximately 20%.

Procedure

In a within-subjects design, participants read two vignettes presented in random order: "Suppose you are running in a 5-K with 50 [500] people of similar running ability as yours. You have been told at the start of the race that all those who finish in the top 10% will get a $1,000 prize." After each vignette, participants responded to the following question: "To what extent would you run faster than normal?" (1 = *faster than normal*, 7 = *fastest in my life*). Participants also responded to the 11 items of the SCO scale (Gibbons & Buunk, 1999).

Results and Discussion

Participants indicated that they would try significantly harder in a 5-km race with 50 contestants ($M = 5.43$, $SD = 1.63$) than in a 5-km race with 500 contestants ($M = 4.89$, $SD = 1.71$): The number of contestants had a significant main effect, $F(1, 46) = 11.4$, $p < .01$. Moreover, when SCO score was included as a covariate in the within-subjects analysis of variance, we observed a significant interaction between number of contestants and SCO score, $F(1, 45) = 5.41$, $p < .05$. As predicted, individuals with higher SCO scores were more likely to exhibit the *N*-effect. We also conducted a median split on SCO scores,[4] finding that among high-SCO participants, the *N*-effect was pronounced (few competitors: $M = 5.87$, $SD = 1.36$; many competitors: $M = 5.22$, $SD = 1.51$), $t(22) = 2.91$, $p = .008$, whereas among low-SCO participants, it was insignificant (few competitors: $M = 4.95$, $SD = 1.85$; many competitors: $M = 4.70$, $SD = 1.95$), $t(19) = 1.00$, $p = .33$. Study 3 thus shows that social comparison is a necessary precondition for the *N*-effect.

STUDY 4: SOCIAL COMPARISON OR RATIO BIAS?

Study 4 examined social comparison against alternative accounts of the *N*-effect, focusing on the potential role of the *ratio bias* (Denes-Raj & Epstein, 1994). The ratio bias leads individuals to think it is easier, for instance, to draw 1 of 10 red jellybeans from a jar containing 100 beans than to draw the only red bean out of a jar containing 10 beans, despite the equal probabilities of the two outcomes. Competitors exhibiting this bias might reduce their efforts when facing a large *N* simply because they think their chances of success are higher than in a small-*N* setting, despite being told otherwise. Although the ratio bias is primarily a within-subjects effect (e.g., Denes-Raj & Epstein, 1994) and thus an unlikely candidate for explaining the between-subjects results of Studies 1 and 2, we sought to examine its explanatory power directly while further illustrating the social-comparison roots of the *N*-effect.

Participants

Two samples participated in this study. The first sample consisted of 54 Midwestern undergraduates who participated in an on-line survey and responded to questions about competitive feelings (~29% response rate). The second sample consisted of 48 Midwestern undergraduates who participated in an on-line survey and responded to questions about social comparison (~25% response rate).

Procedure

All participants read:

> Imagine going for a job interview with a company that is only extending offers to 20% of the equally qualified Michigan students who were invited to interview. Alone in the waiting room, you notice one other Michigan student exiting their interview. . . .

In a within-subjects design, participants in the first sample then responded to four questions that varied the context (presented in random order): "If a total of 10 [30] [50] [100] Michigan students had been invited to interview, to what degree would you harbor competitive feelings toward the exiting interviewee?" (1 = *not at all*, 6 = *very much*).

The second sample answered analogous social-comparison questions (". . . to what degree would you feel inclined to compare yourself to the exiting interviewee?" 1 = *not at all*, 6 = *very much*).

On the next page, all participants responded to a ratio-bias scenario, which was taken verbatim from Denes-Raj and Epstein

[3] An independent sample read about the context of this quiz experiment and answered the following question: "If there were 10 [100] competitors in the aggregated pool, to what extent would you be concerned about how your performance compared to the performance of any one particular competitor?" (1 = *not at all*, 7 = *very much*). Social-comparison concerns were significantly greater in the 10-competitor condition ($M = 4.93$, $SD = 1.78$) than in the 100-competitor condition ($M = 4.14$, $SD = 1.68$), paired-samples $t(58) = 3.44$, $p < .01$.

[4] Median-split statistics are supplemental; the reported covariate analysis is appropriate (MacCallum, Zhang, Preacher, & Rucker, 2002).

(1994, p. 824). Participants had to imagine two parallel scenarios in which a person named "Ralph" was playing a lottery:

> In one of the lotteries, a single winning number is selected from a thousand numbers. In the other, ten winning numbers are selected from ten thousand numbers. In both scenarios, Ralph wins the lottery. Rumor has it that Ralph won because of insider influence. . . .

Participants then had to answer the following question: "In which case would you be more suspicious? (a) When the winning number is 1 out of 1,000, (b) When the winning number was among 10 of 10,000, or (c) It would make no difference."

Results and Discussion

As predicted, results from a within-subjects analysis of variance showed that competitive feelings decreased as the number of other interviewees increased from 10 ($M = 4.43$, $SD = 1.77$), to 30 ($M = 3.80$, $SD = 1.72$), to 50 ($M = 3.59$, $SD = 1.68$), and finally to 100 ($M = 3.19$, $SD = 1.76$), $F(3, 159) = 25.07$, $p < .0001$; linear contrast: $F(1, 53) = 29.6$, $p < .0001$. Moreover, the within-subjects linear *N*-effect pattern did not vary by response to the ratio-bias question, $F(6, 147) = 1.46$, $p = .20$. As for social comparison, participants similarly indicated decreasing desire to compare themselves with another interviewee as the number of interviewees increased from 10 ($M = 5.00$, $SD = 1.35$), to 30 ($M = 4.37$, $SD = 1.29$), to 50 ($M = 3.90$, $SD = 1.42$), and finally to 100 ($M = 3.52$, $SD = 1.53$), $F(3, 141) = 35.3$, $p < .0001$; linear contrast: $F(1, 47) = 42.2$, $p < .0001$. Again, the *N*-effect did not vary by response to the ratio-bias question, $F(6, 132) = 1.59$, $p = .16$. Taken together, these results indicate that the ratio bias does not account for the *N*-effect, while directly linking the latter to social comparison: The importance of social comparison decreases as *N* increases, leading the motivation to compete to subside as well.

STUDY 5: SOCIAL COMPARISON MEDIATES THE *N*-EFFECT

In Study 5, we sought to test directly whether social comparison mediates the *N*-effect, while more generally controlling for the potential role of subjective perceptions of success. Some research suggests that competitors may reduce their competitive motivation to compensate for a perceived increase in the easiness of a task (e.g., Larrick, Burson, & Soll, 2007; Windschitl, Kruger, & Simms, 2003). Competitors may also reduce their motivation and effort as *N* increases if they erroneously believe the task has become more difficult and their prospects have therefore diminished. We therefore controlled for perceived easiness of the task in Study 5. We predicted that the relationship between *N* and the motivation to compete would be mediated by social-comparison processes, and that this effect would be beyond the potential contribution of any biased perceptions of the likelihood of success.

Participants

Fifty undergraduates (25 female, 25 male) from a Midwestern university volunteered to participate in an on-line study. The response rate was approximately 20%.

Procedure

In a between-subjects design, participants read:

> In a competition pool of 10 [10,000] students from around the country, imagine you were given one week to produce as many brand-spanking-new 'friends' to your Facebook account as possible. You would be competing in a pool of 10 [10,000], and those finishing in the top 20% would get a $100 cash prize.

Participants then responded to three questions: Competitive motivation was assessed by the question, "To what extent would you feel motivated to compete to win the cash prize?" (1 = *not at all*, 7 = *very much*). Social comparison was assessed by the question, "To what extent would you be inclined to compare your own progress to your competitors' progress?" (1 = *not at all*, 7 = *very much*). Finally, our measure of perceived ease of the task was the response to the following: "To what extent do you feel it would be easy to win the cash prize?" (1 = *not at all*, 7 = *very much*). Participants were also asked to indicate their gender and answered manipulation checks about *N* and the percentage of competitors that would win.

Results and Discussion

Only 6 participants did not answer a question about the number of other competitors, and only 4 missed the fact that the top 20% would receive the cash prize. We retained their data, as doing so did not affect the direction or statistical significance of the results. A multivariate analysis of variance indicated that individuals reported feeling more motivated to compete in the 10-competitors condition ($M = 4.07$, $SD = 2.02$) than in the 10,000-competitors condition ($M = 2.00$, $SD = 1.51$), $F(1, 48) = 16.1$, $p < .001$. They also indicated they would feel more inclined to compare their own progress with their competitors' in the 10-competitors condition ($M = 4.75$, $SD = 2.10$) than in the 10,000-competitors condition ($M = 2.64$, $SD = 2.01$), $F(1, 48) = 12.9$, $p < .01$. Interestingly, however, participants felt it would actually be easier to win the cash prize in the 10-competitors condition ($M = 3.89$, $SD = 1.89$) than in the 10,000-competitors condition ($M = 2.50$, $SD = 1.85$), $F(1, 48) = 6.82$, $p < .05$, although the effect size was somewhat smaller.

We tested our prediction that social comparison mediates the relationship between *N* and competitive motivation, controlling for the perceived easiness of the task and gender. As predicted, number of competitors (few vs. many) was a significant predictor of the outcome variable, competitive motivation ($b = -1.40$, $\beta = -.34$, $p < .01$). Number of competitors was also a significant predictor of the mediator, social comparison ($b = -1.38$, $\beta = -.30$, $p < .05$). Finally, social comparison was a significant

predictor of competitive motivation ($b = 0.67$, $\beta = .75$, $p < .001$). When this latter effect was included in the model, number of competitors was no longer a significant predictor of competitive motivation ($p = .16$). The drop in this coefficient was significant (Sobel $z = -2.35$, $p < .05$), which further indicates that motivation to compete is mediated by social comparison (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

We also conducted a reciprocal, parallel analysis, testing perceived easiness of the task (rather than social comparison) as the potential mediator, while controlling for gender and social comparison (instead of perceived easiness) at every step. In this case, *N* was not a significant predictor of competitive motivation ($p = .12$) or a significant predictor of perceived easiness ($p = .36$), and perceived easiness was not a significant predictor of competitive motivation ($p = .17$). Unlike social comparison, therefore, perceived easiness does not appear to independently mediate the *N*-effect. However, a mediation analysis cannot fully substitute for a direct manipulation, although it can help limit the inferential scope of possible mediators. The present social-comparison analysis is thus preliminary; its further refinement and development are left for future studies.

GENERAL DISCUSSION

Among a few competitors, people can experience or anticipate social-comparison concerns, which in turn fuels their motivation to compete. As the number of competitors increases, the forces underlying social-comparison processes typically diminish, making social comparison less important and dampening competitive motivation. The present studies found consistent, converging evidence for the *N*-effect across different contexts, methodologies (e.g., between- vs. within-subjects designs, in-person vs. on-line participation), and hypothetical and behavioral measures. Studies 1a and 1b showed that SAT and CRT scores fall as the number of test takers in a given venue increases. Study 2 demonstrated the *N*-effect in completion times when participants were randomly assigned to conditions, and showed that mere knowledge of *N* is sufficient to generate this effect. Study 3 further showed that the *N*-effect is moderated by individual differences in SCO. Finally, Studies 4 and 5 provided evidence against the alternative ratio-bias and perceived-easiness accounts, further linking the *N*-effect to social-comparison processes (Study 4) and showing that these processes mediate the *N*-effect (Study 5).

Despite the centrality of social-comparison processes in generating the *N*-effect, other mechanisms that await further study might well contribute to it. Indeed, decades of research on a similar behavioral phenomenon—bystander apathy—have shown it to be multiply determined (e.g., *diffusion of responsibility*: Darley & Latane, 1968; *social influence*: Darley, Teger, & Lewis, 1973; *confusion of responsibility*: Cacioppo, Petty, & Losch, 1986; *pluralistic ignorance*: Prentice & Miller, 1996; *implicit bystander effect*: Garcia, Weaver, Moskowitz, & Darley, 2002). Hence, we can confidently assert that social comparison is one, but not necessarily the only, mechanism of the *N*-effect.

The present findings do not clarify the limits of the *N*-effect. Our studies, the psychophysics literature (Zipf, 1949), and the *psychosocial law* of social-impact theory (Latané, 1981) all suggest that increasing *N* from 10,000 to 10,100 is unlikely to change competitive motivation significantly. Moreover, the impact of both *N* and changes in *N* may vary across competitive contexts; *N* poker-table competitors may well be perceived differently from *N* marathon runners.

Nevertheless, the present evidence of the *N*-effect already has significant implications that go beyond social-comparison, social-facilitation, and related research. In the workplace, for instance, productivity on individual tasks (e.g., sales in a commission-based system) might be lower when the tasks are performed among many similar workers in a large warehouse than when they are performed among only a few workers in smaller branch offices. In educational settings, the *N*-effect sheds new light on the class-size debate (Mishel & Rothstein, 2002). Some observers argue that class size is rather insignificant (e.g., Hanushek, 2002), whereas others deem it important (e.g., Krueger, 2002). The *N*-effect, however, indicates that as the number of students in the classroom increases, motivation to compete and academic effort are likely to decrease. In fact, perhaps the *N*-effect could partly explain the mystery of the decrease in SAT scores in recent years (Finder, 2007), if the average number of test takers reporting to testing venues has been increasing.

Finally, we conclude by qualifying Zajonc's (1965) recommendation in his seminal article on facilitation:

> If one were to draw one practical suggestion . . . [one] would advise [one's] student . . . to arrange to take his examinations in the company of many other students, on stage, and in the presence of a large audience. The results of his examination would be beyond his wildest expectations. . . . (p. 274)

On the basis of our social-comparison account of the *N*-effect, we recommend having only *a few* others on stage; adding too many competitors may dampen, rather than enhance, the motivation to compete.

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