Looking Back: Exploring the Psychology of Queuing and the Effect of the Number of People Behind

RONGRONG ZHOU
DILIP SOMAN*

Queues are a ubiquitous phenomenon. This research investigates consumers' affective experiences in a queue and their decisions to leave the queue after having spent some time in it (reneging). In particular, we find in our first two studies that, as the number of people behind increases, the consumer is in a relatively more positive affective state and the likelihood of reneging is lower. While a number of explanations may account for this effect, we focus on the role of social comparisons. In particular, we expect consumers in a queue to make downward comparisons with the less fortunate others behind them. We propose that three types of factors influence the degree of social comparisons made and thus moderate the effect of the number behind: (*a*) queue factors that influence the ease with which social comparisons can be made, (*b*) individual factors that determine the personal tendency to make social comparisons, and (*c*) situational factors that influence the degree of social comparisons through the generation of counterfactuals. Across three studies, we find support for each moderating effect. We conclude with a discussion on theoretical implications and limitations, and we propose avenues for future research.

Queues are a ubiquitous consumer experience (Hockenhull 2000; Larson 1987). Consumers routinely queue up to take a bus to work, to use an ATM, to check into a flight, to send a parcel at the post office, to purchase groceries, or to speak to a telephone ticketing agent. There are queues for consumers to get a medical operation (Milne 1998) and even for them to use a public toilet (Shaw, Blume, and Greenhalgh 2000). Given the ubiquity of queues, a rich literature in the field of queuing theory has studied efficiency in queuing using mathematical modeling (see Gross and Harris 1985; Newell 1982; Prabhu 1997). More recently, behavioral researchers in marketing have become interested in understanding the psychological costs that consumers expend while waiting for service (Carmon, Shanthikumar, and Carmon 1995) and in offering prescriptions on how to reduce these costs (Bateson and Hui 1992; Hui and Tse 1996; Katz, Larson, and Larson 1991).

In some queuing situations, consumers have little choice but to stay in the queue. For example, those waiting for an operation or to use a toilet will presumably continue to wait for these essential services. However, consumers in other settings may have a choice. Should they wait at the post office or arrange for a pickup for an additional charge? Should they wait in the grocery queue or use the self-checkout lanes at an additional hassle cost (Levin 2000)? Or, if possible, should they simply leave the queue and return at another time?

In this article, we study consumers who are part of a queue and investigate their affective experiences and their decisions to leave the queue after having spent some time in it. We refer to the decision to leave as "reneging."[1] Prior literature offers suggestions on why a consumer may renege. Reneging could occur when the experienced frustration with waiting (which is a function of the time already spent in the queue) or the expected cost of additional waiting (which is a function of the number of people waiting to be served

*Rongrong Zhou is assistant professor of marketing and a Wei Lun fellow (mkrrzhou@ust.hk) and Dilip Soman is associate professor of marketing (mksoman@ust.hk), both at the Hong Kong University of Science and Technology, Clearwater Bay, Kowloon, Hong Kong. Both authors contributed equally to the research reported in this article, and the order of authorship is random. We thank Stew Carter, Meichi Chan, Emily Chow, Connie Chue, Amanda Snow Conant, and Vivian Lam for excellent research assistance. We also thank Ravi Dhar, Gerry Gorn, Don Lehmann, Michel Pham, the editor, and referees for comments and suggestions on previous drafts of this article. This research was fully supported by grant HKUST6147/02H from the Research Grants Council, Hong Kong SAR.

[1]Note that reneging does not necessary imply that the consumer is not interested in the service; it simply refers to the decision to leave a queue. The consumer could renege and yet consume the basic offering through a competitor, by using a premium version of the service, or by returning at a later time.

ahead of the consumer) exceeds a certain threshold (Becker 1965; Larson 1987). Therefore, reneging and affective reactions will depend on the time already spent waiting and on the number of people ahead of the consumer (see Bateson and Hui 1992).

We suggest, however, that in addition to the number of people ahead, the number of people behind also influences reneging decisions. While there are a number of explanations for this effect, the focus of this article is on one particular mechanism through which the number of people behind matters—social comparisons. More specifically, we propose that consumers in a queue make downward comparisons with others behind them. As a result, while the wait might be aversive in itself, consumers derive some comfort from looking back on a large number of people behind them and thinking, "I bet you all wish you were here where I am."

The rest of this article is divided into three sections. First, we draw upon literature in marketing, decision making, and social psychology to develop our hypothesis about the effect of the number of people behind. In two studies, we show that the greater the number behind, the more positive the consumer's affective state and the lower the likelihood of reneging. Second, we introduce our theoretical framework and propose that three types of factors affect the degree of social comparisons. In three additional studies, we manipulate the strength of these factors and show corresponding changes in the strength of the number behind effect. Finally, we conclude with a discussion on the theoretical implications and limitations of our research and propose avenues for future research.

THE PSYCHOLOGY OF QUEUING AND THE NUMBER BEHIND EFFECT

Operations researchers have extensively studied the structure and management of queues with the objective of developing efficient queuing policies from the perspective of the entire system (Gross and Harris 1985; Newell 1982). Much of this research is based on mathematical modeling (Prabhu 1997), but it typically ignores consumer experiences in queues. However, Carmon et al. (1995) show that the recommendations for queue management arising from a consideration of consumer experiences are quite different from the recommendations from operations research. Since such experiences are critical to reported satisfaction with the service encounter (Taylor 1994; Tom and Lucey 1997), research on consumer experiences is of utmost importance to marketing managers who attempt to maximize the dual objectives of consumer satisfaction and efficiency.

Waiting for service is typically a negative consumer experience and causes unhappiness, frustration, and anxiety (Larson 1987). Past research has shown that consumers retrospectively overestimate the duration of waiting time (Hornik 1984), resulting in a reduction in service evaluation (Katz et al. 1991; Taylor 1994). Researchers have also attempted to uncover strategies for reducing the negative effects of the perception of time. For instance, Katz et al. (1991) found that distractions during the waiting period (e.g., a news board or television) made the wait more palatable and improved service evaluation.

While much of the research on the psychology of waiting has focused on the retrospective evaluation of the service experience measured at the conclusion of the service, relatively less attention has been given to the experiences and decision making of consumers who are waiting in queues. As Meyer (1994) forcefully argues, consumers "are not mindless passengers in a human line" but can make decisions, and their affective states are also open to environmental influence (p. 819). In this article, we study such reneging decisions and affective states.

In the current research, we study common situations where the consumer inherently needs or desires the underlying service offering (e.g., sending a parcel, withdrawing money) but can either come back on another occasion to avail of the service (e.g., the parcel can wait until tomorrow) or pay a premium to avail of the service without further waiting (e.g., pay an extra service charge to arrange for a pickup). We do not consider the extreme conditions in which consumers have no other choice but to wait (e.g., waiting to check in for a flight) or get so exceedingly impatient and frustrated that they decide not to avail of the service at all (Hockenhull 2000).

Three streams of literature are relevant to an understanding of why a consumer may renege. First, an economic analysis of the opportunity cost of waiting (Becker 1965) and the principles of marginal decision making (Frank 1994) suggest that the decision to renege should depend on the trade-off between the cost of the expected additional wait and the cost of the alternative course of action (e.g., the additional cost of arranging for a pickup). The expectation of additional waiting time depends on the expectation of the rate of service and the number of people ahead of the consumer in the queue (Carmon et al. 1995; Carmon and Kahneman 1996; Meyer 1994). Second, consumers may take the time already spent waiting into consideration and fall prey to the sunk cost effect (Garland and Newport 1991). Therefore, the likelihood of reneging will decrease as the time spent waiting increases. Third, the time already spent waiting may result in affective responses such as frustration, impatience, and annoyance (Larson 1987) that cause reneging. The extent of such negative affect experienced by a consumer has a monotonic relationship with the time already spent waiting (Taylor 1994). Across all three literatures, reneging and affective reactions should depend on the time already spent waiting and on the number of people ahead of the consumer (see Bateson and Hui 1992).

Why might the number of people behind matter? First, we note that a larger number of people behind implies a longer queue, ceteris paribus. A consumer may make two inferences on seeing a longer queue: (*a*) it may serve as a social validation cue that the service is worth waiting for (Cialdini 1985), and (*b*) it may lead the consumer to expect a longer queue if she rejoins at a later point in time. Both

these inferences will result in a greater reluctance to leave the queue. Second, the number of people behind may affect the consumer through the process of social comparisons. Specifically, while waiting is unpleasant, seeing many people behind is somewhat of a comfort since "there are people worse off than me."

An extensive body of research in social psychology focuses on the universal human tendency to learn about and improve oneself by making social comparisons with others (Festinger 1954; Gilbert, Price, and Allan 1995; Taylor, Wayment, and Carillo 1995). Social comparisons occur on an ongoing basis, and these have been described as spontaneous, effortless, and relatively automatic (Gibbons and Buunk 1999). However, they are especially likely to occur in situations where there is uncertainty, novelty, evaluation, or change (Schachter 1959).

Consumers waiting in queues are good candidates for making both spontaneous and deliberate social comparisons. The waiting situation is unusual—it is oriented toward meeting a personal goal, and yet it is social in that other individuals are also attempting to attain the same goal. Consumers who are contemplating reneging are in an evaluative mode and may attempt to regulate their own affective states (Meyer 1994). In addition, physical proximity to others can foster easy comparisons (Schachter 1959). Therefore, one reason the number of people waiting behind matters may be related to social comparisons, more specifically, downward comparisons directed toward self-enhancement (Wills 1991). As unpleasant as a wait might be, the act of socially comparing oneself with people behind who are not quite as fortunate could be somewhat of a comfort. We capture our expectations more formally in the following hypothesis:

H1: The number of people behind a consumer in a queue will influence a consumer's decision to renege and her affective reactions. In particular, as the number behind increases, the consumer will experience more positive affect and the likelihood of reneging will decrease.

We note that hypothesis 1 makes predictions about the effect of the number of people behind on positive affect. We had no predictions about negative affect based on downward social comparisons. Based on our review of the affect literature (Cohen and Areni 1991), we kept open the possibility that the effect of our manipulations on negative affect would not mirror the effect on positive affect. While we had no predictions, we collected data on both positive and negative affect in our experimental studies and conducted exploratory analyses on the effects on negative affect.

Hypothesis 1 is tested in two studies. Given that we use a combination of these two studies to test this hypothesis, we first present the analyses and results of each study and then discuss the two studies collectively.

STUDY 1

Subjects, Design, and Procedure

In this field study, we observed individuals who joined a queue at the only ATM in the concourse of a busy commercial building in Hong Kong. In addition to cash withdrawal, the ATM also provided services such as bill payments, cash transfers, tax payments, and other account management functions. We observed people during the lunch hour when the area was fairly crowded. Based on a few days of observation, we noted that queue lengths during the lunch hour typically ranged from five to nine people, the total time spent waiting ranged from five to 10 minutes, and the rate of reneging was about 20%. Further, most reneging occurred within the first three minutes of joining the queue. Based on this information, an experimenter unobtrusively observed 91 individuals who joined the queue and tracked each individual for three minutes. Three pieces of information were then noted: (1) whether the individual reneged or was still waiting at the end of three minutes, (2) the number of people ahead of the individual, and (3) the number of people behind the individual. The number of people ahead and behind were based on an actual count at either the end of the three minutes if they did not renege or at the time they reneged.

Results and Analyses

The results from this study are consistent with our hypothesis. Twenty-seven out of the 91 individuals (29.67%) reneged.[2] A logit model with the likelihood of reneging as the dependent variable and the number of people ahead and behind as independent variables (Wald criterion $= 15.93$; $p < .005$) yielded a negative and significant coefficient of number of people behind (-1.06; $\chi^2(1) = 15.43$; $p < .001$), while the coefficient for number of people ahead was not significant.[3] This implies that, controlling for the number of people ahead, a larger number of people behind the subject resulted in a lower likelihood of reneging.

STUDY 2

In this experimental study, subjects were asked to imagine themselves in a waiting situation at a post office. After ostensibly waiting for some time, they were given information about the number of people in queue. At this time, subjects were given a choice between continuing to wait and reneging by paying an additional fee for immediate service. We measured the likelihood of reneging and affective reactions.

[2]Most of these reneged after spending three minutes in the queue. We ignored data from two additional individuals who reneged almost immediately after joining.

[3]We did not find a significant effect of the number ahead, but note that there was very little variance in the number ahead because we measured AHEAD and BEHIND either at the time of reneging (in 29.67% of the cases) or at the end of three minutes (in 70.33% of the cases).

Subjects, Design, and Procedure

Subjects were 150 students recruited at the student center of a U.S. university. Those that agreed to participate were handed a questionnaire. Subjects were paid $1.00 for their time and were randomly assigned to one of six experimental conditions.

All subjects were asked to imagine that they were at a post office to send important registered letters relating to college tuition and scholarships. They ostensibly had an important midterm on the following day that they needed to study for, but it was also important to send the letters out. The post office had multiple clerks with a common queue. As soon as a clerk became available, the person at the front of the queue would be serviced. They had hoped to spend no more than 10 minutes accomplishing this errand, but were told that it had already been about 10 minutes that they had been waiting.

Within this basic framework, the queue (after the 10-minute wait) was described to subjects in a 2 (Number Ahead: 5, 10) × 3 (Number Behind: 0, 5, 10) between-subjects design. The factor Number Ahead represented the number of people ahead of the consumer, and the factor Number Behind represented the number of people behind the consumer in the queue after the 10-minute wait.

Subjects were then asked to indicate how well each of five statements described how they feel at this stage (scale end points: 1 = strongly disagree, 9 = strongly agree). These statements were selected based on pretests and a review of prior research (Cohen and Areni 1991). They are: "I feel annoyed [calm, happy, relieved, and anxious]." Subjects then turned the page and read the following: "As you look around, you see a sign announcing a rush service where you can drop off all your registered letters to be stamped and mailed for a fee of $5.00. There is no waiting time at this rush service counter. You wonder if you should continue waiting in line, or pay the $5.00 and go home to study for that important exam." Subjects then answered two questions. First, they chose (CHOICE) between waiting and the rush service. Second, they indicated a relative preference between the two options (RENEGE: 1 = definitely wait, 9 = definitely rush service).

Results and Analyses

All subjects faced a decision in which they had to trade off their cost of additional waiting against $5.00. Additionally, all subjects were implicitly aware that the present service rate was five people in 10 minutes, and they had no reason to believe that this rate was going to change in the future. In a preliminary analysis, we found that the correlation between the three positively valenced affective measures (calm, happy, relieved) was high ($\alpha = .72$); hence, we used their mean as a measure of POSITIVE affect. Similarly, we used the mean of annoyed and anxious ($r = .77$) as a measure of NEGATIVE affect. In all subsequent experiments, the correlations were consistently high (ranging from .72 to .96); hence, the means were used as dependent variables.

Two ANOVAs with POSITIVE and NEGATIVE as dependent variables and Number Ahead and Number Behind as independent variables revealed significant main effects of Number Ahead (POSITIVE: $F(1, 144) = 29.66$; $p < .001$; NEGATIVE: $F(1, 144) = 14.98$; $p < .001$) and Number Behind (POSITIVE: $F(2, 144) = 38.57$; $p < .001$; NEGATIVE: $F(2, 144) = 76.41$; $p < .001$). The interaction effect did not approach significance ($p > .25$). These main effects are consistent with our expectations. Not surprisingly, the greater the number of people ahead, the lower was the POSITIVE ($M_{5\text{-ahead}} = 5.77$, $M_{10\text{-ahead}} = 4.81$) and the higher was the NEGATIVE ($M_{5\text{-ahead}} = 3.03$, $M_{10\text{-ahead}} = 3.59$). More interestingly, the greater was the number of people behind, the higher was the POSITIVE ($M_{0\text{-behind}} = 4.26$, $M_{5\text{-behind}} = 5.52$, $M_{10\text{-behind}} = 6.11$) and the lower was the NEGATIVE ($M_{0\text{-behind}} = 4.44$, $M_{5\text{-behind}} = 3.21$, $M_{10\text{-behind}} = 2.27$).

The binary CHOICE data were analyzed using a logistic regression with the log odds of choosing to renege as the dependent variable and contrast codes for Number Ahead and Number Behind as independent variables. The regression revealed a significant main effect of Number Behind ($\chi^2(2) = 24.22$; $p < .001$). The main effect of Number Ahead barely approached significance ($\chi^2(1) = 2.53$; $p = .11$), while the interaction between the two was not significant ($\chi^2(2) = .09$; $p > .90$). The percent of subjects who chose to renege was significantly reduced as Number Behind increased ($M_{0\text{-behind}} = 84\%$, $M_{5\text{-behind}} = 58\%$, $M_{10\text{-behind}} = 32\%$). We obtained an identical pattern of results for the RENEGE score (i.e., relative preference). An ANOVA analysis yielded significant main effects of Number Ahead ($F(1, 144) = 6.87$; $p < .01$) and Number Behind ($F(2, 144) = 29.98$; $p < .001$), while their interaction did not approach significance ($p > .90$). Not surprisingly, the likelihood of reneging was greater when there were 10 people ahead ($M = 5.43$) rather than five ($M = 4.61$). However, consistent with our theorizing, the likelihood of reneging also depended negatively on the number of people behind; that is, reneging was most likely when Number Behind was 0 ($M = 6.52$), less likely when it was 5 ($M = 4.96$), and least likely when it was 10 ($M = 3.58$).

DISCUSSION OF STUDIES 1 AND 2

Across the first two studies, we found a significant effect of the number of people behind, controlling for the number ahead, on the likelihood of reneging and on affective reactions. To what extent can our results be attributed to the inferences about social validation and future queue length? Consider first the social validation inference. In studies 1 and 2, we selected settings (i.e., ATM, post office) in which we did not expect the total queue length to result in any social validation about the worthiness of the service. These are routine services, and consumers' perception of the worthiness of these services is not likely to be affected by the total queue length. Second, consider inferences about the future queue length. While the results of study 1 might admittedly be consistent with this explanation, study 2 was designed to eliminate this possibility. Specifically, in study

2, subjects did not have the option of coming back; they had to choose between staying in the line and paying more for the rush service.

Across the two studies, we conclude that (*a*) the number of people behind the consumer influences reneging decisions and affective reactions (we subsequently refer to this as the number behind effect), (*b*) this effect is robust, and (*c*) inferences about the worthiness of the service and future queue length cannot fully account for the effect. Thus, while any one result may be questioned, the two studies collectively support hypothesis 1, and they show that the number behind matters even after controlling for any inferences based on total queue length.

THE ROLE OF SOCIAL COMPARISON IN THE NUMBER BEHIND EFFECT

Results from the first two studies thus lead us to a subsequent question: If inferences about the worthiness of service and future queue length cannot fully explain the number behind effect, what other factor drives this effect? Our thesis is that the answer lies in social comparisons that consumers make with others. Some of the key underlying motives for making social comparisons identified by previous research include self-assessment, self-improvement, and self-enhancement (Taylor et al. 1995). The self-assessment motive originates from people's need to have stable and accurate appraisals of themselves. In the absence of objective standards for self-evaluation, people often resort to social comparisons, that is, they evaluate themselves using comparisons with other people. In particular, comparisons with similar others (lateral social comparisons) are especially useful for self-assessment. The self-improvement motive refers to the desire to improve oneself. Comparisons with those doing better than the self (upward comparisons) are especially useful for meeting self-improvement needs. Last, the self-enhancement motive refers to the concern to maintain a positive sense of self, and it is usually served by comparisons with people whose outcomes are worse than one's own (downward comparisons; Wills 1991).

In a queuing context, consumers waiting in line could potentially make upward comparisons (i.e., compare themselves with those ahead of them) as well as downward comparisons (i.e., compare themselves with those behind them). However, a great deal of research suggests that when people are feeling anxious and unhappy about their current status, downward comparisons are more likely to occur (see Wills [1981] for a review). Since waiting is an unpleasant experience that causes frustration and stress (Larson 1987), a consumer in a queue may seek comfort and try to reduce anxiety and annoyance through comparisons with those less fortunate people behind her. Such downward comparisons have been found to serve hedonic functions (Brickman and Bulman 1977) and to improve subjective well-being (Wheeler and Miyake 1992). As unpleasant as a wait might be, the act of socially comparing oneself with people behind who are not quite as fortunate is somewhat of a comfort. In short, seeing many people behind oneself may lead to downward comparisons that result in more positive affective reactions and lead to decisions to stay in the queue.

We believe that the number behind effect may arise from spontaneous downward comparisons with others behind in the queue. In addition, we propose that there are three types of factors that affect the degree of social comparisons. Queue factors, such as the physical arrangement of the queue, influence the ease with which social comparisons can be made. Second, individual difference factors influence the personal tendency to make social comparisons. Third, situational factors can influence the degree of social comparisons through the generation of counterfactuals. We next discuss each of these in turn.

Queue Factors

Although the process of social comparisons has been suggested to be "spontaneous, effortless, and unintentional" (Bandura and Jourden 1991, p. 227), social comparisons are more likely to occur when it is easy to obtain information on the distribution of different people along the dimension being compared. In the queuing context, the salience of information about the relative position of the consumer will therefore influence the degree of social comparisons. A linear queue system (in which people queue up one behind another in order of arrival) offers unambiguous information about the position of a consumer relative to others in the queue. However, in other queuing systems, the relative position is not as salient, and thus social comparisons are less likely to occur. One example of such a system is the take-a-number-and-wait system (Hui and Tse 1996), where arriving consumers are not spatially arranged in the order of arrival but instead occupy seats scattered throughout a waiting area. Such consumers are typically provided information about the current number being serviced and the most recent number issued, and thus they have the ability to assess their relative position. However, since the relative position is not made salient, we expect a weaker degree of social comparisons and, hence, a weaker number behind effect. Our formal predictions were as follows:

H2: The effect of the number of people behind a consumer on reneging and affect will be moderated by the salience of the relative position as determined by the queue system; that is, the more salient the relative position, the greater the number behind effect.

Individual Factors

A number of researchers have suggested that certain types of individuals may be more inclined to engage in social comparisons than others (Gilbert et al. 1995; Steil and Hay 1997). Recently, Gibbons and Buunk (1999) developed and validated a scale (the Iowa-Netherlands Comparison Orientation Measure, hereafter referred to as the INCOM scale) to measure individual differences in the tendency to make

social comparisons. In several field and laboratory studies, they showed that the INCOM scale had good psychometric properties. Individuals who scored high on this scale exhibited a greater tendency to make social comparisons. In the context of queues, we expect such individuals to engage in a greater degree of social comparisons and, therefore, to display a stronger number behind effect than individuals who have a lower tendency to make social comparisons. More formally, we propose:

H3: The effect of the number of people behind a consumer on reneging and affect will be moderated by the social comparison tendency; that is, the larger this tendency, the greater the number behind effect.

Situational Factors

If consumers in a queue make downward social comparisons with others behind them, under what set of situational circumstances might the degree of these comparisons be heightened? We turn to the literature on counterfactual thinking to help identify such situational factors. Counterfactual thinking refers to a set of cognitions involving the simulation of alternatives to past or present factual events or circumstances (Roese and Olson 1995). A growing body of research has shown that individuals spontaneously think about "what may have been" (Roese 1997), especially in the context of factors that they could easily imagine to have been different (Markman et al. 1993). A queue is a good example of a situation that is likely to trigger counterfactual thoughts, because arrival times are often beyond the consumer's control, which makes it easier for the consumer to generate alternative scenarios and use them in decision making.

Given that a consumer makes downward comparisons with others behind and feels lucky about being in a superior position, she may feel even more positively when counterfactual thoughts about her position relative to others are triggered. An example of such counterfactual thoughts is, "If I had arrived fifteen minutes later, I would be a long way behind in the queue as compared to where I am now." Past research suggests that such counterfactuals usually lead to relief, feelings of being lucky, and, consequently, a better evaluation of the current state of affairs (Landman 1987; Teigen 1995). In our example, this would result in more positive affect and a lower likelihood of reneging (Gleicher et al. 1990).

While the tendency to generate counterfactuals is pervasive, situational factors play a significant role in the likelihood of thinking counterfactually and in the strength of the resulting counterfactuals. One such factor is the degree of unusualness of the event (Kahneman and Tversky 1982; Roese and Olson 1995). Events that are unusual and perhaps even fortuitous are more likely to result in counterfactuals, as compared with events with the same final outcome but where the path to the outcome is commonplace, mundane, and proceeds as scheduled (Kahneman and Varey 1991; Teigen 1995). In the queuing context, this would suggest that, if the arrival time of the consumer is fortuitous rather than per a predetermined schedule, counterfactuals are more likely to be generated. Due to the salient counterfactual thoughts about one's relative position, the consumer would feel even better about being in a superior position than others behind (i.e., the downward comparison process is magnified) and, hence, the effect of the number of people behind would be stronger. This expectation is captured in the following hypothesis:

H4: The effect of the number of people behind a consumer on reneging and affect will be moderated by the situational determinants of counterfactual generation; that is, the greater the tendency to generate counterfactuals (due to fortuitous arrival time), the larger the number behind effect.

We next report three experiments designed to test hypotheses 2, 3, and 4. In each experiment, we manipulate one moderating factor and show its effect on affective reactions and reneging decisions.

STUDY 3

This experiment was designed to test hypothesis 2. Specifically, we manipulated the salience of the consumer's relative position in a queue and expected that a reduction in salience would reduce the number behind effect.

Subjects, Design, and Procedure

Subjects of the study were 150 students at a university in Hong Kong who participated in exchange for course credit. They were presented with a booklet describing a scenario that involved waiting in line to renew their vehicle registration. The booklet also included photographs (in full-page color) showing the waiting area at different points in time. Subjects were asked to imagine that they worked close to the licensing office and stopped by during a lull at work, hoping to get the job done in 10–15 minutes. They were first presented with photograph A, which showed the waiting area upon arrival, and were asked to imagine that they were the target person in the photo (marked with an arrow in photograph A). Photograph A showed that there were a number of people already waiting at the time the target person arrived.

They then turned a page and read the following: "You have been waiting for 15 minutes, and it is still not your turn to be serviced. You realize that, while you do not have any specific appointments in the next hour or so, you do have some work to complete. Photograph B shows the waiting area at this stage. As you can see, some people have been serviced and have left and some others may have joined."

For all subjects, there were nine people ahead of them when they arrived, of which five had been serviced in the past 15 minutes. Within this basic scenario, we manipulated the queuing information in a 2 (Queue System: linear vs. take-a-number) × 3 (Number Behind: 0, 3, 6) design, and

subjects were randomly assigned to one of the six experimental conditions. The two different queue systems were designed to manipulate the salience of relative position. In the linear queue conditions (high salience), subjects were told that people were seated in a linear queue in front of the service desk in the order in which they arrived. Both photographs A and B showed people seated in a line, and the target person's relative position in the queue was very salient. In photograph A, the target person sat at the end of the line with nine people ahead of him. In photograph B (15 minutes later), five people ahead of the target person had left, and a number of people (0 vs. 3 vs. 6) had joined the queue.

In the take-a-number queue conditions (low salience), subjects were told that arriving consumers were given a ticket number reflecting the order of arrival and asked to take any seat in a waiting area. Photographs A and B showed people sitting in a scattered fashion in a waiting area and also included a display board showing the number currently being served as well as the last ticket number issued. All subjects were told that they were issued the ticket number 210 upon arrival. In photograph A, the display board showed that the number being served at that time was 201 (i.e., there were nine people ahead). In photograph B, five of these nine people had left and an additional number of people (0 vs. 3 vs. 6) had joined. Therefore the display board showed that the number being served was 206 and the last ticket number issued was 210, 213, or 216 (0 vs. 3 vs. 6 people behind).

After reading the scenario and looking over the two photos, subjects answered a number of questions. First, POSITIVE and NEGATIVE affect were measured using the same scales as in study 2. Second, they were asked for their likelihood of reneging: "If you continue waiting, then you have less time to devote to your work. On the other hand, if you leave, you are going to have to come back some other day. Keep in mind that, as a new car owner, you have to physically go to the licensing office to get the paperwork done. What will you do?" (RENEGE1: 1 = definitely stay; 9 = definitely leave). Third, as another measure of reneging, they were told about a drop-off service where they could simply leave their materials without further waiting, pay an additional service fee of HK$50, and get their completed papers in the mail, and they were asked for their intention to use this service (RENEGE2: 1 = definitely wait; 9 = definitely use drop-off service).

Results and Analyses

In a preliminary analysis, we found that the correlation between the two measures of RENEGE was high and significant ($r = .91$; $p < .001$). Hence, we used their mean as the measure of the likelihood of reneging (RENEGE). Further, all subjects also correctly reported the number of people ahead, behind, and serviced during the 15-minute interval.

Our objective in this experiment was to show that the effect of the number of people behind on the consumers' decision making and affective experience is moderated by the salience of the relative position in queue. In the context of this experiment, hypothesis 2 therefore predicted a significant Queue System × Number Behind interaction.

The RENEGE, POSITIVE, and NEGATIVE scores were analyzed using separate 2 (Queue System) × 3 (Number Behind) ANOVAs. Mean values of each dependent variable in each of the experimental conditions are plotted in figure 1. Results for RENEGE revealed a significant Queue System × Number Behind interaction ($F(2, 144) = 7.44$; $p < .001$) in addition to a significant main effect of Number Behind ($F(2, 144) = 31.57$; $p < .001$) and a marginally significant main effect of Queue System ($F(1, 144) = 3.43$; $p = .07$). As panel A in figure 1 shows, the interaction was in the expected direction—the effect of number of people behind on the likelihood of reneging was stronger in the linear queue conditions ($F(2, 144) = 34.7$; $p < .001$) than in the take-a-number queue conditions ($F(2, 144) = 4.31$, $p < .05$). Note that this conclusion was identical for both ways of measuring the likelihood of reneging—leaving to return later, or leaving and using the drop-off service.

The two affective measures also showed an identical pattern of results, namely, a significant Queue System × Number Behind interaction (POSITIVE: $F(2, 144) = 4.52$; $p < .02$; NEGATIVE: $F(2, 144) = 4.83$; $p < .01$) and a significant main effect of Number Behind (POSITIVE: $F(2, 144) = 21.91$; $p < .001$; NEGATIVE: $F(2, 144) = 23.60$; $p < .001$). The main effect of Queue System was not significant (p's $> .15$). As figure 1 shows, the significant interactions were in the expected directions. Specifically, the greater the number behind resulted in a more positive affect, but this effect was stronger in the linear queue conditions ($F(2, 144) = 23.06$; $p < .001$) than in the take-a-number queue conditions ($F(2, 144) = 3.37$; $p < .05$). In addition, the greater the number of people behind resulted in less negative affect, but this effect was stronger in the linear queue conditions ($F(2, 144) = 24.7$; $p < .001$) than in the take-a-number queue conditions ($F(2, 144) = 3.72$; $p < .05$).

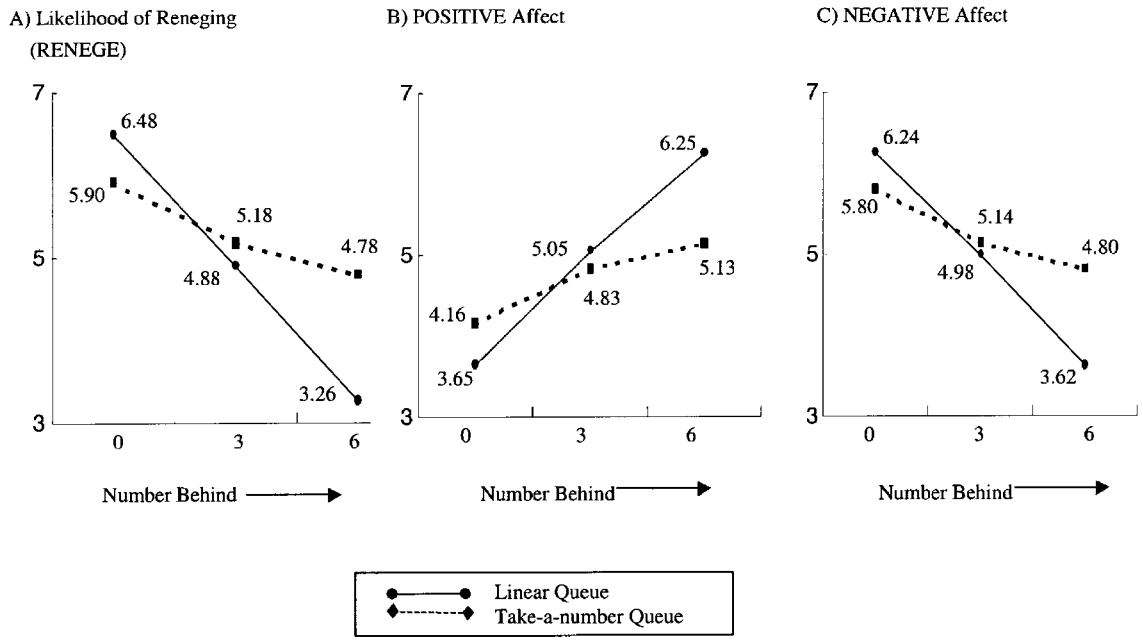
Discussion

The results of the current experiment showed that the effect of the number behind was stronger when the relative position in the queue was salient (e.g., a linear queue) as compared with when it was not salient (e.g., a take-a-number queue). These findings support hypothesis 2.

We note that our manipulation of queue system only changed the salience of the relative position and not the ability to calculate it. In a separate test, we showed subjects photographs of the queues and asked them to (*a*) think aloud as they made reneging decisions and (*b*) indicate their relative positions in the queue. Consistent with what we found in the main experiment, all subjects were able to calculate their correct relative positions when asked. However, very few did this spontaneously in the take-a-number queue conditions. On the contrary, subjects in the linear queue conditions spontaneously used their relative position in their decision making. Therefore, our effects can be attributed to

FIGURE 1

RENEGING AND AFFECT AS A FUNCTION OF NUMBER BEHIND AND QUEUE SYSTEM: STUDY 3



differences in the salience of the relative position rather than to differences in the ability to calculate it.

STUDY 4

The objective of this experiment was to test hypothesis 3. Subjects read and responded to a scenario about waiting for photocopying services. In addition, their tendency to engage in social comparisons was measured through the INCOM scale (Gibbons and Buunk 1999). Hypothesis 3 predicted that the effect of number behind would be greater for people with higher INCOM scores (i.e., those with a greater tendency to engage in social comparisons) than for people with low INCOM scores.

Subjects, Design, and Procedure

Subjects were 135 students at a U.S. university. They were asked to imagine that they were at a university copy center to photocopy some class notes. They had hoped to finish the task in 10 minutes, but at the end of this period, there were still five people ahead of them. The number of people behind them after 10 minutes was varied across three conditions (0 vs. 5 vs. 10).

At this stage, subjects answered two sets of questions. First, they reported POSITIVE and NEGATIVE affective reactions as before. Then they were asked to indicate "the strength of your preference between waiting and leaving" (RENEGE1: 1 = definitely wait; 9 = definitely leave). Subjects were then told about a rush service where they could drop copy jobs immediately for an additional charge of $5.00. "There is no line at the rush service counter. You wonder if you should continue waiting in line, or pay the $5.00 and go home." After reading this additional piece of information, they reported their relative preference between waiting and using the rush service at an additional cost (RENEGE2: 1 = definitely wait; 9 = definitely use rush service). After a 15-minute unrelated task, they completed the INCOM scale.

The INCOM scale (Gibbons and Buunk 1999) consists of 11 statements, and subjects were asked to indicate their agreement with each (1 = disagree strongly; 5 = agree strongly). It includes statements such as "If I want to find out how well I have done something, I compare what I have done with how others have done" to assess people's social comparison orientation. Preliminary analysis showed that the INCOM items were internally consistent ($\alpha = .76$), so we used the total score of all 11 items as the SOCIAL score.[4] A higher SOCIAL score indicates stronger social comparison tendencies. The overall mean was 33.17, which is similar to that observed in previous studies (Gibbons and Buunk 1999).

Results, Analyses, and Discussion

A preliminary analysis showed that the correlation between the two measures of RENEGE was high ($r = .93$; $p < .001$); hence, we used their average as a measure of the likelihood of reneging (analyzing them separately does not change any result). Our objective in this experiment was to

[4]Two of the 11 items were reverse scored and transformed before calculating the summary score.

show that the effect of number behind is greater when social comparison tendencies are higher. In order to test this, we estimated the following regression models:

$$\begin{aligned}\text{RENEGE} = {} & \alpha + \beta_1(\text{SOCIAL}) \\ & + \beta_2(\text{BEHIND}) \\ & + \beta_3(\text{SOCIAL} \times \text{BEHIND});\end{aligned} \quad \textbf{(1)}$$

$$\begin{aligned}\text{POSITIVE} = {} & \alpha + \beta_1(\text{SOCIAL}) \\ & + \beta_2(\text{BEHIND}) \\ & + \beta_3(\text{SOCIAL} \times \text{BEHIND});\end{aligned} \quad \textbf{(2)}$$

$$\begin{aligned}\text{NEGATIVE} = {} & \alpha + \beta_1(\text{SOCIAL}) \\ & + \beta_2(\text{BEHIND}) \\ & + \beta_3(\text{SOCIAL} \times \text{BEHIND}).\end{aligned} \quad \textbf{(3)}$$

Regression results are shown in table 1. We also repeated the regression models after mean centering all variables, and we found that the conclusions remained substantively unchanged.

Our prediction was that, as the number of people behind increases, the likelihood of reneging would be lower, positive affect would be greater, and negative affect would be lower, and these effects would be stronger for individuals with higher SOCIAL scores. Specifically, we predicted a significant negative coefficient for the interaction term for RENEGE and NEGATIVE and a significant positive coefficient for the interaction term for POSITIVE. As table 1 shows, these interactions were all significant and in the expected directions. To aid the interpretation of the interactions, we plotted the mean RENEGE, POSITIVE, and NEGATIVE scores as a function of the number of people behind and a median split of SOCIAL into a "Low" and a "High" group (fig. 2). As the figure shows, the effect of number of people behind on all three variables is larger in the High SOCIAL group.

In support of hypothesis 3, the results from this experiment showed that the effect of the number of people behind on the decision to renege and on affective reactions was stronger for individuals who had a greater tendency to engage in social comparisons.

STUDY 5

The objective of this experiment was to test hypothesis 4, which predicts that the greater the tendency to generate counterfactuals about one's relative position, the greater is the effect of number behind.

Subjects, Design, and Procedure

Subjects (264 students at a university in Hong Kong) participated in a series of unrelated experiments. Subjects were asked to imagine that they needed to go to the bank on campus to pay membership fees for a student club and that they planned to go to the bank upon arriving at campus at noon. They were told that they took a bus to commute to campus. After arriving at the expected time, they were in queue for 15 minutes (they had expected to spend 10 minutes), and yet there were five people ahead (there had been 10 on arrival). They had a class at 1:00 P.M. and planned to prepare for it in the library. Within this basic scenario, we used a 3 (Number Behind: 0, 5, 10) × 2 (Accessibility of Counterfactuals: low vs. high) design. Number Behind referred to the number of people behind them in the queue after their 15-minute wait. Accessibility of Counterfactuals was manipulated by making one of the situations mundane and the other unusual. In the high accessibility conditions, subjects read the following paragraph:

> As expected, you took the minibus from Choi Hung and arrived at the bank at noon. On the way, there was construction on a large portion of Clearwater Bay Road, and the traffic was one-way, controlled by traffic signals. In the past, you sometimes had to wait in this construction zone for an additional 5-10 minutes (the bus ride typically takes 15 minutes). Today, however, you were lucky as your minibus was the last one to go through the traffic signal before it changed to red.

TABLE 1

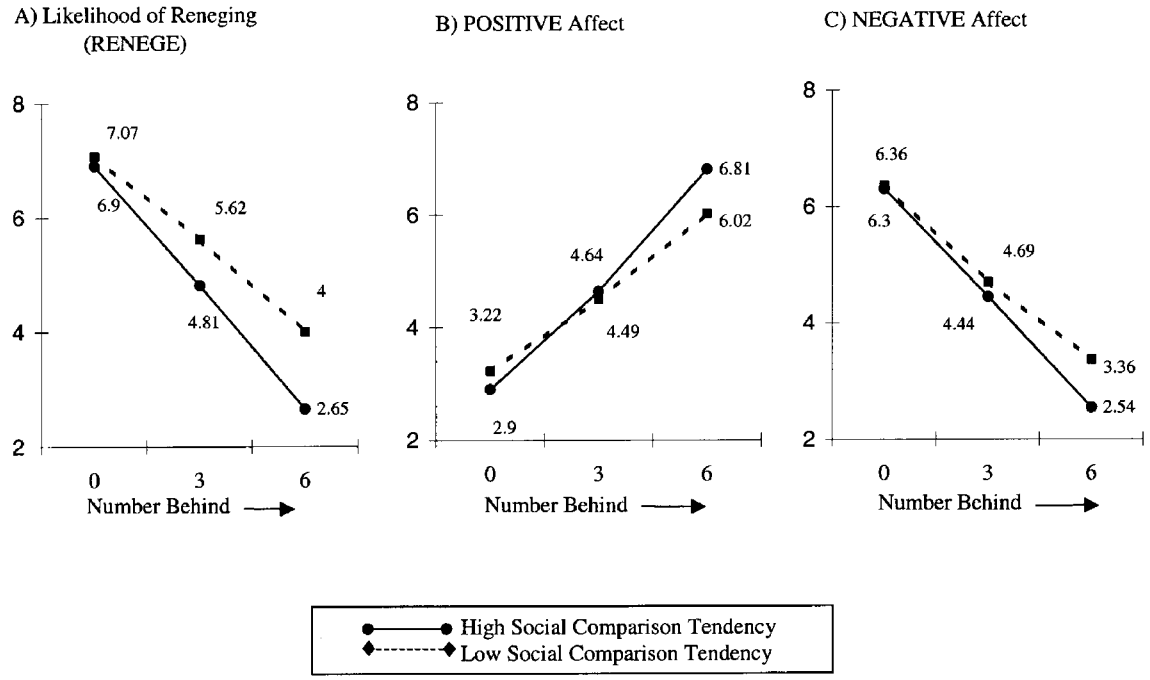
REGRESSION RESULTS: STUDY 4

	DV = RENEGE			DV = POSITIVE			DV = NEGATIVE		
Predictor variable	β	*t*-statistic	*p*	β	*t*-statistic	*p*	β	*t*-statistic	*p*
Intercept	8.23	11.70	.001	3.27	3.49	.001	7.71	9.33	.001
Social comparison tendency (SOCIAL)	.001	.84	NS	−.84	−2.13	.04	.01	.35	NS
Number of people behind (BEHIND)	−.42	−1.31	NS	.32	.76	NS	−.90	−2.43	.02
SOCIAL × BEHIND	−.04	−4.52	.001	.04	3.30	.01	−.02	−2.14	.03

NOTE.—DV = RENEGE: Adjusted $R^2 = .86$, Model $F(1,131) = 265.4$, $p < .001$; DV = POSITIVE: Adjusted $R^2 = .72$, Model $F(1,131) = 116.5$, $p < .001$; DV = NEGATIVE: Adjusted $R^2 = .77$, Model $F(1,131) = 151.21$, $p < .001$.

FIGURE 2

RENEGING AND AFFECT AS A FUNCTION OF NUMBER BEHIND AND SOCIAL COMPARISON TENDENCY: STUDY 4



In contrast, in the low accessibility condition, subjects were just told that they arrived at the bank at the expected time. We expected the fact that they almost got delayed in the traffic would make the counterfactual alternative of arriving later more accessible. Both unusualness (almost getting delayed is more unusual) and closeness (that the minibus was the last one to go through makes it so close) have been shown to facilitate counterfactual thinking (Kahneman and Tversky 1982; Kahneman and Varey 1991).

Subjects first reported their POSITIVE and NEGATIVE affective reactions and were then asked to consider the possibility of leaving the bank and returning the next day. They were told that "tomorrow there are no classes on campus (but you have to come for some other activities), so you will definitely not have to wait for more than five minutes to get the job done." They then indicated their CHOICE and strength of preference between waiting and leaving (RENEGE: 1 = definitely wait; 9 = definitely leave).

Results and Analyses

The RENEGE, POSITIVE, and NEGATIVE scores were analyzed in separate 3 (Number Behind) × 2 (Accessibility of Counterfactuals) ANOVAs. Based on hypothesis 4, we expected a significant Number Behind × Accessibility interaction such that the effect of number of people behind would be greater in the high accessibility situation. Table 2 shows CHOICE, RENEGE, POSITIVE, and NEGATIVE scores in each experimental condition.

First, we consider the two affective measures POSITIVE and NEGATIVE. The ANOVA for POSITIVE yielded significant main effects of Number Behind ($F(2, 258) = 23.95; p < .001$) and of Accessibility ($F(1, 258) = 14.36; p < .001$). Although the two-way interaction of Number Behind with Accessibility was in the expected direction, it did not approach significance ($F(2, 258) = 1.74;\ p = .18$). ANOVA results for NEGATIVE revealed a significant two-way interaction of Number Behind with Accessibility ($F(2, 258) = 4.79;\ p < .01$), as well as significant main effects of Number Behind ($F(2, 258) = 26.84; p < .001$) and of Accessibility ($F(1, 258) = 25.73;\ p < .001$). The interaction was in the expected direction—as table 2 shows, the effect of number of people behind on reducing negative affect was greater in the high accessibility conditions ($F(2, 258) = 27.12;\ p < .001$) than in the low accessibility conditions ($F(2, 258) = 4.51;\ p < .05$).

Second, we consider the results for RENEGE. An ANOVA revealed a significant two-way interaction of Number Behind with Accessibility ($F(2, 258) = 3.46;\ p < .05$), as well as significant main effects of Number Behind ($F(2, 258) = 23.48;\ p < .001$) and of Accessibility ($F(1, 258) = 29.68;\ p < .001$). As table 2 shows, the direction of this interaction is consistent with hypothesis 4. Specifically, in the low accessibility conditions, the reduction in the likelihood of reneging as Number Behind increased ($M_{0\text{-behind}} = 6.20,\ M_{5\text{-behind}} = 5.64,\ M_{10\text{-behind}} = 5.05;\ F(2, 258) = 4.52;\ p < .05$) was smaller than the reduction in the high accessibility conditions ($M_{0\text{-behind}} =$

TABLE 2

RENEGING AND AFFECT AS A FUNCTION OF NUMBER BEHIND AND ACCESSIBILITY OF COUNTERFACTUALS: STUDY 5

	Accessibility of counterfactuals = high			Accessibility of counterfactuals = low		
	Behind = 0	Behind = 5	Behind = 10	Behind = 0	Behind = 5	Behind = 10
Preference toward leaving (RENEGE)	5.77	4.27	3.20	6.20	5.64	5.05
Percent of people choosing to leave (CHOICE)	68.18	38.64	15.91	75.0	63.64	54.55
POSITIVE affect	4.08	5.48	6.33	3.80	4.57	5.11
NEGATIVE affect	5.89	4.43	3.19	6.16	5.50	5.07

5.77, $M_{5\text{-behind}} = 4.27$, $M_{10\text{-behind}} = 3.20$; ($F(2, 258) = 22.42$; $p < .001$). We also analyzed the CHOICE data using a logistic regression with log odds of reneging as the dependent variable. Consistent with the RENEGE data, the reduction in the fraction reneging as number behind increased was not as sharp in the low accessibility conditions as in the high accessibility conditions. While the Number Behind × Accessibility interaction was in the expected direction, it did not approach significance ($\chi^2(2) = 4.68$; $p = .09$).

Discussion

The results from the current experiment showed that the effect of number of people behind on reneging decisions, as well as on affective states, was moderated by the accessibility of counterfactuals. Specifically, when accessibility of counterfactuals was lower, the effect of the number of people behind was weakened. This supports hypothesis 4.

Note that, in this experiment, we explicitly controlled for inferences about future queue length by telling subjects that, if they returned the following day, they would certainly not need to spend more than five minutes in the queue. Therefore, our number of people behind manipulation should not have produced different inferences about tomorrow's queue length. Yet, we still found support for the predicted effects of number of people behind on reneging.

Our experimental setup is open to the possibility that the "high accessibility" subjects might have inferred a higher transaction cost of coming back on the next day. For instance, even though we told subjects that they would spend no more than five minutes in the queue tomorrow, these subjects may have thought that they might not be as lucky tomorrow with the traffic control and might get delayed. We believe that this possibility, while admittedly real, does not explain our results. First, subjects were explicitly told that they had to be on campus the next day, so the transaction cost had to be incurred no matter what and should be irrelevant to their queue-related decisions. Second, even if this transaction cost explanation can account for the observed interaction effect for reneging, it is less clear how the interaction effects for the affective variables can be explained by these inferences. However, we acknowledge that an improved test of hypothesis 4 would involve more complete control for such inferences.

Collectively, the results of studies 3, 4, and 5 support hypotheses 2, 3, and 4. Our results are consistent with the argument that three types of factors (queue-related, individual-related, and situation-related) influence the degree of social comparisons and, hence, shape the effect of the number behind on affective reactions and reneging decisions.

GENERAL DISCUSSION

Summary, Implications, and Contributions

Prior research in the domain of waiting for service has traditionally treated time investment as a cost (Osuna 1985) rather than as an experience that the consumer can regulate. In general, research in the psychology of queuing has typically looked at the retrospective evaluation of the service (see Taylor 1994) as a function of the time spent in queue (see Hornik 1984). However, consumers waiting in a queue "are not mindless passengers in a human line" who are obligated to continue waiting; rather, they can "regulate their behavior and their own internal state during the entire waiting period" (Meyer 1994, p. 819). The current research represents an effort to understand the effect of one aspect of the queue—the number of people behind the consumer—on the consumer's experience and decision making while waiting.

We studied situations in which consumers were waiting in a queue for service, and we examined their affective states and decisions to leave the queue after having spent some time in it. In a series of five studies (both experimental and field), we showed that a larger number of people waiting behind a consumer positively influences one's affective states and decreases the likelihood of leaving the queue. We propose that the number behind matters because consumers tend to make downward social comparisons with the less fortunate people behind them in the queue. Consequently, we show that factors that shape the degree of such social comparisons (queue-related, individual-related, and situation-related) moderate the number behind effect. More specifically, our findings indicate that consumers' affective experiences and reneging decisions are affected by the number behind to a greater extent under the following sets of con-

ditions: (*a*) when the structure of the queue system (i.e., a linear queue) makes one's relative position salient and thus facilitates social comparisons, (*b*) when the individual has a greater tendency to make social comparisons, and (*c*) when situational factors highlight counterfactual thoughts about one's relative position in the queue.

It is noteworthy that the effects of number behind were significant even in situations where social comparisons were less likely to occur. In study 3, when consumers' relative positions in the queue were less salient (the take-a-number queue), the number of people behind still had a significant effect on consumers' decisions to leave the queue as well as on their affective reactions ($p < .05$). Similarly, in study 4, the number behind also had a significant effect among people who were lower in social comparison tendency (the low INCOM score group; $p < .05$). The robustness of this effect is consistent with a large stream of literature that suggests that the social comparison process is spontaneous, effortless, unintentional, and relatively automatic (Bandura and Jourden 1991; Wood 1989). Facilitating social comparisons simply amplifies this spontaneous effect.

Another persistent result that we feel is worthy of discussion is that, across all of our experiments, the effect of number behind on the negative affect mirrored the effect on the positive affect. We had no hypotheses to offer about the effect on negative affect and were surprised to see it behave in the same pattern as positive affect. One possibility is that, in responding to our questions, subjects simply mapped their overall affective state on a positive to negative range and then responded on each scale to be consistent with this.

Our research contributes to the literature on queuing in several ways. First, prior research has typically documented situations in which consumers make evaluations about their positions in the queue on the basis of projected costs and benefits of future waiting. In the current research, we extend this reasoning to include benefits arising from comparing oneself favorably with others in the queue. Therefore, our research adds to a growing body of research suggesting that queues constitute a social system (e.g., Schmitt, Dube, and Leclerc 1992).

Second, we argue that, even when the quantity (i.e., actual time) and quality (e.g., whether empty or filled) of waiting time are held constant, environmental variables such as the queue structure as well as personality variables can influence consumers' decision making and even their in-queue affective experiences. This finding, therefore, joins a large array of prior research suggesting that the evaluation of time is extremely ambiguous and open to many more contextual influences than is the evaluation of money (see. e.g., Leclerc, Schmitt, and Dube 1995; Soman 2001). Finally, we believe that the current research is the first to examine the effect of the number of people behind a consumer in the queue and to propose social comparisons as an underlying mechanism.

Limitations and Future Research

While we would have liked to have tested our hypotheses with consumers who were actually waiting in queues, practical considerations, such as lack of control in the field, inefficiencies, and poor ecological validity of laboratory recreations of queues, prevented us from doing this. Instead, we used a mix of a field study with actual waiting but little control, and a number of hypothetical waiting situations with no actual waiting. We tried to minimize the limitations associated with hypothetical studies by using situations that were real and relevant to our subjects. In addition, in study 3, we used photographs of the queuing situation, which have been shown to have the same ecological validity as actual settings (Bateson and Hui 1992). However, given the above discussion, our research is simply a study about how consumers would behave in a queue, rather than a study of actual consumer decisions made in a queue.

Our empirical work is the first to demonstrate the main effect of number behind and the moderating effects of the three factors, and, hence, it represents a significant first step in understanding the effect of other people in a consumer's decision to wait. However, our data did not allow us to test the mediating effect of the degree of social comparisons. A test of the entire framework requires a complex experiment in which one orthogonally manipulates all three factors in addition to the number behind; it would also require the development and testing (both validity and reliability) of a scale to measure the degree of social comparisons. Given the magnitude of this task, we felt that it would be beyond the scope of the current research.

Our research focuses on downward comparisons and argues that consumers naturally tend to compare themselves with people who are worse off than they are. However, it is possible that, as a consumer moves through the queue, her locus of attention shifts from the back to the front. Such a shift is also possible in other domains. For example, a marathon runner may shift from a looking-back focus when she is toward the end of the group to a forward-looking focus as she moves ahead in the group. In other words, the runner may shift from downward comparisons to upward comparisons in this transition. Our data do not allow us to study the dynamics of the social comparison process as the individual moves through a queue or any hierarchy, but we believe that this will provide a fruitful area for future investigation.

Finally, our experiments typically provided subjects with snapshot descriptions of a queue on their arrival, as well as after a duration of time (e.g., 15 minutes later), and studied the effect of the number of people behind on decision making. Another important factor that we did not study, one that could have a differential impact on each of the three moderating factors, is the temporal distribution of the new arrivals. Consider a situation where a big group of people arrives almost immediately after the consumer does, but then the arrivals reduce to a trickle. In this case, counterfactuals will likely play a much larger role, and the consumer will feel much more relieved about not being delayed. On the other hand, if this temporal pattern of arrivals was uniform (or reversed), we would expect these effects to be weaker.

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