An Attitudinal Model of Technology-Based Self-Service: Moderating Effects of Consumer Traits and Situational Factors

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The accelerating growth in technology-based self-service today is giving rise to questions about the acceptance of such forms of service delivery by all kinds of consumers and under different situational contexts. This study investigates the moderating effects of consumer traits and situational factors on the relationships within a core attitudinal model for technology-based self-service. An experimental design is used with perceived waiting time and social anxiety (through perceived crowding) as the situational treatments. Relevant consumer traits for technology-based self-service are examined and include inherent novelty seeking, self-efficacy with respect to technology, self-consciousness, and the need for interaction with an employee. The results lend support to the hypothesized moderating effects. Implications for service practitioners as well as directions for future research are discussed.

During the past decade, the growth in service delivery options based on technology has been remarkable. Service companies are rapidly employing various kinds of technologies to facilitate their employees' jobs (Quinn 1996) and to encourage consumers to perform services for themselves (Zinn 1993). The benefits to companies in offering service delivery based on technology are many; in particular, getting consumers to perform services for themselves by using technology can result in significant savings for the company (Barrett 1997; Blumberg 1994). In addition, many consumers are becoming increasingly familiar with using technology (Wallace 1995). Indeed, we have come a long way from Abell's (1980) discussion of customer concerns in accepting automated teller machines (ATMs) as an alternative service option to human tellers. But are consumers today quite ready to wholeheartedly embrace "technology-based self-service" (Dabholkar 1994a)?

Technology-based self-service includes "on-site" options such as touch screens in department stores, information kiosks at hotels, and self-scanning in grocery stores and libraries; it also includes "off-site" options such as telephone and online banking and shopping on the Internet (Chandler 1995; Dabholkar 1994a, 2000). In addition, some automakers, retailers, and universities are starting to offer their own ATMs (Gogoi 2001). Moreover, large discount stores such as Staples, Best Buy, and Kmart are installing in-store kiosks that offer access to the Internet (Mearian 2001; Sweeney 2001), thus blurring the line between on-site and off-site options. Is this rampant enthusiasm for offering technology-based self-service, on the part of service marketers, warranted?

Research has found that some consumers may actually prefer using technology-based self-service over traditional service because they find it easy to use, or it helps them avoid interaction with employees (Dabholkar 1996; Meuter, Ostrom, Roundtree, and Bitner 2000). But is this

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true for *all consumers*? As in the case of information technology (Agarwal 2000), do individual traits determine how consumers will evaluate and form intentions for using such options? Retailers experimenting with in-store Internet kiosks are finding out that some consumers are simply not interested (Mearian 2001). But which personality characteristics determine consumer interest in technology-based self-service? These questions are becoming increasingly relevant for service practitioners as they consider (1) whether to offer technology-based self-service, (2) how to design it to appeal to different consumers, (3) to which type of consumer to promote such service options, and (4) how to do so.

Research has shown that consumers negatively evaluate a service when there are long waiting times (Pruyn and Smidts 1998; Tom and Lucey 1995) or delays (Taylor 1994). But is this true for technology-based self-service, where consumers sometimes seem to overlook waiting lines just to be able to perform services for themselves? For instance, some consumers seem happy to use ATMs or grocery self-scanners, despite shorter lines at the tellers or regular checkouts, or to use the Internet even when there are download delays (Associated Press, www.internetindicators.com, October 11, 1999). Perhaps these consumers think the alternatives are too slow (due to the anticipated inefficiency of service employees or the typical verbal interactions that would take place). Or is it possible that intrinsic motivation to use technology-based self-service is stronger than the effect of extrinsic, situational deterrents? As more and more consumers become comfortable with technology, there are likely to be longer waiting lines to use in-store kiosks and greater delays in using the Internet as thousands more log on at any given time. Thus, the question of whether situational factors are important deterrents for technology-based self-service is becoming increasingly important for service firms.

Some researchers have examined the effect of situational factors such as crowding (e.g., Hui and Bateson 1991) and waiting time (e.g., Pruyn and Smidts 1998; Tom and Lucey 1995) on service evaluation in general. However, little research has focused on situational factors in a technology-based self-service context or even a self-service context. An exception is Dabholkar's (1996) study, which examines the direct effect of waiting time on intention to use an on-site touch screen.

Whereas some research has examined how consumer traits (such as self-efficacy) influence technology adoption (e.g., Ellen, Bearden, and Sharma 1991; Hill, Smith, and Mann 1987), this approach has not been widely applied to the services area. Dabholkar's (1996) study examined the influence of need for interaction with a service employee on perceived service quality of an on-site touch screen. Jones and Vijayasarathy (1998) studied the effect of need for cognition on Internet shopping. Parasuraman (2000) measured the technology readiness of consumers with reference to both products and services. Anselmsson (2001) examined the effect of traits such as impatience and self-esteem on the perceived service quality of self-checkouts. However, a comprehensive framework examining the influence of relevant consumer and situational factors on the evaluation and use of technology-based self-service is lacking. A major objective of this study is to fill this gap in the literature in view of the pressing practitioner concerns outlined above.

Our study advances theory in yet another important way. Most consumer studies, including those on services, tend to study *direct effects* of external factors. However, researchers (e.g., Ajzen, Timko, and White 1982; Baron and Kenny 1986; James and Brett 1984; Klein and Yadav 1989) suggest that hypothesizing direct effects may be somewhat redundant and obvious, and it is much more meaningful to investigate the *moderating effects* of external factors, such as consumer traits or situational influences. We build on Dabholkar's (1996) research to encompass a variety of relevant consumer traits and situational factors, and as recommended by researchers, we focus on their moderating effects. Specifically, we examine how these external factors moderate relationships within the core attitudinal model for technology-based self service in Dabholkar's (1994b) research.

Our findings have interesting implications for service practitioners, and we discuss them in terms of service design and promotional strategy for technology-based self-service. We also offer direction for future research on technology-based self-service in particular and service evaluation in general, based on ideas and issues that emerge from our empirical results. Finally, we explain how our conceptual framework can be applied to study the moderating effects of consumer differences and situational factors for *any* service experience, not necessarily based on technology.

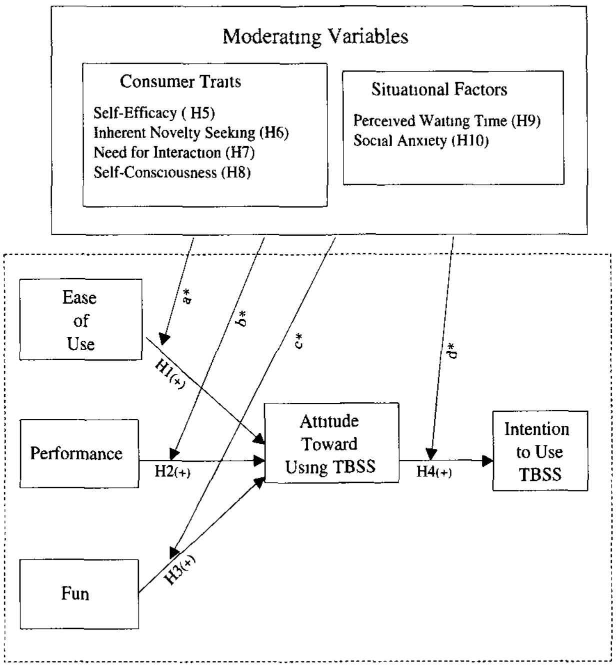
CONCEPTUAL FRAMEWORK

The Core Attitudinal Model

The core attitudinal model in our framework is adapted from Dabholkar's (1994b) study and consists of Hypotheses 1 through 4 (see Figure 1). The basis for these hypotheses is revisited next.

A review of relevant literature reveals that "ease of use," "usefulness," and "enjoyment" are important determinants of attitude in the technology acceptance model (TAM) by Davis (1986; Davis, Bagozzi, and Warshaw 1989, 1992). All three dimensions capture customer perceptions. Two of these dimensions, "ease of use" and "fun (or enjoyment)," are also relevant for technology-based self-service (Dabholkar 1994b). Other researchers have also found dimensions similar to ease of use and fun to be

FIGURE 1
An Attitudinal Model of Technology-Based Self-Service (TBSS): Moderating Effects of Consumer Traits and Situational Factors



NOTE: Model within dotted lines denotes core attitudinal model of TBSS (Dabholkar 1994b). a* = Hypotheses 5a, 6a, 7a, 8a, 9a, 10a. b* = Hypotheses 6b, 7b, 8b. c* = Hypotheses 5c, 6c, 7c, 8c, 9c, 10c. d* = Hypotheses 6d, 7d, 8d, 9d, 10d.

relevant for technology adoption. For example, Szymanski and Hise (2000) found "convenience" to be an important factor in e-satisfaction and defined convenience in terms of ease of finding items, similar to the "ease of use" dimension. "Fun" emerged as important determinant in the use of technology by customers in a study by Webster (1989).

The third dimension in the TAM model, "usefulness," while appropriate for products such as computer software, is not relevant for technology-based self-service, in which the consumer participates but does not own. Instead, the third relevant dimension in Dabholkar's (1994b) study was "performance," extracted from qualitative work in that study and defined as encompassing the reliability and accuracy of the technology-based self-service, as perceived by the consumer. The concept is similar to the "did its job" dimension that emerged in the critical incidents study by Meuter et al. (2000) on causes of consumer satisfaction related to technology-based self-service. We propose, therefore, that perceptions of these three dimensions (ease of use, performance, and fun) will act as determinants of attitudes toward using technology-based self-service.

Hypothesis 1: The perceived ease of using a technology-based self-service will have a direct, positive effect on attitude toward using the technology-based self-service.

Hypothesis 2: The perceived performance of a technology-based self-service will have a direct, positive effect on attitude toward using the technology-based self-service.

Hypothesis 3: The perceived fun in using a technology-based self-service will have a direct, positive effect on attitude toward using the technology-based self-service.

Attitudinal research (e.g., Bobbitt and Dabholkar 2001; Fishbein and Ajzen 1975) suggests that attitudes will have a strong, direct, and positive effect on intentions. This link between attitudes and intentions is fundamental in attitudinal research and has been supported in a wide variety of settings (Bagozzi 1981; Sheppard, Hartwick, and Warshaw 1988; Shimp and Kavas 1984).

Hypothesis 4: Attitude toward using a technology-based self-service will have a direct, positive effect on intention to use the technology-based self-service.

We focus next on how external factors (both consumer differences and situational influences) moderate the relationships delineated in the core attitudinal model (Hypotheses 1-4).

Relevant External Factors

Consumer differences. Consumer differences that are relevant to marketers include demographic factors, psychographic profiles, and personality traits. Researchers (e.g., Darian 1987; Eastlick 1993; Fram and Grady 1997; Stevens, Warren, and Martin 1989) have investigated demographic factors in relation to technology-based self-service and typically found that young, affluent, educated males are more likely to use such service options. However, in today's changed social and economic world, women, older consumers, the less educated, and the less affluent all have access to and some level of familiarity with using simple technologies. Therefore, demographic factors are not of critical interest in understanding why consumers use technology-based self-service.

A few studies have examined psychographic profiles related to the use of technology-based self-service. For example, McMellon, Schiffman, and Sherman (1997) divided older consumers into technology lovers and technology users to understand online behavior. Barczak, Ellen, and Pilling (1997) divided banking consumers into security conscious, maximizers, instant gratifiers, and hassle avoiders to understand their preferences for ATMs, automatic deposit and withdrawal, and telephone banking.

Whereas psychographic studies offer insights to marketers as to different possible consumer segments, they do not go far enough in understanding underlying consumer motivation or how it influences attitudes and behavior related to technology-based self-service.

The variation in consumer differences arising from personality traits is of greater interest than demographic or psychographic factors because such variation is at the heart of consumer attitude formation and behavioral intentions. In this study, we focus on four consumer traits that have direct relevance to technology-based self-service—namely, self-efficacy, inherent novelty seeking, need for interaction with a service employee, and self-consciousness. These factors are drawn from a variety of discussions on consumer trials of new technologies (e.g., Agarwal 2000; Breakwell, Fife-Schaw, Lee, and Spencer 1986; Dabholkar 1996; Davis 1986; Ellen et al. 1991; Hirschman 1980).

Situational influences. A relevant situational variable for any service is related to waiting (e.g., Hui and Tse 1996; Taylor 1994). Research suggests that consumers do not like to wait, and managers have observed this as well. In the case of technology-based self-service, these options may be selected for the enjoyment they offer or because they are perceived as quick. When consumers encounter long lines for automated kiosks or long delays in downloading information on the Internet, does the intrinsic enjoyment in using such options override the negative experience of waiting? Managers need to understand the impact of perceived waiting time on technology-based self-service, given the increasing frequency of long lines and delays in such contexts.

Another situational variable relevant for on-site service encounters is related to crowding. The presence (and number) of other customers may be perceived as positive in some contexts (e.g., a crowded sit-down restaurant); in others, crowding is typically perceived as negative (e.g., a crowded retail store) and can cause social anxiety in shoppers (e.g., Hui and Bateson 1991; Langer and Saegert 1977). Consumers are likely to become anxious if others are watching them use a service, especially an unfamiliar technology-based self-service. Managers need to know whether social anxiety (through perceived crowding) would change consumer evaluations and use of technology-based self-service and, if so, what can be done about it in terms of service design and promotion.

Other possible situational factors may be time pressure, time of day, and location of kiosk. But time pressure and time of day might well be incorporated in *perceptions* of waiting time. Past research (Maher, Marks, and Grimm 1997) has failed to find an independent effect of time pressure in the use of shopping channels. Similarly, whereas the location of a kiosk is relevant for ATMs due to safety concerns (Evans and Brown 1988), most kiosks are located *within* stores, universities, hospitals, hotels, and airports, and therefore the safety issue is not as relevant. Hence, our focus is on two situational factors: perceived waiting time and social anxiety (through perceived crowding).

Moderating Effects of Consumer Traits and Situational Factors

The moderating effects of these consumer traits and situational factors (Hypotheses 5-10) on the relationships within the core attitudinal model (i.e., Hypotheses 1-4) are discussed next (see Figure 1).

Self-efficacy. Self-efficacy is defined as *an individual's assessment of his or her ability to perform a behavior* (e.g., Bandura 1977, 1994). Some consumers may be more familiar with using technology-based products than others and may have higher self-efficacy. According to Bandura (1977), "Experiences based on performance accomplishments produce higher, more generalized, and stronger efficacy expectations" (p. 205). Self-efficacy is a "major factor that underlies intrinsic motivation" (Davis et al. 1989) and is expected to indirectly influence behavioral intentions (Bandura 1994). Such effects have been empirically supported in predicting decisions to use technologies (Davis 1986; Ellen et al. 1991; Hill et al. 1987).

Consumers with greater self-efficacy can be expected to have more confidence in their ability to use technology-based self-service, and therefore ease of use will not be as important to them as to consumers with less confidence in their own abilities. Hence, the relationship between ease of use and attitude will be attenuated with greater self-efficacy (see Hypothesis 5a). At the same time, the sense of self-confidence in one's ability to do something makes it possible to look on that activity as fun. Consumers with higher self-efficacy will tend to focus on the enjoyment in using the technology-based self-service, and "fun" as an attribute will become more important. Thus, with greater self-efficacy, the relationship between fun and attitude will be strengthened (see Hypothesis 5c).[1]

Hypothesis 5: With greater self-efficacy,

(a) the positive relationship between perceived ease of use and attitude toward using a technology-based self-service will be attenuated, and

(c) the positive relationship between perceived fun and attitude toward using a technology-based self-service will be strengthened.

Inherent novelty seeking. Inherent novelty seeking, an aspect of innovativeness, is defined as *the desire to seek out new stimuli* (Hirschman 1980). It is accepted that some aspect of innovativeness would influence attitudes toward technological products (Gatignon and Robertson 1985; Hirschman 1980; Midgley and Dowling 1978; Parasuraman 2000). Rogers (1983) defined "innovativeness" as the degree to which an individual is relatively early in adopting an innovation compared to other members in the social system. This construct captures time taken to adopt and therefore may be subject to group influences and more closely related to behavior than to an innate personality trait (Midgley and Dowling 1978). Instead, Midgley and Dowling (1978) defined "inherent innovativeness" as the degree to which an individual is receptive to new ideas and makes innovation decisions independently of the communicated experience of others. Hirschman's (1980) concept of "inherent novelty seeking" (defined above) is similar to Midgley and Dowling's inherent innovativeness and appears to be most relevant for the technology-based self-service context. The concept involves a search for information that is innate for the individual (e.g., Flavell 1962), and it is also similar to Mehrabian and Russell's (1974) "arousal seeking" and Rogers's (1983) "venturesomeness."

Consumers high in inherent novelty seeking tend to look favorably on technology and the use of technology-based products, have stronger intrinsic motivation to use such products, and enjoy the stimulation of trying new ways to approach old problems (Hirschman 1980; Mehrabian and Russell 1974; Midgley and Dowling 1978). Such consumers would not be greatly concerned whether the new technologies are easy to use or reliable and would want to try them anyway. Therefore, the ease of use or performance of such options would not be quite so important to them in forming an attitude toward using such an option, as it would to consumers who are low in inherent novelty seeking. Consequently, the respective relationships in the core attitudinal model will be attenuated (see Hypotheses 6a and 6b). Also, consumers who are high in inherent novelty seeking seek stimulation in their experiences and would tend to enjoy using new technologies. Therefore, fun as a determinant of attitude would be much more important to them, and this relationship in the attitudinal model will be strengthened (see Hypothesis 6c). Finally, consumers high in inherent novelty seeking are likely to want to use technology-based self-service with less reliance on their existing attitudes about that service and will be guided by their immediate intrinsic motivation instead; hence, the relationship between attitude and intention will be attenuated for these consumers (see Hypothesis 6d).

Hypothesis 6: With greater inherent novelty seeking,

(a) the positive relationship between perceived ease of use and attitude toward using a technology-based self-service will be attenuated,

(b) the positive relationship between perceived performance and attitude toward using a technology-based self-service will be attenuated,

(c) the positive relationship between perceived fun and attitude toward using a technology-based self-service will be strengthened, and

(d) the positive relationship between attitude and intention toward using a technology-based self-service will be attenuated.

Need for interaction with a service employee. The need for interaction with a service employee is defined as *the importance of human interaction to the customer in service encounters* (Dabholkar 1996). Langeard, Bateson, Lovelock, and Eiglier (1981); Bateson (1985); and Cowles and Crosby (1990) suggested that the need for human contact in a service delivery is very important to some consumers. Dabholkar's study (1996) showed that the need for interaction with a service employee is a relevant factor for technology-based self-service. If consumers have a high need for interaction, they will avoid self-service, especially one that is technology based, but if they have a low need for interaction, they will seek such options. Meuter et al.'s (2000) "avoiding personnel" and Anselmsson's (2001) "need for independence" are constructs parallel but opposite in direction to the need for interaction with a service employee.

Several researchers have found that the need for interpersonal contact goes hand in hand with a need to avoid machines. For example, Forman and Sriram (1991) and Prendergast and Marr (1994) found that consumers who have a greater need for interpersonal contact in a retail situation tend to avoid machines. The use of machines may not be compatible with their perspective (cf. Breakwell et al. 1986); instead, they would look forward to interacting with employees. Consequently, for these consumers to look favorably on technological service delivery options, the options would have to be much easier to use, much more reliable, and much more fun than they would for consumers with a low need for interaction with a service employee. In other words, to get consumers with a high need for interaction with a service employee to more favorably evaluate technology-based self-service, all of its attributes need to be much stronger. Thus, all three determinants of attitude toward technology-based self-service (ease of use, performance, and fun) would be strengthened for consumers with a high need for interaction with a service employee (see Hypotheses 7a, 7b, and 7c). It is apparent that consumers with a high need for interaction would lack the intrinsic motivation to use technology-based self-service. Therefore, unlike consumers who are high in inherent novelty seeking, such consumers would place greater reliance on their existing attitudes about technology-based self-service. In other words, their attitude would play a greater role in influencing intentions, and the attitude-intention relationship will be strengthened (see Hypothesis 7d).

Hypothesis 7: With greater need for interaction with a service employee,

(a) the positive relationship between perceived ease of use and attitude toward using a technology-based self-service will be strengthened,

(b) the positive relationship between perceived performance and attitude toward using a technology-based self-service will be strengthened,

(c) the positive relationship between perceived fun and attitude toward using a technology-based self-service will be strengthened, and

(d) the positive relationship between attitude and intention toward using a technology-based self-service will be strengthened.

Self-consciousness. Self-consciousness is defined as *a person's view of himself or herself as a social object, with an acute awareness of other people's perspectives about him or her* (Fenigstein, Scheier, and Buss 1975; Mead 1934). Self-consciousness can be manifested as social risk in using a technology-based self-service in the presence of other consumers. Attitude toward risk is relevant for adoption (Gatignon and Robertson 1985). de Ruyter, Wetzels, and Kleijnen (2001) found that perceived risk negatively influences behavioral intentions for using e-services. Anselmsson (2001) found that social risk aversion negatively influences perceived service quality of self-checkouts. It is expected that social risk would discourage consumers from looking favorably at an on-site technology-based self-service. Being on-site, other consumers would be present, and self-consciousness would be a relevant determinant to be investigated, especially for relatively unfamiliar service options.

Consumers who feel self-conscious about using a technology-based self-service if other consumers are around would be reluctant to use it. For them to want to use technology-based self-service, such options would have to be much easier to use, much more reliable, and much more fun. In other words, to get self-conscious consumers to more favorably evaluate an on-site technology-based self-service, all of its attributes need to be much stronger. Therefore, as in the case of need for interaction with a service employee, all three determinants of attitude toward technology-based self-service would be strengthened for consumers who are high in self-consciousness (see Hypotheses 8a, 8b, and 8c). However, unlike consumers with a high need for interaction with a service employee, self-conscious consumers do not necessarily prefer interacting with employees to using machines. They might have favorable attitudes toward using technology-based self-service when other consumers are not present (e.g., using the Internet at home). But they may be reluctant to use such an option in an on-site encounter despite favorable attitudes. Hence, the relationship between attitude and intention would be weakened with greater self-consciousness (see Hypothesis 8d).

Hypothesis 8: With greater self-consciousness,

(a) the positive relationship between perceived ease of use and attitude toward using a technology-based self-service will be strengthened,

(b) the positive relationship between perceived performance and attitude toward using a technology-based self-service will be strengthened,

(c) the positive relationship between perceived fun and attitude toward using a technology-based self-service will be strengthened, and

(d) the positive relationship between attitude and intention toward using a technology-based self-service will be attenuated.

Perceived waiting time. Perceived waiting time is defined in this study as *the consumer's perception of whether he or she will have to wait for a significantly longer time to use a particular service delivery option than to use an alternative option.* According to Maister (1985), consumer perceptions of waiting time are more relevant than actual waiting time, although the latter certainly influences perceptions of waiting. Consumers tend to be impatient and to look for shorter lines and quicker methods of shopping (Maister 1985). Recent studies have shown that waiting lines or delays can negatively affect customer evaluation of services (Hui and Tse 1996; Pruyn and Smidts 1998; Taylor 1994). Although this may seem intuitive for service encounters in general, many consumers increasingly prefer self-service (technology based or otherwise) (Wallace 1995), to the extent that they are willing to tolerate waiting, in order to avoid full-service. Also, technology-based self-service has special appeal to a growing number of consumers, as seen by the accelerating use of the Internet despite lengthy download times (Associated Press, internetindicators.com, October 11, 1999).

To the extent waiting in line is likely to make consumers impatient, ease of using a technology-based self-service will become more important. Fun or enjoyment in using the service will also be more important to these consumers because it could compensate for their waiting. Therefore, it is expected that for consumers who perceive a long waiting time, it is more important that the technology-based self-service be easy to use, thus saving time once they get to it, and also enjoyable, to compensate for their having waited. Thus, both ease of use and fun will be strengthened as determinants of attitude with an increase in perceived waiting time (see Hypotheses 9a and 9c and Note 1). Despite possible favorable attitudes toward using technology-based self-service, consumers may be reluctant to use it if they have to wait a long time. Hence, the relationship between attitude and intention would be attenuated with an increase in perceived waiting time (see Hypothesis 9d [see Note 1]).

Hypothesis 9: With greater perceived waiting time,

(a) the positive relationship between perceived ease of use and attitude toward using a technology-based self-service will be strengthened,

(c) the positive relationship between perceived fun and attitude toward using a technology-based self-service will be strengthened, and

(d) the positive relationship between attitude and intention toward using a technology-based self-service will be attenuated.

Social anxiety (through perceived crowding). Social anxiety is defined as *the discomfort that is associated with the awareness of other people's perspectives of oneself as a social object* (Fenigstein et al. 1975). This discomfort is stronger than the mere awareness associated with self-consciousness; there is emotion attached to social anxiety but not to self-consciousness. Social anxiety can arise from situational circumstances, such as perceived crowding in an on-site service encounter. Whereas crowding may be viewed positively in certain circumstances (e.g., a sports event or concert), it is apt to be viewed negatively in most retail settings. Rapoport (1975) mentioned that perceived crowding is a "negative subjective experience" (p. 134), and Bateson (2000) stated that unlike "density [which] refers to the physical condition" of crowding, "perceived crowding is [a] subjective, unpleasant feeling experienced by an individual" (p. 136). The literature suggests that crowding causes stress or lack of control in retail settings (Hui and Bateson 1991; Langer and Saegert 1977), and therefore presented with perceived crowding, we expect an emotional response from the consumer in the form of "social anxiety" (e.g., Rachman 1998).

Consumers in a crowded setting would tend to be socially anxious and think that it is more important that the technology-based self-service be easy to use. Thus, the relationship between perceived ease of use and attitude toward using the technology-based self-service would be strengthened (see Hypothesis 10a). Similarly, given their reluctance to use technology-based self-service under conditions of social anxiety, the option would have to be much more enjoyable intrinsically to get these consumers to view it favorably. Thus, the relationship between perceived fun and attitude toward using the technology-based self-service would also be strengthened (see Hypothesis 10c and Note 1). As in the case of waiting time, despite possible favorable attitudes toward using technology-based self-service, consumers may be reluctant to use it in a crowded situation where they are socially anxious. In other words, the relationship between attitude and intention would be attenuated with increased social anxiety through perceived crowding (see Hypothesis 10d and Note 1).

Hypothesis 10: With greater social anxiety (through perceived crowding),

(a) the positive relationship between perceived ease of use and attitude toward using a technology-based self-service will be strengthened,

(c) the positive relationship between perceived fun and attitude toward using a technology-based self-service will be strengthened, and

(d) the positive relationship between attitude and intention toward using a technology-based self-service will be attenuated.

METHOD

Research Design and Procedure

A 2 × 2 research design was used to collect data from 392 college students. The students were undergraduates taking core business classes, but their majors spanned many areas within and outside business. Researchers went to classes (with prior permission from instructors), and students were given an option to participate in the study. The sample was almost equally divided between males and females (48.6% males), and the average age was 25.74.

The treatments were perceived waiting time and social anxiety through perceived crowding. The setting and scenarios used in Dabholkar's (1994b, 1996) research were applied in this study. Specifically, the setting is the use of a touch screen for ordering in a fast-food restaurant. The scenarios were modified to add the treatment for social anxiety through perceived crowding (see Appendix A). Realism checks showed that the scenarios were considered highly realistic, with a rating of 5.8 on a scale of 1 to 7 (see Appendix B). Consumer traits were measured before presenting the scenarios to reduce possible demand artifacts. Perceptions about the touch screen, attitudes, and behavioral intentions were measured last.

Perceived waiting time was manipulated by mentioning whether the line for the touch screen was longer or shorter than that for the traditional service option (see Dabholkar 1996). Social anxiety through perceived crowding was manipulated by mentioning the time of day (to indicate peak time or otherwise), the number of people who were around, and the number who were likely to keep coming in and watch as one placed his or her order. The idea was specifically to induce social anxiety through a negative crowding situation (given that some crowded situations are without tension and others may even be positive, as discussed earlier). It was expected that social

TABLE 1A
Cell Sizes in Research Design (for situational factors)

	Social Anxiety (through perceived crowding)			
	Control	*Low*	*High*	*Total*
Perceived waiting time				
Control	96			96
Low		80	71	151
High		80	65	145
Total	96	160	136	392

TABLE 1B
Cell Sizes for Consumer Traits

	Low Group	*High Group*	*Total*
Self-efficacy	195	197	392
Inherent novelty seeking	195	197	392
Need for interaction	167	225	392
Self-consciousness	185	204	389

anxiety thus induced would be more relevant for the touch screen ordering option as it is still not very common in fast-food restaurants and therefore unfamiliar to most consumers as compared to the traditional verbal ordering option. The exact wording of this manipulation was systematically strengthened through a series of pretests.[2]

Cell sizes for the research design are shown in Table 1A. Manipulation checks for both treatments were measured using Likert-type scales (1 = *strongly disagree*, 7 = *strongly agree*). The manipulation check for perceived waiting time stated that "the waiting time for touch screen ordering was definitely longer than for ordering verbally." This item was compared for the high and low perceived waiting time groups and had means of 5.42 ($n = 145$) and 2.96 ($n = 151$), respectively ($t = 11.27$, $p < .001$). The manipulation check for social anxiety through perceived crowding stated that "the number of consumers lining up behind me would make me anxious about placing the order." This item was compared for the high and low social anxiety treatment groups and had means of 5.04 ($n = 136$) and 3.72 ($n = 160$), respectively ($t = 6.20, p < .001$). Thus, t tests for manipulation checks showed that both treatments had worked well.

Measurement

Attitudinal measures. Attitudes and intentions were measured using 7-point semantic-differential scales, with the words *extremely*, *quite*, *slightly*, and *neither* below the scales to mark each point (e.g., Fishbein and Ajzen 1975). Attitudes were measured using a four-item scale with the endpoints good-bad, pleasant-unpleasant, harmful-beneficial, and favorable-unfavorable, whereas intentions were measured using two items with the endpoints likely-unlikely and possible-impossible. Factor analysis for the two constructs together showed strong and clear factors with loadings ranging from 0.63 to 0.82 for attitude and from 0.73 to 0.92 for intentions. Cronbach's alphas were 0.85 for attitudes and 0.90 for intentions.

Perceived attributes about the touch screen were measured using the 7-point semantic-differential scales developed by Dabholkar (1994b). Ease of use was measured using six items capturing aspects related to complexity, effort, and time in using the touch screen. Performance was measured using four items capturing aspects related to accuracy and reliability of the touch screen, and fun was measured using four items capturing aspects related to enjoyment in using the touch screen. Factor analysis for these three sets of items showed three clearly distinct factors with loadings ranging from 0.52 to 0.82. Cronbach's alphas were 0.86 for ease of use, 0.77 for performance, and 0.84 for fun.

Measures for consumer traits. Inherent novelty seeking was measured using the "need for change" factor from Mehrabian and Russell's (1974) "arousal seeking" scale, the original source for many subsequent novelty-seeking scales. Other factors from the scale such as "unusual stimuli" (weird, out of the ordinary things) and "risk" (as in physically dangerous things) were not relevant for this conceptual framework. The scale in this study consists of six 7-point Likert-type items.

Need for interaction with a service employee was measured using the four-item 7-point Likert-type scale developed and validated by Dabholkar (1996). Self-efficacy in using touch screen technology was initially measured using a two-item 7-point semantic-differential scale based on guidelines from Bandura (1977). Both items were in response to a question about the respondent's confidence in using a touch screen. However, the items correlated too highly ($r = 0.98$) in a pretest and were deemed to be too similar. Hence, the scale was modified by dropping one of these items and adding another one that asked respondents to estimate their ability to use a touch screen on a probability scale.

Self-consciousness was measured using the "public self-consciousness" factor from Fenigstein et al.'s (1975) self-consciousness scale, the most widely accepted scale to measure this construct. The scale consists of seven 7-point Likert-type items. Another factor from Fenigstein et al.'s scale—namely, "private self-consciousness"—was irrelevant for the study, as it represents mulling over oneself and thoughts and reflections about oneself.

Factor analysis for the four variables together—namely, inherent novelty seeking, need for interaction with a service employee, self-efficacy, and self-consciousness—

showed the factors to be completely distinct. Three items had low factor loadings (0.22 for an inherent novelty-seeking item and 0.16 and 0.36 for two self-consciousness items) and were dropped from further analysis. Cronbach's alphas were 0.72 for inherent novelty seeking, 0.83 for need for interaction, 0.71 for self-efficacy, and 0.75 for self-consciousness.[3] Items for all constructs are shown in Appendix B.

RESULTS

Confirmatory factor analysis and construct validity. Confirmatory factor analysis (CFA) was conducted on all the consumer traits and all the measures for perceptions, attitudes, and intentions. Six items had high modification indices and were dropped from further analysis. Two of these related to ease of use, one to performance, one to fun, one to inherent novelty seeking, and one to need for interaction (see Appendix B). Confirmatory factor analysis on all the remaining items (i.e., on the full model) showed an excellent fit ($\chi^2 = 481.16$, $df = 314$, root mean square residual [RMSR] = 0.04, root mean square error of approximation [RMSEA] = 0.04, Non-Normed Fit Index [NNFI] = 0.95, and Comparative Fit Index [CFI] = 0.96), thus providing evidence of convergent validity. In addition, the good fit indices (despite a large number of constructs) lend support for the construct validity of the individual constructs in the model, as indicated by the earlier exploratory factor analysis. The reliabilities of the constructs (Cronbach's alpha values) reported earlier ranged from 0.71 for self-efficacy to 0.90 for intentions.

To confirm discriminant validity among the constructs, correlations among all the variables were examined, and these ranged from –0.31 to 0.52, with the exception of the correlation between attitude and intention, which was 0.71 ($\phi = 0.79$). A chi-square discriminant validity test was done for these two constructs and found them to be quite distinct ($p < .001$). In addition, a simple CFA with the two constructs "as one" had poor fit indices ($\chi^2 = 191.07$, $df = 9$, RMSR = 0.06, RMSEA = 0.22, NNFI = 0.79, and CFI = 0.87), whereas a second simple CFA with the two constructs "separately defined" had excellent fit indices ($\chi^2 = 19.87$, $df = 8$, RMSR = 0.02, RMSEA = 0.06, NNFI = 0.99, and CFI = 0.99).

Test of core attitudinal model. Structural equations modeling (Jöreskog and Sörbom 1993) was used to test the core attitudinal model (see model within dotted lines in Figure 1). The model fit was very good ($\chi^2 = 184.72$, $df = 97$, RMSR = 0.04, RMSEA = 0.05, NNFI = 0.96, and CFI = 0.97). All three determinants—perceptions of ease of use, performance, and fun—had direct, positive effects on attitude toward using the touch screen for self-service (Hypotheses 1-3), with standardized β coefficients of 0.36 ($p < .001$), 0.12 ($p < .05$), and 0.52 ($p < .001$), respectively. Attitude toward using a touch screen for self-service had a direct, positive effect on the corresponding intentions (Hypothesis 4), with a standardized β coefficient of 0.80 ($p < .001$). In other words, the core attitudinal model in the conceptual framework was well supported, lending additional empirical support for Dabholkar's (1994b) model. The model also explained much of the variance for the endogenous variables, with R^2 values of 0.64 for intention and 0.56 for attitude.

Although the focus of the study is on moderating effects, a full direct-effects model was also tested. The issue of concurrent direct and moderating effects from a given exogenous variable is not problematic.[4] Yet, typically, either direct or moderating effects will be stronger, and as discussed, moderating effects are expected to be more meaningful.

The model included direct effects from all four consumer traits on all three perceptions about the technology-based self-service, as well as direct effects from both situational factors on intentions to use the technology-based self-service.[5] The model fit was good ($\chi^2 = 797.69$, $df = 462$, RMSR = 0.06, RMSEA = 0.04, NNFI = 0.91, and CFI = 0.92), and all direct effects were supported except those from self-consciousness and social anxiety. However, this direct-effects model failed to account for much additional variance as compared to the core attitudinal model. The R^2 value for intention was somewhat higher at 0.70, but the R^2 value for attitude was in fact a little lower at 0.54, compared to 0.64 and 0.56, respectively, for the core attitudinal model.

Test of moderating effects. To investigate moderating effects, consumer traits and situational factors were divided into high and low groups. Baron and Kenny (1986) explained that for testing moderating effects, "the levels of the moderator are treated as different groups" (p. 1175). The high and low treatments (see Appendix A) were used as the groups for the situational factors. Cell sizes for high and low levels of situational factors are shown in Table 1A. High and low groups based on a median split were used for the consumer traits. Cell sizes for these groups are shown in Table 1B.

The tests for moderating effects were conducted as follows. For each moderating variable, in turn, the core attitudinal model was tested for high and low groups using structural equations modeling. Rigorous pretests were done to verify that the changes in coefficients were truly due to group differences and not due to measurement error. Only after obtaining evidence of this were β coefficients compared across the high and low group levels. This strict pretesting is not commonly followed for testing moderating effects. It is an adaptation of Jöreskog and Sörbom's (1993) rigorous procedure for verifying whether factor loadings are essentially the same or significantly different across two groups. We apply this procedure to see first if

TABLE 2
Structural Equations Results for Moderating Effects Models

Moderating Variable	*Model*	χ^2	df	*RMSEA*	*Standard RMR*	*NNFI*	*CFI*	$\Delta\chi^2/\Delta df$	p^a
Consumer traits									
Self-efficacy	A	507.88	231	0.08	0.08	0.91	0.91	5.84	0.05[b]
	B	391.12	211	0.07	0.06	0.93	0.94		
Inherent novelty seeking	A	462.53	231	0.08	0.08	0.90	0.91	3.87	0.05
	B	385.14	211	0.07	0.07	0.92	0.93		
Need for interaction	A	545.08	231	0.08	0.10	0.89	0.90	4.86	0.05[b]
	B	447.97	211	0.08	0.06	0.91	0.92		
Self-consciousness	A	541.01	231	0.09	0.09	0.89	0.89	4.13	0.05
	B	458.51	211	0.08	0.06	0.90	0.91		
Situational factors									
Perceived waiting time	A	587.08	231	0.10	0.12	0.84	0.85	8.27	0.001
	B	422.33	211	0.08	0.08	0.90	0.91		
Social anxiety (through perceived crowding)	A	465.55	231	0.08	0.09	0.90	0.90	4.12	0.05
	B	383.14	211	0.07	0.07	0.92	0.93		

NOTE: RMSEA = root mean square error of approximation; RMR = root mean residual; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index.

a. Probability that the two models tested are significantly different.

b. Probability was 0.01 using a third split instead of a median split.

moderating effects are truly present (i.e., not spuriously caused) and only then determine their direction and significance.

To see if moderating effects are present, *two tests* were conducted for each variable, based on *four models* that were examined for each variable. The procedure and the rationale for this step-by-step testing are as follows. Four models were run comparing the low and high groups for each moderating variable. Model A had all factor loadings constrained across the groups, and error variances of the items for endogenous variables were also constrained. Model B had the factor loadings free but error variances constrained. Model C had both factor loadings and error variances free. Model D had factor loadings constrained but error variances free.

The first test compared Model A to Model D (and Model B to Model C). If Models A and D are different from each other (or if Models B and C are different from each other), this difference would be caused by error variances in dependent variables. As Baron and Kenny (1986) explained, "If the amount of measurement error in the dependent variable *varies* as a function of the moderator, then the correlations between the independent and dependent variables will differ spuriously" (p. 1175). In each case, Models A and D were essentially the same (i.e., the χ^2 difference between the models was nonsignificant), and Models B and C were not significantly different either. Both sets of findings indicate (and doubly verify) that error variances do not cause significant differences across the low and high groups, and this is true for *every* moderating variable.

The second test compared Models A and B. If Models A and B are different from each other (or if Models D and C are different from each other), this difference would be caused by factor loadings. Furthermore, if the χ^2 difference between these two models divided by the change in degrees of freedom (i.e., χ^2 difference for one degree of freedom, $\Delta\chi^2/\Delta df$) is significant, then there are significant moderating effects across the low and high groups. The results are presented in Table 2 for Models A and B (which are practically identical to Models D and C, respectively). The fit indices for Models A and B are sufficiently different for each variable, indicating that this difference is caused by factor loadings and not error variances. Furthermore, it is seen that the χ^2 difference for a change in one degree of freedom is significant for *all* the moderating variables, thus confirming significant moderating effects for all external factors, consumer and situational.

The proposed hypotheses for the moderating effects (Hypotheses 5a-10d) are presented in Table 3. The results for these hypotheses, in terms of changes in standardized β coefficients (from the low to the high group) in the presence of a moderating variable, are also shown in Table 3. It is seen that a majority of the moderating hypotheses are supported. Implications of the results are discussed next.

DISCUSSION

Effects of Consumer Traits

Nine of 14 moderating hypotheses for consumer traits were supported with a median split. Higher self-efficacy attenuated the relationship between ease of use and attitude. Greater inherent novelty seeking attenuated the relationships between performance and attitude and between

TABLE 3
Structural Equations Results for Hypotheses in Moderating Effects Model

	Hypotheses for Moderating Effects					
	Consumer Traits				*Situational Factors*	
Relationship Within Core Attitudinal Model of TBSS	*Self-Efficacy*	*Inherent Novelty Seeking*	*Need for Interaction*	*Self-Consciousness*	*Perceived Waiting Time*	*Social Anxiety (through perceived crowding)*
Ease of use → attitude	Hypothesis 5a: Attenuate	Hypothesis 6a: Attenuate	Hypothesis 7a: Strengthen	Hypothesis 8a: Strengthen	Hypothesis 9a: Strengthen	Hypothesis 10a: Strengthen
Performance → attitude		Hypothesis 6b: Attenuate	Hypothesis 7b: Strengthen	Hypothesis 8b: Strengthen		
Fun → attitude	Hypothesis 5c: Strengthen	Hypothesis 6c: Strengthen	Hypothesis 7c: Strengthen	Hypothesis 8c: Strengthen	Hypothesis 9c: Strengthen	Hypothesis 10c: Strengthen
Attitude → intention		Hypothesis 6d: Attenuate	Hypothesis 7d: Strengthen	Hypothesis 8d: Attenuate	Hypothesis 9d: Attenuate	Hypothesis 10d: Attenuate

	Results (change in standardized β values) for Moderating Effects											
	Consumer Traits								*Situational Factors*			
	Self-Efficacy		*Inherent Novelty Seeking*		*Need for Interaction*		*Self-Consciousness*		*Perceived Waiting Time*		*Social Anxiety (through perceived crowding)*	
Relationship Within Core Attitudinal Model of TBSS	*Low High*		*Low High*		*Low High*		*Low High*		*Low High*		*Low High*	
Ease of use → attitude	0.38 to 0.21	(S**)	0.12 to 0.58	(COD)	0.12 to 0.25	(S**)	0.32 to 0.24	(COD)	*ns* to 0.80	(S**)	0.43 to 0.63	(S**)
Performance → attitude	0.27 to 0.24	(NCH)	0.45 to *ns*	(S**)	0.17 to 0.13	(NS)	0.15 to 0.21	(S*)	0.81 to *ns*	(UF)	0.35 to 0.16	(UF)
Fun → attitude	0.40 to 0.43	(NS)^	0.28 to 0.40	(S**)	0.27 to 0.32	(S*)	0.35 to 0.53	(S**)	0.53 to 0.75	(S**)	0.45 to 0.63	(S**)
Attitude → intention	0.93 to 0.95	(NCH)	0.86 to 0.76	(S**)	0.39 to 0.39	(NS)^	0.95 to 0.86	(S*)	0.98 to 0.74	(S**)	0.79 to 1.32	(COD)

NOTE: TBSS = technology-based self-service; S** = supported (change is in correct direction and ≥ 0.1); S* = supported (change is in correct direction, ≥ 0.05 and < 0.1); NCH = no change as hypothesized (i.e., change < 0.05); ^ = hypothesis is supported with a third split (instead of a median split); NS = not significant (change is < 0.05, not supporting hypothesis); UF = unexpected finding, not hypothesized; COD = change in opposite direction as hypothesized and ≥ = 0.05.

attitude and intention, and strengthened the relationship between fun and attitude. A higher need for interaction with a service employee strengthened the relationships between ease of use and attitude, and between fun and attitude. Increased self-consciousness strengthened the relationships between performance and attitude, fun and attitude, and attitude and intention.

Two more hypotheses were supported using a third split instead of a median split. Thus, with a slightly less conservative test, higher self-efficacy strengthened the relationship between fun and attitude, and need for interaction strengthened the relationship between attitude and intention.[6]

Contrary to expectations, the relationship between ease of use and attitude was strengthened (instead of attenuated) for consumers high in inherent novelty seeking. An explanation may be that unlike those who are high in self-efficacy, consumers high in inherent novelty seeking do not have the confidence that they can use technology-based self-service easily. Hence, they would tend to try these options for the fun they offer, but *only* if they are also easy to use.

Also, unlike the strengthening hypothesized, the relationship between performance and attitude was not significantly changed with a higher need for interaction. A reason may be that consumers at the higher end of this scale like to interact with employees not because they think employees are more reliable than technology-based self-service but simply because they value the human interaction. Thus, the reliability of the technology-based self-service is no more important or relevant to them than to consumers with a low need for interaction with a service employee.

Last, the relationship between ease of use and attitude was slightly attenuated (and not strengthened as hypothesized) for consumers high in self-consciousness. This does seem counterintuitive. One would expect ease of use of the technology-based self-service to be important to someone who is self-conscious. Future research could investigate whether self-consciousness would work as hypothesized for different populations (e.g., older consumers unused to technology).

Managerial implications. Our findings suggest that marketers should promote the *ease of use*, or "user-friendliness" of their technology-based self-service, especially if their target market is likely to (1) be low in self-efficacy or (2) have a high need for interaction with a service employee. In addition, service firms must ensure that through sufficient pretesting their technology-based self-service is actually designed to be easy to use by typical consumers in these target groups.

Our results also suggest that emphasis on the *performance* or "reliability" of the technology-based self-service is important if the target market is likely to be (1) low in inherent novelty seeking or (2) high in self-consciousness. As consumers in these segments would be typically reluctant to use technology-based self-service, it is important to design such options for these segments so that they are truly reliable and "debugged" for performance-related problems.

Finally, our study indicates that marketers should heavily promote the fun aspect of using their technology-based self-service if their target market is likely to (1) be high in inherent novelty seeking, (2) be high in self-efficacy, (3) be highly self-conscious, or (4) have a high need for interaction with a service employee. For the first two segments, this is a natural promotional fit because consumers high in self-efficacy or inherent novelty seeking would have a strong inclination to try such options anyway, but especially if they are seen as fun. For the other two segments, the enjoyment in using technology-based self-service still needs to be emphasized but in a subtle way. The idea here is to persuade these consumers to try technology-based self-service *despite* their natural resistance to them in on-site encounters. Perhaps an ad could show a self-conscious-looking person approaching a technology-based self-service option rather reluctantly, then being pleasantly surprised as he or she interacts with the machine, and smiling as the transaction is completed. Any claims of fun should be backed up by designing the technology-based self-service so that it is indeed enjoyable for consumers.

Directions for future research. Future research could investigate how the role of any given consumer trait differs for different types of technology-based self-service options. For example, is self-efficacy just as relevant for shopping on the Internet, or does financial risk outweigh the proclivity to use technology-based self-service?

Possible interactions between consumer traits constitute another promising research avenue. For example, a consumer high in self-efficacy may also be self-conscious, or a consumer high in novelty seeking may also like to interact with a service employee.

Future research could examine a whole continuum of technology-based self-service to see how the influence of consumer traits might differ as consumers become more familiar with technology-based self-service in general. For example, with greater familiarity, self-efficacy should increase, but the novelty aspect might not be quite as relevant.

Finally, researchers can explore whether other consumer traits moderate the core attitudinal model in different technology-based self-service contexts (both on-site and off-site). A personality trait such as impatience would be relevant, but it might already be captured in perceptions of waiting time. Similarly, self-confidence may be too similar to self-efficacy in most contexts involving technology-based self-service. On the other hand, need for cognition, which is not as relevant for a typical on-site technology-based self-service, may be quite relevant for using the Internet. Researchers might find it fruitful to explore whether need for cognition has a greater influence for complex information searches using the Internet compared to simple information searches. Similarly, researchers could investigate whether a trait such as self-monitoring has an influence in contexts such as library self-scanners or automated car rentals, where one is likely to pick up consumer behaviors by watching other consumers with similar backgrounds or lifestyles.

Effects of Situational Factors

Five of six moderating hypotheses for situational factors were supported. Greater perceived waiting time strengthened the relationships between ease of use and attitude and between fun and attitude, and attenuated the relationship between attitude and intention. Higher social anxiety strengthened the relationships between ease of use and attitude and between fun and attitude.

Only one hypothesis was not supported. Contrary to expectations, the relationship between attitude and intention was not attenuated with greater social anxiety. At first glance, this is surprising, especially because a parallel hypothesis for self-consciousness was supported. An explanation may be that with higher social anxiety, consumers tend to rely on their attitudes to determine their intentions. Given the emotion associated with social anxiety (as opposed to self-consciousness, which encompasses awareness rather than emotion), this makes some intuitive sense. Placed in a situation that gives rise to negative emotion, consumers may decide whether to use technology-based self-service by drawing on their own evaluations or overall feelings about these service options. Hence, the attitude-intention relationship is strengthened.

Also, two moderating effects were found that were not hypothesized. The relationship between performance and attitude was attenuated with greater perceived waiting time as well as with higher social anxiety through perceived crowding. It appears that faced with situational impediments to using technology-based self-service, "reliability" is not much of a consideration. In fact, the combined increase in importance of ease of use and fun as determinants of attitude (under situational pressures) may cause the relative importance of performance to decline.

Managerial implications. Our findings suggest that promoting the *ease of use*, or "user-friendliness," as well as the *fun* or "enjoyment" of their technology-based self-service is critical if marketers expect that consumers will encounter either long waiting lines or crowded conditions that could cause social anxiety. For example, marketers can stress the ease of use so that waiting (or situationally anxious) consumers recognize that the service will be fast (easy) once they get to it. Similarly, they can emphasize the fun aspect in their promotions so that using technology-based self-service may be seen as worth waiting for (or as not causing further anxiety). Designing these attributes (ease of use and fun) into their technology-based self-service is important if such situational pressures are expected to be typical. In contrast, promoting the *performance*, or "reliability," of the technology-based self-service is more relevant if marketers do not typically expect delays or crowded conditions in their service delivery. Again, any claims of reliability of the technology-based self-service need to be backed up through service design.

An important issue in this study was whether consumers choose to use technology-based self-service when faced with waits or delays. The attenuation of the attitude-intention relationship suggests that with increased waiting time, consumers will select alternative options *despite* favorable attitudes toward the technology-based self-service. Thus, waiting time is a strong deterrent to the use of on-site technology-based self-service despite contrary observations. Implications for practitioners are to plan service design and layout so as to minimize waiting time. A sufficient number of kiosks or scanners in retail stores can further minimize waiting time but must be weighed against possible idle capacity. In addition, special promotions may be offered during off-peak hours to reduce waiting time during peak hours. This finding may also have relevance for off-site technology-based self-service, where recurring delays in using telephone or online shopping may result in lost consumers due to an attenuation of the attitude-intention relationship.

Implications of the findings for social anxiety are somewhat different. In the short term, marketers can try to reduce crowded conditions for on-site technology-based self-service through promotions and layout as suggested for reducing waiting time. But the fact that the attitude-intention relationship was strengthened with greater social anxiety has interesting implications for practice. Marketers, who expect that consumers might become anxious due to crowded situations, need to ensure that positive attitudes toward technology-based self-service are already in place so that these (the positive attitudes) will guide intentions to use that service option, when the attitude-intention relationship is strengthened. This strategy involves taking a long-term approach to educate consumers about the benefits of technology-based self-service so that they form positive attitudes toward using such options.

Directions for future research. The findings related to perceived waiting time may be equally applicable for other technology-based self-service settings and should be explored in future research. For example, in using the Internet, do perceptions of excessive waiting time turn off many would-be users and make them more demanding in terms of enjoyment? Internet providers may have to work at minimizing waiting time, on one hand, and at the same time somehow continue to make the process enjoyable even during delays to keep would-be shoppers online. Researchers can study different formats of Web pages to determine how best to do this.

Future studies could investigate whether waiting time becomes less relevant with greater involvement. For example, are consumers more willing to wait to use technology-based self-service kiosks for services that they are more involved in, such as medical and financial services?

Researchers could also test the effect of greater social anxiety (through perceived crowding) for different populations and more complex technologies. For example, older consumers may be more likely to be adversely affected by physical crowding than students. Also, social anxiety may be higher if customers have to use a computer keyboard instead of a touch screen in a retail setting. Another interesting research issue for future study is whether the impact of social anxiety increases with greater financial risk, such as when consumers do online shopping at Internet kiosks in retail stores, with other customers watching them.

Future research could also explore the effect of other situational factors (e.g., time pressures, layout of facility) as well as interactions between situational factors. For example, time pressures combined with long waiting times may have a stronger negative effect on consumer response to technology-based self-service options. Similarly, an ergonomically poor layout combined with in-store crowding may have a strong adverse effect on consumer response to such options. In off-site contexts, such as using the Internet from home or work, situational factors such as unavailability of other shopping modes, especially at certain times, and unavailability of products in local stores would be relevant (Bobbitt and Dabholkar 2001). A situational factor such as in-store (or online) music may have a positive or negative effect on perceptions of waiting time (e.g., Hui, Dube, and Chebat 1997). Researchers need to understand the consequences of various situational factors (and their interactions) so that managers can plan to avoid negative situational influences, whether in-store or online.

Limitations

On one hand, a scenario approach may be viewed as making the findings less applicable to the real world. On the other hand, situational factors in a field setting are usually uncontrollable. Using a realistic scenario that the respondents can easily imagine themselves in allows the researcher to control treatments and test outcomes effectively. Another possible limitation, common to most studies using paper-and-pencil measures, is that using roughly the same sequence for measures as for latent constructs can lead to "self-generated validity" (Feldman and Lynch 1988). However, an alternative order may measure poorly formed intentions or mere guesses, especially in a scenario where subjects have to immerse themselves in the situation and then answer the questionnaire.

A student sample somewhat restricts generalizability of the results to a broader population. Yet, in today's fast-paced world, most consumers, including students, are time conscious and look for service options that are easy and quick. Also, most consumers, including students, tend to seek a service option that is likely to be dependable and accurate. To the extent that students have certain priorities in common with the general population, the results of this study may be extended to the general population. Where differences might occur, such as in reactions to perceived crowding or in being self-conscious, future research is recommended with samples from a broader population.

Finally, the study does not directly investigate affective reactions to situational factors. Studies on consumers' affective response to delays (Dube, Schmitt, and LeClerc 1991; Hui and Tse 1996; Taylor 1994) and to crowding (Machleit and Eroglu 2000) have shown that the emotion that arises due to situational factors can mediate service or shopping evaluation. In our study, social anxiety was manipulated through perceived crowding and possibly had an affective effect on the core attitudinal model. However, this was not directly proposed or measured. Future research could incorporate consumers' affective reactions to further enrich our understanding of consumer motivation, especially in emotionally charged technology-based self-service contexts such as using health kiosks, medical kits at home, or online investment banking in a turbulent financial market.

Conclusion

Our extended framework of Dabholkar's (1994b) attitudinal model of technology-based self-service was well supported and captured a variety of consumer traits and situational factors. A comparison with a full direct-effects model showed the moderating effects to be much more significant empirically and far more meaningful in terms of implications for researchers and practitioners. Thus, we recommend an increased focus on moderating effects in future research.

The conceptual framework in this study can be applied to future research on *any* service experience. Starting with a core attitudinal model that incorporates the critical attributes for *that* experience, researchers can then investigate both the strength and form of the moderating effects of relevant consumer traits and situational factors. In addition, the analytical procedure used in this study may serve as a guide to researchers for conducting a rigorous testing of moderating effects by first verifying their existence, and then testing their direction and significance in a variety of research areas and empirical contexts. If researchers plan to test possible interactions among moderating factors, a much larger sample will be needed based on the testing procedure outlined in this study.

APPENDIX A
Scenarios Used in the Study

Base Scenario (Dabholkar 1994b)

You are in a fast-food restaurant for lunch. Approaching the counter, you find that you have two ordering options: you may order verbally as usual or use the newly installed touch screen machine. (The touch screen is located on the counter and has directions for use and the complete menu on the screen itself. Ordering is done by touching the appropriate boxes on the screen and items can be re-entered if you make a mistake or change your mind.) Both options have the same menu at the same price and allow you to personalize your order (e.g., "hold the mustard," etc.). In each case you pay the cashier after placing the order, and the cashier hands you the food you ordered when it is ready.

Perceived Waiting Time Manipulations (Dabholkar 1996)

High: You estimate that the waiting time for using the touch screen will definitely be longer than the waiting time for placing a verbal order.

Low: You estimate that the waiting time for using the touch screen will definitely be shorter than the waiting time for placing a verbal order.

Social Anxiety Manipulations (Through Perceived Crowding)

High: You also observe that the lunch crowd is pouring into the restaurant behind you (it is now 12:00 noon) and the ordering area is quickly becoming crowded. You realize therefore that whichever line you choose, there will be several consumers lining up behind you who will observe you as you place your order.

Low: You also observe that you have missed the peak lunch rush (it is now 2:00 P.M.) and so you expect the ordering area to remain uncrowded. You realize therefore that whichever line you choose, there will be few, if any, consumers lining up behind you who could observe you as you place your order.

APPENDIX B
Measures Used in the Study

Realism Checks (Dabholkar 1994b)

(1) The situation described was realistic.
(2) I had no difficulty imagining myself in the situation.

Attitude (Dabholkar 1994b), $\alpha = 0.85$

In the situation described, how would you describe your feelings toward using the touch screen? Endpoints: (1) *good-bad*, (2) *pleasant-unpleasant*, (3) *harmful-beneficial*, (4) *favorable-unfavorable*.

Intention (Dabholkar 1994b), $\alpha = 0.90$

In the situation described, would you intend to use the touch screen? Endpoints: (1) *likely-unlikely*, (2) *possible-impossible*.

Ease of Use (Dabholkar 1994b), $\alpha = 0.90$

Using a touch screen for self-service . . .

(1) will be complicated
(2) will be confusing[a]
(3) will take a lot of effort
(4) will require little work
(5) will take a long time at the register[a]
(6) will be slow once I'm at the screen

Performance (Dabholkar 1994b), $\alpha = 0.77$

Using a touch screen for self-service . . .

(1) means I will get just what I ordered
(2) will result in errors in the order
(3) is something I don't expect to work very well[a]
(4) will be reliable

Fun (Dabholkar 1994b), $\alpha = 0.84$

Using a touch screen for self-service . . .

(1) will not be interesting[a]
(2) will be entertaining
(3) will not be fun
(4) will be enjoyable

Inherent Novelty Seeking (Mehrabian and Russell's 1974 Arousal Seeking), $\alpha = 0.72$

I am always seeking new ideas and experiences.
When things get boring I like to find some new and unfamiliar experience.
I prefer a routine way of life to an unpredictable one full of change.[a]
I like to continually change activities.
I do not like meeting consumers who have new ideas.[b]
I like to experience novelty and change in my daily routine.

Need for Interaction (Dabholkar 1996), $\alpha = 0.83$

Human contact in providing services makes the process enjoyable for the consumer.
I like interacting with the person who provides the service.
Personal attention by the service employee is not very important to me.[a]
It bothers me to use a machine when I could talk to a person instead.

Self-Efficacy (Adapted From Bandura 1977), $\alpha = 0.71$

I am highly confident that I can use a touch screen.
The probability that I can use a touch screen is ____%.

Self-Consciousness (Fenigstein, Scheier, and Buss 1975), $\alpha = 0.75$

I'm usually unaware of my appearance.[b]
I usually worry about making a good impression.
One of the last things I do before I leave my house is look in the mirror.[b]
I am concerned about what other consumers think of me.
I'm concerned about my style of doing things.
I'm concerned about the way I present myself.
I'm self-conscious about the way I look.

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a. Item dropped due to high modification index on confirmatory factor analysis.
b. Item dropped due to low loading on factor in exploratory factor analysis.

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NOTES

1. The moderating hypotheses (a, b, c, d) match the corresponding relationships in the core attitudinal model (i.e., they correspond to Hypotheses 1-4; see Figure 1).

2. At first, we simply said it was peak time (or not), but the manipulation did not work well with this phrasing. Next, we added that many consumers (or few) were in the restaurant, but this did not work perfectly either. Finally, we made the description more vivid and suggested that many consumers (or few) were likely to come in and watch you as you order. This social anxiety (through perceived crowding) manipulation worked well (see Appendix A).

3. Cronbach's alphas for inherent novelty seeking and self-consciousness were computed after dropping the items with low factor loadings (see Appendix B).

4. A particular variable may assume both direct and moderating roles, "even in the same functional relation and equation" (James and Brett 1984:314).

5. The rationale for modeling direct effects along these lines is as follows. The theory of reasoned action (Fishbein and Ajzen 1975) suggests that external factors, such as personality traits, will typically influence beliefs or perceptions, whereas the theory of planned behavior (Ajzen 1991) suggests that situational factors will influence intentions without the mediation of attitudes.

6. Parallel to the group selection for the situational factors, where the middle or control group is dropped, a third split was used for consumer traits for comparison purposes. The middle third was dropped and the high and low thirds compared. The results were very similar to those reported for the median split, except that two additional hypotheses were supported with the third split (see note in Table 3). The reason is that a median split tends to be more conservative, and if respondents end-pile their ratings, as is common in personality research, then relationships with other variables are harder to detect using this method (McCarty and Shrum 2000).

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