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Lined up? Examining a "waiting line" effect in technology-enabled menu orderings

Highlights

- The presence of a waiting line can induce time-pressured menu ordering behavior.
- SST (vs. human-based) menu order interactions amplify the "waiting line" effect.
- The SST-conditioned "waiting line" effect is explained by perceived responsibility.
- Allocating a single line for multiple SSTs can mitigate the "waiting line" effect.

Abstract: This research examines the impact of a waiting line on menu ordering behavior when interacting with self-service technology (SST), along with the underlying mechanisms and an intervention strategy drawing on attribution theory. We conducted three experimental studies to simulate a real-life event of menu ordering in a quick-service or fast-casual restaurant. According to the results, the presence of a waiting line can lead to time-pressured menu ordering behavior, especially when interacting with SSTs (vs. human staff). Further, we verified that customers' perceptions of responsibility for service outcomes explain this SST-conditioned effect. Our findings also suggest a line design strategy that can mitigate the negative consequences of the "waiting line" effect in SST-enabled menu ordering. This research provides valuable insights into the unintended consequences of waiting lines and offers practical strategies for minimizing negative outcomes associated with SST-mediated services.

Keywords: waiting line, queue, self-service technology, menu ordering, attribution theory

1. INTRODUCTION

The hospitality industry has witnessed a vital role of technologies in enhancing customer experiences. A prominent facet of such technological advancements is self-service technology (hereafter SST), defined as "technological interfaces that enable customers to produce a service independent of direct service employee involvement" (Meuter et al., 2000, p. 50). Forecasted data indicate a remarkable growth in the market value of SST, projected to increase from $1.71 trillion in 2020 to $6.25 trillion by 2028 (Global View Research, 2021). In recent years, SSTs have also been widely adopted in restaurants, primarily facilitating menu ordering processes and transforming traditional human-to-human interactions into technology-driven engagements. This trend is particularly attributed to a growing number of quick-service (e.g., McDonald's, Wendy's) and fast-casual (e.g., Applebee's, Chipotle, Shake Shack) restaurants that have increasingly implemented self-service kiosks to streamline menu ordering processes and cope with the rising labor shortages (Gagnon, 2022; Tillster, 2019). A noteworthy example is McDonald's, which has implemented menu order kiosks in over 1,000 U.S. stores, with a strategic objective of offering self-service options in all company-owned locations (Johnson, 2018).

Waiting line (i.e., queue) management is an indispensable aspect of the hospitality industry, facilitating a smooth operation of service processes (Durrande-Moreau, 1999). Certainly, queues are commonplace in various hospitality settings, including hotels, theme parks, and airports, where customers often wait in line for services such as check-in/-out, accessing attractions/services, and boarding flights. Notably, in the restaurant industry, the surge in the popularity of fast-casual and quick-service segments has increased the prevalence of customers waiting in lines while placing menu orders (Technomic, 2019). This circumstance has drawn significant attention to the potential influence of social factors on the ordering experience of focal customers (Hanks et al., 2016). Perhaps, the most influential

"others" are often those in close physical proximity, such as fellow customers standing in the waiting line (Otterbring, 2022). As an anecdotal instance from industry practice, Wendy's executed a simulation study, wherein select participants displayed visible signs of anxiety in the presence of co-queuing patrons; some individuals even turned around to count the number of people behind them and gestured for others to pass by, seeking more time to consider their options (Jargon, 2018).

As the phenomenon becomes acknowledged, a couple of questions remain unanswered: If customers recognize others waiting behind, would this lead them to feel pressured while ordering menu items? How would this felt pressure influence their menu ordering behavior? These questions are relevant to the hospitality industry, which values customer experience as the core of business success (Gursoy, 2018). A smooth and pleasant menu ordering experience is integral to dining out while experiencing pressure during this process can significantly impact customer behavior, including the speed of decision-making, food expenditures, and the selection of menu items (e.g., familiar vs. novel dishes) (Hyun et al., 2016; Kim et al., 2018). Along with this notion, our research suggests that restaurant customers adhere to the social norm of not interfering with the utility of others while in a waiting line (Fisk et al., 2010). Consequently, the focal customer may experience psychological pressures to make quick decisions when ordering menu items due to the presence of a waiting line behind him/her, leading to *time-pressured* ordering behavior, such as ordering familiar items without adequate consideration and exploration of the entire menu.

Despite businesses' premonition that a waiting line can cause unease to customers, the behavioral implications of such queues have been overlooked by hospitality scholars. This literature gap has become more evident in recent years, primarily due to the increasing adoption of SSTs in restaurant interactions. Our research posits that the rising usage of SST accentuates the impact of waiting lines on customers' pressured behavior. Customers who opt

for SSTs, instead of engaging with human staff might be particularly susceptible to this "waiting line" effect due to the elevated sense of control they experience over the ordering process (Fishman & Husman, 2017). The greater sense of control is likely to heighten customers' felt responsibility for the speed of their transactions and the potentially extended waits experienced by others, consequently leading to pressured ordering behavior. As such, an empirical investigation of waiting lines and their potential impact on menu ordering behavior warrants significant attention. In this research, we examine the effect of waiting lines associated with SSTs via the lens of attribution theory (Weiner, 1985).

The present research seeks to investigate the impact of waiting lines on customer menu ordering behavior when interacting with SSTs. In specific, the study aims to (1) examine a "waiting line" effect on menu ordering behavior while accounting for two service interfaces (SST vs. human staff), (2) identify the underlying mechanisms of the proposed effect, and (3) explore the effectiveness of a line-design intervention in mitigating the "waiting line" effect. Our research contributes to the existing literature by shedding light on the unintended consequences of having waiting lines in SST-mediated services (e.g., menu ordering) and the theoretical account for the proposed effect. The findings also provide valuable managerial insights into customer ordering behavior resulting from SST-mediated services and suggest practical strategies for restaurants to manage customers' food ordering experience. The findings also highlight the importance of effective line design in minimizing the negative effects of waiting lines.

2. LITERATURE REVIEW

2.1. Waiting lines (queues)

Waiting lines, also known as queues, have received mounting attention historically as they have become a significant factor in making informed business decisions regarding

resource allocation. Organizations are keen to minimize operational costs, improve productivity, and enhance efficiency by optimizing queues. Effective queue management can positively impact businesses' revenue generation and cost reduction by, for example, reducing idle time for employees, utilizing resources to their full potential, and maximizing customer turnover rates (Errecart, 2023). Hence, early literature has been predominantly centered around operational advancements in queue management (Durrande-Moreau, 1999; INFORMS, 2023; Jones & Peppiatt, 1996; Penttinen, 1999). As queueing theory began in the early 20th century and has evolved, a significant body of research has been dedicated to developing mathematical models, equations, and algorithms to forecast and regulate production and customer flow across industries. For instance, some waiting line policies have been proposed in several sectors to minimize wait times. The first-come-first-served (FCFS) approach, where customers with the most extended wait times are attended to first, or the last-come-first-served (LCFS) approach, where customers with the shortest wait times are prioritized, may be selected based on circumstances to reduce the overall wait time (Penttinen, 1999). Alternatively, the shortest-job-next (SJN) rule may be employed, prioritizing customers with the smallest size (e.g., checkout counters reserved for small purchases).

Queues are ubiquitous in the service industry, where customer experiences are integral to the delivery process (Durrande-Moreau, 1999). In service operations, proficiently managed waiting lines can be perceived as buffer inventories, instrumental in facilitating seamless operational activities. However, unlike in manufacturing, customers have their own perceptions regarding waits and queues, which may affect their service consumption and subsequent behavior. The existence or length of the waiting line can serve as a consideration or a cost factor for customers deciding on service consumption (Kokkinou & Cranage, 2015; Wang et al., 2012). Many customers perceive the waiting experience as unpleasant, which

has been a challenge for service providers (Jones & Peppiatt, 1996).

Furthermore, customers' perception of wait time can often differ from the actual duration, influenced by various internal or external factors such as anxiety, uncertainty, and perceived unfairness (Dickson et al., 2005; Maister, 1985). This highlights the subjective nature of customers' waiting experience and emphasizes the importance of managing not only the objective waiting time but also the customers' perceptions. In certain situations, however, making consumers wait can signal service quality or attractiveness, increasing satisfaction and purchase intentions (Giebelhausen et al., 2011; Kostecki, 1996). The mixed findings have underscored the intricacy of managing customers' waiting experiences as an integral part of service consumption.

Most queuing theories and models are based on the economic perspective, where economic agents make rational, albeit bounded, decisions. In service settings when consumption involves other customers in a shared environment, waiting lines are also regarded as *social systems* where decision-making is not solely based on self-interest but is also influenced by social factors and the presence of others (Mann, 1969; Ülkü et al., 2022). For example, queue jumpers violate social norms, causing resistance and moral outrage, even if the additional person does not significantly increase waiting times or reduce service quality (Schmitt et al., 1992). Also, first-come-first-served (FCFS) is widely accepted as socially agreed to be fair, although other queue policies could be more efficient (e.g., prioritizing VIPs) (Mcguire & Kimes, 2006). More recently, Ülkü et al. (2022) have found that consumers are more likely to speed up their transactions and service consumptions when others are waiting in line, at the sacrifice of their own consumption experience. Rather than assuming consumers are solely self-interested, we believe that the "waiting line" induced behaviors should be understood via a social lens to maintain fairness and justice. In line with this stream of queuing studies, our research follows the social account of queues and

examines consumers' menu ordering behavior as a function of the "waiting line." We propose this effect within an important operating territory (i.e., SST) that significantly occupies the restaurant and service industries.

2.2. Restaurant SST

The hospitality industry has heavily invested in service technologies to drive innovation and provide more accurate, efficient, and consistent services (Gummerus et al., 2019; Park et al., 2023). SSTs represent a particular type of service technology that allows customers to self-produce services without interaction with service employees (Meuter et al., 2000). SSTs have been implemented by many businesses as a means of addressing operational inefficiencies, such as high labor costs, high employee turnover, and inconsistency/bottlenecks in service deliveries (Shin & Perdue, 2019). With the hospitality industry representing an icon of the experience economy, SSTs have also offered pleasant and engaging experiences by incorporating interactive elements or gamifying monotonous service processes (Ahn & Seo, 2018; Niels & Zagel, 2018). The demand for contactless services has further prompted the industry to continue to implement SSTs (Wheeler, 2020). A considerable body of literature has supported this trend of SST prolifications, which investigated numerous factors influencing customer adoption of SST; among these factors are customer readiness (Shim et al., 2020), customer innovativeness, perceived risk (Jeon et al., 2020), customization option (Ahn & Seo, 2018; Xu et al., 2022), and entertainment (Xu et al., 2022).

In restaurant service, SSTs have gained prominence as efficient tools for menu ordering and facilitating purchases. The advent of digital interfaces, such as iPads equipped with digital menus, has led to the widespread adoption of tabletop or tableside touchscreen monitors in numerous casual dining establishments (Ahn & Seo, 2018). Restaurant SST

interaction process diverges from traditional human-mediated menu ordering as it eliminates the need for customers to engage with human employees. Due to the lack of employee involvement, this shift to SST interactions places a greater emphasis on active, effective customer participation in the service delivery process for positive customer experiences (Meuter et al., 2000). Accordingly, by engaging with SSTs, customers are empowered to independently navigate the menu, place orders, and conduct payment transactions, consequently cocreating core products and experiences with the business (Kelly et al., 2017). A prevailing trend among customers is their inclination for increased control over service experiences (Davis et al., 2011). However, these environments devoid of employee presence reinforce the customer's responsibility to ensure enhanced service quality, value, and satisfaction (Antwi et al., 2021; Kelly et al., 2017).

In the context of SSTs, where human employees play limited roles in shaping the customer experience, it is imperative to consider the impact of other customers on the focal customers. For instance, Kelly et al. (2017) investigated the implementation of SSTs at airports and highlighted instances where certain individuals assisted fellow customers who faced challenges with digital check-in services. Nevertheless, customer-to-customer interactions in SST contexts may not always result in favorable outcomes and experiences. Extensive research on SSTs has emphasized the significance of the presence of other individuals as a critical situational factor influencing customer anxiety and discomfort when surrounded by others (e.g., López-Bonilla & López-Bonilla, 2015; Nam & Kim, 2022; Shim et al., 2020). Therefore, given the need to examine the influence of others in SST contexts, the present research aims to investigate an essential external situational factor, namely the presence of a waiting line in the process of menu ordering via restaurant SSTs.

2.3. Attribution theory

In the current research, we use *attribution theory* as the theoretical framework which conceptualizes how people interpret events' occurrence (Martinko & Mackey, 2019). It is not one singular theory but rather a set of theories and concepts (e.g., the covariation model, correspondent inference theory, locus of control) which collectively address inquiries concerning the reasons behind and comprehension of event occurrences (or behaviors). Attribution theory is grounded in the assumption that the causes of certain events are attributed to either internal factors (e.g., ability, effort) or external factors (e.g., task difficulty, luck) that can facilitate or impede outcomes (Heider, 1958). Accordingly, attributions encompass a dual-locus dimension, comprising internal attributions, which stem from individual characteristics or personal dispositions, and external attributions, which arise from situational or environmental factors (Weiner, 1985).

The literature on attribution theory has attempted to discern antecedents of attribution to understand how individuals form judgments and whether they attribute certain outcomes to themselves or external situations (e.g., Jones & Davis, 1965; Kelley, 1973). Per this theory, the degree of control over an event holds significant importance in evaluating the attribution paths because it demonstrates an individual's mastery of the situation and drives subsequent behavior (Inesi et al., 2011). Individuals possessing a high level of control are more inclined to engage in internal attribution, assigning outcomes primarily to their actions. Conversely, when individuals perceive limited control over environmental conditions, they attribute outcomes to external factors, diminishing their roles' significance (Fishman & Husman, 2017). In the business world, service technologies have the potential to influence user control by offering specific features (e.g., customization options, self-service functions) that enhance certain aspects of controllability.

Frequently, consumers rely on heuristics to make judgments, leading to potential errors and biases in the attribution process (Muschetto & Siegel, 2021). One prominent bias is

the fundamental attribution error, wherein individuals tend to underestimate the impact of situational factors while overestimating the influence of dispositional characteristics when assessing others' behavior (Ross, 1977). Conversely, individuals tend to emphasize external attributions more when evaluating their own behavior. Another noteworthy bias is the self-serving bias, whereby individuals attribute success (or positive outcomes) to personal traits while attributing failure (or negative outcomes) to external circumstances (Buss, 1978). However, within the realm of service technology, scholars have uncovered an intriguing phenomenon known as the "reversed" self-serving bias, where positive (vs. negative) outcomes of service technologies are more likely to be attributed externally rather than internally (Jörling et al., 2019).

2.4. The "waiting line" effect on time-pressured menu ordering behavior

Previously, the economically rational approach has been adopted to understand customer perceptions about waiting lines (i.e., queues) (Ülkü et al., 2022). This rationale prioritizes self-interests in consumption utility through material or experiential gains. However, waiting lines are also viewed as *social systems*; thus, customers consider social norms when making decisions (Mann, 1969; Schmitt et al., 1992). Likewise, social pressure arises in the situation where a customer browses and orders menu items while many customers are waiting behind. There is a cross-cultural consensus that consumers assume moral obligations not to interfere with others' utility while consuming products/services (Fisk et al., 2010). When working with SSTs to place menu orders, holding a waiting line may lead the focal customer to feel socially concerned about damaging other customers' service experience. In a similar vein, Chatterjee (2020) suggests that service times should not be longer for those waiting behind because all customers are socially expected to wait equally. In real-world settings, menu ordering is often susceptible to social pressure so that customers

conform to social norms that they need to order promptly (Kim et al., 2018). An occurrence like this disqualifies the economically rational approach to understanding consumers' behavior since pursuing self-interests could collide with others' benefits in a shared social system.

Therefore, we suggest that the presence of a waiting line enables *time-pressured* menu ordering behaviors: 1) reduced menu order time, 2) reduced purchase amount, and 3) likelihood to purchase familiar items, characterizing a "waiting line" effect. Restaurant customers would shorten ordering time under time pressure, which is both intuitive and empirically evidenced (Kim et al., 2018; Ülkü et al., 2022). Menu browsing is a form of information retrieval as well as recreation (Bloch et al., 1989). If customers are under pressure to make a quick decision, they are less likely to take time to explore new items or take chances on novel dishes. In previous research, menu browsing has been linked to hedonism and impulsive purchase behavior, such as purchasing new items or spending more money than usual (Hyun et al., 2016). The pressure to complete a transaction quickly may prevent customers from browsing the menu and exploring more food options. Hence, we hypothesize:

Hypothesis 1: During menu ordering, the presence of other customers in the waiting line reduces (a) menu order time and (b) total purchase amount but increases (c) familiar menu purchases.

Hypothesis 2: The “waiting line” effect on (a) menu order time and (b) total purchase amount, and increases (c) familiar menu purchases, is mediated by perceived time pressure.

2.5. SST-conditioned “waiting line” effect

In this research, we propose that the impact of the “waiting line” effect is more pronounced when customers place menu orders through SSTs (vs. human staff). Drawing on attribution theory, individuals tend to attribute outcomes to external factors when they lack control over certain events, thereby diminishing their roles' perceived influence (Fishman & Husman, 2017). Within the context of restaurant services, customers typically attribute service outcomes (e.g., success/failure) to service providers who possess a higher degree of control over the service delivery process (Inesi et al., 2011). However, using SSTs in restaurants grants customers greater control over the menu ordering process as they can self-manage their own service experiences (Jörling et al., 2019; Meuter et al., 2000). This dynamic results in customers functioning as co-producers of the service experience with shared autonomy and control over service outcomes (Wu et al., 2021). Underpinned by the attribution theory, customers who interact with SSTs (vs. human staff) are more likely to engage in internal (vs. external) attributions for service outcomes, thus feeling more responsible for the service experience of others who share the same waiting line. For this reason, customers could be pressured to make prompt decisions or opt for familiar items to streamline the process to shorten their ordering time to minimize the negative influence on others' experience. This alteration of ordering behavior could potentially limit overall expenditures due to less time devoted to exploring alternative options.

A counterargument can be made that since the self-serving bias (Buss, 1978) posits that individuals tend to attribute failure or negative outcomes to external factors, customers interacting with SSTs may still attribute long waits of others externally to the restaurant management or even to the self-service machine itself. However, empirical evidence from a service technology context suggests a "reversed" self-serving bias phenomenon, wherein consumers tend to engage in internal attribution, even when they experience negative outcomes (Jörling et al., 2019). This phenomenon warrants further exploration, particularly in

the context of SSTs. Hence, we propose:

Hypothesis 3: The “waiting line” effect on (a) menu ordering time, (b) total purchase amount, and (c) familiar menu purchases, mediated by time pressure, is stronger when customers interact with SSTs (vs. human staff).

According to attribution theory, previous research has suggested that individuals tend to attribute outcomes to internal factors when they possess greater control over specific events; this tendency leads individuals to assume a higher level of responsibility for their roles (Fishman & Husman, 2017; Inesi et al., 2011). In light of previous literature, our research endeavors to extend these findings by proposing that interacting with SSTs (vs. human staff) can reinforce the proposed "waiting line" effect (Hypothesis 3). This effect arises due to the internal attributions elicited by the high level of control that customers experience during the coproduction process of SST-enabled menu ordering (Jörling et al., 2019; Wu et al., 2021). The focal customers, therefore, perceive greater responsibility towards their fellow customers who share the same waiting line. Consequently, the degree of perceived responsibility plays a vital role in accounting for the "waiting line" effect during SST-enabled menu ordering. If our theoretical framework holds to this mechanism, the introduction of intervention strategies aimed at reducing customers’ perceived responsibility has the potential to weaken the impact of the “waiting line” effect. Based on this premise, we further propose:

Hypothesis 4: When placing menu orders via SSTs, releasing customers’ perceived responsibility can mitigate the “waiting line” effect on (a) menu order time, (b) menu purchase amount, and (c) familiar menu purchases.

Following the abovementioned conceptualization and attribution theory, line design strategies may significantly influence the "waiting line" effect. The two most common ways to design lines are allocating 1) a "single" line or 2) "multiple" lines in front of multiple SSTs/machines (Al-Kadhimi et al., 2021; Kokkinou & Cranage, 2015). That is, either one line feeds a designated ordering machine, or one line simultaneously feeds multiple ordering machines. When joining a single waiting line that feeds multiple machines (i.e., SSTs), each customer-facing multiple machine shares the responsibility of making the next customer wait before they can be served. This shared responsibility can attenuate the negative outcomes of the waiting line effect. The literature suggests that the number of people waiting behind would be immaterial to the "waiting line" effect as the physical proximity decreases with each additional individual (Otterbring, 2022). Hence, we propose:

> **Hypothesis 5:** When placing menu orders via SSTs, lines designed as one line feeding multiple (vs. one) machines can attenuate the "waiting line" effect on (a) menu order time, (b) menu purchase amount, and (c) familiar menu purchases.

This research examines the proposed hypotheses via three studies. The following conceptual framework (Figure 1) is an overview of the three studies and the proposed effects.

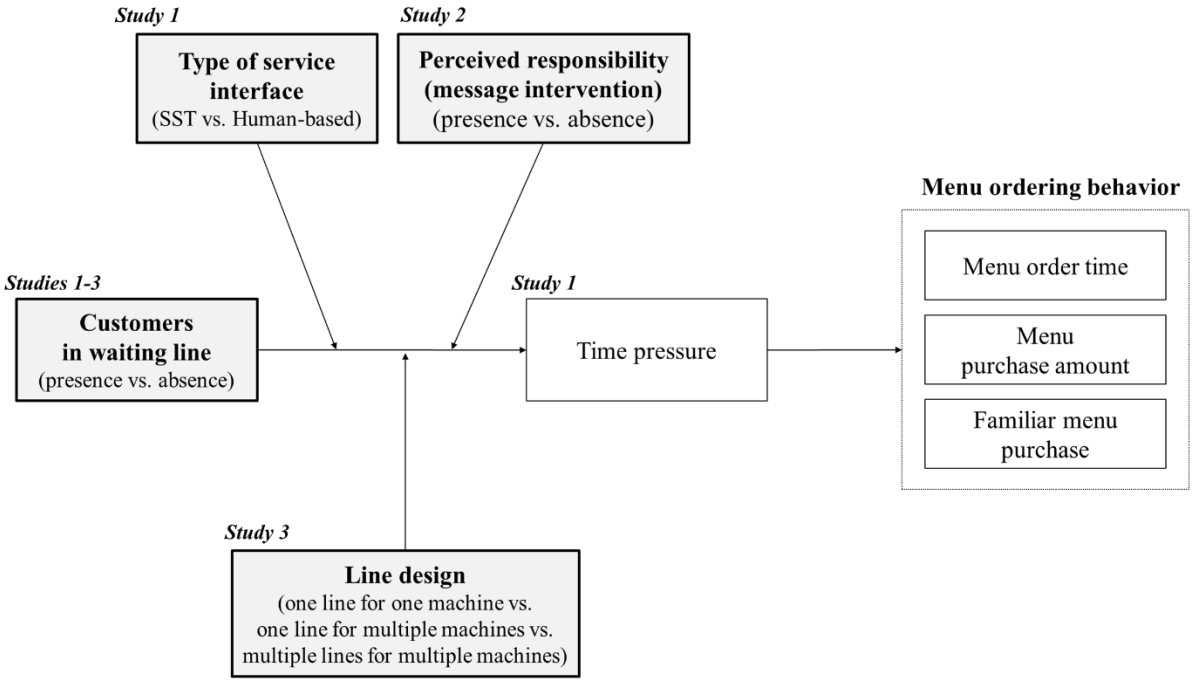

Figure 1. Conceptual framework and study overview.

3. STUDY 1: THE "WAITING LINE" EFFECT ACCENTUATED BY SSTS

The primary objective of Study 1 was to investigate the potential influence of the presence of other customers in the waiting line on menu ordering behaviors (i.e., menu order time, purchase amount, and familiar menu purchase) while also seeking to substantiate the underlying mechanism responsible for such effect (i.e., time pressure). Additionally, the study sought to examine the role of service interface (SST vs. human staff) as a conditioning factor contributing to the observed effects of this waiting line phenomenon. Hence, Study 1 aimed to test Hypotheses 1, 2, and 3. Two types of restaurants were included in the study—fast-casual and quick-service establishments—where SST is most prevalently employed in their operations to augment the generalizability of the findings.

3.1. Research design and procedure

U.S. adults who have visited fast-casual and quick-service restaurants in the past year

were invited to participate. Participants were recruited from an online consumer panel platform (i.e., Prolific, www.prolific.co). We included attention check questions to ensure attentiveness while completing the experiment. We conducted a power analysis (via G*Power) to determine the appropriate sample size for Study 1. To achieve sufficient power that exceeds 0.8, we recruited a sample size greater than 128 for a 2 × 2 × 2 design with six covariates. Upon excluding one response that did not pass attention checks, a total of 200 respondents were retained for data analysis (63% females, with an average age of 36.95 years, 69% Caucasian, 58% married, and 66.5% holding a bachelor's degree or higher).

We carried out a 2 (waiting line: presence vs. absence) × 2 (types of service interface: SST vs. human-based) × 2 (restaurant type: fast-casual vs. quick-service restaurants) between-subjects experiment. Participants were randomly assigned to eight factorial groups. Apart from being subjected to manipulations of the waiting line effect and service interface types, participants were allocated to either fast-casual or quick-service restaurants as the experiment context. These two segments were chosen as they are considered the dominant segments where SSTs are commonly implemented in the restaurant industry (Tillster, 2019). The context itself was not a variable of concern; instead, this deliberate step was to enhance the real-world representation so that the findings of the waiting line effect were not limited to any particular segment.

Subsequently, participants rated their current hunger level and familiarity with restaurant SSTs which were included as control variables. They were then instructed to read a scenario that simulated the experience of menu ordering either from a fast-casual or quick-service restaurant; each scenario specified the presence/absence of a waiting line, depending on the groups. Once participants completed reading the scenario, they answered several survey questions concerning manipulation checks, a control variable that measures fear of negative evaluation from the *service provider* (Leary, 1983), and research variables using a

seven-point scale. Research indicates that technology-powered services are seen as less judgmental than humans (Holthöwer & van Doorn, 2023). Likewise, studies show that diners may alter their ordering behavior in the presence of human employees due to the fear of being judged based on their choices (e.g., Hanks et al., 2016). Therefore, we included fear of negative evaluation from the service provider as a control variable to rule out potential confounding effects. We asked participants to indicate their perception of time pressure with three items (e.g., "My menu order decision-making was rushed," $\alpha = .96$) (Ashley & Noble, 2014), intentions to reduce menu order time ($\alpha = .98$), menu purchase amount ($\alpha = .97$), and intentions to purchase familiar menu items ($\alpha = .97$), respectively, with three items.

3.2. Manipulation and realism check

Participants assigned to the "presence of waiting line" groups reported higher agreement that customers were waiting behind the focal customer compared to the "absence of waiting line" groups ($M_{presence} = 6.66$, $M_{absence} = 1.53$, $t = 34.97$, $p < .001$). For the types of the service interface, participants assigned to the "SST" (vs. "human-based") condition reported greater agreement that they placed orders through SST ($M_{sst} = 6.70$, $M_{human} = 1.85$, $t = 29.28$, $p < .001$) whereas those assigned to the "human-based" (vs. "SST") condition reported greater agreement placing orders with a cashier ($M_{sst} = 1.32$, $M_{human} = 6.32$, $t = 31.97$, $p < .001$). Participants reported that the scenario was highly realistic ($M = 6.34$), it was easy to project themselves in the scenario ($M = 6.40$), and it was easy to imagine the scenario happening in real life ($M = 6.40$). Thus, the manipulation and realism checks were successful.

3.3. Results

A series of one-way ANCOVA was conducted. Participants' hunger level, familiarity with SST, fear of negative evaluation, age, gender, and income were included as control

variables. The results revealed a significant "waiting line" effect; when a waiting line was present, participants reported higher intentions to make a quick decision ($M_{presence}$ = 5.13, $M_{absence}$ = 3.47, $F_{1,192}$ = 71.59, p < .001), to spend less money ($M_{presence}$ = 2.52, $M_{absence}$ = 2.93, $F_{1,192}$ = 4.16, p < .05), and more likely to purchase familiar items ($M_{presence}$ = 5.88, $M_{absence}$ = 5.53, $F_{1,192}$ = 6.89, p < .01). Hence, Hypothesis 1 was supported.

Subsequently, a series of mediation analyses were conducted to examine the underlying mechanism of the "waiting line" effect via PROCESS modeling (Model 4, with 10,000 resamples). The results revealed indirect effects of the presence of a waiting line on three behavioral intentions—menu order time (1.01, 95% CI = [0.67, 1.40]), menu purchase amount (-.87, 95% CI = [-1.17, -0.53]), and familiar menu purchase (.31, 95% CI = [0.10, 0.52])—mediated by perceived time pressure. Moderated mediation analyses were conducted using Model 7 (10,000 resamples) to further explore the phenomenon. The results showed a stronger indirect "waiting line" effect on menu order time (.34, 95% CI = [0.02, 0.70]) and familiar menu purchase (.11, 95% CI = [0.01, 0.24]) when participants placed orders through SSTs (vs. human staff). The indirect "waiting line" effect on menu purchase amount was not significantly different between SST and human-based interactions. The results supported Hypothesis 2 and partially supported Hypothesis 3.

4. STUDY 2: INTERVENTION MESSAGE TO REDUCE PERCEIVED RESPONSIBILITY

Study 1 revealed a conditional "waiting line" effect on menu order behavioral outcomes—the effect was more pronounced when interacting with SSTs (vs. human staff). Per the attribution theory, one limitation of Study 1 was that it did not examine the responsibility attribution account in the event of interacting with SSTs due to the subsequent internal attribution (Jörling et al., 2019). As conceptualized previously, customers tend to feel

responsible for service outcomes when interacting with SST, including others' long waits. This ultimately leads them to feel obligated to order quickly or choose familiar items to simplify the decision process. In Study 2, we manipulated perceptions of responsibility by displaying a "pop-up message" as an intervention strategy, indicating that the restaurant management takes full responsibility for any delays in service experience during menu orders. If the responsibility theorization holds, the "pop-up message" will alleviate consumers' perceived responsibility and lessen the "waiting line" effects. Hence, Study 2 aimed to test Hypotheses 1 and 4.

Further, Study 1 examined the "waiting line" effect by assessing menu ordering behaviors (i.e., dependent variables) using survey-based measurements at the intention level. To bridge this intention-behavior gap, Study 2 employed a simulation experiment that approximated a real-life event in a hypothetical fast-casual restaurant. Unlike Study 1, we could directly observe participants' behavior during the simulated menu ordering event, with recorded measures including the duration of order completion, total expenditure ($), and the ratio of familiar items relative to the total number of items purchased. These recorded measures were subsequently used as dependent variables.

4.1. Research design and procedure

Based on the power analysis (via G*Power), Study 2 needed a sample size greater than 128 to yield a statistical power exceeding 0.8 for a 2 × 2 ANCOVA with six covariates. We used the same criteria and survey platform as Study 1. Following the exclusion of 14 responses that failed to meet the attention check and demonstrated inadequate participation in the menu order simulations (e.g., inability to provide the correct simulation ending code), we retained 254 U.S. adult respondents (49% females, with an average age of 39.28 years, 72% Caucasian, 51% never married, and 55.1% holding a bachelor's degree or higher) for data

analysis.

The experiment used a 2 (waiting line: presence vs. absence) × 2 (message intervention: presence vs. absence) between-subjects design. Participants were randomly assigned to four combinatory groups and rated their present hunger level and familiarity with restaurant SSTs. Subsequently, participants were presented with a list of menu items generated explicitly for a hypothetical fast-casual restaurant, which served as the basis for our simulation experiment. Participants were then required to identify menu items they found familiar among the options provided. Before starting the web simulation, participants were asked to read a scenario of ordering menu items in a fast-casual restaurant that specified the presence or absence of a waiting line. The simulation was a website developed for this research, mimicking the user interface of a self-service kiosk through which participants could browse categories (e.g., sandwiches, pizzas, salads) of food and beverage items (see Appendix 1 for a screenshot of the website). The simulation site allowed participants to browse and order the menu items virtually. Before starting browsing items, participants assigned to the intervention message group received a "pop-up message" indicating that the restaurant takes full responsibility for any delays in service and customer experience during menu orders (see Appendix 2 for a "pop message" intervention). All participants then completed their menu orders on the simulation site.

In Study 2, we directly measured dependent variables from the participants' behaviors. For menu ordering time, we measured the time each participant spent (seconds). For the menu purchase amount, we recorded how much each participant spent on their orders (U.S. dollars). For familiar menu purchases, participants were asked to indicate their familiarity with all menu items used in the simulation before participating in this study. Then, the rate of familiar item purchase (%) was determined by dividing the number of familiar items purchased by the total number of items purchased.

4.2. Manipulation and realism check

Participants assigned to the "presence of waiting line" groups (vs. "absence of waiting line" groups) exhibited a greater inclination to agree that others were waiting behind the focal customer ($M_{presence}$ = 6.55, $M_{absence}$ = 1.09, t = 77.55, p < .001). Participants exposed to an intervention message (vs. without the message) reported a higher level of agreement that the restaurant takes responsibility for outcomes associated with the menu order process ($M_{presence}$ = 6.45, $M_{absence}$ = 1.80, t = 30.94, p < .001) and a lower level of agreement that they felt responsible for the outcomes ($M_{presence}$ = 3.51, $M_{absence}$ = 5.56, t = 9.33, p < .001). In addition, participants reported that the scenario was highly realistic (M = 6.08), it was easy to project themselves in the scenario (M = 6.30), and it was easy to imagine the scenario happening in real life (M = 6.24). Thus, the manipulation and realism checks were successful.

4.3. Results

The results of a series of two-way ANCOVA confirmed the "waiting line" effect when a menu order was placed via SSTs. When participants were informed of a waiting line (vs. without a waiting line), they ended up spending less time placing an order ($M_{presence}$ = 92.15, $M_{absence}$ = 108.29, $F_{1,246}$ = 3.80, p <.1), spending less money ($M_{presence}$ = 15.41, $M_{absence}$ = 17.92, $F_{1,246}$ = 6.72, p <.05), and purchasing more familiar items ($M_{presence}$ = 67.69, $M_{absence}$ = 54.01, $F_{1,246}$ = 6.51, p <.05), therefore supporting Hypothesis 1.

Further, the presence/absence of an intervention message significantly moderated the waiting line effect on menu order time ($F_{1,244}$ = 4.35, p < .05), menu purchase amount ($F_{1,244}$ = 4.37, p < .05), and familiar menu purchase ($F_{1,244}$ = 3.88, p < .05). In instances participants did not receive a "pop-up message," they reported shorter menu order time, lower purchase amount, and purchased a greater amount of familiar items when there was a waiting line (vs.

no line) behind them. However, for participants who received the intervention message, the "waiting line" effect on these behavioral outcomes was significantly attenuated (Figure 2). Hence, Hypothesis 4 was supported.

Study 2 provided further evidence that refuted an alternative explanation for the perceived pleasure derived from the intervention message. The effect of the intervention message could be attributed to a pleasurable experience rather than the sense of responsibility evoked, which might have been influenced by visual appeals in the message and/or the perceived sincerity of the management. The existing literature suggests that pleasure is an important precursor of impulsive buying (Iyer et al., 2020). Hence, the intervention message may have elicited pleasure among customers, subsequently leading to impulsive orders (i.e., higher expenditures, unfamiliar purchases). If this alternative explanation were true, the groups with the intervention message (vs. without the message) would have reported a higher level of pleasure. To address this, we ran an additional ANCOVA, incorporating three survey items (e.g., "I experienced a sense of pleasure during the menu ordering process," $\alpha = .96$) as indicators of perceived pleasure. The results revealed no statistically significant difference in reported pleasure between participants exposed to the intervention message and those without, negating the alternative explanation associating feeling pleasure with the message.

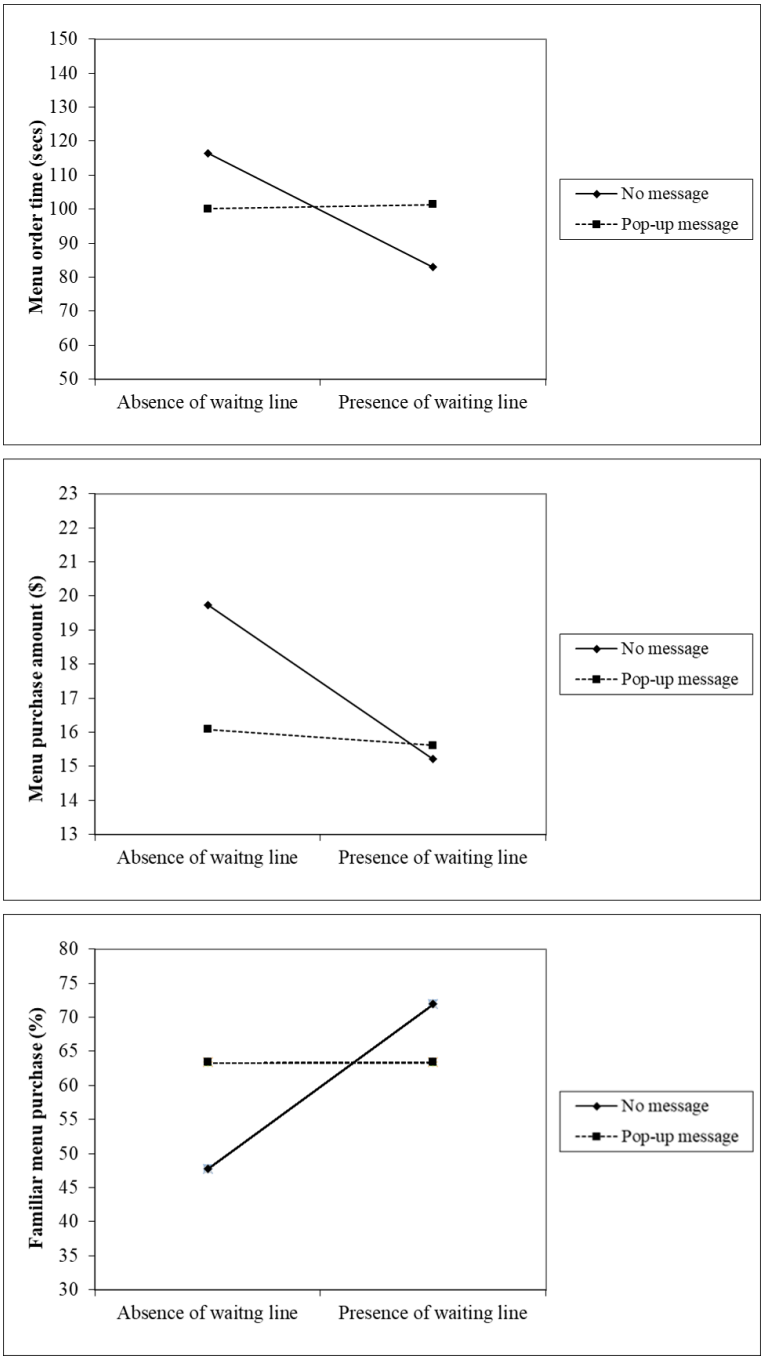

Figure 2. The moderating effect of the intervention message (Study 2).

5. STUDY 3: MITIGATING THE "WAITING LINE" EFFECT VIA LINE DESIGN

Studies 1 and 2 collectively suggested that the "waiting line" effect was particularly concerning when using SSTs. Study 2 also evidenced the importance of reducing perceived responsibility through testing an intervention strategy. Along the same line, we conducted

Study 3 to suggest a managerial strategy to reduce the "waiting line" effect through line design, thus testing Hypotheses 1 and 5.

5.1. Research design and procedure

The power analysis (i.e., G*Power) indicated that Study 3 would require at least 158 participants for a statistical power exceeding 0.8 for a 2 × 3 ANCOVA with six covariates. This study also employed the same criteria and survey platform as the previous two studies. Upon excluding five responses that did not pass attention checks, 371 U.S. adult respondents (59% males, with an average age of 37 years, 71% Caucasian, 55% never married, and 55% holding a bachelor's degree or higher) for data analysis were retained.

Study 3 compared the "waiting line" effects across three different line designs—a single line for a single machine vs. a single line for multiple machines vs. multiple lines for multiple machines—influencing the "waiting line" effects. A "single line for a single machine" design was treated as a baseline. We used a 2 (waiting line: presence vs. absence) × 3 (line designs: a single line for a single machine vs. a single line for multiple machines vs. multiple lines for multiple machines) between-subjects design. Participants were instructed to read a scenario and imagine themselves being in a menu ordering experience in a fast-casual restaurant. The scenario included verbal descriptions and pictorial stimuli regarding the presence/absence of a waiting line and three different line designs. Once participants completed the experiment, they were asked to indicate responses to survey measures as did in Study 1.

5.2. Manipulation and realism check

Participants assigned to the "presence of a waiting line" groups reported a higher level of agreement on the existence of a waiting line compared to the "absence of a waiting line"

group ($M_{presence}$ = 6.34, $M_{absence}$ = 1.39, t = 41.42, p < .001). Participants in the two "multiple machines" groups reported that there were multiple self-service kiosk machines than those in the "single machine" group ($M_{singleLsingleM}$ = 1.57, $M_{singleLmultiM}$ = 6.45, $M_{multiLmultiM}$ = 6.50, F = 829.10, p < .001). Also, the "a single line for a single machine" and "multiple lines for multiple machines" groups showed stronger agreement that each machine had a line of customers, compared to the "a single line for multiple machines" group ($M_{singleLsingleM}$ = 5.43, $M_{singleLmultiM}$ = 2.59, $M_{multiLmultiM}$ = 5.80, F = 86.54, p < .001). Participants reported that the scenario was highly realistic (M = 5.88), it was easy to project themselves in the scenario (M = 6.16), and it was easy to imagine the scenario happening in real life (M = 6.22). Thus, the manipulation and realism checks were successful.

5.3. Results

A series of two-way ANCOVA was conducted. Consistent with Studies 1 and 2, participants who had customers in the waiting line (vs. no waiting line) reported higher intentions to make a quick decision ($M_{presence}$ = 6.47, $M_{absence}$ = 3.68, $F_{1,363}$ = 131.13, p < .001), to spend less money ($M_{presence}$ = 3.09, $M_{absence}$ = 3.79, $F_{1,363}$ = 6.72, p < .05), and to purchase familiar items ($M_{presence}$ = 2.96, $M_{absence}$ = 3.95, $F_{1,363}$ = 22.68, p < .001), supporting Hypothesis 1.

Further, line design significantly moderated the "waiting line" effect on menu order time ($F_{1,359}$ = 3.50, p < .05), menu purchase amount ($F_{1,359}$ = 3.71, p < .05), and familiar menu purchase ($F_{1,359}$ = 2.99, p < .1). When there was a waiting line behind the focal customer, participants from groups of "single line for multiple machines" (vs. "single line for single machine" and "multiple lines for multiple machines") reported longer menu ordering time, higher purchase amounts, and less familiar purchases (see Figure 3). Hence, Hypothesis 5 was supported.

This study included the two varying levels of line design—one line feeding one machine (baseline) and multiple lines feeding multiple machines—as a robustness test as they are conceptually identical. The consistent findings between these two groups have attested to the methodological rigor.

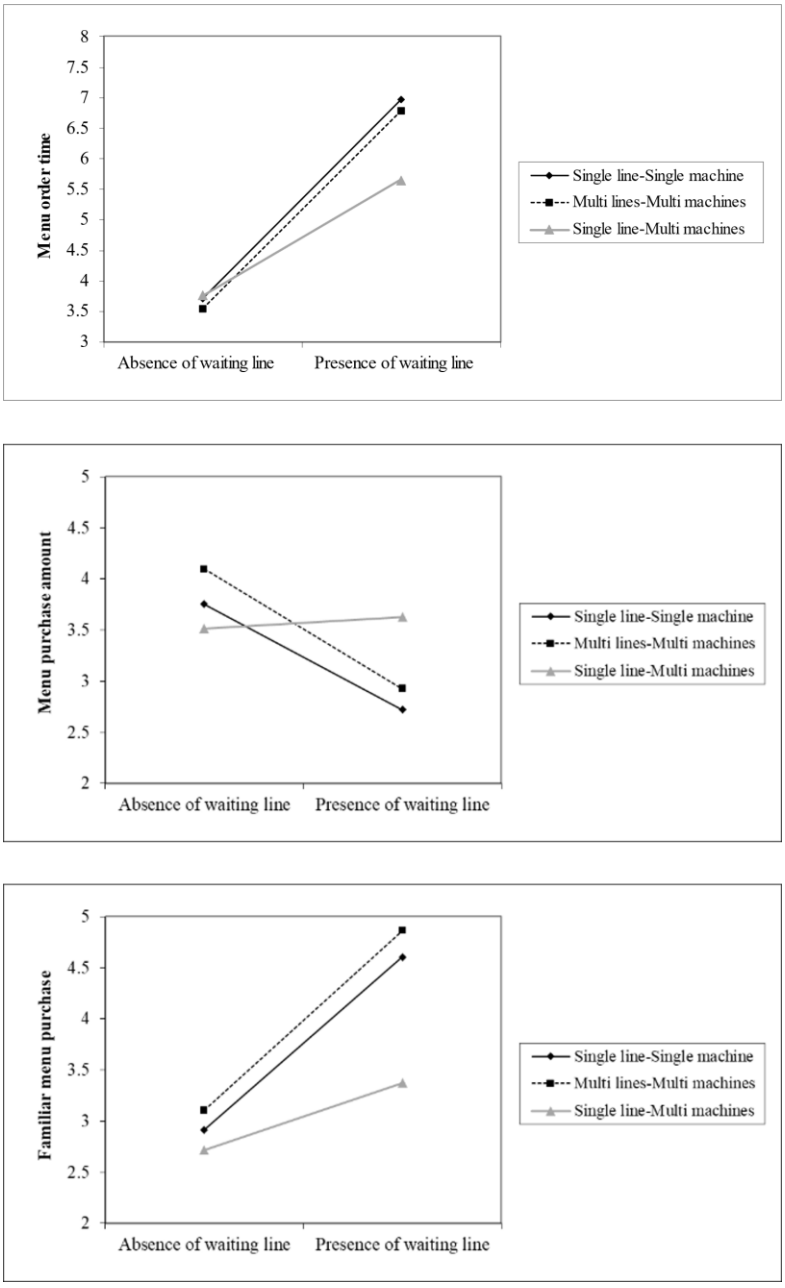

Figure 3. The moderating effect of line design (Study 3).

6. GENERAL DISCUSSION

This research investigates the impact of waiting lines on menu ordering behaviors, explicitly examining how this effect is intensified in SST (vs. human-based) interactions. Additionally, we elucidate the underlying mechanisms responsible for this effect and propose a managerial strategy. We conduct three studies, employing measures of both behaviors (Study 2) and intentions (Studies 1 and 3) to achieve the research objectives.

Our findings indicate that waiting lines influence customer decision-making, resulting in quicker choices, reduced spending, and a greater likelihood of ordering familiar menu items. The study is among the first examinations of the impact of waiting lines on menu ordering behaviors and the validation of its underlying mechanism. While waiting lines have been a significant concern of operations research, this study rebalances the literature toward the service marketing aspect by drawing on behavioral metrics. As a result, we extend the work of Ülkü et al. (2022), which solely focused on the effect of waiting lines on service time, by exploring additional behavioral outcomes such as menu purchase amount and familiar menu purchase.

Our findings regarding the "waiting line" effect support the perspective that a queue should be regarded as a social system that reflects social norms (Mann, 1969). The extant literature on queues proposes reducing service time when customers are in a waiting line (Chatterjee, 2020; Kim et al., 2018; Ülkü et al., 2022). Our study, in concurrence with these studies, also demonstrates that customers can exhibit socially pressured behaviors that are not necessarily in their best interest as a result of the “waiting line” effect. However, our observations differ from those reported by Koo and Fishbach (2010) in the context of a cafeteria. Their study demonstrates that expenditures are higher when many others are waiting behind, as opposed to when no one is in line. We attribute this discrepancy to the business context. In their cafeteria setting, food items such as salads, sandwiches, and soda

were displayed on shelves along the waiting line, allowing customers to explore and decide what to purchase while waiting. As a result, time pressure resulting from waiting in line would not have influenced how customers placed their orders at the cashier.

In this research, we further enlighten the mechanism that accounts for the "waiting line" effect for SST-mediated services. Our first study reveals that customers exhibit pressured menu ordering behavior more profoundly when waiting lines are present during SST (vs. human-based) interactions. Two subsequent studies suggest that mitigating perceived responsibility for the service experience of others, either through an intervention message or adopting a line design strategy, can effectively weaken the “waiting line” effect in SST-enabled services. Consumers perceive a heightened sense of control when interacting with SSTs in lieu of service employees (e.g., Meuter et al., 2000). Such a perception creates an internal attribution. These findings are consistent with the findings of Jörling et al. (2019), which propose a “reversed” self-serving bias: when customers engage with service technologies, they consider even negative outcomes, such as service failure, as their responsibility. To this end, we reinforce the rationale of consumers’ tendency toward internal attribution for technology-enabled services.

In addition, the effectiveness of using line design to mitigate the negative impacts associated with the "waiting line" effect has enriched the existing queuing literature. Previous research has highlighted the advantages of utilizing a single line to serve multiple machines in order to ensure fairness and expediency (e.g., Norman, 2009). Adding to this existing endeavor, our research contributes value to the field by offering experimental evidence of how line design can effectively tackle unintended consequences while implementing technology-based services (e.g., Chan et al., 2022).

6.1. Theoretical implications

This research makes several significant contributions to the existing body of knowledge. Firstly, it advances the hospitality marketing and service technology literature by investigating the influence of waiting lines on restaurant menu ordering behavior. We examine various aspects, such as menu order time, purchase amount, and familiar menu choices. We also delve into the underlying mechanisms of the "waiting line" effect by exploring the roles of time pressure and perceived responsibility in explaining pressured ordering behaviors. Further, we highlight the significance of service interface type by comparing interactions between human staff and SSTs. Our findings align with the attribution theory, indicating that self-service options empower customers with greater control and responsibility for service outcomes. Consequently, this research offers fresh insights into the role of SSTs in reinforcing the suggested "waiting lines" effect.

Our research adds to the burgeoning literature on queuing that extends the mathematical operational perspective. Although some previous research has examined the impact of waiting lines on consumer-perceived service usage time, this area is primarily occupied by behavioral operations research (e.g., Chatterjee, 2020; Kim et al., 2018; Ülkü et al., 2022). By adopting a service marketing lens, this research delves into consumers' menu ordering behavior that is influenced by the presence of a waiting line. The perceptions of others waiting in line behind oneself become an integral part of the overall service encounter, significantly affecting consumption and spending behavior. Therefore, our research provides valuable insights moving beyond the predominant focus on reducing the objective wait times or optimizing queue configurations highlighted in the operational research literature (Durrande-Moreau, 1999; Jones & Peppiatt, 1996; Penttinen, 1999). As businesses strive for service excellence and design more effective and customer-centric queuing systems, queuing research shall introduce diversified theoretical lenses considering both service marketing and operational strategies. By doing so, we can provide a comprehensive understanding of the

phenomenon and offer more valuable insights for businesses to optimize their operations while meeting customer expectations. Our research, thus, broadens the scope to encompass customer experiences, highlighting the crucial consequences of customer-perceived time pressure and responsibility induced by waiting lines.

In addition, our study emphasizes a social system perspective to comprehend queuing behavior. In service settings, waiting lines create a shared space where social norms, rules, and obligations exist and persist (Mann, 1969; Schmitt et al., 1992). Our study suggests that restaurant customers can experience social pressure when ordering in front of a waiting line, thereby altering behavior to be other-oriented, such as reducing time and amount spent on an order and choosing familiar items. According to our findings, line designs can alleviate the perception of responsibility by influencing the social dynamics among customers sharing the same space—i.e., a waiting line, preventing time-pressured ordering behavior. Recent research has also shed light on the social implications of waiting in lines. In particular, Chan et al. (2022) suggest that line design can alleviate anticipated technology embarrassment, influencing consumers' willingness to use service technologies. To this end, our study has contributed to the ongoing discourse in queuing literature by highlighting the importance of social dynamics in a waiting line and the impact on consumer behavior.

Our research also answers the call for exploration of other customers' impact on SST-enabled services. Previous literature has stressed the importance of exploring customer-to-customer interactions in cocreating service value (e.g., Nicholls, 2011), considering their influence on service experience and customer loyalty (e.g., Lin et al., 2020). The SST context entails a great deal of customer-to-customer interactions, either direct or indirect, as employees have a limited role in creating service experiences. This is particularly apparent in hospitality settings where experiences are derived from interacting with "people" (Gursoy, 2018). However, certain types of interactions with other customers may rather co-destruct the

service experiences by causing the focal customers to feel anxious or uncomfortable in SST contexts (López-Bonilla & López-Bonilla, 2015; Nam & Kim, 2022; Shim et al., 2020). As such, this research adds empirical evidence that dissects other customers' impact on SST-enabled services.

6.2. Managerial implications

Our study provides managerial insights into restaurant management. The SST-conditioned "waiting line" effect provides timely marketing intelligence for businesses that adopt SSTs for customer services. For instance, fast-casual and quick-service restaurants are leading segments that have heavily implemented service technologies with a rapid growth rate (Technomic, 2019). Many restaurants are replacing human service employees with technologies to reduce operational costs (Shin & Perdue, 2019), prevent inconsistency in service deliveries (Gummerus et al., 2019), and meet the high demand for contactless services (Wheeler, 2020). Our findings suggest that restaurants should address the "waiting line" effect, especially for self-service counters (e.g., ordering food via SSTs). When pressured by a waiting line, customers tend to spend less, rush their orders, and forgo the opportunity to explore the menu. Although fast turnovers make self-service machines more operationally efficient, businesses risk losing market interest if new products constantly fail to generate sufficient appeal. Revenue from newly developed products is critical to a restaurant's annual income (Hyun & Han, 2012). Therefore, to increase awareness under pressure, restaurants can revamp their digital menu to allow new items to easily fall on customers' radars. For example, promotional messages (e.g., "You must try our house special!") or graphic designs/icons to spotlight new or signature dishes can quickly grab consumer attention. Also, implementing a display screen that showcases the menu items to customers in the queue can facilitate their decision-making process by allowing them to preselect their desired orders

prior to reaching the kiosk machines.

According to our results, restaurants may seek strategies to fundamentally alleviate customers' perceptions that they are responsible for others' service experience because of using SSTs. Our results suggest an important line design strategy—"single line for multiple self-service machines"—to minimize the "waiting line" effect on menu ordering behaviors. Businesses with multiple self-service machines on-premises may consider implementing the proposed recommendation in queue management if their physical establishments and service circumstances permit them to operate the suggested line design. In addition, to alleviate the pressure on customers who are placing an order, restaurants may provide various forms of entertainment or distractions to keep other customers in the waiting line engaged and occupied. For instance, Slutty Vegan, a vegan restaurant chain, has successfully transformed their waiting lines into an entertaining party-like atmosphere, complete with music and food, with staff members appearing in the lines to enhance the guest experience (Gregory, 2021). Nonetheless, businesses should carefully consider the suitability of the entertaining materials for their target audience and brand image. For instance, a classic dining establishment may offer reading materials, whereas a family-oriented restaurant may offer mini-board games or coloring books for younger customers. Digital entertaining tools, such as tablets or TVs, may also be made available by restaurants. In another way, restaurants can also use virtual queue systems by developing a dedicated ordering app for the business or utilizing an existing platform (e.g., Yelp Waitlist). Unlike a physical queue, a virtual queue is anonymous and invisibly functioning and therefore does not provide any salient clues about the long queue of customers. Thus, restaurants should expect a reduced "waiting line" effect with virtual queue systems.

6.3. Limitations and future research

This research has several limitations. First, we only examine the waiting line effect as a matter of line presence (vs. absence). How the proposed effect operates as a function of the number of customers remains unknown. Future research should consider testing the pattern of this effect (e.g., linear, curvilinear) by taking into account the number of people in the waiting line and its subsequent influence on the focal customers' time-pressured ordering behavior. Further, in this research, we did not consider the physical distance between the focal customer and customers in the waiting line (i.e., other customers). Physical proximity can be a critical factor that influences each other (Otterbring, 2022). Therefore, future research may investigate whether a near (vs. far) distance can exacerbate (vs. diminish) the waiting line effect.

Next, although our research recommends a line design strategy (i.e., "single line for multiple self-service machines") to mitigate the perceived negative impact of waiting lines, it is important to note that this approach primarily influences customers' perceptions rather than optimizing operational logistics. Businesses should consider implementing customized line design strategies in different establishments, including branches of the same restaurant brand, by considering physical facilities and service conditions. Future research could deepen the investigation via techniques often utilized in operational research and management science (e.g., mathematical modeling, optimization techniques, and computer simulation) to continue to explore a wide range of line design strategies that factor in customer volume, servicescape, restaurant size, and layout. This comprehensive investigation aims to enhance both customer experience and operational efficiency in queue management. By understanding the nuances and trade-offs associated with different line design strategies, businesses can develop tailored queue management approaches that suit the operating environments and customer expectations.

Lastly, we emphasize line design to alleviate the "waiting line" effect. Managers may

also control the effect by introducing line distractors to ease tension. For example, installing a widescreen with fun and appealing videos might be an option to manage the waiting experience. Scholars could investigate whether the focal customer's perceived time pressure can be alleviated when others' waiting experience is fun. Investigating these new methods will provide richer insights into the "waiting line" research in the restaurant SST context.

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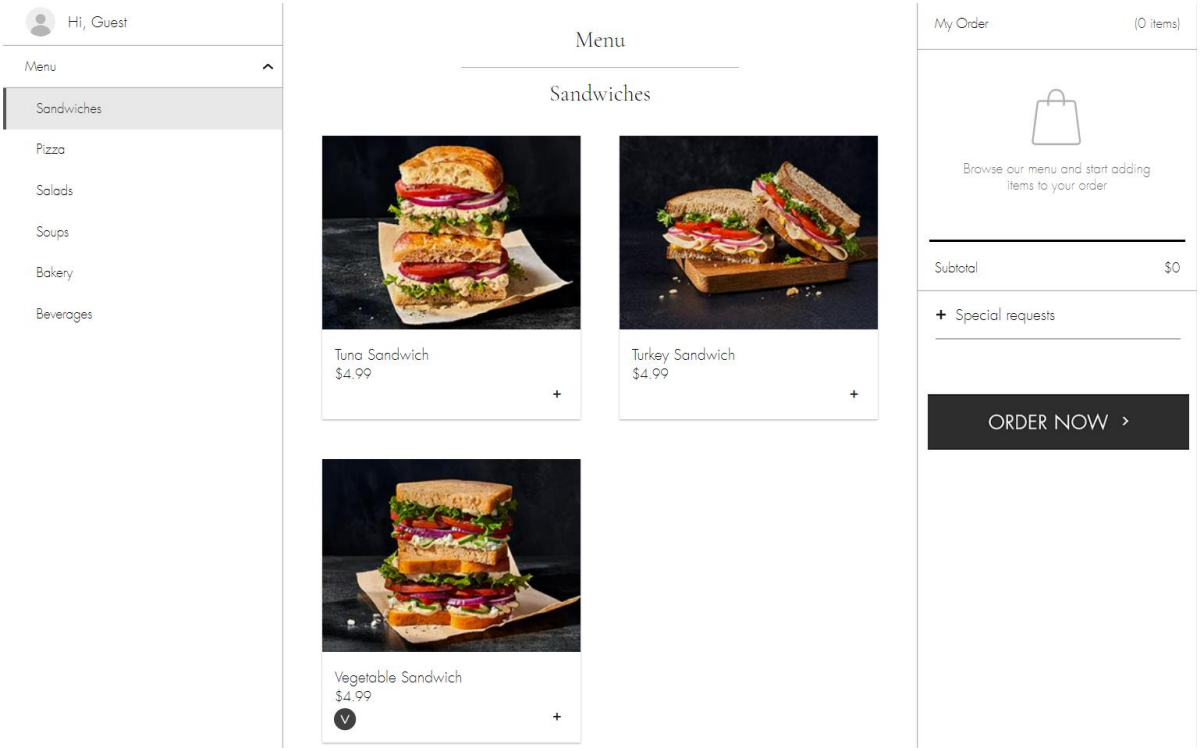
Appendix 1. A screenshot of the menu order simulation webpage (Study 2).



Note: For Study 2, a simulated website that approximates an experience of menu browsing and ordering using an SST was designed to provide participants. This is just a screenshot of one page of the simulated site.

Appendix 2. An intervention message (Study 2).