An Experimental Study of Customer Patience and Abandonment in Online Customer Service

Research Thesis

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Behavioral and Management Sciences–Behavioral Marketing (with thesis)

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1. Abstract

We undertake a multidisciplinary approach and study the impact of delay announcements and customer meandering (shifting focus to another website) on patience and abandonment in online waiting. The research addresses three predictions that build on theories in Psychology: First, based on theories that describe information as a tool to increase people's sense of control (Averill 1973, Osuna 1985) we expect delay announcements to reduce customer abandonment. Second, the theory of Cognitive Anchoring (Tversky and Kahneman 1974), as well as theories on the optimism bias and learning lead us to predict that customers will anchor on the content of delay announcements, which in turn affects their patience to wait. Third, building on Resource Allocation Theory (Zakay and Hornik 1991) we propose that customer meandering will decrease abandonment. Results of three experimental online studies with a total sample of 3,430 participants indicate that announcing a delay to customers decreases their likelihood of abandoning the wait. Interestingly, the content of delay announcements does not affect immediate abandonment (balking): regardless of the delay announced, nearly 20% of the customers balk. Our findings confirm that customers anchor on the delay information, i.e. they are more patient following the announcement of a higher delay. And, when the announced delay entails a range (i.e. 'between x and y min'), customers adjust their initial, low wait expectations (x minutes) in the direction of the upper range point (y minutes), once the wait time announced in the lower point has passed. As a consequence of this adjustment, these customers are less likely to abandon, compared to customers who received delay information comprising only the lower point of the range (i.e. 'about x min'). Lastly, customers who meander while waiting are less likely to abandon the wait. This effect occurs regardless of the specific delay announcement given. Our findings carry important implications for the theoretical and empirical study of online queue wait in Operations Research and Psychology, as well as for the design and management of service systems.

List of Abbreviations and Notations

Abbreviations

AIC .... Akaike information criterion

Notations

W .... Actual wait

i .... Index for participant

k .... Index for experimental condition

d .... Dummy variable

M .... Mean

SD .... Standard deviation

Min .... Minimum

Max .... Maximum

N .... Number

α .... Random intercept for the model

β, γ .... Coefficients for independent variables

ϵ .... Error term

E .... Expected

τ .... Patience

Pr .... Probability

T .... Anchor

j .... Index for random sample

SE .... Standard error

2. Introduction

People hate to wait and will often lose patience and abandon a queue (Mandelbaum and Zeltyn 2013). However, service companies cannot eliminate all waiting, as this would imply high labor costs (Allon et al. 2011b). Hence, a key challenge in service delivery is to increase customers' willingness to wait and to prevent them from abandoning the queue. These issues are particularly challenging in online service, as customers are more impatient with waiting (Lee et al. 2012, Ryan et al. 2015). In this paper, we explore the effectiveness of different delay announcements and the importance of distracting customers while waiting in increasing customer patience and thereby reducing abandonment in online wait. In the following we will shortly introduce the framework of customer online wait and discuss the importance of addressing the topic of customer abandonment. Then, we will outline the main contributions and organization of the paper, before presenting previous literature and finally deriving our rationale.

2.1. Online waiting

Despite enormous amount of money invested in technological progress, customers continue to wait online (Mital 2014, Lee et al. 2017). The modern customer expects to wait minimal time for online services since the internet has become so fast (Ryan et al. 2015, Elmorshidy 2013). However, with service companies offering live customer support (Oracle 2016, Cleveland 2015), service agents must handle customers' requests, and online wait times are induced due to capacity limitations of staff resources. Yet, online wait time is still usually much shorter than physical or telephone wait (Elmorshidy 2013), as employee multitasking allows increased flexibility, reduced idle time, and increased efficiency (Altman 2017). Customer online wait experiences are different from physical wait experiences in other ways as well: A customer waiting in a physical line can see other customers waiting, and use this information to estimate the required waiting time (from now on *offered wait*). In contrast, a customer waiting online is totally detached from others and must depend on information provided by the service provider concerning the estimated wait. Delay announcements, and what exactly these entail, influence customer patience and abandonment decisions (cf., Mandelbaum and Zeltyn 2013, Yu et al. 2017, Dong et al. 2015). Lastly, a customer waiting online (vs.

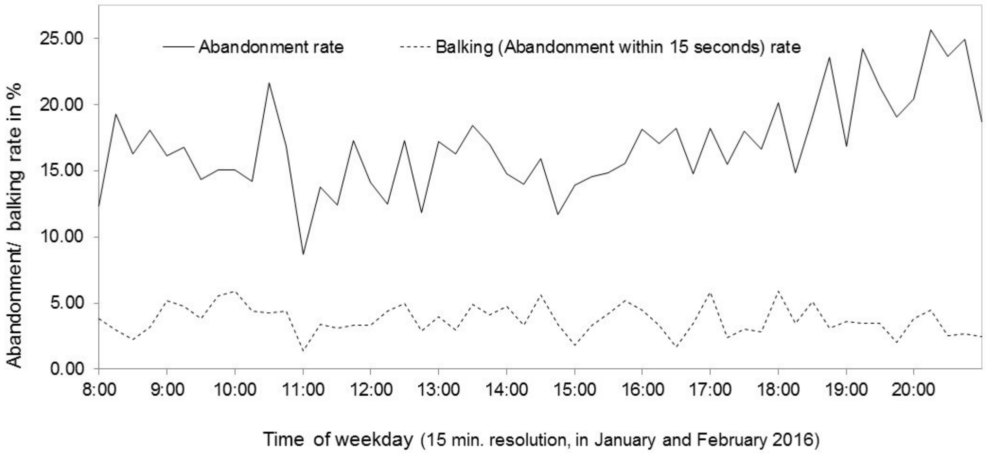
physically or on the phone) can engage more in other activities while waiting and return later to see if a service agent has become available in the meantime. Whether or not a customer focuses on the wait time during queue wait or not also influences customer patience and abandonment (cf., Zakay and Hornik 1991, Munichor and Rafaeli 2007, Mobach 2013).

2.2. Online waiting and customer abandonment

Waiting has been studied for over three decades from a variety of perspectives, including Marketing, Management, Psychology, and Service Operations (Ryan et al. 2015). The common premise that underlies this research is that waiting elicits negative affective reactions, leads to customer dissatisfaction, and hurts service quality evaluations (Taylor 1994, Xie 2017). Service companies connect online wait metrics to important outcomes, e.g. satisfaction, conversation rates, and perceived service quality, and report a dramatic decrease in these metrics when customers must wait (Mital 2014). Online queue wait has also been linked to negative business outcomes, such as lack of trust, interrupted interactivity, and negative brand attitudes (Ryan et al. 2015). Customers are particularly impatient online and quick to abandon a queue when they are not immediately served (Lee et al. 2012, Mital 2014).

Figure 1 exemplifies the low impatience of customers waiting online for chat service. The data displayed was provided by LivePerson (`https://www.liveperson.com/`). In particular, Figure 1 shows the mean abandonment and balking (abandonment within 15 seconds) rates of customers who arrived to an online wait queue between 8:00 a.m. and 9:00 p.m. on weekdays in January and February 2016. Out of 16,033 customers, 2,692 customers (17%) abandoned the queue (see dark line in Figure 1), and out of these, 597 customers (4% of total customers) balked (see light line in Figure 1). On average, all customers were required to wait about 1.5 minutes in line. Those customers that abandoned were on average required to wait three minutes (SD: 4.5 min). This data, taken from real-life, makes clear the dramatic effect of firms losing customers quickly when forcing them to wait a few minutes before entering the chat service. Customer abandonment is a highly important measure of both service quality and operational performance (Mandelbaum and

Figure 1 **Abandonment and balking rates in online chats**



Zeltyn 2013). Abandoning customers may entail high operational costs for the organization, such as a foregone profit or over-staffing. Moreover, customers may be less likely to return to service providers after abandoning the queue (Pender et al. 2016). Hence, it is in service organizations' best interest to increase customer patience and avoid abandonment.

2.3. Main contributions of the paper

In this research, we unravel direct and indirect (through customer anchoring) effects of delay announcements (1), and effects of customer meandering (2) on customer patience and abandonment in online wait. As the majority of research on waiting relates to traditional waiting (i.e. physical or telephone wait), our research sheds a new perspective on waiting. First, we replicate some of the previous findings observed in traditional waiting for online waiting (i.e. high balking rates, and the merit of announcing delays). To the best of our knowledge, this is the first study to reveal that customers anchor on the content of the delay information provided to them upon their arrival to the queue: We illustrate that announcing a higher delay increases patience; and that announcing a delay as a range (i.e. 'between x and y min', vs. 'about x min') decreases abandonment. Lastly, we demonstrate that customers are more likely to abandon an online wait when they focus on the waiting screen, as opposed to meandering to other websites.

We adopt a multidisciplinary approach and contribute to the existing theoretical and empirical research on queues and waiting; we specifically integrate the fields of Operations Research and Psychology. Methodologically, we combine previous theoretical and empirical research of the first field regarding the effect of delay information on customer abandonment decisions in queue wait with knowledge gained from theories from the latter field that can explain these effects. In the second part of the research, we predict customer abandonment behaviors from meandering based on an additional psychological theory–an effect not yet researched in the field of Operations. The classical experimental approach in Psychology enables us to conduct research in a controlled setting and assess actual behavior. Our findings provide novel insights into modern service operations, and carry important implications for management, with the ultimate goal of increasing customer patience and reducing abandonment. Practical recommendations of our research involve when to display delay information, and what delay information to display. We also offer practical implications regarding the distraction of customers while waiting, based on our findings.

2.4. Organization of the paper

In Section 3, we describe previous findings regarding the *direct* (§3.1) and *indirect* (through customer anchoring) (§3.2) effects of delay announcements, as well as the effects of customer meandering (§3.3) on customer patience and abandonment. All three subsections include a short overview of previous research, integrating findings in Operations Research and Psychology. In addition, each subsection entails a short discussion of theories from the field of Psychology that can help explain the prior findings and finally lead to the hypotheses. The next two sections (Section 4, and Section 5) report the research design and data, results, and a brief discussion of the experimental studies. Finally, Section 6 concludes with an in-depth discussion about important implications of the findings for future research and the management of customer wait in online service systems.

3. Scientific background and rationale

3.1. Delay announcements

Announcing a delay to customers has become a common practice in service systems (Allon et al. 2011a), especially in non-visible queues (Huang et al. 2017). The underlying motivation for this is that delay announcements presumably induce the customer behavior the service company desires, and thus aid in maximizing profit (Allon et al. 2011a, Allon and Bassamboo 2011, Yu et al. 2017).

However, research has also reported opposite outcomes regarding the delay announcements, e.g. increased customer abandonment and a lower likelihood of returning (Mandelbaum and Zeltyn 2013, Huang et al. 2017, Pender et al. 2016). These findings highlight the importance of displaying the "right" delay announcement to the customer. Delay announcements vary from very vague to relatively accurate, real-time information (Allon et al. 2011b, Dong et al. 2015, Allon and Bassamboo 2011, Yu et al. 2017). Operations Research is mostly theoretical in nature, and underlies the assumption that delay announcements lead customers to update their beliefs about offered wait (cf., Yu et al. 2017). The field mainly explores methods for estimating delays to enable accurate delay announcements. There are limited empirical studies that tested the impact of delay announcements on queuing and abandonment processes of service systems (cf., Ibrahim et al. 2016). In contrast, the–mainly experimental–research in Psychology focuses on the behavioral effects of delay announcements on customers (cf., Munichor and Rafaeli 2007, Kumar et al. 2016, Taylor 1994).

Previous theoretical research in Operations on the impact of delay announcements on customer patience and abandonment reports the following findings: Whitt (1999) revealed that average waiting times can be reduced by providing accurate delay information. Guo and Zipkin (2007) continued this line of research and added different levels of information accuracy. They report two possible, yet contradicting outcomes of announcing accurate delay information: improving or hurting system performance. While in the two previously mentioned papers the models assume that customers do not make patience and abandonment-related decisions dynamically throughout the wait, other models do (cf., Akşin et al. 2013, Huang et al. 2017). Huang et al. (2017) indicates that customer patience is a function of delay announcements, both upon arrival to the queue and during waiting. They then use the model to optimize staffing levels and time of the announcements. Lastly, Allon et al. (2011a) studied a model where customers are not only strategic in their actions, but also in the way they interpret delay information, whereas the service provider is strategic in deciding how the information is provided. They show that even though delay information is costless, it can improve the outcome for both parties. They specifically advise firms to manage customers' wait expectations by displaying vague information to make the customers join a queue they would not join if given complete delay information. Hence, Allon et al. (2011a) were the first one to demonstrate that providing more vague delay information to the customers may actually cause more positive reactions. From this theoretical research in Operations, we learned that in order to understand customer patience and abandonment behaviors, delay information, its content and display time, must be considered.

Previous empirical research on the impact of delay announcements on customer patience and abandonment has focused on call centers and waiting in hospitals (cf., Mandelbaum and Zeltyn 2013, Yu et al. 2017, Dong et al. 2015), and revealed that customer choices are indeed influenced by delay announcements, which affects system performance. One study found that call center customers are the least patient when no delay information is provided (Feigin 2006). In line with this, Munichor and Rafaeli (2007) demonstrated that informing telephone customers about their progress in queue makes them experience more positive affective reactions and less likely to abandon the queue. In addition, the time of abandonment is affected by delay announcements; Akşin et al. (2016) showed that customers abandon earlier (later) when a high (low) delay is announced, compared to those not given any delay information.

We argue that the above findings can be explained by two psychological theories: (i) The Theory of Personal Control over averse stimuli (Averill 1973), which describes information as a tool that gives people a sense of control and allows them to perceive a situation as more predictable, thereby influencing their decisions. In regards to service systems, a sense of control and predictability would influence the decisions of whether to abandon a queue as well as when to do so. (ii) The Theory of Uncertainty Reduction (Osuna 1985), that discusses the increased stress level connected to the uncertainty of the situation when no (here: delay) information is provided, suggests that the expected consequence is withdrawal from the situation. In the context of waiting, this would present itself as abandoning the queue. Based on these theoretical frameworks and previous empirical findings from waiting situations, we hypothesize that:

Hypothesis 1 *Announcing a delay will decrease customer abandonment.*

Hypothesis 1 refers to any form or type of delay information. In addition, we ask whether wording of the delay information has an effect on the likelihood of abandonment. Therefore, we include the three delay announcement conditions '5 min or less', 'between 4–6 min', and 'about 5 min' in the first study to explore this question. We do not formulate hypotheses regarding these comparisons, as they are not the focus of the current research.

Delay announcements and customer balking. Next, we want to investigate the patience of customers at the beginning of the wait, regardless of whether delay information was announced and what wording was used exactly. Upon arrival to the queue, some customers decide to remain in the queue while others choose to balk as they are not willing to wait at all (Huang et al. 2017, Mandelbaum and Zeltyn 2013). Once the latter customers realize that they will not be served immediately, they abandon the queue. Mandelbaum and Zeltyn (2013) provide evidence that around 8% of the customers balk regardless of the delay announcement, using call center data. Interestingly, they also reported an upward jump in abandonment rates following delay announcements, no matter the time of the announcement (Mandelbaum and Zeltyn 2013). In our study the delay is announced upon arrival of the queue, hence we argue that there will be high balking rates.

Since customer patience is notoriously low in online waiting, we assume the same phenomena to occur in online services, i.e. that a significant percentage of customers will balk once understanding that waiting is required. Figure 1 (see Section 2) illustrates that around 4% of customers waiting online for chat service balk if no delay is announced. However, these data includes all customers who requested service, out of which almost 40% were served immediately (not required to wait), and many only had to wait a few seconds. If we specifically consider the proportion of balking customers out of all customers that were required to wait more than 15 seconds, around 8% balked. Altogether, we predict a significant percentage of balking rates in the current study. In particular, we expect balking rates to be even higher than previously recognized, since we do not provide the option to be served within the first three minutes:

Hypothesis 2 *Regardless of the content of the announced delay, more than 8% of the customers will balk.*

3.2. Customer anchoring

Our next research question is: Do customers anchor on the content of delay announcements, and does this in turn influence their patience? We propose that the wait expectation we create following the delay information will affect customer patience more than the offered wait. In particular, we assume to see different customer balking and abandonment dynamics, depending on the delay information given. Cognitive Anchoring (cf., Tversky and Kahneman 1974) occurs when initial information has an (not always irrational) effect on a later event. People have been shown to make insufficient adjustments following initial information, even when the information is completely unrelated to the later judgment. In accordance with the same line of thought, a customer relying on the numerical content of the delay announcement would take it for the offered wait, and consequently make patience and abandonment-related decisions based on this information.

Upon arrival to the queue, a rational decision based on the delay information would be to either balk or wait at least the announced time. This behavior would be *anchoring*. Since people do not estimate time well (Katz et al. 1991), we should see a change in behavior *around* the announced time, as opposed to at the *exact* announced time. The decisions made based on the delay information would be inaccurate estimates if the offered wait did not equal the content of the delay announcement. In our studies offered wait either exceeded or undercut the announced delay for most participants, which enabled us to test the proposed anchoring effect.

Customer anchoring and balking. If customers anchor on the delay information, their patience, and consequently the decision to balk or not to balk, should be shaped by the information received upon entering the queue. Jouini et al. (2011) report that a long (short) delay, which is likely to exceed (undercut) the announced delay, increases (decreases) balking rates; if an announced wait exceeds the customer's patience, this customer leaves the system immediately. Similarly, Pazgal and Radas (2008) found that very few people balk if a short delay is announced.

Hence, we propose that customers will anchor on the content of the delay announcements, such that:

Hypothesis 3 *Customer balking will increase with the length of the announced delay.*

Customer anchoring and patience. Feigin (2006) reported that customers become impatient after some time when a short delay is announced in the beginning of the wait. Armony et al. (2009) showed that customers become irritated as soon as the wait time reaches the announced delay, and that an increase in abandonment rates occurs as a consequence. Another study (Jouini et al. 2011) reported a similar phenomenon: More customers abandon when their wait time exceeds the delay announced in the beginning of the wait. Kumar et al. (2016) found that the deviance of preliminary wait expectations and updated estimations, which is a violation of wait expectations, results in customer irritation and lower satisfaction upon entering the service. We assume that when a higher delay is announced, participants will be more patient during the wait, since they expect to wait a long time from the start. However, when a short delay is announced, participants will be less patient during the wait since their preliminary wait expectations (low wait time) are violated. Summarized, we hypothesize that customers will anchor on the content of delay announcements, such that:

Hypothesis 4 *Customer patience will increase with the length of the announced delay.*

Customer anchoring: The special case of optimism bias and learning. The next research question within the framework of the proposed anchoring effect is: Which number will customers anchor on when the delay announcement entails a range of information (i.e. 'between x and y min')? And, how will this anchoring influence customer abandonment decisions? Previous research on the "optimism bias" (Sharot 2011) suggests that when estimating future outcomes people are likely to overestimate (underestimate) the occurrence of positive (negative) events. In other words, people tend to think that "the bad things will not happen to them", and make decisions accordingly. Based on this theory, we propose that customers will anchor on the lower point of the announced delay range **until** the wait time reaches the time of the lower announced delay. It follows:

Hypothesis 5 *Before the anchor, customers provided with delay information comprising a range will abandon as much as customers provided with delay information comprising the lower point of the range, only.*

Furthermore, according to standard learning theories people make adjustments to their prior decisions as soon as they are faced with dis-confirmation (Sharot 2011). With this in mind, we propose that when the wait time announced in the lower point of the announced delay range passes, customers will come to the realization that their initial wait estimation was inaccurate, and will reevaluate it. Consequently, they will adjust their initial estimate from the lower into the direction of the upper point of the announced delay range, which will affect their abandonment decisions after the anchor.

Hypothesis 6 *After the anchor, customers provided with delay information comprising a range will abandon less than customers provided with delay information comprising the lower point of the range, only.*

3.3. Customer meandering

The next effect we explore in in this research is the effect of customer meandering during wait for online service on customer patience. We also examine meandering independently of delay announcements in its effect on customer abandonment.

More than 30 years ago Maister (1985, p. 115) noted that "occupied time feels shorter than unoccupied time". Subsequent empirical research on physical and telephone waiting showed the positive effects of keeping waiting customers busy, and creating a "pleasant" wait environment by adding music (phone wait), or chairs, magazines, and a news board (physical wait) (Munichor and Rafaeli 2007, Mobach 2013, Katz et al. 1991, van Riel et al. 2012). The psychological explanation for these effects is provided by Zakay and Hornik (1991), who suggested that people use cognitive timers to monitor the wait. Specifically, in Resource Allocation Theory, Zakay and Hornik (1991) explain that when all attention is focused on the wait, cognitive timers make the passing of time feel slower. However, when people are distracted while waiting, their mental activity increases and their cognitive timers are distracted in other activities, thereby reducing their sense of how much time has passed. In response to this theory, customer distraction is expected to have a positive impact on customer reactions towards the wait–also in online waiting.

However, contradicting Zakay and Hornik (1991)'s theory, service companies are frequently reminded of the importance of always keeping customers focused on their website. A customer not active on the site (i.e. not responding) is considered a customer the company is about to lose. Various blogs explain how to add exit (intent) pop-ups (see for example `https://socialtriggers.com`, `https://blog.kissmetrics.com`, and `https://blog.wishpond.com`) to the website to keep customers focused on the site. These exit pop-ups monitor customer mouse movements and are designed to prevent customers from switching to other websites (a term called 'bouncing') by capturing their attention (i.e. "Don't leave us, check out our ..."). The underlying fear for companies is that the customers will leave their website for competitors' websites and end up switching "to the enemy".

There is minimal empirical research on how meandering in online wait affects customer abandonment behaviors. In an online purchasing study, Ding et al. (2015) developed a model to capture the real-time dynamics of a customer's latent intentions while going through the purchase process. When the developed algorithm detects that a customer might switch to another site, the customer is immediately transferred to the next web page in the purchase process. Although this finding is not directly related to customer waiting online, it suggests that companies are becoming highly encouraged to halt customers from even temporarily leaving their website. Following this paper and current marketing trends, we conclude that service companies have not yet understood the importance of "keeping their customers busy" during online wait, hence disregarding Zakay and Hornik (1991)'s theory. So far only one recent study, Sigurdsson et al. (2015), suggested that the possibility of customer abandonment itself may not be a "bad thing", as 75% of the customers return to the site later and reconsider the purchase. Building on this finding, as well as on Zakay and Hornik (1991)'s theoretical framework, that was further supported by empirical findings, our next hypothesis is that:

Hypothesis 7 *Meandering will increase customer patience.*

Following Hypothesis 1 in which we propose that delay announcements influence customer abandonment, we further hypothesize that meandering will have a negative effect on the likelihood of abandonment, regardless of if and what delay was announced to the customer:

Hypothesis 8 *Regardless of the announced delay, meandering will decrease customer abandonment.*

3.4. Overview over the studies

To test our predictions, we conducted five experimental studies (including two pilot studies) with an overall sample size of 3,430 participants. For the data collection, we used a different online platform for Study 1 (`https://www.crowdflower.com`) than for the following two studies (`https://prolific.ac`) in order to replicate the findings of the first study on another platform.

In short, Pilot 1 (N=40) was designed to identify what participants perceive as a short, and Pilot 2 (N=61) as a long wait. Based on the findings of Pilot 1 and Pilot 2, Study 1 (N=311) was designed in which we tested the first hypothesis. Study 2 (N=2,162) then followed to replicate the findings regarding Hypothesis 1, and to test all other hypotheses (Hypothesis 2, 3, 4, 5, 6, 7 and 8). In Study 2, either no delay, or a medium or a high delay was announced to the participants. Lastly, we ran a third study (Study 3, N=856) to replicate the findings of Study 2 for a low delay announcement. Study 2, as well as Study 3 comprised a large sample size which enabled us to analyze abandonment dynamics throughout the entire waiting time.

We combined the datasets of Study 2 (N=2,162) and Study 3 (N=856) for all statistical analyses, which was possible as these two studies were conducted under the same conditions (i.e. same weekday and hour of study conduction, same study design and procedure), and consisted of a similar amount of participants in each condition ($N_{condition}$= 424 to 439). The merging enabled us to better compare between the different delay announcement conditions regarding the hypothesized effects, as Study 3 added two low delay announcement conditions ($N_{condition}$= 424, 432) to the five medium, high, and no delay announcement conditions ($N_{condition}$= 428 to 439) of Study 2. Therefore, from now on, we will refer only to Study 1 (originally: Study 1) and Study 2 (merged Study, originally: Study 2 and Study 3), respectively.

In both Study 1 and Study 2, the procedure was the same: In the beginning, participants were informed that the study was about customer online service, and they were told there might be a wait before they could proceed to the task. Since the time the participants waited in queue was the focus of the study and not the task, the latter was completely unrelated to the research questions. Participants entered the queue wait and (except for the control condition) received some information about the estimated wait time. Note that the delay information did not equal the time participants were actually required to wait. During the wait, participants either abandoned the wait by exiting the study, or stayed in queue and later entered the service. We presume that starting the experimental task is equivalent to starting the service interaction. Finally, the remaining participants (those that entered service) were asked to report their experience with online service, as well as their demographics.

4. Study 1

4.1. Pretests

We ran two small pilot studies to determine what participants perceive as a short wait (Pilot 1, N=40), and as a long wait (Pilot 2, N=61). A detailed description of the procedure of Pilot 1 and Pilot 2 can be found in Appendix A. In Pilot 1, all participants were given the delay information ‘about 2 min’, and actually had to wait between 1–3 minutes. Results revealed that only 2.5% of the participants abandoned. In Pilot 2, participants received the delay information ‘about 5 min’, and actually were required to wait between 5–10 minutes. We found that about half of the participants abandoned. Hence, we assumed that participants perceive a wait of two (five or more) minutes as low (high), and built Study 1 based on this assumption.

4.2. Sample

In Study 1, we studied 311 participants, recruited on Crowdflower (https://www.crowdflower.com), who received $0.5 upon completion of the study. Out of our preliminary dataset (N=336), nine participants did not agree to participate. These participants left the study before starting to wait and did not receive any delay information, thus, they were excluded from the analysis. In addition, some participants had to be excluded from the analysis even though they did enter the wait queue: Nine participants used the data collection platform incorrectly (e.g., using an incompatible device, although reporting the opposite), which resulted in missing data regarding some wait-related variables. Another seven participants (outliers) were excluded as their actual wait was more than 3.5 SD above the mean. Hence, the final sample size (N=311) included 95% of the participants who entered the wait queue.

4.3. Procedure

As an introduction, we informed participants that there might be some wait due to system load before they can start the requested task. We were only interested in the participants' behaviors during queue wait, and <u>not</u> in their responses to the task following the wait. In the beginning of the study, participants had to confirm their willingness to participate in the experiment and that they are using a compatible device (i.e. laptop, with Javascript enabled). Upon confirmation, participants were asked to wait. Whether and what type of delay was announced, was randomly determined by the platform on which we built the experiment. In particular, participants were randomly allocated to four delay announcement conditions: Some (1 condition, N=76) did not receive any information concerning the estimated wait time, whereas others (3 conditions, N_{total}=235; $N_{condition}$=76 to 79) were provided with some delay information.

The delay information, if provided, was visible on the screen throughout the entire wait time, as well as a button with the following message: "If you do not want to continue the study, click here (if you press this button, you cannot go back)". This button gave participants the option to opt out and desert the queue wait. Participants who clicked this button saw the message "You decided not to wait. The study is over". All participants were required to wait between 180 and 420 seconds in queue, as randomly determined by the platform. Thus, the delay information a participant received might have undercut, equaled, or exceeded offered wait. The participants were totally unaware of the time they were actually required to wait. Once offered wait had passed (meaning, wait was over), participants could proceed to the task by clicking the "Next button". If customers went to a different web location while waiting, the wait time clock continued, and the "Next button" was displayed until they came back and pressed it. Hence, customers might have returned only after the wait had finished, and thus waited more than required. While waiting, we recorded of each participant (a) how much time she waited in queue, (b) if she abandoned, (c) and when she abandoned.

Participants, who continued to wait until the end and reached the service point, were asked to complete a short task of reading a customer service interaction conducted via Twitter, and to respond to a some questions concerning this interaction (e.g., "How satisfied was the customer with this service interaction?", "How likely is it that this customer will recommend this service provider to a friend or colleague?"). After completing the task, participants were instructed to record their experience with online customer service in the past, and asked a few demographic questions. Importantly, the responses to the task following the wait, as well as the questions following the task, were not used for any research purposes, as this data was available only for participants who agreed to wait until the end and then completed the study. As no such information was available for abandoning participants, we neither included it in the statistical analyses, nor report it in this research.

4.4. Variables

Our two key variables, *delay announcement* and *offered wait*, were manipulated. By manipulating the former, we created four experimental conditions. Two other variables, *actual wait* and *abandonment*, were recorded while participants waited in queue.

Delay announcement. The variable *delay announcement* was manipulated through the information that was shown to participants; whereas all participants got the information "Please wait", the statement "Your estimated wait time is X" was shown only to the participants who were not in the control (no delay announcement) condition. In place of 'X' participants in Study 1 either saw the delay information '5 min or less', or 'between 4–6 min', or 'about 5 min'. For the statistical analyses, the variable $DelayAnnouncement_i$ includes for every participant i a vector of indicators (with the length of the number of conditions included in the analysis), that indicate which condition the participant i was assigned to. In Study 1 there are four conditions, therefore $DelayAnnouncement_i = (d_1, d_2, d_3)$, where $d_k = 1$ if condition k was active, and otherwise 0.

Offered wait. *Offered wait* was programmed in JavaScript and uniformly distributed between 180 and 420 seconds. Thus, all participants (excluding those in the control condition) randomly either had to wait less or more than (or, in very rare cases exactly) the time that was announced in the delay information. Participants were totally unaware of the exact value of offered wait assigned to them.

Abandonment. *Abandonment* was a binary variable, coded as one (1) when a participant exited the wait queue (and thereby the study), by clicking the button "If you do not want to continue waiting, click here (if you press this button, you cannot go back)", or zero (0) for participants who did not abandon (did not click the button).

Actual wait. Following Mandelbaum and Zeltyn (2013), *actual wait* referred to the time in seconds a participant actually waited, either until abandoning or until proceeding to the task (by clicking the "Next" button). We denote a participant's actual wait by W.

4.5. Results

Delay announcements. Summarized in Table 1 are the means and standard deviations of offered and actual wait, as well as the abandonment rates for each of the four delay announcement conditions in Study 1. As the table details, participants had to wait a similar amount of time in queue (5 minutes on average), and actually waited approximately between two and three minutes on average in each condition. Abandonment rates were the highest in the control (no announcement) condition, and the lowest in the 'between 4–6 min' condition.

Table 1 Summary statistics wait time variables all conditions Study 1

		Variable								
		Offered wait				Actual wait				Abandoned
Delay announcement		*in seconds*				*in seconds*				*in %*
condition	*N*	*M*	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*	
about 5 min	79	291.23	38.00	194	380	251.49	174.79	1.39	773.96	34.18%
5 min or less	78	291.49	39.91	200	398	251.41	191.41	2.32	842.21	30.77%
between 4-6 min	78	294.91	36.21	203	381	312.83	140.81	1.51	797.45	12.82%
no announcement	76	300.32	44.19	195	398	204.14	155.09	1.53	648.28	48.68%

Note. N=311.

In Study 1, we aimed at testing our first hypothesis which regards the effect of announcing a delay on customer abandonment. The model we propose for testing Hypothesis 1 is the following binominal regression model (Model 1):

$$Logit(\Pr(Abandonment_i) = \alpha + \beta DelayAnnouncement_i + \epsilon_i \quad (1)$$

where $Logit(\Pr(Abandonment_i)$ is the likelihood that a participant i will abandon, α is the random intercept for the model, β is the vector of indicators for each of the delay announcement conditions, and ϵ_i is an error term. The results of the analysis are presented in Table 2. The logistic

Table 2 Effect of delay announcement on likelihood to abandon Study 1

	Null model		Model 1	
Variables	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	-0.78***	0.12	-0.05***	0.23
Delay announcement condition				
about 5 min			-0.60†	0.33
5 min or less			-0.76*	0.34
between 4-6 min			-1.86***	0.41
base=no announcement				
-2 LogLikelihood	387.59		362.81	
AIC	389.59		372.81	

Dependent variable: Whether a participant abandoned (no=0, yes=1).
Note. †p<.10, * p<.05, *** p<.001.
Note. N=311.

regression model was statistically significant ($\chi^2(3) = 24.8, p < .001$). The model explained 11% (Nagelkerke R^2) of the variance in abandonment and correctly classified 69% of the cases. In support of Hypothesis 1, the effect of delay announcement is negative and significant. The odds of a participant abandoning decrease by a factor of 0.155–0.547, when a delay is announced. Altogether, as predicted, we found a negative effect of announcing a delay on the likelihood to abandon in all three delay announcement conditions.

In the next step, we were interested to test for the effect of delay information wording on abandonment. As outlined in Table 1, the abandonment rate was remarkably lower in the 'between 4–6 min' condition, compared to the '5 min or less' and 'about 5 min' conditions. To test for statistical significance of these differences, we changed the reference group from 'no announcement' to 'about 5 min' and 'between 4–6 min', and ran the binominal regression analysis again. Results revealed that the likelihood to abandon was not significantly different for the two conditions '5 min or less' and 'about 5 min' ($p > .10$), but significantly smaller for 'between 4–6 min' than '5 min or less' ($p < .01$), and than 'about 5 min' ($p < .01$).

4.6. Discussion

In Study 1, results revealed the hypothesized negative effect of announcing a delay to the customer on her likelihood to abandon the queue. This result gives the first hint of the merit of announcing any delay to the customer upon entering the queue. In Study 2 we aim at replicating this effect, including other delay announcement conditions. Moreover, regarding the effect of wording on abandonment, Study 1's results showed that, whereas customers seemingly expect to wait five minutes when given the delay information '5 min or less' or 'about 5 min', they might expect to wait some other time when given the delay information 'between 4–6 min'. Hence, wording seems to play an important role in the effect of delay announcement on abandonment under some conditions. As there was no difference in the likelihood to abandon between the condition 'about 5 min' and '5 min or less', we decided to include only one of those conditions in the following study, namely 'about 5 min'. The interesting finding that participants given the delay information 'between 4–6 min' might anchor on '4 min' or '6 min' instead of expecting to wait five minutes, provides the first evidence of the hypothesized anchoring effect (Hypotheses 5 and 6), which we will discuss in Section 5.

5. Study 2

5.1. Sample

In Study 2, we studied 3,018 participants, recruited on Prolifics (https:/prolific.ac), who received $0.5 upon completion of the study. Out of the preliminary dataset (N=3,345), 79 participants did not agree to participate. These participants in effect left the study before starting to wait, did not receive any delay information, and thus were not included in the analysis. Also, 115 participants reported that they did not use a compatible device and therefore could not participate in the study. In addition, some participants had to be excluded from the analysis although they did enter the wait queue: 109 participants used the data collection platform inappropriately (e.g., using an incompatible device, although reporting the opposite), which erased some of the participants' wait variables. Another 24 participants (outliers) were excluded as their actual wait was more than 3 SD above the mean. Hence, the final sample size (as outlined above) included 96% of the participants who entered the wait queue.

5.2. Procedure

The procedure in Study 2 corresponded to the procedure in Study 1. However, we also recorded for each participant during the wait if she meandered. In addition, for two experimental conditions (those that originally stem from Study 3), we recorded for each participants (a) how many times she meandered, as well as (b) how much time in total she spent meandering.

5.3. Variables

As in Study 1, our two key variables, *delay announcement* and *offered wait*, were manipulated. By manipulating the former, we created seven experimental conditions. Four other variables, *abandonment*, *balking*, *actual wait*, and *meandering* were measured while participants waited in queue. In addition, *expected patience* was estimated based on the variables measured.

Delay announcement. Similar to Study 1, the variable *delay announcement* was manipulated through the information that was shown to participants; whereas all participants saw the information "Please wait", the statement "Your estimated wait time is X" was shown only to the participants who were not in the control (no delay announcement) condition. For 'X' participants in Study 2 either saw the delay information 'about 2 min', 'between 2–4 min', 'about 3 min', 'about 4 min', 'between 4–6 min', or 'about 5 min'. While the two former (low delay announcement) conditions originally stem from Study 3, the five latter (high delay announcement) conditions originally stem from Study 2. For the statistical analyses, the variable $DelayAnnouncement_i$ includes for every participant i a vector of indicators (with the length of the number of conditions included in the analysis), that indicate which condition the participant i was assigned to. In Study 2 there are seven conditions, therefore $DelayAnnouncement_i = (d_1, d_2, d_3, d_4, d_5, d_6)$, where $d_k = 1$ if condition k was active, and otherwise 0.

Offered wait. *Offered wait* in Study 2 corresponded to offered wait in Study 1.

Abandonment. *Abandonment* in Study 2 was defined exactly as abandonment in Study 1.

Balking. *Balking* referred to abandonment within 15 seconds, based on previous empirical reports (Mandelbaum and Zeltyn 2013), and was coded as a binary variable: yes (1), no (0).

Actual wait. *Actual wait* in Study 2 followed the same definition as actual wait in Study 1. Again, we denote a participant's actual wait by W.

Expected patience. We denote a participant's patience to wait in line by τ. The design of our study did not allow us to measure patience for *all* participants, as the participants who did not abandon provided only a lower bound of their patience through their actual wait. We only know that those participants were at the very least willing to wait the offered wait (patience is right censored, see Yu et al. (2017)). Censored data analysis is the main statistical approach for patience estimation (Mandelbaum and Zeltyn 2013). The latter is based on the Maximum Likelihood Estimator method (MLE) which assumes that patience is exponentially distributed. Accounting for the right censoring of the data, we estimated *expected patience*, denoted by $E[\tau]$. To estimate expected patience in each delay announcement condition, we used the following formula by Mandelbaum and Zeltyn (2004):

$$E[\tau] = \frac{E(Actual\ wait)}{Pr(Abandonment)} \tag{2}$$

Anchor. We denote the *anchor* by T. When a delay announcement entailed only one number (e.g. 'about x min'), we refer to 'x' as the *anchor*. When the delay announcement entailed two numbers (i.e. 'between x and y min'), we again refer to 'x' as the *anchor*, which is in this case the lower limit of the range. Specifically, in the delay announcement condition 'between 2–4 min', the anchor was 2 minutes ($T = 2$), and in the delay announcement condition 'between 4–6 min' the anchor was 4 minutes ($T = 4$).

Meandering. *Meandering* was programmed using JavaScript and coded as a binary variable: one (1) when a participant left the screen by going to another window while waiting, and zero (0) if the participant stayed on the screen. To check for the robustness of the results concerning the effect of meandering on abandonment, we recorded two more meandering variables: *meandering count*, which measured how many times a participant meandered, and *meandering time*, which measured how much time in total a participant spent meandering.

5.4. Results

5.4.1. Delay announcements

Table 3 details the means and standard deviations of offered and actual wait, as well as the abandonment and balking rates for each of the seven delay announcement conditions in Study 2. As depicted in the table, on average participants were required to wait a similar amount in all conditions, namely around five minutes. Actually, participants waited about a minute less on average

Table 3 Summary statistics wait time variables all conditions

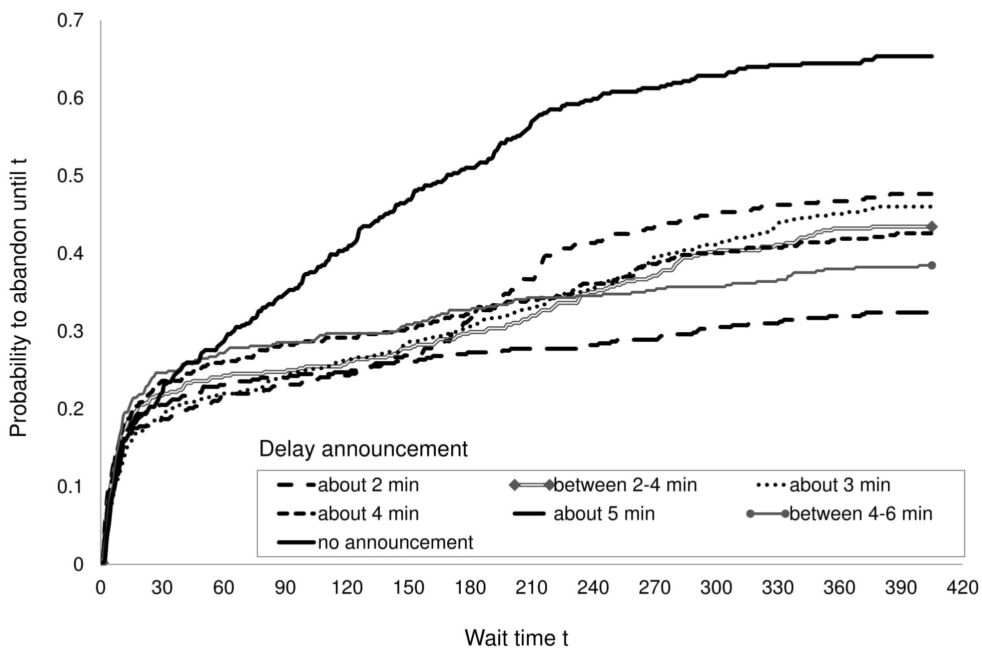
		Variable									
		Offered wait				Actual wait				Abandoned	Balked
Delay announcement condition	*N*	*in seconds* *M*	*SD*	*Min*	*Max*	*in seconds* *M*	*SD*	*Min*	*Max*	*in %*	*in%*
about 2 min	424	297.79	69.45	180	419	241.42	186.65	0.08	1,796.08	48.35%	17.69%
between 2-4 min	432	298.06	69.40	180	419	244.68	221.51	1.00	2,375.77	43.05%	18.75%
about 3 min	428	300.36	69.25	182	419	256.05	224.92	0.32	1,816.37	46.03%	15.89%
about 4 min	432	305.12	67.44	181	419	279.49	295.63	1.02	2,375.77	42.59%	19.44%
between 4-6 min	434	297.23	70.10	180	418	256.67	224.12	1.00	1,738.98	38.48%	20.97%
about 5 min	429	302.79	69.44	180	418	284.01	226.06	1.05	1,826.51	32.63%	18.18%
no announcement	439	293.20	70.1	181	419	184.62	161.68	0.96	1,223.73	65.38%	16.85%

Note. N=3,018.

in each condition if delay information was provided. In the control (no announcement) condition participants waited only three minutes on average. The high standard deviation and maximal value of actual wait in each condition show that participants highly engaged in meandering. The highest abandonment rate was observed when no delay was announced. The second highest abandonment rate was in the lowest ('about 2 min') delay announcement condition, the lowest in the highest ('about 5 min', 'between 4–6 min') delay announcement conditions.

We again estimated Model 1 to test the effect of delay announcement on the likelihood to abandon. Our results show that the results of Study 1 could be replicated (see Appendix B). Figure 2 notes the probability of abandonment up until time t for all seven delay announcement conditions. Interestingly, Figure 2 illustrates that the dramatic effect of not announcing a delay comes into play after 60 seconds of wait time; by then, the probability to abandon the queue is higher for those participants who were not informed about any delay, compared to participants given some type of delay information. This finding has important implications for the management of service systems, which will be discussed in Section 6.

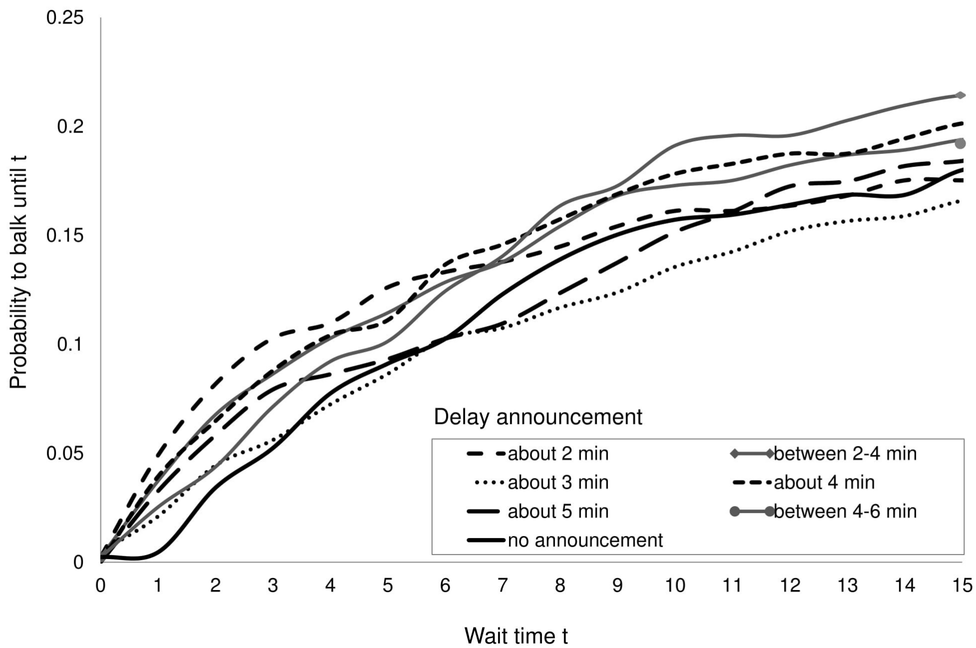
Figure 2 Probability to abandon until time t in all delay announcement conditions



Delay announcements and customer balking. Next, we tested for Hypothesis 2, which refers to the prediction of a baseline balking rate of at least 8% for online wait, regardless of the announced delay. We can see in Table 3, as well as in Figure 3, that 16–21% of the participants balked in each condition. Thus, Hypothesis 2 could be fully supported. Interestingly, there seems to be not a slightly higher, but rather a dramatic increase in balking rates compared to telephone wait

(8%, see Mandelbaum and Zeltyn 2013), and regarding short delays in online wait (as previously recognized, see Section 3.1).

Figure 3 **Probability to balk until time t in all delay announcement conditions**



5.4.2. Customer anchoring

Customer anchoring and balking. Besides a high baseline balking rate, which occurs regardless of the announced delay, we hypothesized that customers will anchor on the content of the delay announcement, such that more customers will balk following a higher announced delay (Hypothesis 3). We propose the following binominal regression model for testing Hypothesis 3 (Model 2):

$$Logit(\Pr(Balking_i) = \alpha + \beta DelayAnnouncement_i + \epsilon_i \quad (3)$$

where $Logit(\Pr(Balking_i)$ is the likelihood that a participant i will balk, α is the random intercept for the model, β is the vector of indicators for each delay announcement condition, and ϵ_i is an error term. Although not part of Hypothesis 3, we were interested to see if there is a higher likelihood to balk for the control (no announcement) condition, compared to when a delay was announced.

Therefore, we also included the control condition in Model 2, and took the condition 'about 2 min' as the reference group in the analysis. The results are presented in Table 4.

Table 4 Effect of delay announcement on likelihood to balk

	Null model		Model 2	
Variables	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	-1.50***	0.05	-1.67***	0.13
Delay announcement condition				
between 2-4 min			0.25	0.18
about 3 min			0.16	0.18
about 4 min			0.34†	0.18
between 4-6 min			0.07	0.18
about 5 min			0.13	0.18
no announcement			0.20	0.18
base=about 2 min				
-2 LogLikelihood	2893.57		2863.85	
AIC	2895.57		2879.85	

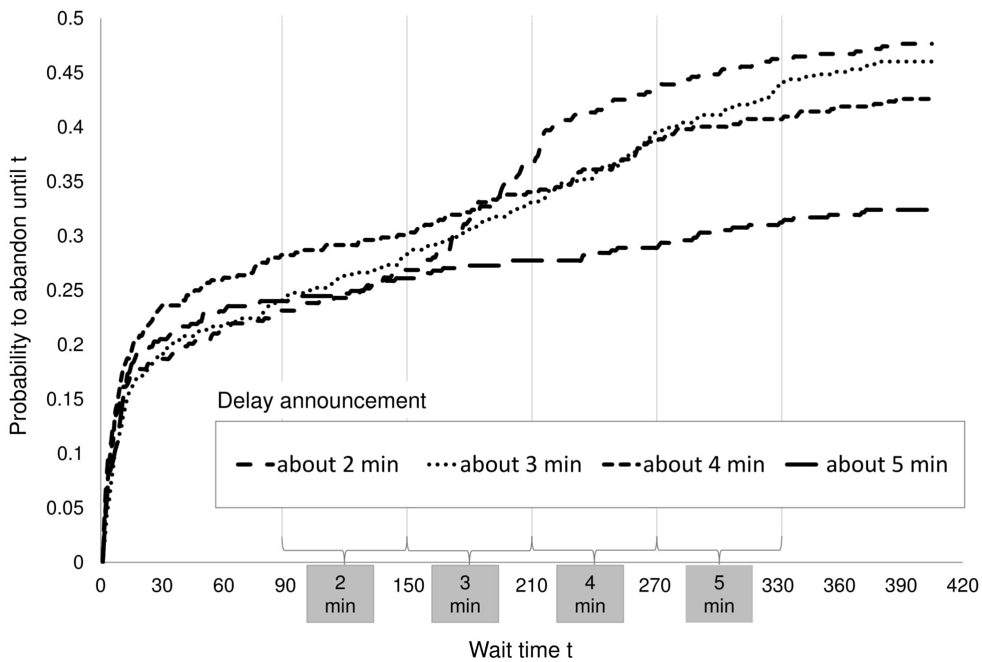
Dependent variable: Whether a participant balked (no=0, yes=1).
Note. †p<.10, *** p<.001.
Note. N=3,018.

The logistic regression model was not statistically significant ($\chi^2(6) = 4.9, p > .10$). There was only a marginally significant difference between two conditions: The likelihood to balk was higher for the 'about 4 min' than the 'about 2 min' condition ($p < .10$). Summarized, Hypothesis 3 could not be supported, as there was no effect of delay announcement height on the likelihood to balk, as illustrated in Figure 3. This finding is in itself surprising and interesting and leads us to formulate some suggestions regarding the optimal handling of online service systems, which we will discuss in Section 6.

These results do not speak for an anchoring effect. But, maybe customers just do not show anchoring behavior in the beginning of the wait? Maybe they only start to show a change in patience and abandonment behaviors once the time announced in the anchor has passed and they continue to wait?

Customer anchoring and patience. To test Hypothesis 4, where we proposed to find a higher expected customer patience following a higher announced delay, we used all 'about x min' delay announcement conditions. Figure 4 displays the probability to abandon until time t for the different conditions. When looking at the lines for each condition in the second part of the wait time (approx. from 180 seconds onwards, which refers to the lower limit of offered wait in our studies), the steepest

Figure 4 **Probability to abandon until time t in all 'about x min' delay announcement conditions**



slope is in the 'about 2 min' condition, followed by 'about 3 min', then 'about 4 min', and finally 'about 5 min'. This picture gives the first hint that indeed participants anchor on the announced delay and hence are more (less) patient, following a higher (lower) delay. Specifically, we interpret the steepness of the slopes as resulting from the violation of wait expectations, which were formed due to the delay information. As the slopes get steeper, the delay information correlates less with offered wait.

We built the following One-way Anova model (Model 3) to test for statistical significance of the effect of delay announcement height on expected customer patience (Hypothesis 4):

$$E[\tau]_j = \alpha + \beta DelayAnnouncement_j + \epsilon_j \tag{4}$$

where $E[\tau]_j$ is the estimated expected patience for a random sample j ($j = 1, ..., 400$), α is the random intercept for the model, β is the vector of indicators for each delay announcement condition, and ϵ_j is an error term. We used bootstrapping procedure (Preacher and Hayes 2008) and drew 400 random samples (sample size: 100) within each of the four delay announcement conditions. Then, we calculated expected patience for each of the 400 samples, using Equation 2.

Table 5 details the means and standard deviations of expected patience for all four ‘about x min’ delay announcement conditions. Participants in the ‘about 2 min’ condition had the lowest expected patience, followed by ‘about 3 min’, and ‘about 4 min’. The highest expected patience participants had in the ‘about 5 min’ condition.

Table 5 Summary statistics expected patience

Delay announcement condition	*N*	Expected patience *in seconds* *M*	*SD*	*Min*	*Max*
about 2 min	100	508.20	87.43	343.51	811.14
about 3 min	100	550.54	106.30	365.92	861.49
about 4 min	100	671.13	126.92	422.32	1180.21
about 5 min	100	876.99	177.88	539.64	1459.60

Note. N=400.

Results of a One-Way Anova showed that the level of expected patience significantly differed between the four conditions ($F[3, 396] = 163.849, R^2 = .554, p < .001$), as depicted in Table 6. Tukey Post-hoc tests revealed that expected patience increased with the height of the delay announcement, such that participants in the condition ‘about 2 min’ had the lowest expected patience, followed by the conditions ‘about 3 min’, ‘about 4 min’ and finally ‘about 5 min’. All differences in expected

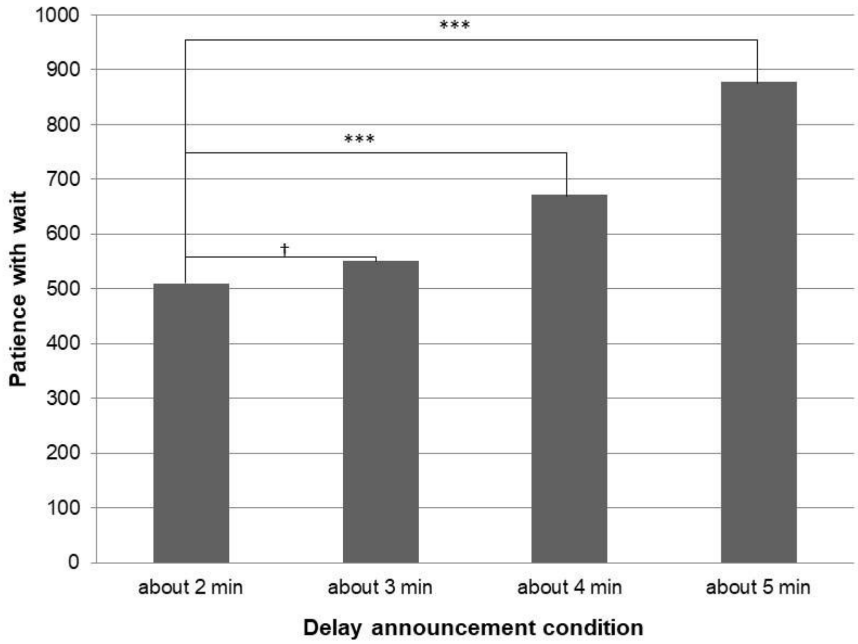
Table 6 Effect of ‘about x min’ delay announcements on expected patience

Variables	Model 3 *coefficient*	*SE*
Intercept	704.77***	17.95
Delay announcement condition		
about 3 min	42.34†	18.26
about 4 min	162.93***	18.26
about 5 min	368.79***	18.26
base=about 2 min		
R^2	0.55***	
Adj. R^2	0.55***	
F	163.85***	

Dependent variable: Expected patience.
Note. N=400 (100 in each condition).
Note. †p<.10, *** p<.001.

patience between conditions were highly significant ($p < .001$), except for the difference between the conditions ‘about 2 min’ and ‘about 3 min’, which was only marginally significant ($p < .10$). For more details, see Figure 5. Summarized, Hypothesis 4 could be fully supported.

Figure 5 **Expected patience in all 'about x min' delay announcement conditions**



Customer anchoring: The special case of optimism bias and learning. For Hypotheses 5 and 6, we were interested in the proposed anchoring effect on the abandonment for the two types of delay announcements 'between x and y min' and 'about x min'. Specifically, we looked separately at the two (i) low delay announcement conditions 'about 2 min' and 'between 2–4 min', and at the two (ii) high delay announcement conditions 'about 4 min and 'between 4–6 min'. Both in case of (i) and (ii), the second delay information entails a range, whereas the first entails the lower point of the range, only.

Customer abandonment before the anchor. The binominal logistic regression model (Model 4) we propose for testing Hypothesis 5, which regards equally high abandonment rates before the anchor in the 'between x and y min' and the 'about x min' delay announcement conditions, is the following:

$$Logit(\Pr(Abandonment_i, W_i < T)) = \alpha + \beta DelayAnnouncement_i + \epsilon_i \qquad (5)$$

where $\Pr(Abandonment_i, W_i < T))$ is the likelihood that a participant i will abandon before the anchor T, α is the random intercept for the model, β is the vector of indicators for each delay announcement condition, and ϵ_i is an error term. Specifically, we defined 'before the anchor' as the wait time period preceding the time of the anchor. Thus, we predicted the likelihood to abandon between (i) 0 and 120 seconds for the two low, and (ii) 0 to 240 seconds for the two high delay announcement conditions.

Results revealed that the model was not significant for none of the two analyses (low delay information (i): $\chi^2(1) = 0.2, p > .10$; high delay information (ii): $\chi^2(1) = 0.2, p > .10$), see Table 7. In support of Hypothesis 5, the effect of not announcing the delay as a range on the likelihood to abandon before the anchor is not significant. In particular, the likelihood to abandon the queue within two minutes is statistically equal for participants provided with the low delay information 'about 2 min' and 'between 2–4 min' (as noted on the left side of Table 7). Similarly, the likelihood to abandon the queue before four minutes is equally high for participants provided with the high delay information 'about 4 min' and 'between 4–6 min' (as noted on the right side of Table 7).

Table 7 Effect of 'about x min' and 'between x and y min' delay announcements on likelihood to abandon before anchor

	Null model		Model 4 ($T=2$)			Null model		Model 4 ($T=4$)	
Variables	*coefficient*	*SE*	*coefficient*	*SE*	Variables	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	-1.09***	0.08	-1.06***	0.11	Intercept	-0.60***	0.07	-0.64***	0.10
Delay announcement condition					Delay announcement condition				
about 2 min			-0.06	0.16	about 4 min			0.07	0.14
base=between 2-4 min					*base=between 4-6 min*				
-2 LogLikelihood	964.91		964.75		-2 LogLikelihood	1,124.93		1,124.70	
AIC	966.91		970.75		AIC	1,126.93		1,130.70	

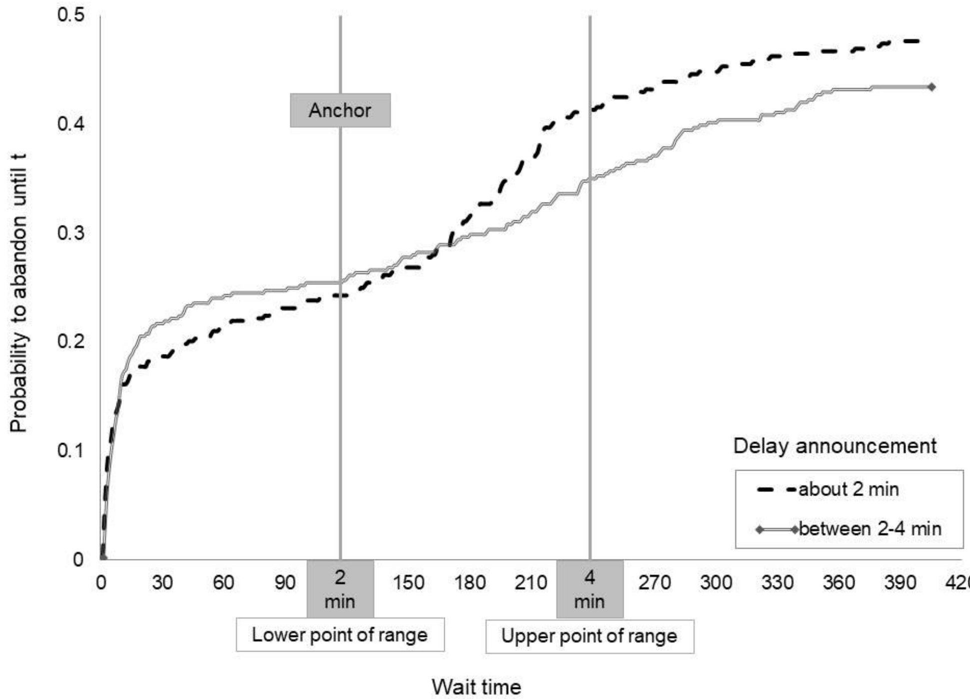
Dependent variable: Whether a participant abandoned before 120 seconds (no=0, yes=1).
Note. *** p<.001.
Note. 'about 2 min':N=424, 'between 2-4 min':N=432.

Dependent variable: Whether a participant abandoned before 240 seconds (no=0, yes=1).
Note. *** p<.001.
Note. 'about 4 min':N=432, 'between 4-6 min':N=434.

Figure 6 and Figure 7 show that there is very little difference in the probability to abandon until around one minute after the anchor for the two low delay announcement conditions (Figure 6), and no difference until shortly before the anchor for the two high delay announcement conditions (Figure 7).

Customer abandonment after the anchor. In the next step, we were interested to see if there is a lower abandonment rate after the anchor for participants receiving the delay information

Figure 6 **Probability to abandon until time t in 'about 2 min' and 'between 2–4 min' delay announcement conditions**



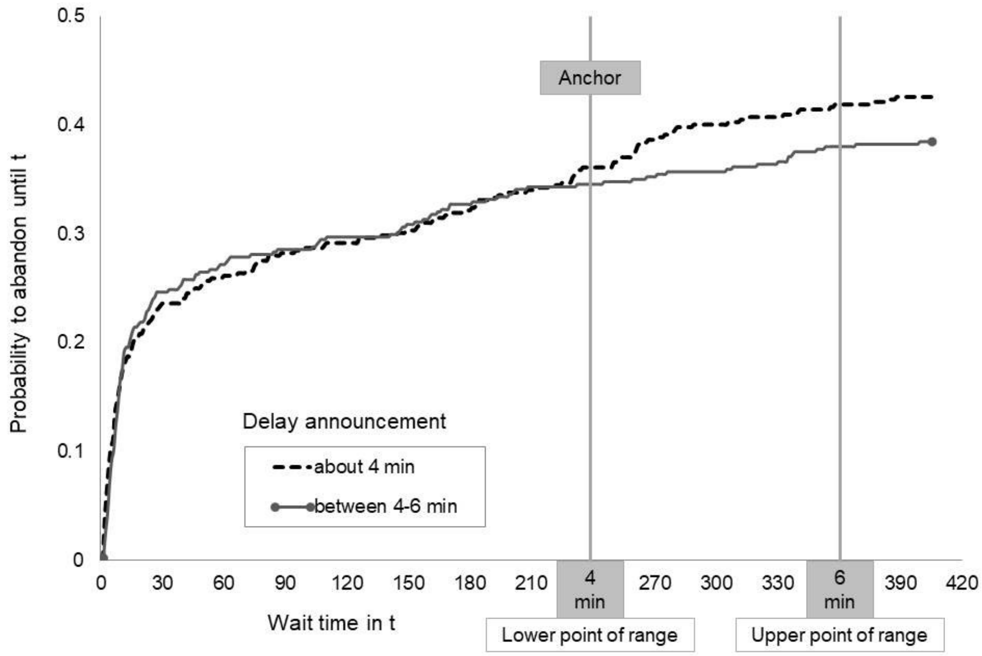
'between x and y min' than for those we provided with the delay information 'about x min'. The binominal regression model we propose to test (Hypothesis 6) is the following (Model 5):

$$Logit(\Pr(Abandonment_i|W_i > T)) = \alpha + \beta DelayAnnouncement_i + \epsilon_i \quad (6)$$

where $Logit(\Pr(Abandonment_i|W_i > T))$ is the likelihood that a participant i will abandon given that she waited at least until T, α is the random intercept for the model, β is the vector of indicators for each delay announcement condition, and ϵ_i is an error term. Specifically, we defined 'after the anchor' as the wait time period following the time of the anchor. Thus, for a low delay announcement (i), we predicted the likelihood to abandon after 120 seconds, and for a high delay announcement (ii) after 240 seconds.

The results for both analyses are presented in Table 8. The logistic regression model was (at least marginally) statistically significant (low delay information (i) $\chi^2(1) = 5.4, p < .05$; high delay information (ii): $\chi^2(1) = 3.2, p < .10$). The models explained 1% (Nagelkerke R^2) of the variance in abandonment and correctly classified 73% (i), and 90% (ii) of the cases.

Figure 7 **Probability to abandon until time t in 'about 4 min' and 'between 4–6 min' delay announcement conditions**



In support of Hypothesis 6, the effect of not announcing a delay as a range on the likelihood to abandon after the anchor is (at least marginally) significant and positive. This indicates that, for a low (high) delay information, the odds of a participant abandoning after the anchor increase by a factor of 1.513 (i), and 1.770 (ii), when the delay information does not comprise a range. In other words, the likelihood to abandon the queue after two minutes is higher for participants provided with the delay information of 'about 2 min' than 'between 2–4 min' (see left side of Table 8). Also, the likelihood to abandon the queue after four minutes is higher for participants provided with the delay information of 'about 4 min' than 'between 4–6 min', as reported on the right side of Table 8.

Figure 6 and Figure 7 show that, whereas for the two conditions 'about 2 min' and 'between 2–4 min' the difference in the probability to abandon arises only about a minute after the anchor, for the two conditions 'about 4 min' and 'between 4–6 min' it arises shortly before the anchor. We assume that the participants anchor on two minutes (i), and on four minutes (ii), and that they do

Table 8 Effect of ‘about x min’ and ‘between x and y min’ delay announcements on likelihood to abandon after anchor

Variables	Null model coefficient	Null model SE	Model 5 ($T=2$) coefficient	Model 5 ($T=2$) SE
Intercept	-0.97***	0.09	-1.19***	0.13
Delay announcement condition				
about 2 min			0.41*	0.18
base=between 2-4 min				
-2 LogLikelihood	753.50		748.08	
AIC	755.50		752.08	

Dependent variable: Whether a participant abandoned after 120 seconds (no=0, yes=1), given not abandoned before 120 seconds.
Note. *p<.05, *** p<.001.
Note. ‘about 2 min’:N=320, ‘between 2-4 min’:N=321.

Variables	Null model coefficient	Null model SE	Model 5 ($T=4$) coefficient	Model 5 ($T=4$) SE
Intercept	-2.29***	0.16	-2.61***	0.25
Delay announcement condition				
about 4 min			0.57†	0.32
base=between 4-6 min				
-2 LogLikelihood	300.44		297.20	
AIC	302.44		303.30	

Dependent variable: Whether a participant abandoned after 240 seconds (no=0, yes=1), given not abandoned before 240 seconds.
Note. †p<.10, *** p<.001.
Note. ‘about 4 min’:N=242, ‘between 4-6 min’:N=247.

not exactly know when the time has passed. Consequently, they show a change in behavior around the anchor, but not exactly at the anchor. Figure 6 seems to hint to participants’ overestimating short wait times, and Figure 7 seems to hint to participants’ slightly underestimating long wait times.

5.4.3. Customer meandering

Customer meandering and patience. In the next step, we were interested in the (proposed positive) effect of customer meandering on expected patience (Hypothesis 7), and in the (proposed negative) effect on abandonment over and above the delay that was announced (Hypothesis 8). To test for the first effect, we built the following One-way Anova model (Model 6):

$$E[\tau]_j = \alpha + \beta Meandering_j + \epsilon_j \tag{7}$$

where $E[\tau]_j$ is the estimated expected patience for a random sample j ($j = 1, ..., 200$), α is the random intercept for the model, β is a vector of indicators for each meandering condition, and ϵ_j is an error term. We used bootstrapping procedure (Preacher and Hayes 2008) and drew 200 random samples (sample size: 100) for the two populations–those that meandered and those that did not meander. We then calculated expected patience for each of the samples, using Equation 2.

Table 9 details the means and standard deviations of expected patience for those that meandered and those who did not meander. It becomes clear that participants’ expected patience was much higher for those that meandered (about 20 minutes) than for those that did not (about 1.5 minutes).

Table 9 Summary statistics meandering and expected patience

Meandering	N	Expected patience *in seconds* M	SD	Min	Max
meandering	100	1,283.51	272.59	799.23	2,230.9
no meandering	100	95.41	17.86	53.61	136.77

Note. N=200

Results of the One-Way Anova revealed that expected patience significantly differed between participants that meandered and participants that did not meander ($F[1, 198] = 1891.649, R^2 = .905, p < .001$), as summarized in Table 10. In particular, expected patience was statistically significantly higher for participants that meandered. Hence, Hypothesis 7 could be fully supported.

Table 10 Effect of meandering on expected patience

Variables	Model 6 *coefficient*	*SE*
Intercept	1,283.51***	19.32
Meandering	-1,188.10***	27.32
R^2	0.91***	
Adj. R^2	0.91***	
F	1,891.65***	

Dependent variable: Expected patience.
Note. N=200 (100 in each condition).
Note. *** p<.001.

One could argue that the effect of customer meandering on expected patience occurs, as customers who are highly impatient are less likely to meander; these customers already made the decision to leave the queue upon arrival. To rule out this possible explanation for the effect of meandering on expected patience, we excluded the balking customers and ran the One-way Anova again (Model 7, see Appendix C). In short, the model remained significant and therefore further supported Hypothesis 7. For more details concerning the One-way Anova analysis and the significance of its results, see Appendix C.

Customer meandering and abandonment. Lastly, we were interested in the effect of meandering on customer abandonment–beyond the effect of delay announcement. Table 11 details the summary statistics regarding meandering in all delay announcement conditions. We can see that the proportion of meandering (out of total) participants, who received a low delay announcement, was as high as the proportion of meandering (out of total) participants, who did not receive any delay information (62%). About 10% more participants meandered when given medium or high delay

Table 11 Summary statistics meandering

Delay announcement condition	N	Meandering rate *in %*	Abandonment rate given meandering *in %*	Abandonment rate given no meandering *in %*
about 2 min	424	0.62	0.34	0.72
between 2-4 min	432	0.62	0.29	0.66
about 3 min	428	0.75	0.29	0.96
about 4 min	432	0.72	0.21	1.00
between 4-6 min	434	0.72	0.16	0.97
about 5 min	429	0.77	0.14	0.95
no announcement	439	0.62	0.45	0.98

Note. N=3,018.

information. In addition, as Table 11 depicts, only about 25% of the participants who meandered abandoned on average throughout the conditions. However, about 90% of the participants who did not meander abandoned on average throughout the conditions. Interestingly, in one condition ('about 4 min') all participants abandoned, given they did not meander.

To test our last hypothesis, Hypothesis 8, which is the prediction of a negative effect of customer meandering on abandonment, while controlling for delay announcement, we propose a binominal logistic regression model (Model 8):

$$Logit(\Pr(Abandonment_i) = \alpha + \beta DelayAnnouncement_i + \gamma Meandering_i + \epsilon_i \quad (8)$$

where $Logit(\Pr(Abandonment_i)$ is the likelihood that a participant i will abandon, α is the random intercept for the model, β is the vector of indicators for each delay announcement condition, γ is the vector of indicators for each meandering condition, and ϵ_i is an error term. The results are presented in Table 12 (which is the continuation of Table 15, hence including Model 1 which is relevant to Hypothesis 1).

The logistic regression model remains statistically significant after including meandering ($\chi^2(7) = 1175.0, p < .001$). The model explained 43% (Nagelkerke R^2) of the variance in abandonment, and correctly classified 78.2% of the cases. In support of Hypothesis 8, the effect of meandering is negative and highly significant ($\gamma_1 = -3.08, SE = 0.12, p < .001$), over and above the announced delay. This indicates that the odds of a participant abandoning decrease by a factor of 0.046, when the participant meanders while waiting, while controlling for the delay announcement. In other words, a participant's likelihood to abandon is almost zero when she meanders! After including meandering in the model, the effect of delay announcement on the likelihood to abandon also remains significant and negative, regarding all delay announcement conditions ('about 2 min': $\beta_1 = -1.03, SE = 0.17, p < .001$; 'between 2–4 min': $\beta_2 = -1.38, SE = 0.17, p < .001$; 'about 3 min': $\beta_3 = -0.70, SE = 0.16, p < .001$; 'about 4 min': $\beta_4 = -1.98, SE = 0.17, p < .001$; 'between 4–6 min': $\beta_5 = -1.23, SE = 0.17, p < .001$; and 'about 5 min': $\beta_6 = -1.43, SE = 0.12, p < .001$).

Table 12 **Effect of delay announcement and meandering on likelihood to abandon**

	Null model		Model 1		Model 8	
Variables	*coefficient*	*SE*	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	***-0.19	0.04	***0.64	0.1	2.97***	0.15
Meandering					-3.08***	0.12
Delay announcement						
condition			-0.70***	0.14	-1.03***	0.17
about 2 min			-0.92***	0.14	-1.38***	0.17
between 2-4 min			-0.80***	0.14	-0.70***	0.16
about 3 min			-0.93***	0.14	-0.98***	0.17
about 4 min			-1.11***	0.14	-1.23***	0.17
between 4-6 min			-1.36***	0.14	-1.43***	0.12
about 5 min						
base=no announcement						
-2 LogLikelihood	4,156.69		4,044.50		2,981.70	
AIC	4,158.69		4,060.50		2,999.70	

Dependent variable: Whether a participant abandoned (no=0, yes=1).
Note. *** p<.001.
Note. N=3,018.

However, as Table 12 shows, the effect of meandering is remarkably stronger than the effect of delay announcement.

To check for the robustness of our results, we also checked for the effect of meandering count and meandering time on customer abandonment. These two variables were only available in the original Study 3 (before the merge of Study 2 and Study 3), including the two low delay announcement conditions 'about 2 min' and 'between 2–4 min', respectively. Table 13 details the means, standard deviations and correlations of the three meandering variables. As the table depicts, participants

Table 13 **Means, standard deviations, and correlations meandering variables**

Variable	*M*	*SD*	1	2	3
1 Meandering			1	.601**	.516**
2 Meandering count	2.91	3.80	.601**	1	.416**
3 Meandering time	121.09	184.45	.516**	.416**	1

Note: ** indicates $p < .01$.
Note. N=856.

meandered three times on average during the wait, regardless of how much time they waited and what delay information they received. Besides, they meandered about two minutes on average during the wait, regardless of how much time they waited and what delay information they received.

We estimated a binary logistic regression model (Model 9) to predict the likelihood of customer abandonment from meandering count:

$$Logit(\Pr(Abandonment_i) = \alpha + \beta MeanderingCount_i + \epsilon_i \quad (9)$$

where $Logit(\Pr(Abandonment_i)$ is the likelihood that a participant i will abandon, α is the random intercept for the model, β is an indicator for each meandering count condition, and ϵ_i is an error term. Results reveal that the model was statistically significant ($\chi^2(1) = 74.3, p < .001$) and explained 11% (Nagelkerke R^2) of the variance in abandonment, and correctly classified 67% of the cases, see Table 14. The effect of the number of times a participant meanders on the likelihood to abandon is negative and significant. The odds of a participant abandoning decrease by a factor of 0.831 for each time this participant meanders while waiting.

We then estimated another binary logistic regression model (Model 10) to predict the likelihood of customer abandonment from meandering time:

$$Logit(\Pr(Abandonment_i) = \alpha + \beta MeanderingTime_i + \epsilon_i \quad (10)$$

where $Logit(\Pr(Abandonment_i)$ is the likelihood that a participant i will abandon, α is the random intercept for the model, β is a coefficient for each meandering time condition, and ϵ_i is an error term. Results show that the model was statistically significant ($\chi^2(1) = 192.9, p < .001$) and explained 27% (Nagelkerke R^2) of the variance in abandonment, and correctly classified 68% of the cases. The effect of the total amount of time spent meandering on the likelihood to abandon is negative and significant. The odds of a participant abandoning decrease by a factor of 0.992 for each second the participant meanders while waiting, see Table 14. Summarized, the findings of these two binominal regression analyses provide further support for Hypothesis 8.

Finally, we checked that the effect of customer meandering on abandonment remains significant, when we exclude balking customers. We ran another binominal logistic regression (Model 11) to provide further support for our last Hypothesis 8. For more details concerning the analysis and the significance of the results, see Appendix D.1.

Table 14 Effect of meandering count and meandering time on abandonment

	Null model		Model 9			Null model		Model 10	
Variables	*coefficient*	*SE*	*coefficient*	*SE*	Variables	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	-0.17*	0.07	0.31**	0.09	Intercept	-0.17*	0.69	0.62***	0.09
Meandering count			-0.01***	0.01	Meandering time			-0.01***	0.01
-2 LogLikelihood	1,180.26		1,105.96		-2 LogLikelihood	1,180.26		987.34	
AIC	1,182.26		1,109.96		AIC	1,182.26		991.34	

Dependent variable: Whether a participant abandoned (no=0, yes=1).
Note. * p<.05, ** p<.01, *** p<.001.
Note. N=856

Dependent variable: Whether a participant abandoned (no=0, yes=1).
Note. * p<.05, *** p<.001.
Note. N=856

5.5. Discussion

In Study 2 we replicated the results of Study 1 regarding Hypothesis 1, that is announcing a (any!) delay decreases the likelihood to abandon. We also showed that, regardless of when and what delay is announced, about 20% of the customers balk (thereby supporting Hypothesis 2). Besides, we expected to find an anchoring effect at the beginning of the wait, i.e. more balking customers following a higher announced delay. However, our results demonstrated that balking rates are rather randomly distributed between the delay announcement conditions (not supporting Hypothesis 3). In contrast, we found evidence for an anchoring effect regarding customer patience and abandonment dynamics throughout the wait: Customers are more patient following a longer announced wait (supporting Hypothesis 4). In addition, customers receiving the delay information 'between x and y min' and 'about x min' are equally likely to abandon before the anchor, but the former are less likely to abandon after the anchor (supporting Hypotheses 5 and 6). Besides an anchoring effect, our findings reveal that customer meandering positively affects customer patience (supporting Hypothesis 7), and that the effect remains significant after excluding balking customers. Lastly, customer meandering negatively affects the likelihood to abandon–and that over and above the delay announcement (supporting Hypothesis 8). Again, this effect remains significant after excluding balking customers. We also show that the effect of customer meandering on the likelihood to abandon is robust; both the number of times and the total time a customer meanders decrease the likelihood of abandonment.

6. Concluding remarks

6.1. Summary of results

Drawing from the results of three experimental studies online, we show that delay announcements influence customer patience and abandonment decisions in online wait. Specifically, we report that delay information provided upon queue arrival has an effect on customer patience dynamics later during the wait: Following the delay information, a change in customer behavior occurs once the customers are required to wait more than the time announced. We call this phenomenon the "anchoring effect". In the second part of the research, our findings highlight the importance of keeping customers distracted while waiting, as they would otherwise focus on the wait and lose patience.

6.2. Limitations and future research

We followed the classical, experimental approach in Psychology research. Hence, results might have suffered from certain limitations: (1) Customers waiting online in real-life might have a different motivation to wait than the participants in our studies. Specifically, our participants waited to conduct a task (for which they received payment), instead of actually entering service (e.g. to get a problem solved). (2) The payoff structure might have influenced the participants' response to the delay announcement in terms of their patience and abandonment decisions. In real customer service, customers are not paid for waiting, and might experience the cost of waiting differently than in our studies. (3) Customers usually have the option to choose a different service provider if the expected wait time exceeds their patience. Hence, there is competition between the different service providers. A customer entering a restaurant, provided with an estimated delay of x minutes, might decide to go to a different restaurant where the expected wait is shorter (x-k), or to stay and wait x minutes for the next available table. In our study the wait context is somewhat different; we can compare it to a customers decision of whether to cancel a booked GetTaxi. This context is different from the former, as a customer of the latter risks to lose reputation if she decides to cancel the taxi. Specifically, a GetTaxi driver might decide not to pick up that customer in the future, based on the customer record. Similarly, a participant in our study might not fulfill the requirements (level of trustworthiness/ study abandonment rate) to be able to participate in a specific study on the online platform in the future. Following (1),(2) and (3), real-life customer behavior in online wait should be observed and analyzed in future research.

Surprisingly, we observed similar balking rates across all delay announcement conditions. Maybe, customers either perceived an announced delay of two to five minutes as similar and thus showed a similar likelihood of balking in our study, (and/) or, again, waiting for an experimental task shapes customer abandonment behaviors differently than in real online service. Future research should address these and potential other underlying reasons for not finding an effect of delay announcement on balking.

In our study, we could not test for a possible learning from experience effect regarding customer behavior following delay announcement information, as this study was designed as a one-time study. When choosing a service provider in real life, customers might initially prefer the one with an estimated delay of ‘about x minutes over another with an estimated delay of ‘between x and y minutes, as the latter hints to the possibility of a longer wait than x. However, we assume they will learn that the former information is actually less accurate (though more informative), and start to prefer the latter information (see literature on the trade-off between accuracy and informativeness in judgment decisions, e.g., Yaniv and Foster (1995)). Future research could investigate in the proposed learning from experience effect within the context of online wait.

Furthermore, the strong negative effect of meandering on customer abandonment raises various questions for future research on online queue waiting. This research was exclusively conducted on laptops, so maybe customers meander differently on a tablet or phone? And, how does keeping oneself busy on the phone or physically distancing oneself from the device affect customer patience? Next, we suggest to conduct a laboratory experiment that controls for the ability to meander, to test for potential confounding variables of the effect of meandering on abandonment.

Besides, future research should explore signs that can help distinguishing between meandering customers and those customers who switched to another screen but in the end do not return. These customers engage in ‘silent abandonment’ as they abandon but do not actively close the site. Future research should address questions as is there a critical point of time spent on different websites after which a customer is likely to not return to the website? Or, in other words, how can companies pull customers back into the waiting process when they cross the bridge from meandering to silently abandoning?

6.3. Implications

Implications for research. This paper emphasizes the merit of conducting multidisciplinary research in the fields of Operations Research and Psychology. While theoretical and empirical research in the first field focused on the optimization of service systems, the second field delivers theories that can explain how delay announcements and customer meandering can help in this regard, i.e. by increasing customer patience. By following the classical experimental approach in Psychology we were able to measure actual behavior in a controlled setting. Specifically, we could manipulate which delay information the customers see, monitor whether they switch to another screen while waiting, and then predict customer patience and abandonment decisions.

In addition, we replicate previous findings on traditional types of wait from both fields for the modern type of wait: online. In particular, we show the merit of announcing a delay to the customer, as previously shown for call center wait by Munichor and Rafaeli (2007). This finding is in line with the finding that customers who do not receive any delay information are the least patient (Feigin 2006). Also, we report on balking rates more than twice as high in online wait (nearly 20%), compared to telephone wait (8%, see Mandelbaum and Zeltyn 2013), and nearly five times as high as in online wait with (very) short delays where no delay was announced (about 4%, see Section 2).

Next, we show that customer meandering positively affects patience, and negatively affects abandonment. These findings are in line with Zakay and Hornik (1991)'s theory and previous empirical findings in the field of Psychology on the positive effect of wait distractions in call center and physical wait (such as music, chairs, magazines etc.) (cf., Munichor and Rafaeli 2007, Mobach 2013, Katz et al. 1991, van Riel et al. 2012). In particular, we provide first evidence that meandering affects customer abandonment much stronger than and regardless of delay announcements.

Other than replicating findings–which is especially important for Psychology research (see Open Science Collaboration 2015)–we provide the first evidence for an anchoring effect (based on Cognitive Anchoring, see Tversky and Kahneman 1974) in online waiting. Whereas previous empirical (and most theoretical) research in Operations and Psychology focused on frequently updated delay information to the customers during waiting (cf., Mandelbaum and Zeltyn 2013, Akşin et al. 2016, Yu et al. 2017, Allon and Bassamboo 2011), our research shows that initially one-time provided delay information has a strong effect on customer patience and abandonment decisions throughout the entire wait. In detail, we show that customers anchor on the announced delay, i.e. they expect to wait the announced time. Customers seeing low delay information at the beginning of the wait expect to wait little, and hence abandon to a higher extent once the wait time exceeded the announced time. Following the announcement of a short delay, customers quickly become impatient (as previously shown in Mandelbaum and Zeltyn 2013). On the other hand, customers provided with high delay information expect to wait more from the start and are consequently more patient. Zohar et al. (2002) reported higher patience of call center customers in the middle, compared to at the beginning and toward the end of the day. Similar to our result, this is because these customers expect a higher number of other customers to call around noon than in the morning or evening. Hence, they expect to wait longer to begin with and are consequently more patient around noon. Although no delay was announced in this study, this finding connects well to our finding.

Further, we report the merit of announcing a delay as a range (i.e. 'between x any min', vs. 'about x min'). Once the wait time announced as 'x' has passed, customers come to realize that their initial, low wait estimation (x minutes) is incorrect, and adjust it to the upper limit of the range (y minutes). As a consequence, they abandon less. This finding is in line with the literature on the optimism bias and learning theories (cf., Sharot 2011, McKenna 1993).

Practical implications. Based on our results, we recommend service companies to always announce a delay to customers waiting online for service, given a required wait time of at least 60 seconds. Surprisingly, even delay information which is remarkably (up to 250%!) higher than offered wait is preferable over no delay information. This shows that customers believe in such delay information even though it is not accurate. However, we do not recommend to lie to the customers as this may have undesired long-term consequences for relationship the customer has with the company. Also, a delay should be announced at the beginning of the wait, as well as be visible on the screen throughout the entire wait time, since customers might not focus on the screen and hence miss information displayed for a short time. In addition, in the case of high system load, service companies should announce a high delay, as this information induces higher levels of customer patience. An alternative is to announce the delay as a range, to ensure lower abandonment rates once the wait time of the anchor passed. This is a good policy if a service company wants to enhance customer patience and at the same time be truthful in the delay information it provides to the customers.

Following the finding of meandering increasing patience and decreasing abandonment, we highly recommend service companies to make sure to "keep their customers busy" during online wait. Service companies should be aware that customers are far more likely to abandon, when they focus on the screen while waiting. Consequently, once a customer starts waiting, we recommend distracting her from waiting. We suggest two different types of distraction: Either, information can be displayed on the same screen, thereby catching the customers' attention at a different position on the screen (than where the wait information is displayed); or, a link can be added to temporarily send the customers away to a different web location. Both types of distractions serve to increase customer patience and hence the probability of these customers finally entering the service. Importantly, service companies need to understand that a customer leaving the site temporarily is the one who will likely have enough patience to wait and later enter the service. Hence, building an algorithm to detect when customers are about to leave the site, and then displaying exit pop ups to keep them focused on the screen, is likely to have opposite, damaging consequences for both the customer, and the service company (cf., Pender et al. 2016, Allon and Bassamboo 2011, Mandelbaum and Zeltyn 2013).

Summarized, while our experimental design entails some limitations, this paper is the first one to show that customers make abandonment decisions based on initial, one–time delay information dynamically throughout the wait. In addition, we reveal that wait–distracted customers are remarkably more patient. Our results carry various important practical implications, and enrich the existing theoretical research in both the fields of Operations Research and Psychology.

7. References

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Appendix A: Detailed description of Pilot 1 and Pilot 2

We conducted Pilot I and Pilot 2 (both on http://www.crowdflower.com) to test what wait time participants perceive as low and high. Participants were paid $0.5 upon completion of the experiment.

In Pilot 1 we tested if 'about 2 min' is perceived as a low wait time (which would manifest itself in low abandonment rates). Participants first read a short introduction about the study which did not include any information concerning possible wait times before the task. Then, participants joined the wait queue and received the information "Please wait. Your estimated wait time is about 2 min". As in all other studies, participants had the option to exit the wait queue (as detailed in Section 4). Offered wait varied between one and three minutes for all participants. After offered wait had passed, participants that did not abandon the wait and hence actually entered "service", reported their previous experience with online customer service, as well as their demographics. As this was only a short pilot study, we did not include any task. Results showed that only one out of 40 participants (3%) abandoned. As almost none of the participants abandoned, we assumed that 'about 2 min' is perceived as a low wait time for online wait. Even three minutes might still be perceived as a low wait time, as half of the participants had to wait between two and three minutes.

In Pilot 2, we tested if 'about 5 min' is perceived as a high wait time (which would manifest itself in high abandonment rates). The entire study procedure corresponded to the procedure in Study 1. However, there was only one delay announcement condition, 'about 5 min' and participants had to wait a random amount of seconds between five and ten minutes. Results revealed that 31 out of 61 participants (51%) abandoned. Hence, 'about 5 min' is perceived a long(er) wait time during online wait.

Based on these two pilot studies, we designed Study 1, Study 2, and Study 3. In detail, we chose a medium required wait time (offered wait = 3–7 minutes) for all three studies, and checked for a range of low ('about 2 min', 'between 2–4 min', 'about 3 min'), medium ('about 4 min'), and high ('about 5 min', '5 min or less', 'between 4–6 min') delay announcements.

Appendix B: Further support for Hypothesis 1

To replicate Hypothesis 1, we ran again the same binominal logistic regression (Model 1) as in Study 1. The logistic regression model was statistically significant ($\chi^2(6) = 112.2, p < .001$), see Table 15. The model explained 5% (Nagelkerke R^2) of the variance in abandonment and correctly classified 59% of the cases. In support of Hypothesis 1, the effect of delay announcement is negative and significant. This indicates

Table 15 Effect of delay announcement on likelihood to abandon

	Null model		Model 1	
Variables	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	***-0.19	0.04	***0.64	0.1
Delay announcement condition				
about 2 min			-0.70***	0.14
between 2-4 min			-0.92***	0.14
about 3 min			-0.80***	0.14
about 4 min			-0.93***	0.14
between 4-6 min			-1.11***	0.14
about 5 min			-1.36***	0.14
base=no announcement				
-2 LogLikelihood	4,156.69		4,044.50	
AIC	4,158.69		4,060.50	

Dependent variable: Whether a participant abandoned (no=0, yes=1).
Note. *** p<.001.
Note. N=3,018.

that the odds of a participant abandoning decrease by a factor of 0.257-0.496, when a delay is announced. Altogether, as predicted, we again found a negative effect of announcing a delay on the likelihood to abandon for all six delay announcement conditions.

Appendix C: Further support for Hypothesis 7

C.1. Excluding balking customers

To gain further support for the effect of customer meandering on expected patience (Hypothesis 7), we excluded all balking participants, and built the following One-way Anova model (Model 7):

$$E[\tau|\text{no Balking}]_j = \alpha + \beta Meandering_j + \epsilon_j \quad (11)$$

where $E[\tau|\text{no Balking}]_j$ is the estimated expected patience for a random sample j $(j = 1, ..., 200)$, excluding balking participants, α is the random intercept for the model, β is the vector of indicators for each meandering condition, and ϵ_j is an error term. At first, we excluded all participants from the dataset that balked. We then used bootstrapping procedure (Preacher and Hayes 2008) and drew 200 random samples (sample size: 100) for the two following populations: participants that meandered, and participants that did not meander. Finally, we calculated expected patience for each of the 200 samples. Table 16 details the means and standard deviations of expected patience for both populations, while excluding balking participants. As depicted in the table, expected patience was much higher amongst participants that meandered (approx. 23 minutes) compared to those that did not meander (approx. 4 minutes).

Results of a One-Way Anova revealed that the effect of meandering on expected patience remains significant after excluding balking participants ($F[1, 198] = 1283.508, R^2 = .866, p < .001$), as depicted in

Table 16 Summary statistics meandering and expected patience, given no balking

		Expected patience *in seconds*			
Meandering	*N*	*M*	*SD*	*Min*	*Max*
meandering	100	1,374.98	314.70	838.77	2,628.43
no meandering	100	242.02	31.2	172.84	314.79

Note. N=200.

Table 17. When excluding balking participants, expected patience is still significantly higher for those who meandered, compared to those who did not. Hence, Hypothesis 7 could be further supported.

Table 17 Effect of meandering on expected patience, given no balking

	Model 7	
Variables	*coefficient*	*SE*
Intercept	1,374.98***	22.36
Meandering	-1,132.96***	31.62
R^2	0.87***	
Adj. R^2	0.87***	
F	1,283.508***	

Note. N=200 (100 in each condition).
Note. *** p<.001.

Appendix D: Further support for Hypothesis 8

D.1. Excluding balking customers

To test for the effect of meandering on customer abandonment (controlling for delay announcement), while excluding the balking customers, we built the following binominal logistic regression model (Model 11):

$$Logit(\Pr(Abandonment_i|\text{no Balking}_i)) = \alpha + \beta DelayAnnouncement_i + \gamma Meandering_i + \epsilon_i \tag{12}$$

where $Logit(\Pr(Abandonment_i|\text{no Balking}_i))$ is the likelihood that a participant i will abandon, given she did not balk, α is the random intercept for the model, β is the vector of indicators for each delay announcement condition, γ is the vector of indicators for each meandering condition, and ϵ_i is an error term. Results revealed that the logistic regression model remained statistically significant ($\chi^2(7) = 128.1, p < .001$), as detailed in Table 18 (the table also includes a model with delay announcement only (Model XX); this is the step between the null model and Model 11 and thus has to be included in the table). The model explained 25% (Nagelkerke R^2) of the variance in abandonment, and correctly classified 75% of the cases. In remaining support of Hypothesis 8, the effect of meandering is negative and significant ($\gamma_1 = -2.07, SE = 0.13, p < .001$), over and above the announced delay, and excluding balking (see in Table 18). The odds of a participant abandoning decrease by a factor of 0.126 when this participant meanders while waiting, whilst controlling for the delay

Table 18 **Effect of delay announcement and meandering on likelihood to abandon, given no balking**

Variables	Null model		Model XX		Model 11	
	coefficient	*SE*	*coefficient*	*SE*	*coefficient*	*SE*
Intercept	0.71***	0.04	0.98***	0.11	1.98***	0.16
Meandering			-2.10***	0.12	-2.07**	0.13
Delay announcement condition						
about 2 min					-1.00***	0.17
between 2-4 min					-1.39***	0.17
about 3 min					-0.80***	0.16
about 4 min					-1.13***	0.17
between 4-6 min					-1.48***	0.18
about 5 min					-1.69***	0.19
base=no announcement						
-2 LogLikelihood	3,130.30		2,780.43		2,652.33	
AIC	3,132.30		2,784.43		2,670.33	

Dependent variable: Whether a participant abandoned (no=0, yes=1), given no balking.
Note. ** p<.01, *** p<.001.
Note. N=2,467.

announcement, and excluding balking participants. The effect of delay announcement also remains significant, regarding all conditions (‘about 2 min’: $\beta_1 = -1.00, SE = 0.17, p < .001$; ‘between 2–4 min’: $\beta_2 = -1.39, SE = 0.17, p < .001$; ‘about 3 min’: $\beta_3 = -0.80, SE = 0.16, p < .001$; ‘about 4 min’: $\beta_4 = -1.13, SE = 0.17, p < .001$; ‘between 4–6 min’: $\beta_5 = -1.48, SE = 0.18, p < .001$; and ‘about 5 min’: $\beta_6 = -1.69, SE = 0.19, p < .001$). However, the effect of meandering is still remarkably stronger than the effect of delay announcement (Table 18).

ניסוי בנושא סבלנות ונטישת לקוחות בשירות לקוחות מקוון

חיבור על מחקר

לשם מילוי חלקי של הדרישות לקבלת התואר מגיסטר למדעים ב מגיסטר למדעים במדעי ההתנהגות והניהול - שיווק התנהגותי (עם תזה)

מוניקה ווסטפל

הוגש לסנט הטכניון - מכון טכנולוגי לישראל
חשוון ,תשע"ח ספטמבר 2017

המחקר נעשה בהנחייתן של פרופ 'ענת רפאלי וד''ר גלית יום-טוב בפקולטה להנדסת תעשייה וניהול.
אני מודה לטכניון על התמיכה הכספית הנדיבה בהשתלמותי.

אנשים אינם אוהבים להמתין בתור ולעיתים קרובות מאבדים את סבלנותם תוך כדי ההמתנה ונוטשים את התור (Mandelbaum and Zeltyn 2013). מאידך גיסא, חברות הנותנות שירות לא מסוגלות לבטל לחלוטין את ההמתנה בשל עלויות כוח אדם גבוהות שביטול כזה ידרוש (Allon, Federgruen and Pierson 2011). לכן, אחד האתגרים המרכזיים בתכנון ותפעול של מערכות שירות הוא להצליח להגביר את נכונות הלקוחות להמתנה ולצמצם את הסבירות לכך שינטשו. אתגרים אלו באים לידי ביטוי ביתר שאת בשירות מקוון, מאחר ובהקשר זה הלקוחות חסרי סבלנות במיוחד. הלקוחות המודרנים מצפים להמתין מעט זמן, או לא להמתין כלל לשירות מקוון, יתכן שזה מפני שהתרגלו לכך שבערוץ זה ניתנים בדרך כלל שירותים עצמיים (ללא תורים) ומהירות האינטרנט גבוהה מאוד והם משליכים מכך על שירותים אנושיים הניתנים בערוץ זה. חברות רבות מציעות כיום שירות לקוחות אנושי מקוון ומידי דרך אתרי האינטרנט, הרשתות החברתיות או אפליקציות יעודיות. עם זאת, נותני השירות אשר מטפלים בבקשות הלקוחות פועלים במסגרת משאבים מוגבלים וזמני ההמתנה משתנים בהתאם לזמינות המשאבים. זמני ההמתנה בשירות אישי מקוון קצרים משמעותית מאלו הניתנים בטלפון או בשירות פנים-אל-פנים, לעובדה זו כמה סיבות ביניהן היכולת של עובדים בשירות המקוון לתת שירות לכמה לקוחות במקביל, להיות גמישים ויעילים יותר ולהתבטל פחות (Altman 2017).

חווית ההמתנה לשירות מקוון שונה מהמתנה לשירות פנים-אל-פנים במובנים נוספים: ראשית, בהמתנה פיזית בתור לשירות, הלקוח יכול לראות את מספר הלקוחות הממתנים בתור לפניו ולהשתמש במידע הנ"ל בכדי להעריך את זמן ההמתנה הנדרש. בניגוד לכך, לקוח הממתין לשירות מקוון "עיוור" לחלוטין למצב התור ועל כן נאלץ להסתמך על המידע שמספק לו נותן השירות בנוגע לזמן ההמתנה הנדרש. הכרזה על עיכוב במתן השירות, כמו גם תוכן ההכרזה, משפיעים על מידת סבלנותו והחלטתו של הלקוח לנטוש את התור (Mandelbaum and Zeltyn 2013; Yu, Allon, Dong, Yom-Tov and Yom-Tov 2015; and Bassamboo 2017). שנית, המידה בה תשומת לב הלקוח מופנית להמתנה משפיעה על סבלנות הלקוח; לקוח הממתין לשירות מקוון יכול בזמן ההמתנה לעסוק בפעילויות אחרות ולשוב מאוחר יותר על מנת לבדוק האם נותן השירות התפנה.

במאמר זה, נקטנו בגישה רב-תחומית על מנת לחקור את יעילותן של הודעות עיכוב שונות בשירות למטרת הגברת מידת סבלנות הלקוחות והפחתת הסבירות לנטישתם. אנו גם בוחנים את החשיבות הסחת הדעת ללקוחות הממתינים לשירות מקוון, שוב ביכולת של הסחה זו להגדיל את סבלנות הלקוחות ולהפחיתנטישה.בפרט, אנו בוחנים את השפעת הודעות העיכוב ושוטטות לאתר אינטרנט אחר, על מידת סבלנותם ונטישתם של הלקוחות הממתינים לשירות מקוון. מחקרנו עוסק בשלושה ניבויים המבוססים על תאוריות פסיכולוגיות: 1. בהתבסס על תאוריות הקשורות לתחושת שליטה, שמתארות מידע ככלי המגביר את תחושת השליטה של בני אדם (Averill 1973; Osuna 1985), אנו משערים כי עצם מסירת מידע על ההמתנה הצפויה בעזרת הודעות עיכוב תקטין נטישת לקוחות. 2. על סמך תיאורית ה"עיגון פסיכולוגי" (Tversky and Kahneman 1974),כמו גם בהסתמך על תיאוריות העוסקות ב"אופטימיות הטיה" ולמידה (Sharot 2011; McKenna 1993), ננבא כי לקוחות ישתמשו בתוכן ההודעה כעוגן אשר ישפיע על התפתחות ודינמיקת סבלנותם. 3. על סמך "תיאוריית הקצאת משאבים" (Zakay and Hornik 1991) נציע כי שוטטות הלקוחות הממתינים לאתרי אינטרנט אחרים יפחיתו את נטישתם.

תוצאות שלושה ניסויים מקוונים שערכנו, הכוללים מדגם של 3,430 משתתפים, מראות כי ההכרזה על זמני המתנה צפויים מפחיתה את הסבירות שלקוחות ינטשו את התור. תוכן הודעת העיכוב לא השפיע על החלטת אי-הצטרפות לתור (נטישה מיידית – balking); ללא תלות בתוכן הודעת העיכוב, כ-20% מהלקוחות נטשו מיידית, עם תחילת ההמתנה. ממצאינו מראים כי לקוחות יצרו עוגן בהתאם להודעה והיו סבלניים יותר לאחר הודעה על עיכוב ארוך יותר. כמו כן, אם הודעת העיכוב כללה טווח עיכוב משוער (*בין X ל-Y דקות*), לקוחות התאימו את ציפיותיהם הראשוניות לזמן המתנה קצר (*X דקות*) לכיוון נקודת הגבול העליון להמתנה (*Y דקות*) כאשר זמן ההמתנה הוכרז מראש, לאחר שחלף הגבול התחתון לזמן המתנה (*X*). כתוצאה מהתאמה זו, לקוחות אלו נטשו פחות בהשוואה ללקוחות אשר קיבלו את

הודעת העיכוב הכוללת רק את הנקודה התחתונה של הטווח (*"בערך X דקות"*). לבסוף, לקוחות הגולשים באתרי אינטרנט אחרים בזמן ההמתנה נטשו פחות את התור וזאת ללא תלות בסוג ההודעה שהוצגה בפניהם. לממצאי המחקר יש השלכות חשובות על המחקר התיאורטי והאמפירי של המתנה מקוונת של תורים בחקר ביצועים ובפסיכולוגיה, וכן על תכנון וניהול של מערכות שירות.