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Preface to the Special Issue on Behavioral Queueing Science: The Need for a Multidisciplinary Approach

Modern service systems are economically important but operationally complex. In “Preface to the Special Issue on Behavioral Queueing Science: The Need for a Multidisciplinary Approach,” Ingolfsson, Mandelbaum, Schultz, and Yom-Tov discuss how this special issue advances the scientific study of queues in services systems by acknowledging the central role of human behavior. Behavioral queueing science requires a multidisciplinary approach, using tools that include mathematical modelling, lab experiments and field studies. Each discipline has strengths and weaknesses, but together they have complementing goals, and jointly they give rise to a scientific paradigm for behavioral queues. Cross-disciplinary work is challenging but necessary. The eleven papers in our special issue show how this can be done successfully while setting an example for future work.

Airplane Boarding with Respect to Passenger Satisfaction

When boarding an aircraft, it is often assumed that minimizing the total boarding time meets economic objectives and passenger satisfaction. However, there are indications that not only the total boarding time should be considered in order to satisfy passengers. In “Air Passenger Preferences: An International Comparison Affects Boarding Theory,” by Bachmat, Erland, Jaehn, and Neumann a large survey among airplane passengers, which was conducted in Germany, Israel, and the United States, confirms that a significant share of passengers prefers short individual boarding times. Interestingly, if boarding is restricted to two boarding groups that differ by the passengers’ speed of taking their assigned seat (e.g., passengers with and without hand luggage), “slow-first” is best for minimizing the total boarding time, but “fast-first” is best for minimizing average individual boarding time. Thus, the authors present a new boarding strategy called “slow-back-first,” where the resulting total boarding time and the resulting average individual boarding time are both close to their respective optimum.

Improve Emergency Department Operations Through Patient Prioritization

In “Who Is Next: Patient Prioritization Under Emergency Department Blocking,” Li, Sun, and Hong study how physicians and nurses choose the next patient for treatment in hospital emergency departments (EDs). Using data from a tertiary hospital in Alberta, Canada, they conduct an empirical investigation and find that both clinical factors and resource constraints are considered in patient-prioritization decisions. In particular, discharged patients are prioritized when ED beds are increasingly occupied by boarding patients so as to avoid further blocking the ED. A stylized model is developed to explain the rationale behind the prioritization behavior. Using a simulation study, they show such behavior can improve ED operations by reducing the average patient

waiting time and length of stay without adding extra capacity, which results in significant cost savings for hospitals.

When Should I Transfer This Customer?

“Please hold while I transfer you to next level of support.” Most of us have been on the receiving end of this message. In “The Gatekeeper’s Dilemma: When Should I Transfer This Customer?,” Hathaway, Kagan, and Dada look at transfers from the service worker’s perspective. They create an online experiment in which participants play the role of call center agents who need to decide whether to transfer a virtual service request or continue attempting to resolve it. Consistent with compensation schemes common in call centers, participants receive a bonus for each successful resolution and may pay a penalty if they transfer. The authors find that these incentives generally work well; however, agents appear to overreact to transfer penalties by handling more requests than they should and transferring too few requests. Although this may be good news for customers who dislike being transferred, such behaviors may be costly for the call center; thus, managers need to be careful when rolling out complex compensation schemes.

To Pool or Not to Pool? Analyzing Customer-Intensive Services with Strategic Agents

In customer-intensive services where service quality increases with service time, service providers commonly pool their agents and give performance bonuses that reward agents for achieving greater customer satisfaction and serving more customers. Conventional wisdom suggests that pooling agents reduce customer wait time whereas performance bonuses motivate agents to produce high-quality services, both of which should boost customer satisfaction. However, in “Pooling Agents for Customer-Intensive Services,” Wang, Yang, Cui, Ülkü, and Zhou find that when agents act strategically, they may choose to speed up under pooling in an attempt to serve more customers, thus undermining service quality. If this happens, pooling can backfire and result in both lower customer satisfaction and agent payoff. Consequently, the researchers propose a simple practical solution to restore the efficiency of pooling. They propose pooling a portion of the performance bonuses (incentive pooling) in conjunction with pooling agents (operational pooling).

The Impact of Delays on Customer Behavior in Online Retail

Online retail has become more prominent around the world in the last decade. As a result, online retailers’ website performance is increasingly important. Previous literature has extensively studied customer sensitivity to service speed and wait times in offline services. In “Need for Speed: The Impact of In-Process Delays on Customer Behavior in Online Retail,” Gallino, Karacaoglu, and Moreno extend this literature to online retail. They study the impact of delays in online retail on customer behavior. They estimate sizable negative effects of website slowdowns on online sales and conversion rates. Moreover, the authors explore how

customer sensitivity to online delays varies throughout customers' shopping journeys. They find that the impact of waiting times varies along the different stages of the shopping journey, with customers becoming more sensitive to slowdowns at the checkout stage. Their findings have implications for website design decisions. This research is especially relevant in the current regulatory environment with ongoing policy debates about net neutrality.

How Does Congestion Affect Diagnostic Decisions?

Diagnostic processes are difficult to manage because they require the decision maker (DM) to dynamically balance the benefit of acquiring more diagnostic information against the cost of doing so. When additional and unattended diagnostic tasks build up over time, making this tradeoff becomes especially challenging. In "Mismanaging Diagnostic Accuracy Under Congestion," Kremer and de Véricourt uncover different biases to which DMs are subject when making diagnostic decisions while unattended diagnostic tasks accumulate over time. The authors find that, in their experiments, DMs are overall insufficiently sensitive to congestion. As a result, DMs acquire too little information at low congestion levels, but too much at high levels, compared with an optimal normative benchmark. This in fact increases both the diagnostic errors and congestion levels in the system. The authors disentangle the underlying mechanisms for these effects and suggests different approaches to debias the DMs.

Shall Follow-up Appointments Be Booked in Advance?

Appointment systems are ubiquitous, especially in healthcare. By looking into a large data set with over 1.6 million appointments, we observe that many doctors booked a follow-up appointment at the end of their meeting with their patients. This strategy ensures that the patients would follow up but at the risk that the patient may not show up and the appointment ends being wasted. In "Early Reservation for Follow-up Appointments in a Slotted-Service Queue," Ding, Gupta, and Tang develop a slotted-service queue model to study if and when such a strategy should be used in three representative appointment systems, respectively. In an open access system, it is optimal to never use this strategy. In a traditional appointment system that allows patients to book in advance, it is optimal to apply this strategy to some patients. While in a hybrid system with both walk-in patients and patients with appointments, whether to use this strategy depends on the load balancing between the two patient queues.

Trade-offs Caused by Batching Inpatient Admissions from Emergency Departments

In "To Batch or Not to Batch? Impact of Admission Batching on Emergency Department Boarding Time and Physician Productivity," Feizi, Carson, Berry Jaeker, and Baker tackle the important problem of identifying causes of emergency department (ED) boarding with the goal of identifying a managerial lever to reduce it. They investigate the impact of batching admissions of ED patients. The authors empirically show that batching occurs frequently at the end of shifts when physicians wrap up their tasks. Interestingly, they find a trade-off. Batching improves individual physician productivity, which explains its prevalence. However, it increases boarding times, an outcome that negatively impacts patients and the hospital. A counterfactual analysis comparing empirical results to theoretical queuing models finds that eliminating batching reduces boarding times by 15%. The paper

highlights that boarding can be reduced by physicians completing admissions work as it occurs rather than delaying to the end of shift.

Prior Shared Work Experience Encourages Multitasking in the Emergency Department

Patient demand for emergency medical services has never been greater. In the United States, as fewer people access medical care through a primary care provider, more people access care through the hospital emergency department (ED). Unlike other types of queuing systems, however, the ED allows physicians discretion in whom they serve. That is, ED queues do not operate solely under a policy of "first-come, first-served, by severity." Therefore, the authors wanted to know: "What leads physicians to select which patients, and how many patients, they will treat?" In "Physician Discretion and Patient Pick-up: How Familiarity Encourages Multitasking in the Emergency Department," Niewoehner, KC, and Staats explore how familiarity between peer physicians affects patient selection and the chosen multitasking level, a process more commonly known in the ED as "patient pick-up." They find greater familiarity leads to an increase in patient pick-up rate, observed multitasking, and shorter patient wait time, with no identifiable negative impact to patient processing time or length of stay.

Queuing in The Gig Economy: While Keeping Your Customers Happy, Be Careful of Not Churning Your Workers

The gig economy open a new business model in which services have access to a large pool of workers that are compensated based on their actual production, which can be useful to operate at lower levels of utilization to improve response times to customers. However, having a large pool of workers with low utilization may lower their motivation and increase employee turnover, which can hurt productivity in the long run. In "Balancing Agent Retention and Waiting Time in Service Platforms," Musalem, Olivares, and Yung look at this tradeoff and provide a data-driven approach to manage worker capacity in on-demand service platforms, showing evidence through a real-world application of an outbound call center with freelance agents.

Nudging Patient Choice: Reducing No-Shows Using Waits Framing Messaging

Healthcare providers have long grappled with patients not showing up for their scheduled medical appointments; such no-shows lead to wasted resources and longer wait times for other patients. However, new operations research offers a promising solution to this problem. In "Nudging Patient Choice: Reducing No-Shows Using Waits Framing Messaging," Liu and KC find that using text message reminders that include an additional line of text indicating a potentially long wait for the next available appointment can significantly reduce no-shows by a factor of 28.6%. The intervention, called waits framing, was found to be more effective among patients who were more sensitive to wait times and when the information in the message was novel and credible. The study also uncovered the mechanism underlying the intervention. Specifically, the waits framing messages increased the perceived cost of missing an appointment, leading to a reduction in queue abandonment. This study provides insights into how behavioral science can improve service operations and help tackle challenges in healthcare delivery.